

IT Adoption for Supply Chain Integration in Retail Sector

A.V.Nageswara Rao, Dr. Dasarathi Sahu and Dr. V. Krishna Mohan

Abstract— Application of Information Technology (IT) in Supply Chain Integration (SCI) has enabled Organizations to meet everchanging dynamic global markets. The present article tries to investigate important determinants for IT adoption and tests the value of Supply Chain co-ordination and Organization strategies in enhancing performance. The Indian Retail Sector due to its own characteristic features has utilized IT only to some extent and it is still in the nascent stage. In the present study Survey method is used to collect Data from Indian Retail sector. Simple Regression and ANOVA were used to test the Hypothesis. The results confirmed with the Literature that IT adoption was significantly related to Supply Chain integration level

Index Terms— IT Adoption, Supply Chain integration, Organization performance, retail sector, global markets

1 INTRODUCTION

INDIAN Retail Sector is at a very nascent stage when compared to the Developed world in IT Adoption. The retail sector within a short period of time has undergone several dynamic everchanging business situations. The sector continues to experience severe competition from domestic and international markets in various forms. The challenges arise from different factors viz uncertain nature of product demand, product obsolescence, changing consumer taste and preferences, global outsourcing, information technology adoption and environmental factors. These challenges inturn result in shrinking available lead time, increasing information co-ordination within organization and supply chain partners. There is immense pressure on Retailers to shorten lead – time, cut costs and improve product quality and customer service. Industrial revolution has proved that increasing Efficiency at various stages is the key for Organizations to survive and remain competitive. The Revolution of the 1990's has witnessed innovation not by changes in production and transportation but by changes in Co-ordination levels. Whenever people work together they must communicate, make decisions, allocate resources and get products and services to the right place at the right time (Malone and Rockart, 1991, p. 128). Supply chain management (SCM) , which expands the scope of the organization being managed beyond the enterprise level to include interorganizational relationships, is an example of this management idea in practice (Strader, Lin & Shaw , 1999). SCM is inherently information intensive and successful SCM approach necessitates two im-

portant technological requirements for sharing information : (1) stable and secure electronic linkages between organizations and (2) an integrated high-bandwidth environment to provide a host of SCM support services. Information technology innovations are apt to meet these demands and they have an integral role to perform in creating and facilitating new forms of SCM (Nambisan, 2000 p. 198). IT adoption had a stimulating effect on SCM which resulted in changing the focus of SCM from engineering efficient manufacturing process to co-ordination of activities and processes in supply chain network through knowledge management innovations (Tan, Shaw and Fulkerson, 2000).The idea of electronically exchanging information existed during Industrial Revolution and IT adoption is not a new concept . An example of the earlier commercial application of Information technology is Electronic Data Interchange (EDI) . The reach of EDI systems is limited due to lack of standardization in the approach. Web technology is a solution to the problem of system incompatibility by encapsulating enterprise system as object oriented components. These are made accessible by standardized interfaces and thereby defining a protocol for transmitting documents between these components. In the recent years there is increase in IT expenditure needed for having supply chain co-ordination mechanism in organizations. It is the trend of Information technology innovation i.e the diffusion of IT adoption within Supply chain is the focus of this research. .

This study proposes to investigate the factors that influence IT Adoption for Supply chain integration in Indian Retail sector. The purpose of this exploratory study is to

To build a foundation for understanding the Determinants for IT Adoption in Supply chain Integration

To contribute to the emerging literature of IT innovation and new forms of supply chain integration in Retail sector

To test the value of supply chain integration and Retail Organization strategies in implementing IT Adoption

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2 HYPOTHESIS

Ho1: IT Adoption will have no effect on Supply Chain co-ordination.

Ha1: IT Adoption will have a significant positive effect on Supply chain co-ordination.

Ho2: IT Adoption will have no effect on information co-ordination with Suppliers.

Ha2: IT Adoption will have significant positive effect on information co-ordination with Suppliers.

Ho3: IT Adoption will have no effect on information co-ordination with customers.

Ha3: IT Adoption will have significant positive effect on information co-ordination with customers.

3. LITERATURE REVIEW

Slack and Christopher (1992) explains that the reason for this is the emergence of globalized market place. Woods (1997) argues that firms need to be more integrative amongst other firms to reduce the vulnerability of the supply chain. Christopher (2000) The requirement for organizations to become actively responsive to the needs of customers has increasingly been important. Power (2005) observes that speed (delivering customer demand quickly), agility (responsiveness to customer demand) and leanness (doing more with less) are the contributing factors that would make firms more competitive. According to Lawrence and Lorch [23, p.1] integration is "the quality or state of collaborations that exist among departments that are required to achieve unity of effort by the demands of environment". Recent studies in the context of supply chain management however have proposed a broader concept of integration that includes not only integration of buyers but also integration of suppliers in the chain. For the purpose of research we define Integration as the collaboration and linkages between and across organizational functions as well as organizational partners, including customers and suppliers.

