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FINDING CRITICAL SUCCESS FACTORS OF UBIQUITIOUS SUPPLY CHAIN MANAGEMENT

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"FINDING CRITICAL SUCCESS FACTORS OF UBIQUITOUS SUPPLY CHAIN MANAGEMENT"

Abstract

The objective of this paper is to identify the critical success factors and to examine their relationship with the benefits of ubiquitous supply chain management (USCM) adoption. To achieve it, this research firstly selected the critical success factors and the benefit issues related to the adoption of USCM through the literature review, case analysis and interview. Second, after collecting the survey data, we empirically investigated the relationship between critical success factors and USCM adoption benefits. Data analysis showed that the adoption of USCM was significantly associated to management factors such as USCM planning, management support, relationship management, new USCM model, process management and risk management. In addition, there was significant association to technical factors such as USCM system infrastructure, USCM technology application, efficient USCM use, USCM network foundation, enacted technology acceptance and USCM development plan. On the basis of research findings, this paper proposes a model of USCM adoption, which is a guideline helping one find the academic foundation for further studies and a practical insight of USCM adoption and ubiquitous computing applications.

Key Words: *Ubiquitous Supply Chain Management, Critical Success Factors, USCM Adoption Benefits, USCM Adoption Model, Empirical Examination*

1 INTRODUCTION

Ubiquitous computing is being recognized as a new wave of computing paradigm, which can be identified as a computing environment in which people can use computing whenever and wherever with whomever by installing an invisible computing and embedded computer network into objects, locations and people (Weiser 1993). Furthermore, this technology will integrate physical and electronic virtual worlds (Roussos 2006a).

There are several types of ubiquitous computing technologies such as automatic identification technology, sensors, wireless communication technology and embedded computing technology (Acquisti 2006, Fleisch & Tellkamp 2006, Fish & Forrest 2006). However, these technical characteristics alone seem to be inadequate for understanding the diverse assortment of ubiquitous business models enabled by ubiquitous computing (Acquisti 2006). The most successful application of ubiquitous computing technology has been run in the supply chain field (Bose & Pal 2005, Roussos 2006a). Therefore, ubiquitous supply chain management (USCM) has been recognized as a new thechnology for the effective supply chain management (SCM). However, in spite of the increasing adoption of USCM, very little is known about the success factors associated to the adoption of USCM. Particularly lacking is a theory for explaining the phenomenon of USCM adoption on an a priori basis. The focus of the research is on examing the success factors of USCM adoption and their relationship with USCM adoption benefits. In order to do so, we attempt to first identify a list of success factors and benefits that are closely related to USCM adoption, and secondly analyze their interrelation.

In the following section, we review the overview of USCM and previous research on USCM. Section 3 deals with a research model and procedure. Following is another section containing an empirical analysis and result. Finally, the conclusions and implications derived from this research are summarized in section 5.

2 LITERATURE REVIEW

2.1 Overview of USCM

Generally, a supply chain means the process from the purchase of raw materials to the finished product that reaches the hands of the consumer, which means the whole process from the supplier to the consumer (Taalluri 2000, Moberg et al. 2004). The goal of SCM is to minimize the cost in the supply chain, to increase the value of the supply chain, and to remove wasteful business activities (Kopczak & Johnson 2003, Moberg et al. 2004, Ranganathan et al. 2004). Recently, supply chain management is a digitally enabled inter-enterprise process activity that focuses on improvement and innovation of end-to-end process between enterprises and their customers and suppliers (Barua et al. 2004, Rai et al. 2006). Since SCM involves complex systems of interorganizational activities and processes relevant to the flow of products, services and information, effective SCM is influenced by information technology (Barua et al. 2004, Subramani 2004, Ranganathan 2004, Forman & Lippert 2005, Nissen 2006, Rai et al. 2006).

