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Supply Chain Management with ICT support at Jammu Based SMEs

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Abstract

The crux of any business lies in its ability to manage its Supply Chain effectively. In today's global business context, firms that can streamline their Supply Chain and churn out finished products faster will undoubtedly benefit the most. Unfortunately in India, most manufacturers are faced by hurdles of inefficiencies. While some of them are external, most of them are internal and can be addressed with the help of technology. In Indian SMEs, experience in Supply Chain Management is generally lacking. This phenomenon has particular relevance in the SME sector, which is being forced to perform or perish in the face of global competition. SMEs need to develop the tools, techniques and training products that help companies to adapt and achieve viability. They need to focus on linkages by which SMEs can integrate themselves in the Supply Chains of large enterprises. SMEs must use technology-based tools in such a manner that they become the technology sources for larger companies. Having said that, it is not about using the highest technology or the most sophisticated techniques alone, SMEs need to concentrate on the fundamental principles of being a good supplier or distributor. To incorporate Supply Chain Management, SMEs need to concentrate on assessing the technology requirements for improvement in processes and management practices. The objective of every Supply Chain is to maximize the overall value generated by an enterprise. It consists of all stages involved - directly or indirectly - in fulfilling a customer's request. The management of an enterprise often finds itself caught between customers' mounting demands and the company's need for growth and profitability. Hence, Supply Chain Management (SCM) is an art as well as a science that involves the management of flow between and among stages in a Supply Chain to maximize profitability. The present paper highlights the comparative study of the Performance Factors as regards to ICT-SCM for SMEs' and the present scenario in J&K based units. The comparison has been made on the primary as well as secondary data available from various sources. This paper presents a thought provoking opinion that the need of the hour is to realize the importance of use of ICT in Supply Chain Management and to develop solutions best suited for a particular enterprise. This is to say that the ICT-Supply Chain Management is all about how you work today for your tomorrow.

Key words: phenomenon, SMEs, customers', enterprise, Supply Chain, manufacturers

Introduction

Rapid advancements in information and communication technology (ICT) in recent years, coupled with the collapse of entry-to-market and other trading barriers, have changed significantly the way organizations operate in terms of business model and operating scale (Ritchie & Brindley, 2002). Globalization, lead-time reduction, customer orientation, and outsourcing are some major changes contributing to an increasing interest in advanced logistics services and global Supply Chain Management (Hertz & Alfredsson, 2003). Successful global logistics depends heavily on communication and transportation. Improved communication between different business partners through the use and sharing of real-time information facilitates the logistics of production and inventory over wider geographic areas. Efficient transport arrangement, such as volume consolidation and cross docking, makes possible the actual transactions between nodes (Bookbinder, 2005). Owing to the increased levels of resource requirement, complexity, and risk in running global logistics, many firms tend to outsource their logistics operations to third-party logistics (3PL) providers and focus on their core businesses. Successful management of global supply chains therefore requires radical changes in supply chain structure, business processes, and relationships with business partners particularly logistics service providers.

Traditionally, supply chain is relatively linear in structure. A typical manufacturing supply chain

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involves a few tiers of suppliers, the manufacturer (the focal company), a few tiers of distributors (including wholesalers and retailers), and finally the end customers.

Materials mainly flow from upstream to downstream (i.e., from suppliers to end customers) with a small reverse flow of returns while information tends to flow in both directions. Transportation is provided either in-house by the various parties separately or outsourced to different 3PL providers (see for example Ballou, 2004; Bowersox, Closs & Cooper, 2002; Chopra & Meindl, 2007; Coyle, Bardi & Langley Jr., 2003; Wisner, Leong & Tan, 2005). With globalization and disintermediation as a result of advancement in ICT, the linear supply chain model and the associated uncoordinated logistics operations can no longer meet the demand of customers for higher efficiency, shorter lead time, and wider geographic coverage. Supply chain tends to become networked (Figure-2) with the focal company as the hub and a major 3PL provider looking after the logistics operations of the whole supply chain for the focal company in different regions (Ritchie & Brindley, 2002; Simchi-Levi, Kaminsky & Simchi-Levi, 2008; Waters, 2003).