Rogers (1995) presents several models of Innovation Diffusion. Rogers identifies the steps in the Diffusion process and some now well understood characteristics of Innovations that help explain their different rates of Adoption. Markus (1990) which considers all types of Interactive communications technology and looks at how they are actually used within communities. (Markus 1990, pg. 197) Innovation spreads when others either observe the early adopters and imitate them to replicate their profits or communicate with the early adopters and are persuaded or induced to adopt. (Fulk, Schmitz et al. 1990, pg. 121) Media perceptions are, in part, subjective and socially constructed. Clearly, they are determined to some degree by objective features such as ability to provide a permanent record, asynchronicity and the like. However, they are also determined to a substantial degree by the attitudes, statements, and behaviors of co-workers. (Mukhopadhyay, Kekre et al. 1995) The larger companies have driven EDI because they are the ones with the most to gain due to having greater order throughput and information transmission require-

ments (Mak and Johnson 1999, pg.1). It makes it difficult for the large customers to achieve 100% EDI Compliance, leaving them supporting both electronic and paper-based systems and creating a barrier to implementation of Advanced supply chain and logistics management techniques.

(Riggins and Mukhopadhyay 1999) considers the reluctance of trading partner uptake of EDI and compare the findings of several case studies. They also concentrate upon the perspective of the Initiator attempting to ensure widespread Diffusion amongst trading partners. Riggins and Mukhopadhyay define two types of Risk. Adoption risk exists when trading partner adoption is not always a certainty. The initiator may attempt to persuade partners by highlighting the benefits or by offering incentives. Implementation risk is where trading partners that do adopt might not use the technology to its maximum possible effect. Since the trading partners are dependent upon one another, this can have a knock-on effect. (Riggins and Mukhopadhyay 1994) also shows that the issue of Integration of the trading partners internal systems with EDI system is important factor in Data integrity and therefore has a direct impact upon the expected benefits.

Premkumar, RamaMurthy et al. (1994) identify several characteristics based upon the objective qualities of the technology and the internal situation of the trading partners, that are the factors in the adoption decision. Nault, Dexter et al (1998) considers the supplier strategies available to combat the Risks involved. Two of these are Innovation support, which involves supplying financial or expertise resources as an incentive to adopt, and discount pricing, where the customer is offered a lower price after adoption. (Chau 2001, Pg.1) The three most significant inhibitors to EDI adoption in small businesses are all related to the degree of Organizational readiness rather than to those factors related to the costs and benefits of adopting the technology.

4 SUPPLY CHAIN INTEGRATION

The dynamic changing market environments coupled with severe threat of competition among organizations have resulted in a challenge in managing effective supply chain mechanism. Effective supply chain mechanism is inevitable for organizations which are planning to reduce supply chain costs, flow of material and information in order to secure competitive advantage and improve organizational performance. The basic concept of supply chain integration is to integrate production and information flow across the various processes in the chain. In the context of organization, supply chain integration is defined as an effective mechanism whereby all the activities of suppliers, vendors, supply chain partners and customers are integrated within the system.

An effective supply chain co-ordinates various activities linked with information flow from raw material procurement, transformation and on-time delivery of finished products to end customers. Frohlick and Westbrook [6] identified two forms of integration which is employed by manufacturers in the organization viz forward and back-

ward integration. Forward integration involves integration of material and information in the forward direction between suppliers, manufacturers and customers. Backward integration involves the flow of information and data from customers towards the suppliers. Stevens [9] classifies supply chain integration into three important levels viz functional integration, internal integration and external integration. IT Adoption and Supply chain integration are two emerging areas of Research which have attracted the attention of many Researchers. This paper reveals their complementary nature and applies Innovation Diffusion theory to ascertain the implications in day to day business operations. Diffusion is the process by which an innovation is communicated through certain channels over a time among the members of a social system (Rogers, 1995, p. 5). Adoption is a component of the diffusion process that refers to the evaluation of the results of a trial use of the innovation and a decision to continue using the innovation (Rogers, 1962). Diffusion theory is quite relevant to the adoption of a new innovation within the supply chain (Apaiwongse, 1991; Brown and Craig, 1981) in this particular case IT adoption.

Organization innovativeness and rate of IT adoption have been the two most Dependent variables throughout the study of literature review. Organization innovativeness i.e how innovative an organization is was typically measured as a composite score composed of the scores from ten to twenty innovations (Rogers, 1995, p. 378). Rate of adoption refers to the relative speed with which an innovation is adopted by members of a social system. It is generally measured as the number of individuals who adopt a new idea in a specified period (Rogers, 1995, p. 206). These two concepts are closely related to each other if organizations are more innovative, the rate of adoption of an innovation will be higher.