Recently, ubiquitous computing technologies are offering firms a new opportunity in terms of supply chain management within and across companies, and integrating a number of organizational, functional, and technological issues (Fish and Forrest 2006; Hackenbroich et al. 2006, Roussos 2006b, Singh 2007). As ubiquitous computing becomes more mobile and pervasive, USCM has emerged as a key issue for organizations pursuing supply chain transaction processing accurately, quickly and efficiently. In this research, USCM is defined as the planning, control and management of the supply chain based on ubiquitous computing technologies such as radio frequency identification (RFID), sensors, mobile devices, personal data assistant (PDA) and so on. An USCM encompasses a range of

activities, such as purchasing, materials handling, production planning and control, warehousing, logistics, inventory management, distribution, delivery and vendor management (Ranganathan et al. 2004, Fish and Forrest 2006). Thus, it is not surprising that more enterprises are adopting USCM.

USCM has been regarded as one of various functional systems in organization, because USCM serves a vital role between organizations and their suppliers activities in the global supply chain, and furthermore supports new kinds of ubiquitous business related to the supply chain. Though the USCM plays a critical role in managing global supply chain activities, however, theoretical and empirical research has been limited. The following section deals with the review of previous research on USCM.

2.2 Review of Previous Research on USCM

As previously indicated, although there have been some studies of the ubiquitous computing and SCM, there has been little research focusing on the USCM, which integrates the ubiquitous computing and SCM. Previous SCM research has been concerned with various issues such as inventory management (Cohen & Lee 1998, Mabert & Venkatraman 1998), materials management (Turner 1993), interorganizational capabilities (Ho et al. 2002), framework (Gunasekaran and Ngai 2005, Finley & Srikanth 2005), strategy (Vickery et al. 2003), effect (Subramani 2004, Moberg et al. 2004, Corsten & Kumar 2005), development (Rajib et al. 2002, Welch & Wietfeldt 2005) and IT application in SCM (Barua et al. 2004, Subramani 2004, Ranganathan 2004, Nissen 2006, Rai et al. 2006).

In addition to previous research, the following review of these studies provides useful background to this research. Firstly, from a management perspective, recently, Fish and Forrest (2006) reported seven factors underling successful RFID adoptions and the reasons for launching RFID implementations, according to the consulting experience to RFID adoption companies. The following seven success factors were identifed: 1) Develop a clear strategy with top management support; 2) Implement RFID as a project; 3) Manage a gradual rollout: ‘start small, dream big”; 4) Continually improve procedures; 5) Work on negotiation and build trust among flexible partners; 6) Utilize a cross-functional team; and 7) Fully develop the technology throughout the whole supply chain. Though the seven factors suggested by this study were not verified by empirical data, it seems that this paper provides a theoretical basis to further the research in selecting appropriate major variables closed to successful USCM adoption. Moreover, Kourouthanassis and Roussos (2006) addressed the design of pervasive retail experiences brought about by the emergence of ubiquitous computing. They argued that the most important issues deriving from the development of ubiquitous retail applications are trust and privacy. This study might be meaningful in showing practical application of pervasive retail business within ubiquitous computing.

Secondly, from technical perspective, Roussos (2006b) addressed the SCM standards for ubiquitous commerce. He reviewed firstly the history of unique identifier and product classification systems, and then an overview of the European Article Number (EAN) UCC system, including its recent specifications for the wireless auto-identification of products. Finally, global cataloguing schemes and standards for ubiquitous commerce are examined. Since this article tends to focus on the review of supply chain management standards, it would contribute to further research on the emerging standards for USCM. In addition, Hackenbroich et al. (2006) described enterprise software for supply chain management, focusing on SAP’s SCM and Auto-ID technology, discussing two Auto-ID pilot cases. As both RFID and Auto-ID are major technologies in USCM adoption, it would apper that this study is a good example of better understanding the relationship between ubiquitous technology and U-business application. Thiesse et al. (2006) described the design and adoption of a real-time identification and localization system using RFID and ultrasound sensor technologies to improve tracking visibility for inbound logistics. Their article is reliable for extending our view of the RFID and ubiquitous technology applications in ubiquitous computing. Recently, Singh et al. (2007) concentrate on issues related to information technology-enabled supply chains and their impact on organizational processes. They argued that the choice of adopting the right technology depends on the compatibility of the technology with appropriate organizational practices and polices.

