

Effectiveness and Efficiency of Information Technology and Information Systems in Supply Chain Management in Hong Kong

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Abstract

This study explored the effectiveness and efficiency of information technology (IT) and information systems (IS) in supply chain management (SCM) in Hong Kong firms.

The research model is comprised of three parts. The first part relates to the relationship among the three different functions of IT/IS utilized in a supply chain. The second part demonstrates to the relationship between IT/IS utilization and supply chain performance. The third part relates to relationship between organizational factors and different roles of IT/IS utilization. Several hypotheses have been set up for the model.

In the research, 36 measurement items extracted from literature to specify the characteristics of information systems utilized in supply chain management and structural relationship between these latent variables. Factor analysis, reliability test, correlation matrix, path analysis were used to analyze the data and model testing.

The results justify the acceptance of the proposed research model and some our hypotheses, they are, IT/IS for organizational value creation management has significant contribution to SCM performance. IT/IS for logistics operations and value creation management have significantly mutual influences each other. IT/IS for organizational infrastructure only influences the value creation management. In addition, they also confirm the contributions of IT/IS in SCM performance, and further this study develops and validates a measurement scale for IT/IS utilizations on SCM performance. The scale provides a preliminary foundation for facilitate research and in IT/IS utilizations in logistics operations in wider spectrums.

This research also empirically justifies that IT/IS for infrastructural support and logistics operations has indirect effects on SCM performance through value creation management. This gives an insight that IT/IS is fundamental for organizational value management, through value creation and growth, SCM performance, and further organizational performance can be enhanced. Finally, knowledge of IT/IS utilization and organizational factors can be contributed to their consideration and planning for IT/IS strategy and adoption.

Recommendations for further research and organizational IT/IS strategy are suggested based on these outcomes, such as supply chain integration, and consideration for implementation of IT/IS. IT/IS utilizations with strategic planning are believed to be more efficiency and effectiveness in SCM performances for the organizations.

Keywords: *Information Systems, Information Technology, Logistics, Supply Chain Management*

1. Introduction

1.1 General Background

Many firms today were effective management of logistics and supply chain activities both as a prerequisite to overall cost efficiency and as a key to ensuring their ability to competitively price their products and services. Information systems (IS) and information technology (IT) are being used by leading-edge firms to increase competitiveness and developed a sustainable competitive advantage [9]. Although capabilities relating to information systems and information technology have traditionally regarded also as key strategic resources, expertise in these areas is now thought to be among the most valuable and essential of all corporate resources.

In the previous studies, the introduction of information technology by a firm for integrated supply chain management could lead to better efficiency and effectiveness [21]. Integrated supply chain management utilizing information systems can enable the company to identify optimal inventory levels, reduce warehouse space, and increase inventory turnover [23][24][39]. Porter and Millar [33] suggested the utilization of IT has significant influence on the relationship among value chain activities and Porter and Millar believes that management of information systems focusing on cost reduction.

IS must have a potential to be a strategic weapons for improving supply chain management performances. In Hong Kong, a great numbers the companies focus on their efforts on value-added activities such as international marketing, product planning product R&D so on. Hong Kong companies also concerned about how information technology/information systems can enhance the competitiveness and efficiency of supply chain. [25]

This paper is organized as follows. First, previous research on the role of functional information systems for supply chain management is discussed. Next the characteristics of information systems utilized for supply chain management are identified, based on factor analysis of sample data from 71 of Hong Kong firms. Third, a conceptual model and hypotheses relating to utilization of information system and supply chain management (SCM) performance and tested using path analysis. A set of discussion and recommendations are explained and based on the results.

1.2 Objectives of study

The objectives of study are to 1) to test a research model of organizational factors with IT/IS utilization in SCM performance; 2) to develop recommendations for companies in Hong Kong to establish IT/IS utilization strategy for SCM performance; 3) to find out the critical factors of IT/IS in SCM; and 4) to establish the performance measurement criteria for using IT/IS in SCM.