Objectives

Even though a solid foundation of supply chain research exists (Chandra and Kumar, 2000; Levy and Grewal, 2000; Mentzer, Dewit, Keebler, Min, Nix, Smith and Zacharia, 2001; Lambert, Cooper, and Pagh, 1998; and Croxton, Garcia-Dastugue, Lambert, and Rodgers, 2001) there is inconsistent evidence that any of the Supply Chain Management research can be effectively integrated into industry practice or provide sustainable performance improvements (Moberg, Speh, and Freese, 2003). Since it is estimated that poor coordination between the supply chain participants in the U.S. food industry is wasting $30 billion annually (Fisher, 1997), it becomes clear that an analysis of the supply chains is of interest. It then becomes important to analyze the degree to which this industry is contributing to the waste. Salin's (2000) research is to seek whether or not sustainable process improvements by Supply Chain Integration has been realized in the US food industry. More specifically, the objective of the research is to assess the impact of internet technologies on the industry's supply chain. In order to meet this objective, the following propositions are proposed:

H_1: Perceived usefulness is positively related to user satisfaction with ICT usage in SCM.

H_2: Perceived ease of use is positively related to user satisfaction with ICT usage in SCM.

H_3: Training is positively related to user satisfaction with ICT usage in SCM.

H_4: Computer anxiety is negatively related to user satisfaction with ICT usage in SCM.

H_5: Computer self-efficacy is positively related to user satisfaction with ICT usage in SCM.

Research methodology

Model Factors

User satisfaction is an important indicator of the success of an information system. DeLone and McLean (1992) evaluate this through six indicators: the quality of the system, the quality of the information, the system usage, user satisfaction, individual influences, and organizational influences.

In 2003 DeLone and McLean reviewed the successful information system models that were implemented during the intervening decade, and reasserted that successful information systems are those that promote user working performance and efficiency. The parameters used to directly evaluate the success of information systems include the promotion of cost-effectiveness, productivity, accuracy of decision making, and competitive advantage. However, at the time of the present study, the application of ICT in SCM in Jammu based SMEs is/was still in its infancy, and data related to these parameters were difficult to acquire; thus, user satisfaction was chosen as an index to evaluate the success of a SCM with ICT usage. Indeed, this is consistent with many studies assessing the success of information systems based on user satisfaction Whitten, 2004).

Acceptance behavior is considered to be influenced by a variety of factors, including individual differences, social influences, beliefs and attitudes, situational influences, and managerial interventions (Agarwal, 2000). The subjects in the present study were suppliers, with the focus on the individual user level. Individual user's differences may influence user evaluations of a ICT-SCM in this environment. Moreover, because the ICT usage in SCM is/was in the introductory stage, system characteristics such as functions and interfaces had significant effects on user satisfaction. Training performances was another possible influencing factor due to the users having been trained by the ICT-SCM software provider. This study therefore investigated the factors influencing user satisfaction in three dimensions: system, individual differences and training. The system dimension includes the perceived ease of use and perceived usefulness, and the factors of individual differences include computer self-efficacy and computer anxiety.

Instrument

The survey questionnaire contained two parts: (1) general demographic questions, and (2) perceptual scales of each construct in the research model. The demographic questions were used to collect information about the respondent's sex, age, level of

education, working experience, previous experiences of using computers and the Internet, and similar experiences of applying other information systems. To investigate the factors that may affect supplier satisfaction with a ICT usage in SCM, the respondents were asked to indicate their degree of agreement with 42 statements and the user satisfaction was measured by 4 items (Table-2). The six constructs other than computer self-efficacy were scored on a 7-point Likert scale ranging from strongly disagree (=1) to strongly agree (=7). Computer self-efficacy was measured on a percentage scale comprising 10 increments, ranging from 0% (not at all confident) to 100% (totally confident).