Most research relevant to USCM is carried out recently and tends to focus on exploratory approaches. Furthermore, previous research related to USCM tends to have been carried out from two different perspectives: 1) management and 2) technology. The research on the technical perspective has a somewhat narrow focus and barely considers such aspects as interorganization, supplier and supply chain, all of which are closely associated with USCM adoption. On the other hand, research on the management view is much wider in research focus but there is a limit to its explanatory power due to its lack of technical concern. Based on this review, it can be argued that the further research on USCM would be meaningful if it deals with in-depth analysis considering both a management and technology issues, according to empirical data, because both perspectives together may help explain and analyze more adequately the phenomenon of USCM adoption.

2.3 Review of Previous Research on Information Technology Adoption

Information technology (IT) is recognized as a major enabler for organizations to increase their efficiency and effectiveness and to gain competitive advantage (e.g. Oh et al., 2003; Karakostas et al., 2005; Khoumbati et al., 2006; Yiu et al., 2007; Ramamurthy, et al., 2008). The adoption of information technology takes place in many organizations, societies and countries. In relation to this, there are growing concerns in the adoption of information technology (e.g. Ramamurthy et al., 2008; Yiu et al., 2007; Khoumbati et al., 2006; Pederaen, 2005; Oh et al., 2003).

Since this research concentrates on the adoption of USCM, it may be useful to use innovation theory as a foundation theory for this study. Innovation diffusion theory has used to explain the adoption of different types of new IT. These consist of open systems (Chau and Tam, 1997), groupware (Dennis et al., 1998), software packages (Lassila and Brancheau, 1999), Web technology (Nambisan and Wang, 2000), Internet (Mehrtens et al., 2001), web site (Beatty et al., 2001), telemedicine technology (Hu et al., 2002), broadband Internet (Oh et al., 2003), IT platform (Fichman, 2004), CRM (Karakostas et al., 2005), mobile Internet service (Pederaen, 2005), enterprise application integration (Khoumbati et al., 2006), Internet banking (Yiu et al., 2007) and data warehouse (Ramamurthy, et al., 2008).

A growing number of literature has noted that IT plays a vital role in enhancing the competitive advantage of organizations and industries (Fichman, 2004; Karakostas et al., 2005; Khoumbati et al., 2006; Yiu et al., 2007; Ramamurthy, et al., 2008). Given the characteristics regarding the technological innovation of USCM, this study attempts to add some academic contribution related to new IT adoption – USCM. This is because since the research on IT adoption has been conducted for the various information technology, little research has been executed to investigate factors affecting the adoption of USCM. Moreover, the use of ubiquitous computing in SCM represents a special case of technology adoption (Chopra and Sodhi, 2007; Singh and Cheng, 2007).

3 RESEARCH MODEL AND PROCEDURE

Various factors influence the adoption of USCM. Among them, it appears that the information technology tends to play a significant role for conducting supply chain transactions and facilitating the sharing of information and collaboration with suppliers and business partners (Subramani 2004, Rai et al. 2006, Nissen & Sengupta 2006, Singh et al. 2007). Particularly, the most successful applications of ubiquitous computing technologies are applied to supply chain areas for improving a company's competitiveness (Fish and Forrest 2006, Hackenbroich et al. 2006, Roussos 2006b, Singh 2007). In spite of the increasing applications of the ubiquitous computing technology on USCM, there is a lack of research concerning the factors related to the adoption of USCM in terms of management and technical aspects. Concerning this circumstance, we attempt to identify USCM success factors into

two groups, such as management factors and technical factors and then empirically investigate their relationship with the adoption of USCM.

The research procedure is as follows: Firstly, in order to discern the critical success factors and benefits of USCM adoption, we carried out a literature review, a case analysis and interviews. Secondly, we developed a measurement questionnaire and then elaborated it by executing interviews with academics and practical participants. The interview process helped us to identify problems in instrument items and revise them. Thirdly, with regards to the cost, time and possibility to collect reasonable survey data, this research collected empirical survey data by email survey for Korean participants. Fourthly, we dealt with an in-depth analysis for the relationship between critical success factors and USCM adoption benefits. Finally, according to current research findings, the conclusions and implications were presented in the conclusion.