2. Literature Review

2.1 Supply Chain Management

Supply Chain Management (SCM) deals with control of material and information flows, structural and infrastructural process relating to transformation of the materials into value added products and delivery of finished products through suitable channels to customers in order to maximize customer value and satisfaction. [34]. As Council of Logistics Management noted that: Logistics is that part of the supply chain process that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customers' requirements.[31] By Integration of internal functions within an organization (e.g. marketing, manufacturing, product design and development) and effectively linkage them between suppliers and customers, SCM can help to enhance competitive performances and meet the customers' requirements.[34] The benefits of SCM can be obtained through the information linkage among various supply chain activities utilizing information technology and construction of integrated supply chain information systems. [9]

2.2 Information Systems and its Roles in Supply Chain Management

Information systems in logistics and supply Chain can be defined as: an interacting structure of people, equipment and procedures that together make relevant, timely and accurate information available to logistics manager for purpose of planning and implementation and control. [29][41]

According to Computer Sciences Corporation [15], suggested that the highest priorities of critical current issue in information systems are on customers, productivity, and performances. These issues show that they can affect the use and function of information systems in SCM. Information systems were viewed as

providing infrastructural support to the value chain and having impact on competitiveness of products. Companies started to utilize information systems to directly influence the processes comprising the value chain [37] [45].

Earl [18] classified the scope of information technology into following categories according to whether information technology is widely used in the value chain or used for only information processing and whether it is applied for value creation or applied for connection of value chain activities: 1) Information Technology (IT) that automates or improves every activity; 2) IT is used for connecting each value activity 3) Information systems facilities support, management and implementation of value chain activities, and 4) Information systems optimize or adjust the connection of each value activity. Earl can be applicable to internal value chain, but also be extended to the company's supply chain.

Porter and Millar [33] suggested that utilization of IT has significant influence on the relationship among value chain activities as well as on the physical aspects of individual value chain activities. The following proposition can be made: 1) Competitiveness comes from creating customer value; 2) value creating activities are interdependent in the value chain 3) Firms can optimize or integrate their value chain through IT to improve their competitiveness and efficiency. Porter and Millar suggested that proper use of information minimize the costs while maximize the value, optimizing value chain activities and improve the efficiency.

From the work of Earl, Porter and Millar, the utilization of information systems shows the enhancement of competitiveness and improving efficiency in the value chain. To better understand the utilization of IS, the general research questions should be considered. How can IS applications support through information processing, value creation management for improving the value activities and logistics operation connection of activities? What are the performance measures for proving that IS influence in the supply chain? Porter and Millar believe that management of information systems focusing on cost reduction. The ability to pursue the cost reduction should be criterion of IS utilization.

2.3 Performance Measurement

Apart from the cost reduction, performance measures can be used to indicate the SCM performance in order to illustrate the IS utilization influence. According to University of Tennessee Logistics Survey[44], a list of measures varying degrees of utilization among companies. "Outbound Freight Cost", "Inventory Count Accuracy", "Order fill" are the highest three priorities for performance measures capturing on a regular basis within the company. Logistics Metrics suggested to use to measure the performances with Logistics Key performance indicators (LKPI). [20] The logistics Metric was divided into four categories: Finance (Cost), Productivity, Quality, Response Time.

2.4 Organizational Factors

The role of individual and organizational factors may also be played in the benefits of SCM. These Factors highlights the importance of organization's experience to implement information systems to enhance the competitive advantages and efficiency. [38] A creativity framework has been adapted from organizational literature will be used to illustrate the implementation effort of IS in the company. The individual and organizational characteristics used to improve the implementation of IS. [46] Amabile [1][2][3][4][5] conceptualizes individual creativity from the framework. The framework includes three major components – domain relevant skills (task knowledge), creativity (cognitive abilities) and task motivation (intrinsic and extrinsic). Intrinsic motivation is individual baseline attitude toward to the task and extrinsic motivation is individual perceptions of undertaking the task in a given instance. Organizational characteristics create the contextual influences that operates whole organization members to influence creativity. Organizational creativity is group of creativity influences such as leadership, reward, availability of information and so on. [46] Kartz and Allen [27] indicated that the importance of leadership and management is influenced on the interaction of other components of organization and acquisitions of resources. Another way to improve organizational creativity is through the structure and culture. [10][11][32]. More organic structure, lack of formalization and high levels of complexity establish an linkage between high level of organizational creativity.

2.5 IS in Supply Chain Management in Hong Kong

In Hong Kong, a great numbers the companies focus on their efforts on value-added activities such as international marketing, product planning product R&D so on. Hong Kong companies also concerned about how information technology/information systems can enhance the competitiveness and efficiency of supply chain.[9] In the meantime, Hong Kong SAR Government proposed the development of Digital Trade and Transportation Network (DTTN) for companies which provide a neutral e-platform and IS for facilitating information flow and service integration locally and globally.