Data collection and sample analysis

Table 1: Demographic Characteristics of the Samples

Characteristic	Category	Frequency (%age)
Age (in years)		
21-30	62	42.5
31-35	42	28.8
36-40	19	13.0
41-45	16	11.0
>45	7	4.8
Level of education		
Matriculation	20	13.7
Hr. Sec. Part-II	71	48.6
Graduation	53	36.3
Masters Degree	3	2.1
Working experience (in years)		
1	28	19.0
2	43	29.3
3	31	21.1
4	17	11.6
5	8	5.4
6	20	13.6
Experience of computer (in years)	1	8
5.4		
2-3	11	7.5
3-4	27	18.4
4-5	42	28.6
>5	59	40.1
Experience of using internet (in years)	1	2
1.4		
2-3	7	4.8
3-4	25	17.0
4-5	44	29.9
>5	43	29.3
Position/Job heiratchy		
Manager	18	14.17
Junior Manager	17	13.39
Managing Director	7	5.51
Clerical Staff	37	29.13
Computer Skilled Staff	8	6.30
Engineering Staff	7	5.51
Other Employee	33	25.98

The sample vendors of this study were manufacturers of varied products and were located in the industrial hubs of Jammu. The paper-based questionnaires were distributed to 450 representatives of the suppliers, in which ICT presence was felt only in 164 units, representing the response rate of ICT based units at 36.44% and also out of these responses 14 questionnaires were discarded due to the presence of many missing values, hence 150 completed questionnaires were used in statistical analyses, representing a response rate of 91.46% for ICT based units.

Table 1 lists the demographic statistics of the sample. Among the 150 respondents, most of them (n = 104, 71.3%) were between 21 and 35 years old. The majority (n = 124, 84.9%) were educated to the Bachelors' Degree Level, and had worked for 1–3 years (n = 118, 69.4%). Most of them (n = 131, 87.1%) had used computers for at least 5 years, and had at least 5 years of experience using the Internet (n = 116, 76.8%). In our samples it is notable that about 33% were staffs of management level who were not directly associated with the complete handling if the ICT while 1/3rd of the respondents were the potential system users. The combination of our research samples was suitable for representing the suppliers' attitude toward the system usage.

Results and Discussion

Construct Validity and Reliability

First, an exploratory factor analysis was used to examine the construct validity. Principal components analysis with varimax rotation revealed that all items loaded on their expected constructs greater than the threshold loading of 0.45 for more than 150 samples (Hair, Anderson, Tatham, & Black, 1998). Cronbach's alpha coefficient was assessed to examine the internal consistency of the items in each construct, and exceeded the threshold of 0.6 recommended by Nunnally and Bernstein (1994) for all six constructs. As indicated in Table 2, all constructs in the model exhibited adequate construct validity and reliability.

We also examine the discriminant validity by comparing the square root of the AVEs (Average Variance Extracted) and the inter-construct correlations which indicates that more variance is shared between the construct and its indicators than with other constructs. Table-4 shows that the square roots of all the AVEs (i.e., the numbers on the diagonal) are greater than the correlations among constructs (i.e., the off-diagonal numbers), indicating satisfactory discriminant validity of all the constructs.

Hypothesis Testing

Multivariate regression analysis with the stepwise method was used to validate the hypothesized relationships among the research constructs (Table 3). User satisfaction was set as the dependent variable, and the independent variables were perceived