4 EMPIRICAL ANALYSIS AND RESULTS

4.1 Research Procedure

This research sent survey questionnaires by email to 780 samples in Korea. A total of 152 marked questionnaires were received from Korean respondents. Among these, eleven questionnaires were unusable because of accuracy problem. Thus, the responses from 141 organizations in Korea were used for further analysis, representing a 19.03 percent response rate.

4.2 Validity and Reliability Tests

The validity and reliability of collected data is used to judge its quality for further analysis. According to the results of the factor analysis, it can be argued that critical success factors of management aspects have higher construct validity. This is because all factor loadings were above 0.4 and the percentage of variances was over 68%.

Through the factor analysis, we could identify 6 factors in Management Aspect. Factor 1 loaded on 9 items as provided and we labeled it as “USCM planning”. 8 items were loaded on Factor 2 and it may be categorized as “management support”. Factor 3 is comprised of 5 items, which may be called “relationship management”. Likewise Factor 4 and Factor 5 holds4 items each and they may be identified as “new USCM model” and “process management” respectively. Finally, factor 6 had loading on only 2 items of ‘organizational knowledge level for USCM’ and ‘risk management for USCM’. Therefore, these factors may be named as “risk management”. Table 1 summarizes the grouping results for the categorized 6 factors.

Group Name	Factors	
USCM Planning	-Development of a USCM strategy planning	-End-to-end process management
	-Trust building among business partners	-Cultural change management
	-High level of trust with suppliers and customers	-Cross-functional USCM planning
	-Offer of good U-supply chain service	-Cross-functional project team
	-Planning for long-term supply chain improvement	
Management Support	-Standardization of business and process	-Top management strong support
	-Right view of the top management for USCM	-Continuous investment in the new IT
	-CEO’s cooperative relationship with CIO	-Firm’s USCM environment awareness
	-Providing valuable information for a supplier	-Supplier performance management
Relationship Management	-Long-term relationship with suppliers	-Working experience of project participant
	-Strong cooperation with suppliers on USCM	-Adoption level for ubiquitous technology
	-Strategic alignment among supply chain participants	
New USCM Model	-Creation of a new source of profit	-New USCM model development
	-Innovative ideas of the management board	-Firms’ progressive image change

Process Management	-Entrepreneur spirit to enter into new business -Process design on the portability -Adoption of the payment model on convenience -User-oriented USCM adoption
Risk Management	-Organizational knowledge level for USCM -Risk management for USCM

Table 1. Group Results for Critical Success Factors of Management Aspect

In the same manner, we identified relevant factors for both Technical Aspect and USCM Adoption Benefits. Each construct revealed to have 6 factors and the summary results are presented in Table 2 and 3 respectively.

The six factors for Technical Aspect provide strong construct validity, as all factor loadings were above 0.4 and the explanatory power of the factors has exceeded 66%. More detailed explanations on the six categorized factors are as follows.

Group Name	Factors
USCM System Infrastructure	-Adoption of user-friendly USCM systems -Pursuit of technological stability -Successful connection to the existing systems -Convenient user interface -Accumulated systems development ability -Good network infrastructure -Adoption of USCM in a stable system infrastructure -Successful replacement of the existing system by USCM adoption -Ubiquitous technology price such as RFID tag, sensors, mobile device, PDA, etc. -Design of USCM systems with a long term view
USCM Technology Application	-CIO as a business innovator, not simple as technology manager -Selection of the best outsourcing provider for USCM system development -Utilization of the RFID technology -Optimal USCM network design -Adoption of suitable RFID technology -Adoption of the standardized security management -Project participant's broad skills across multiple dimensions in USCM -Periodical evaluation of supply chain networks -Continual improvement of USCM systems
Efficient USCM use	-Adoption of the standard client server method -System use efficiency improvements
USCM Network Foundation	-Industry-level databases on supplier performance -Interconnected supply chain network of firms -Standardisation for USCM -Consideration of customer information as the most important element
Enacted Technology Acceptance	-Enacted view of technology adoption -Inventory visibility -Full development of the technology throughout the whole supply chain
USCM Development Plan	-Adoption of USCM as a project -Gradual development of USCM

Table 2. Group Results for Critical Success Factors of Technical Aspect

The construct validity test on USCM adoption benefits was carried out for all of the measurement items. The construct validity for all items was confirmed. This is because all the items show evidence of their construct validity, with a factor loading over 0.4 and with an explained variance of over 67%. More detailed explanations on the six categorized factors are as follows.