In summary, influence of IS utilization (i.e. effectiveness and efficiency) can be shown through different roles of IS applications in supply chain value-creation management, logistics operation and infrastructural support through using different performance measures, such as financial and non-financial indicators.

3. Research Model, Hypothesis and Methodology

3.1 Research Model

The research model is comprised of three parts. The first part relates to the relationship among the three

different functions of IS utilized in a supply chain. The second part demonstrate to the relationship between IS utilization and supply chain performance. The third part related to relationship between organizational factors and different roles of IS utilization.

3.2 Hypothesis

This research model is derived from prior studies discussed in the literature review section [13][30][33]. Information systems for information processing provide the basis for establishing strategic competitive advantage. IS utilization makes it possible for achieving strategic competitive advantage. IS plays roles as infrastructural support for direct IS utilization in supply chain functions

H1: IS/IT utilization for infrastructural support has a direct influence on IS use for value creation management.

H2: IS/IT utilization for infrastructural support has a direct influence on IS use for logistics operation

Prior research on the process of supply chain integration illustrates show that internal integration with the company should precede external connection with suppliers and customers. [9] To identify the casual relationship between IS for values creation management and IS for logistics operation, we should consider the reciprocal relationships between two variables.

H3: IS/IT utilization for value creation management has a direct influence on IS use for logistical operation.

H4: IS/IT utilization for logistical operation has a direct influence on IS use for value creation management.

The pervious studies introduce the relationship between IS/IT utilization of IS/IT in value chain processes would eventually enhance the company's supply chain activities. [9][13][30][33] The focus of IS utilization should shift form information processing to value creation and value connection. The change of IS/IT utilization focus would make it possible for IS/IT utilization have a direct effect on supply chain competitiveness and efficiency.

H5: IS/IT utilization for value creation management has a direct influence on supply chain performance.

H6: IS/IT utilization for logistical operations has a direct influence on supply chain performance.

According to Legare [38], organizational factor is contributed to the implementation of IS/IT in order to enhance competitiveness and efficiency of work. Organizational factor is contributed by individual characteristics and organization characteristics within an organization[46]. So the following hypothesis can be assumed:

H7: Organizational factor for an organization has a direct influence on IS/IT infrastructural support.

H8: Organizational factor for an organization has a direct influence on IS/IT utilization for value creation management.

H9: Organizational factor for an organization has a direct influence on IS/IT utilization for logistics operations.

3.3 Research Methodology

3.3.1 Measurement

a. IS/IT utilization level

Based on prior research, [34] which classify logistics activities in integrated supply chain management and functional information systems for logistics management, 12 traditional uses for information systems in supply chain management were identified: plant and warehouse location selection, order processing, resource management, production plan and process control, inventory and warehouse management, distribution and transportation management, sales and price management, consumer service and customer management, and forecasting. network planning and design system, office information system, and accounting information system.

b. SCM Performance Measurement

The approach to measuring SCM performance has been used by previous researchers [9][20]. Measures [8][20][43][47] consisted of cost reduction, cycle time reduction, on-time delivery of materials from suppliers and customers, product quality, response time for customers and suppliers, the speed of suppliers' order processing, the reduction degree of response time of suppliers and customers, the accuracy of order processing for customers, the speed of order handling, and perfect order fulfillment.

c. Organizational Factors

The measurement based on the vision, sense of business urgency, authority and responsibility, reward, skill knowledge, cognitive abilities, motivation, resources, structure and culture [38][46]. Knowledge, cognitive abilities, motivation are items for individual while resources, structure and culture are the items for organization.

3.3.2 Questionnaire Design

The questionnaire is composed with two parts. In part I, it consists of three general questions. First, respondents were asked to whether they have experience of using information systems in logistics before. Secondly, respondents would answer the current business type for their company. Finally, the position the respondents are. In Part II, it consist of 36 measurement items that used to measure the extent to which items described are information systems application, organizational issue and supply chain management performance. The scale ranges from Strong Disagree (1) to Strongly Agree (7). Respondents are needed to rank them.

3.3.3 Sampling

Target Corporations to be sampled were large and small-medium corporations which can carry out or provide value-added activities in a supply chain to other company in Hong Kong. The data were collected through questionnaires sent to supply chain managers. In order to raise the reliability of measurement, respondents will be requested to consult with others in

the SCM department or functional executives to answer the questions.