Table 2: Reliability, Descriptive Analysis & Factor Loadings

Construct	Source(s)	Cronbach's alpha	Measure	Mean	Std. Dev.	Factor Loading
Perceived Usefulness	Davis, 1989	0.970	Using ICT based SCM in my job helps me to perform tasks quickly	4.787	1.207	0.813
			Using ICT based SCM will improve my working performance	4.737	1.173	0.846
			Using ICT based SCM will increase my working productivity.	4.660	1.169	0.880
			Using ICT based SCM will increase my effectiveness in the job.	4.691	1.170	0.894
			Using ICT based SCM will assist me to handle my job easily.	4.740	1.184	0.865
			Using ICT based SCM is useful for my job.	4.927	1.136	0.810
Perceived Ease of Use	Davis, 1989	0.956	I believe that learning ICT based SCM will be easy for me.	4.739	1.028	0.846
			I can operate ICT based SCM easily to complete my job.	4.620	1.054	0.879
			Interfaces of ICT based SCM are simple and clearly understood.	4.704	1.067	0.825
			I can use ICT based SCM skillfully.	4.507	1.035	0.859
			It is easy for me to become a skill use of ICT based SCM.	4.844	2.622	0.420
			I consider ICT based SCM to be easier to operate than the traditional system.	4.676	1.020	0.812
Training	Nelson & Cheney, 1987	0.931	The in-house training of ICT based SCM is comprehensive.	4.777	1.073	0.829
			My understanding on the use of ICT based SCM improved after the training.	4.765	1.083	0.821
			Training assists me to adopt ICT based SCM more efficiently.	4.693	1.041	0.753
			The in-house training is adequate and provides the basics of the ICT based SCM in use.	4.537	1.162	0.817
			The in-house instructors have sufficient working knowledge to clarify all my doubts towards ICT based SCM usage.	4.805	1.109	0.816
Computer Anxiety	Heinssen et. al, 1987	0.950	I am anxious towards using computers.	2.704	1.432	0.909
			I am very much worried that the computer will delete/destroy my data if I happened to press the wrong key accidently.	2.822	1.409	0.897
			My fear of making unrecoverable mistakes resist me of using computers.	2.510	1.423	0.945
			Computers use scare me just like ghosts.	2.308	1.415	0.916
Computer Self-Efficacy	Venkatesh et. al. 2003-2004		I believe I require no instructions to complete my job using ICT based SCM.	5.514	1.806	0.701
			I believe I require help to complete my job on ICT based SCM when I am stuck into difficulties of use	7.141	1.845	0.869
			I believe I can complete my job using ICT based SCM if I have sufficient time.	7.490	1.686	0.881
			I believe I can complete my job using ICT based SCM if it contains a help option in detail.	7.280	1.755	0.875
User Satisfaction	DeLone and McLean, 1992	0.879	I am satisfied with the information I receive from ICT based SCM system.	4.587	0.936	0.672
			I consider ICT based SCM a success factor.	4.615	0.948	0.660
			I am satisfied with ICT based SCM in use.	4.608	0.997	0.651
			I consider that ICT based SCM in use fulfills my expectations.	4.538	0.988	0.633

Table 3: Square Root of Average Variance Extracted

Construct	Training	Perceived Use	Perceived Ease of Use	Computer Anxiety	Computer Self-Efficacy	User Satisfaction
Training	0.8857					
Perceived Use	0.6032	0.9333				
Perceived Ease of Use	0.4989	0.5307	0.8496			
Computer Anxiety	-0.1334	-0.1357	-0.1472	0.8373		
Computer Self-Efficacy	0.1428	0.2218	0.2353	-0.3258	0.8550	
User Satisfaction	0.7304	0.6920	0.5312	0.0109	0.1795	0.9615

Table 4: Regression Testing Results

Independent Variable	Dependent Variable (User Satisfaction)			
	Standard Coefficient (Beta)	Sig. (p)	Variance Inflation Factor	Correlation
H_1 Perceived Usefulness	0.326	0.000*	1.770	YES
H_2 Perceived Ease of Use	0.127	0.035*	1.505	YES
H_3 Training	0.468	0.000*	1.693	YES
H_4 Computer Anxiety	-0.141	0.005*	1.029	YES
H_5 Computer Self-Efficacy	0.057	0.277	1.180	NO
R^2 value	0.661			
Adjusted R^2 value	0.651			

* Sig. (p) < 0.05

usefulness, perceived ease of use, training, computer self-efficacy, and computer anxiety. Multi-collinearity was examined in the regression analysis using the variance inflation factor, which was below the common cutoff threshold of 10 (Hair et al., 1998) for all constructs, indicating the absence of significant multi-collinearity.

Four factors, perceived usefulness (H_1), perceived ease of use (H_2), training (H_3), and computer anxiety (H_4) were significant ($P < 0.05$), indicating that they affected user satisfaction with the ICT based SCM (Table 4). Training explained most variance (53.03%) of user satisfaction, next perceived usefulness explained 9.75% variance, and computer anxiety was negative effect that accounted 1.51% variance, finally perceived ease of use accounted 0.85% variance. However, computer self-efficacy (H_5) was not significantly related to user satisfaction. A total of 65.14% of the variance (adjusted R^2) was accounted for user satisfaction.

The hypothesis testing results are as summarized in Table 4.

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