Group Name	Factor

Competitive Advantage	-Increase collaboration with business partners -Improve supply-chain visibility -Enable competitiveness or strategic advantage -Enable more reliable demand forecast -Enable easier access to information related to the supplier -Link the ubiquitous technology into back-office legacy system -Enable better response to partners in the supply chain -Enable your organization to catch up with competitors -Establish real-time supply chain intelligence
Inventory Management	-Eliminate packing and shipping errors -Enable track and trace authentication -Improve data collection accuracy -Improve supplier relationships -Provide accurate inventory quantities and locations -Enable protection against business counterfeiting ot theft -Eliminate excess inventory by drawing on the latest data -Enhance customer responsiveness and satisfaction -Enhance logistics and transportation management
Increased Business Productivity	-Enhance employee productivity or business efficiency -Improve the way your organization conducts business -Eliminate a lot of the manual intervention
Reduced Logistics Cost	-Reduce logistics cost -Reduce procurement costs
Cost Savings	-Save money by avoiding the need to increase the work force -Cost savings in lost, stolen or wasted products
New Market Opportunity	-Enable the organization to create new market opportunities -Reduce stock-outs

Table 3. Group Results for USCM Adoption Benefits

To sum up, based on the reasonable construct validity observed, all items were used for reliability tests. The reliability tests on the six groups of management success factors of USCM adoption, the six groups of technical success factors of USCM adoption and the six groups of USCM adoption benefits were carried out. The reliability of each group factors is determined by Cronbach-α. Table 4 exhibits the results of the reliability test.

Division		Factors	No of items	Cronbach-α
Critical Success Factors	Management Aspect	USCM Planning	9	.904
		Management Support	8	.894
		Relationship Management	5	.846
		New USCM Model	4	.749
		Process Management	4	.792
		Risk Management	2	.697
	Technical Aspect	USCM System Infrastructure	10	.911
		USCM Technology Application	10	.902
		Efficient USCM use	2	.795
		USCM Network Foundation	4	.770
		Enacted Technology Acceptance	3	.774
		USCM Development Plan	2	.672
USCM Adoption Benefits		Competitive Advantage	9	.888
		Inventory Management	7	.893
		Increased Business Productivity	3	.727
		Reduced Logistics Cost	2	.825
		Cost Savings	2	.671
		New Market Opportunity	2	.261

Table 4. Reliability Analysis Result

As can be seen from the table 4, the coefficient alpha values of all the constructs, except the new market opportunity factor due to a low Cronbach-α value, are over 0.67, which satisfies the internal consistency of the instrument, with a coefficient of over 0.80 being indicated for many of the variables. Based on this result, all items except the new market opportunity factor were used for further investigation.

4.3 Empirical Study

A correlation analysis is conducted for examining the relationship between critical success factors and USCM adoption benefits. The results of a correlation analysis are summarized in Table 5.

Division	Factors	USCM Adoption Benefits				
		Competitive Advantage	Inventory Management	Increased Business Productivity	Reduced Logistics Cost	Cost Savings
Management Aspect	USCM Planning	0.273**	0.396**	0.302**	0.243**	0.215**
	Management Support	0.264**	0.264**	0.164*	0.161*	0.032
	Relationship Management	0.274**	0.247**	0.121	0.066	0.265**
	New USCM Model	0.189**	0.243**	0.119	0.210**	0.127
	Process Management	0.247**	0.273**	0.101	0.105	0.170**
	Risk Management	0.230**	0.189**	0.203**	0.190**	0.107
Technical Aspect	USCM System Infrastructure	0.186**	0.264**	0.244**	0.129*	0.085
	USCM Technology Application	0.224**	0.143*	0.113	0.095	0.211**
	Efficient USCM use	0.218**	0.092	0.199**	0.146*	0.075
	USCM Network Foundation	0.209**	0.121*	0.104	0.088	0.166*
	Enacted Technology Acceptance	0.261**	0.200**	0.066	0.095	0.067
	USCM Development Plan	0.148*	0.173**	0.180**	0.115	0.034