The group of respondents is from randomly selected the companies under web directory and company directory in Hong Kong Trade Development Council's official website.

3.3.4 Data Collection

For the replied respondents, 72 copies of paper questionnaire have been collected in the total of 200 copies of distribution (36% response rate), 1 of them were invalid due to missing data contained (35.5% useable response rate), so that sample size of respondent was 71.

4. Research Findings

4.1 Descriptive Analysis

Of the 71 questionnaires from the respondents' company, all of them had experience to use information systems applications in logistics. In current business type, A quarter (25 %) of them was logistics service providers, 22.5% of them were distribution and transportation, nearly 20 % of them are retailers. In the current position of respondents, nearly half of them (49.3%) are information technology or information systems manager, and while nearly 41% of them are operation managers. Less than 10% of them are general manager. Neither of them are Chairman nor Chief Executive Officer. In Organizational factors, Authority, responsibility and policies have a higher means in the factors. In SCM performance, Perfect Order Fulfillment, Accuracy of order processing, and reduction of response time from customers have a higher means in the factors.

4.2 Factor Analysis

Factor analysis by Varimax rotation was used to assess the constructs of 12 measured degrees of functional IS utilizations. The eigenvalues and the cumulative variance were shown in Table 1. According to Bryman and Cramer, factors that have eigenvalues greater than one were selected and extracted for further analysis. As a result 3 factors were extracted, with 68.417% of total variance.

All 12 variables were found to be loaded on one of 3 factors with factor loading greater than 0.5 which is consider significant.

The 12 functions identified can be divided into 3 major utilization areas. The detail discussion about classification of characteristics of IS for supply chain management will be founded in the discussion part.

Table 1: Convergence/divergence of extracted factors

	Components (Extracted Factors)		
	1	2	3
Distribution and transportation management.	.904		
Resource management	.870		
Forecasting	.848		

Order processing	.810		
Plant and warehouse	.707		
Accounting		.895	
Networking planning and design system		.827	
Office management		.784	
Sales and price management			.743
Inventory and warehouse management			.722
Service and customer management			.703
Production plan and process control			.650
Cronbach Alpha	0.8991	0.8149	0.7299
Eigenevalue	4.357	2.414	1.439
Cumulative variance %	36.309	56.428	68.417

4.3. Reliability

The reliability test result shows that the alphas of factor 1 to 3 are already greater than the reliability ratio (0.7)

4.4 Path Analysis

The multiple regression analysis technique was used to model the interrelationship among the latent variables. The R^2 were shown in Table 2.

Table 2: Path coefficients of all variables

Variables	IS for Infrastructural Support	IS for Value Creation Management	IS for Logistics Operations	SCM Performance
Organizational Factors	1.868x10 ⁻²	0.199	-2.756x10 ⁻²	0.445*
IS for Infrastructural Support	---	0.227*	-3.422x10 ⁻³	0.445*
IS for Value Creation Management	---	---	0.448*	0.445*
IS for Logistics Operations	---	0.333*	---	0.445*
R ²	0.00	0.260	0.180	0.180

P < 0.05

To conclude, the organizational factors do not have a significant direct effect on the IS for Infrastructural support, Value Creation Management, and Logistics Operations respectively. IS for Infrastructural support has a significant direct effect on the IS for Value Creation Management. IS for Value Creation Management has a significant direct effect on the IS for Logistics Operations and SCM Performance. IS for Logistics Operations has a significant effect on the IS for Value Creation Management.

After that, the total effect of each variable was calculated by sum of the direct effect and indirect effect

of variables. So total effect of IS for Value Creation Management was 0.560 (0.227+0.333 = 0.560). The total effect of IS for Logistics Operations was 0.550 (0.448+ 0.448 x 0.227=0.555). The total effect of SCM performance was 0.694 (0.445 + 0.227 x 0.445 + 0.333x 0.445 = 0.6942).

5. Discussion and Implications

5.1 Discussion

a. The classification of the characteristics of IS utilized for supply chain management

The 12 functions identified can be divided into 3 major utilization areas. The first is the IS/IT utilization for logistics operations that focuses on the connection among value chain activities within and outside of a corporation (plant/warehouse location, resource management, order processing, distribution and transportation management, and forecasting). The second is IS/IT utilization for value creation management that focus on automation and improvement of the physical aspects of individual value chain activities (product/process control, inventory/warehouse management, sales/price management, and consumer service/customer management). The third is the IS/IT utilization for infrastructural support which provides infrastructural foundation for the effective operation of value chain activities (network planning/design system, office information system, accounting information system).

The above classification into 3 clusters of utilization areas has validity in light of the previous studies on the classification of logistics activities and information systems for logistics management [6][9][14][22][31][36][41]. The functional information systems comprising the same factor has high-level factor loadings on the factor, thus a high validity.

The result from the research model confirms H1, H3, H4, H5, but do not lend support for H2, H6, H7, H8 and H9.

b. IS/IT for infrastructural support

First, IS/IT for infrastructural support does not have a direct effect on SCM performance. However IS/IT utilization for infrastructural support has a direct effect on IS/IT utilization for value creation management, and IS utilization for value creation management has a direct effect on supply chain management performance. This means that IS/IT utilization for infrastructural support may play an indirect effect in enhancing supply chain management performance through IS/IT utilization for value creation management. The validity So it can be served as the foundations for IS/IT utilization for infrastructural support provides the basis for establishing strategic linkages that direct IS/IT application to value chain activities which can help increase the supply chain performance and consequently gain competitive advantage [13][17][18][33]

c. IS/IT for value creation management

Second, It is about the structural relationship among the three IS/IT latent variables showing IS/IT

utilization in a supply chain. The paths that are statistically significant indicating the structural relationship: infrastructural support → value creation management → logistics operations. This implies that IS for infrastructural support enhances the utilization level of IS for value creation management brings about use of IS/IT for logistics operations. The result shows that IS utilization for value creation management is a precondition for the utilization of IS/IT for logistics operations. In other words, IS/IT utilization for value creation management should be established in order to make sure that utilization of IS for logistics operations work properly. This coincides with the previous studies, which emphasize that improvements of each internal function should precede the external connection with suppliers and customers, IS/IT utilization strategy should be step by step in the processes [9][12][40].

d. IS/IT for logistics operations

Thirdly, the relationship between use of IS/IT for logistics operations and supply chain management performance. The result shows that the path coefficient is not statistically significant. This can suggest that benefits of IS/IT for logistics operations on supply chain management performance are not supported in the study sample. Partial explanation for this result was shown in the previous studies. The majority of the items related to aspect of supply chain over which the logistics function does not exercise direct control. Another explanation could be that IS/IT utilization for logistics operations and its influence could be related to the firm's stage of supply chain integration. That means it can be speculated that IS/IT utilization for logistics operations is more beneficial in firms that are pursuing external integration than in firms that are pursuing internal integration [40].

Fourth, the relationship between utilization of IS/IT for logistics operations and IS/IT for value creation management. The relationship was not shown in the previous studies, especially utilization of IS for logistics operations → IS for value creation management. The path coefficient is statistically significant on these utilizations. This situation can be explained that the logistics operations in several areas such as order processing, resource management, distribution management which can support the IS/IT for value creation management. Functional support of logistics operations serve as a factor for value creation management such as inventory and sales which give provide the value-added service to customers. The recursive relationship between utilization of IS/IT for logistics operations and IS/IT for value creation management shows that the both functions of IS should not be ignored in the supply chain activities and well-established in order to utilize both functions. Although the relationship between use of IS for logistics operations and supply chain management performance is not valid, IS/IT for logistics operations can be served as an indirect effect on supply chain performance, so the logistics operations have some degrees of effect of the performance such as time and costs.

e. Organizational Factors

Finally, the relationship of organizational factors with IS utilization of infrastructural support, IS for value creation management and IS for logistics operations. There are no statistically significant effects on these IS utilizations. Some reasons can be explained in the following:

First of all, the respondents were mainly small and medium enterprises in Hong Kong. The size and structure of the organization are small. The functions of IS and IT are limited for their current business. Functions of IS and IT can be accepted if the sales and revenues can be generated and recover the revenue. The functions and scope of IS and IT are limited due to size of organization and amount of investments. A small group of staff are responsible for all functions in the business. Organizational factors, such as leadership, motivation, policies, skills and knowledge may not fully be utilized and concerned by top managements in the companies.

Secondly, the respondents are from different business in Hong Kong, and from the descriptive analysis, there is no dominated business groups in the study, so that no clear dominated organizational factors can be found in the study. This may minimize the effect of organizational factors to different functions of IS utilization.

f. SCM Performance

From data analysis, respondents mainly concern about supply chain performance. Perfect order fulfillment, accuracy, reduction of response time have a higher ranking which mainly concerned by the management in the company. The major concerns for the company are customer-orientated measurement.