**: Significance level at < 0.01 *: Significance level at < 0.05

Table 5. Summary of Correlation Analysis Result

First, in the management aspect, as can be seen from Table 5, the results indicate that the competitive advantage of USCM adoption benefits were found to have a significant association with critical success factors including the USCM planning, management support, relationship management, the new USCM model, process management and risk management ($p < 0.01$). Moreover, from a technical aspect, the competitive advantage has a strong positive relationship with the USCM system infrastructure, the USCM technology application, the efficient USCM use, the USCM network foundation and the enacted technology acceptance at $p < 0.01$ as well as the USCM development plan at $p < 0.01$. It would therefore appear that the competitive advantage of USCM adoption in the Korean context tends to be facilitated by solid USCM planning, strong management support, close relationship management, new USCM model, efficiency process management and effective risk management in management aspect as well. The list also includes reliable USCM system infrastructure, broad USCM

technology application, productive USCM use, qualitative USCM network foundation, extended technology acceptance and wrought USCM development plan from a technical aspect.

USCM Adoption Benefits	Critical Success Factor	
	Management Aspect	Technical Aspect
Competitive Advantage	-USCM Planning -Management Support -Relationship Management -New USCM Model -Process Management -Risk Management	-USCM System Infrastructure -USCM Technology Application -Efficiency USCM Use -USCM Network Foundation -Enacted Technology Acceptance -USCM Development Plan

Table 6. Critical Success Factors Associated to Competitive Advantage

Second, the inventory management of USCM adoption benefit tends to be influenced by the USCM planning, the management support, the relationship management, the new USCM model, process management and risk management ($p < 0.01$) in the management aspect. Furthermore, the USCM adoption with the solid USCM system infrastructure ($p < 0.01$), the wide USCM technology application ($p < 0.05$), the qualitative USCM network foundation ($p < 0.05$), the enacted technology acceptance ($p < 0.01$) and the systematic USCM development plan ($p < 0.01$) tend to influence the inventory management of USCM adoption. To sum it up, it can be seen that the inventory management derived from USCM adoption is closely associated to both the management and technical factors.

USCM Adoption Benefits	Critical Success Factor	
	Management Aspect	Technical Aspect
Inventory Management	-USCM Planning -Management Support -Relationship Management -New USCM Model -Processs Management -Risk Management	-USCM System Infrastructure -USCM Technology Application -USCM Network Foundation -Enacted Technology Acceptance -USCM Development Plan

Table 7. Critical Success Factors Associated to Inventory Management

Third, the increased business productivity of USCM benefit would be affected by USCM planning ($p < 0.01$), risk management ($p < 0.01$) and management support ($p < 0.05$) in the management aspect. Moreover, the USCM system infrastructure, the efficient USCM use and the USCM development plan ($p < 0.01$) are related to the increased business productivity of USCM benefit. On the basis of this empirical result, we can see that if an organization wants to increase the business productivity of the supply chain, it would be required to focus on solid USCM planning, strong management support, careful risk management, stable USCM system infrastructure, efficient USCM use and valuable USCM development plan.

USCM Adoption Benefits	Critical Success Factor	
	Management Aspect	Technical Aspect
Increased Business Productivity	-USCM Planning -Management Support -Risk Management	-USCM System Infrastructure -Efficient USCM use -USCM Development Plan

Table 8. Critical Success Factors Associated to Business Productivity

Fourth, USCM planning ($p < 0.01$), new USCM model ($p < 0.01$), risk management ($p < 0.01$) and management support ($p < 0.05$) in the management aspect have a positive relationship with the reduced logistics cost of USCM benefit. From the technical aspect, the USCM system infrastructure ($p < 0.05$) and efficient USCM use ($p < 0.05$) are positively associated to the reduced logistics cost of USCM benefit. According to this result, it seems that logistic cost tends to associate with the USCM based on the solid USCM planning, strong management support and reliable risk management as well as the stable system foundation and efficient USCM use.