To conclude, the companies mainly concern about customer orientated performance measurement because customers are sources of generating revenue and sales. Because of limited customer resources for small and medium enterprises, if they lose the customers, they suffer the loss on sales and profits. This can motivate them to provide an excellent customer services with IS utilizations to gain their competitive advantages.

5.2 Implications

First of all, this research develops and validates a measurement scale for SCM performance on IS utilization in Hong Kong enterprises. This scale will give a preliminary foundation for facilitating research and analysis on SCM performance in Hong Kong, and examines its casual relationship and its effect on SCM performances. Research model adapted by previous studies will enrich current findings and clarify the IS influences on SCM performances thus enabling the further studies and theory development.

Secondly, this research provides empirically justified studies so that Hong Kong companies can understand that IS utilization are likely effect on SCM performance. From result of data analysis, IS/IT for infrastructural support and logistics operation has an indirect effect on SCM performance through value creation management while value creation management

has a direct effect on SCM performance. This gives an insight that IS value creation management is supported by infrastructural support and logistics operation in IS/IT functions and in order to provide an improved SCM performances.

Finally, knowledge of IS/IT utilization and organizational factors can be contributed to their consideration and planning for IS/IT strategy and adoption. IS strategy requires system preparations in term of gathering information about supply chain processes organization, environments, user and customers requirements [17]. Through these processes, company can understand the user requirements and customer requirements on IS/IT functions in order to full utilized the systems and improve SCM performances, i.e. efficiency and effectiveness of supply chain activities.

6. Recommendations

6.1 Supply chain integration

In order to full utilization of information systems in the supply chain management, top management should consider development of integration of supply chain. The existing study on supply chain management emphasize that supply chain integration should be accomplished sequentially from internal integration to external integration. [40]. In the sense, Stevens presents the integration process of supply chain management comprehensively starting with integration of related function to internal integration and on to external integration. Internal Integration is characterized by fully system visibility with a focus on tactical rather than strategic issues and emphasis on efficiency rather effectiveness. External Integration is characterized by completely sharing information on products, processes and specification changes; technology exchange and design support; a focus on strategic rather than tactical issues and long term planning. Management should have operational, tactical and strategic issue in the processes and IT development.

6.2 Continuous support on IS/IT development

Government and SMEs should cooperate together for continuous development of IT/IS in Hong Kong. According, to Hong Kong Logistics Council, Digital Trade and Transportation Network study completed in December 2002 confirmed the strategic value of the initiative and the importance of jump-starting the project so as to enhance HK's competitiveness as an international logistics hub. It is kind of e-platform for logistics system to facilitate information flow and sharing amongst the trade and logistics industry stakeholders. These features can be suggested to implement through Digital Trade and Transportation Network in Hong Kong for SMEs provided by Hong Kong SAR Government. This can increase the efficiency and effectiveness of processes and organization, which can enhance the competitiveness, and SCM performance of the company.

6.3 Considerations of implementing the IS utilization

The utilization of IS can actually have an effect on SCM performance, but how can we make sure that IS can be fully utilized? The several suggestions can be raised as consideration before implementing IS utilization which fulfill the organizational requirements and performance requirements.[16]

- a. It is important to have a scientific as well as an intuitive understanding of customer and supplier requirements, as well as all supply chain participants. Information systems and technology should be flexible and adaptable, depending on specific sets of needs.
- b. It is important to see that logistics organizational strategies move from a functional to a process orientation. Emphasis on the latter assures a more meaningful measurement of relevant processes and assures more timely and accurate process feedback and process knowledge.
- c. It is necessary for firms to create opportunities for interaction and team efforts among logistics managers and those others most knowledgeable about information technologies. Logistics managers need to know more information systems and information specialists must develop greater insight in to types of problems faced on the daily basis involved in managing in the logistics process.
- d. Financial resources are needed to assure a smooth, full implementation. The employees' cooperation and make use the systems also are very critical.

7. Conclusion

This research also empirically justifies that IT/IS for infrastructural support and logistics operations has indirect effects on SCM performance through value creation management. This gives an insight that IT/IS is fundamental for organizational value management, through value creation and growth, SCM performance, and further organizational performance can be enhanced. Finally, knowledge of IT/IS utilization and organizational factors can be contributed to their consideration and planning for IT/IS strategy and adoption.