USCM Adoption Benefits	Critical Success Factor	
	Management Aspect	Technical Aspect
Reduced Logistics Cost	-USCM Planning -Management Support -New USCM Model -Risk Management	-USCM System Infrastructure -Efficiency USCM Use

Table 9. Critical Success Factors Associated to Reduced Logistics Cost

Finally, the cost savings of USCM adoption benefit is positively related to USCM planning, relationship management and process management at $p < 0.05$ in management aspect, whilst USCM technology application ($p < 0.01$) and USCM network foundation ($p < 0.05$) in the technical aspect were associated to the USCM cost savings. It would therefore appear that the cost saving benefit of USCM adoption tends to be influenced by USCM organization dealing with advanced USCM planning, beneficial relationship management with supplier, wastefulness process management, efficiency USCM technology application and qualitative USCM network foundation.

USCM Adoption Benefits	Critical Success Factor	
	Management Aspect	Technical Aspect
Cost Savings	-USCM Planning -Relationship Management -Process Management	-USCM Technology Application -USCM Network Foundation

Table 10. Critical Success Factors Associated to Cost Savings

5 CONCLUSION AND IMPLICATIONS

The following Table 11 condenses the results related to the relationships between critical success factors and USCM adoption benefits derived from Korean data.

Division	Factors	USCM Adoption Benefits				
		Competitive Advantage	Inventory Management	Business Productivity	Reduced Logistics Cost	Cost Savings
Management Aspect	USCM Planning	++	++	++	++	++
	Management Support	++	++	+	+	
	Relationship Management	++	++			++
	New USCM Model	++	++		++	
	Process Management	++	++			++
	Risk Management	++	++	++	++	
Technical Aspect	USCM System Infrastructure	++	++	++	+	
	USCM Technology Application	++	+			++
	Efficient USCM use	++		++	+	

	USCM Network Foundation	++	+			+
	Enacted Technology Acceptance	++	++			
	USCM Development Plan	+	++	++		

Table 11. Summary on Critical Success Factors and USCM Adoption Benefits

As shown in Table 11, the results indicate that the critical success factors including management and technical aspects were positively related to the USCM adoption benefits, particularly competitive advantage and inventory management. Based on the discussion so far, in summary, it can be argued that the Korean companies are more likely to adopt the USCM in order to gain competitive advantage and for effectively dealing with inventory management. In addition, it can be observed that among critical success factors from a management aspect, USCM planning is playing a crucial role in the successful adoption of USCM in the Korean ubiquitous computing context. On the other hand, with regards to technical success factors, the USCM system infrastructure was found to be one of the major factors which were closely associated to the USCM adoption benefit. According to research findings so far, it is reasonable to argue that the USCM planning among six management success factors and the USCM system infrastructure among six technical success factors have emerged as being the most important factors for adopting USCM successfully in a Korean context.

As can be seen from Table 11, the USCM adoption model derived from the Korean data consists of six management factors such as USCM planning, management support, relationship management, new USCM model, process management and risk management as well as six technical issues such as USCM system infrastructure, USCM technology application, efficient USCM use, USCM network foundation, enacted technology acceptance and USCM development plan. Moreover, the USCM adoption model includes five USCM adoption benefits such as competitive advantage, inventory management, business productivity, reduced logistics cost and cost savings. On the basis of the research findings, it is reasonably argued that the six management and six technical factors can be seen as major driving forces for USCM adoption in contemporary Korean USCM settings. Moreover, the Korean organizations tend to adopt the USCM to obtain the following benefits: competitive advantage, inventory management, business productivity, reduced logistics cost and cost saving.

In conclusion, the USCM adoption model presented in this research would be beneficial for both academics and practical areas, as it corresponds as a framework explaining the major issues relevant to the adoption of USCM. It is hoped that the USCM adoption model would be applied in other research and validated for its application within different ubiquitous computing contexts.

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