Recommendations for further research and organizational IT/IS strategy are suggested based on these outcomes, such as supply chain integration, and consideration for implementation of IT/IS. IT/IS utilizations with strategic planning is believed to be more efficiency and effectiveness in SCM performances for the organizations.

References

- [1]Amabile, T.M (1979) "Effects of External Evaluation on Artistic Creativity", *Journal of Personality*, Society of Psychology, Vol. 37, pg 221-233
- [2]Amabile, T.M (1983). *The Social Psychology of Creativity*. New York, Springer-Verlag.
- [3]Amabile, T.M.(1988) "A model of creativity and innovation in organizations." *Res. Organ. Behav.*, 10:123-167
- [4]Amabile, T M (1990) "Within you, within you: the social

- psychology of creativity and beyond." In M.A. Runco and R.S. Albert (Eds.), *Theories of Creativity*, Newbury Park, CA: Sage, pp.61-91
- [5]Amabile, T.M. (1996), *Creativity in Context*, Boulder, CO: Westview Press, Inc.
- [6]Ballou Ronald. A (1985), *Business Logistics Management*, Prentice Hall, Englewood Cliffs, N.J.
- [7]Baroudi, J.J., and Orlikowski, W.J. "A short-Form Measure of User Information Satisfaction: A Psychometric Evaluation and Notes on Use," *Journal of Management Information Systems*, vol.4, no. 4, 1998, pg. 50
- [8]Birou, Laura M., Stanley E. Fawcett, and Gregory M. Magan (1998), "The Product Life Cycle: A Tool for Functional Strategic Alignment," *Internal Journal of Purchasing and Material Management*, Vol.34, No.2, pg. 37-51
- [9]Bowersox, Donald J and Patricia J Daugherty (1995), "Logistics Paradigm: The Impact of Information Technology", *Journal of Business Logistics*, Oak Brook, Vol. 16, No 1; pg. 65-80
- [10] Burgelman, R (1983). "A model of interaction of strategic behavior, corporate context, and the concept of strategy". *Academic Management Review*, 3(10), 61-69
- [11] Burgelman, R. (1984), "Designs for corporate entrepreneurship in established firms." *California Management Review*, 26, Spring 154-166.
- [12]Byrne, Patrick M. and William J. Markham (1991), *Improving Quality and Productivity in the Logistics Processes: Achieving Customer Satisfaction Breakthroughs*, Oak Brook, IL: Council of Logistics Management.
- [13]Closs, David J. (1994), *Positioning Information in Logistics: The Logistics Handbook*, New York: The Free Press, pg. 699-713
- [14]Cooper, Marath C. Lisa M. Ellram (1993), "Characteristics of Supply Chain Management and Implications for Purchase and Logistics Strategy," *The International Journal of Logistics Management*, Vol. 4, No. 2 pg. 13-22
- [15]Computer Sciences Corporation (2000), *13th Annual Critical Issue of Information Systems Management Survey*, Computer Sciences Corporation, Cambridge, Mass.
- [16]Coyle, John J., Edward J. Bardi and C. John Langley, Jr.(2002), *The Management of Business Logistics: A Supply Chain Perspectives*, SouthWestern Thomson Learning, Mason, OH.
- [17]Daugherty, Patricia J. (1994), *Strategic Information Linkage: The Logistics Handbook*, New York: The Free Press, pp. 757-769.
- [18]Earl Michael J. (1989), *Management Strategies for Information Technology*, Prentice Hall, Englewood Cliffs, N.J.
- [19]Ellram, Lisa M. (1992), "Partner in International Alliances," *Journal of Business Logistics*, Vol.13, No.1, pg. 1-25.
- [20]Frazelle Edward J. (2002), *Supply Chain Strategy: the Logistics of Supply Chain Management*, McGraw-Hill, New York
- [21]Goldhar, Joe D. and David Lei (1991), "The Shape of Twenty-First Century Global Manufacturing," *The Journal of Business Strategy*, Vol. 12, No.2, pg. 37-41
- [22] Gustin, Craig M. (1994), *Distribution Information System: The Distribution Management Handbook*, New York: McGraw-Hill.
- [23]Kaeli, James K (1990), "A Company wide perspective to Identify, Evaluate, and Rank the Potential for CIM," *Industrial Engineering*, Vol. 22, No.7, pg. 23-26
- [24]Kaplan, Robert S. (1986), "Must CIM be Justified by Faith Alone?" *Harvard Business Review*, Vol 64. No.2 pg. 27-29
- [25]Lee, Humphrey Y H (2000) "Manufacturing Support for Hong Kong Manufacturing Industries in Southern China", *Journal of Supply Chain Management*, Tempe, Vol. 36, No. 1, pg. 35-44
- [26]Lummus, Rhonda R., Robert J. Vokurka, and Karen L. Alber (1998), "Strategic Supply Chain Planning," *Production and Inventory Management Journal*, Vol. 39, No.3, pg. 49-58
- [27]Kartz, R and Allen T.J. (1985) "Project performance and locus of influence in the R&D matrix", *Academic Management Journal* Vol.28 pg 67-87
- [28] Keebler J S, K.B. Manrodt, D. A. Durtsche, and D.M. Ledyard (1999), "Keep Score", Oak Brook, Council of Logistics Management, pg. 4-10
- [29]Philip Kotler (1986), *Principles of Marketing*, Prentice Hall, Englewood Cliffs, N.J. pg. 87
- [30] McFarlan, F. Warren and James L. McKenney (1984), "Information Technology Changes the Way you Compete," *Harvard Business Review*, Vol. 62, No.5 pg 98-103
- [31] Mentzer John T, William DeWitt; James S Keebler, Soonhong Min, et al (2001), "Defining supply chain management", *Journal of Business Logistics*, Oak Brook, Vol. 22, No.2; pg. 1-26
- [32]Nislen, R Peters, M., and Hisrich, R. (1985). "Intrapreneurship strategy for internal markets – corporate, non-profit and government institution case" *Strategic Management Journal*, 6, 181-189
- [33]Porter, Michael E. and Victor E. Millar (1985), "How Information Gives You Competitive Advantage," *Harvard Business Review*, Vol. 63, No. 4, pp. 149-160.
- [34] Ram Narasimhan and Soo Wook Kim (2001), "Information System Utilization Strategy for Supply Chain integration" *Journal of Business Logistics*, Oak Brook, Vol. 22, No.2; pg. 51-75
- [35] Mentzer, John T. ,Camille P Schuster and David J. Roberts (1990), "Microcomputer Versus Mainframe Usage in Logistics," *Logistics and Transportation Review*, Vol. 26, No. 2, pp.115-132.
- [36] Robeson, James R. and Robert G. House (1985), *The Distribution Handbook*, New York: Free Press; London: Collier Macmillan Publishers.
- [37]Rushton, Alan and John Oxley (1994), *Handbook of Logistics and Distribution Management*, Kogan Page Ltd., pg. 248-249.
- [38]Thomas L. Legare (2002), "The Role of Organizational Factors in Realizing ERP Benefits", *Information Systems Management*, Vol 19 No. 4, pg. 21-42
- [39]Shull, Duane H. (1987), "migrating Toward CIM", *Control Engineering*, Vol.34 (May), pg. 161-164.
- [40]Stevens, Graham C (1989), "Integrating the Supply Chain," *International Journal of Physical Distribution and Material Management*, Vol. 19, No.8, pg. 3-8
- [41]Stenger, Alan J (1986) "Information Systems in Logistics Management: Past, Present and Future," *Transportation Journal*, Vol. 26 No.1 pg. 65-82
- [42]Sullivan Jr., Cornelius H (1985), "System Planning in Information Age," *Sloan Management Review*, Vol. 26, No.2 pg. 3-11.
- [43]Tan, Keah C., Vijay R. Kannan, and Robert B. Handheld (1998), "Supply Chain Management: Supplier Performance and Firm Performance," *International Journal of Purchasing and Materials Management*, Vol. 34, No. 3, pg. 2-9.
- [44]University of Tennessee (1998), "University of Tennessee Logistics Survey", Council of Logistics Management
- [45]Williams, Lisa R., Avril Nibbs, Dimples Irby, and Terence Finley (1997), "Logistics Integration: The Effect of Information Technology, Team Composition, and Corporate Competitive Positioning," *Journal of Business Logistics*, Vol. 18, No. 2, pg. 31-41.
- [46]Woodman, R.W., Sawyer, J.E., and Griffin, R.W. (1993)

“Toward a theory of creativity”, Academic Management Review, Vol. 18, pg 293-32

[47]Zaheer, Akbar, Bill McEvily, and Vincenzo Perrone (1998),
“ The Strategic Value of Buyer-Supplier Relationships,”
International Journal of Purchasing and Materials