The concept of rate of adoption concerns the diffusion of certain innovations through the social system during a specific time period. It is a very important measure when comparing different innovations or different social systems regarding the adoption of the same innovation irrespective of testing the value of the characteristic of a specific

Innovation and other factors in explaining the adoption behavior of one group of organizations within the same social system. In consideration these concepts serve a limited purpose of the study. Instead a new concept IT Adoption level was developed as the Dependent variable and defined as the average level of utilization of technology solutions in material procurement, merchandising, sourcing, supply chain co-ordination levels and Decision support areas .

There are various conceptual frameworks developed to understand innovation adoption. Many of these frameworks from literature are not specifically designed to explain IT adoption for supply chain integration but they are theoretical base for understanding IT adoption level in organizations. Among these conceptual innovation models, Sheth (1981) and Ram (1987) studied individual consumer innovation resistance and provided basic understanding for

individual consumer and organization innovation adoption.

5 RESEARCH METHODOLOGY

This study used Survey method to investigate IT Adoption and Supply chain integration characteristics in Pantaloon Retail sector. A questionnaire is drafted with independent variables in IT adoption, Supply chain integration and organization performance. This draft questionnaire was then pre-tested with academicians and practitioners to check the content validity and then modified as suggested. The modified questionnaire was pilot tested to examine content validity and research suitability for the target sample size. The data was obtained from supply chain, logistics and purchasing managers who had thorough knowledge and experience of IT adoption and supply chain integration practices followed in organization. These respondent managers were asked to rate their supply chain integration practices in relation to understanding of IT Adoption and its impact on organization performance. The independent variables of supply chain integration practices usually reflect corporate level practices and dependent variable organization performance reflects corporate level results.

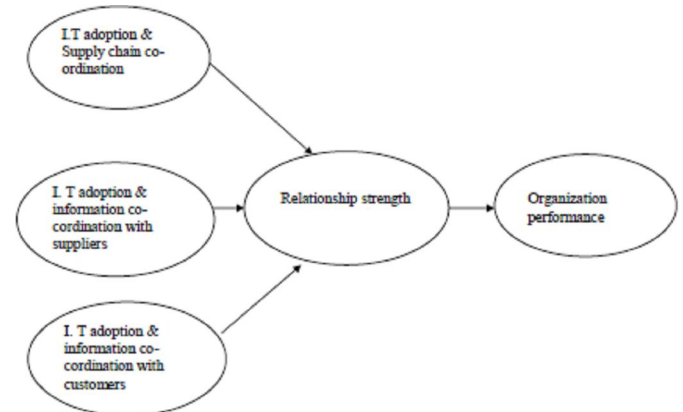


Fig. 1. Research Methodology

The survey specifically concentrates on Pantaloon Retail supply chain integration practices and its impact on Organization.. The total number of distributed questionnaires was 400. Initially ninety 90 completed questionnaires were received and with follow ups another 20 twenty added to the score. Overall 110 completed questionnaires were received with a response rate of 27 % which is an average response rate.

5.1 Hypothesis Testing:

Three Hypotheses were used to test the relationships between IT adoption, Supply Chain co-ordination, information co-ordination with Suppliers and Information co-ordination with Customers. Each item of the answer for the question regarding IT adoption, Supply chain integration and organization performance was created as a dependent variable and one-way ANOVA analysis was performed to

test whether using each Strategy effects the overall performance.

As Table 1 shows Supply Chain Co-ordination was confirmed to have positive effect on Organization with $F=9.074$ (Ha1) which is accepted, Information Co-ordination with Suppliers was confirmed to have positive effect on Organization with $F=8.063$ (Ha2) which is accepted, Information Co-ordination with Customers was confirmed to have positive effect on Organization with $F=8.024$ (Ha3) which is accepted, the Null Hypothesis Ho1, Ho2, Ho3 were rejected.

TABLE 1

ANOVA ANALYSIS: EFFECTS OF IT ADOPTION AND SUPPLY CHAIN INTEGRATION

Strategy	H-type	Category	N	Mean	F-value	Sig.
IT adoption and Supply chain co-ordination		0	65	2.127		
	Ha1	1	45	1.934	9.074	0.008
IT adoption and information co-ordination with Suppliers		0	60	2.112		
	Ha2	1	50	1.924	8.063	0.007
IT adoption and information co-ordination with Customers		0	58	2.102		
	Ha3	1	52	1.913	8.024	0.006

This study was an exploratory investigation examining the effects of IT Adoption, supply chain integration and organization performance. Regression analysis was used to analyse and examine the effects in respective areas. The questionnaire includes seventeen constructs consisting of seventy four items. Most of the variables used formative multi-item scales. The composite reliability index (coefficient) for the only reflective scale for customer pressure was 0.74. This coefficient number exceeds the 0.70 threshold for acceptable reliability and indicates that the measure for customer pressure is internally consistent (Fornell and Larcker, 1981).

TABLE 2

EFFECTS OF IT ADOPTION , SUPPLY CHAIN INTEGRATION CHARACTERISTICS AND ORGANIZATION PERFORMANCE

Independent variables	Parameter estimate	t-value	p-value	R-Square	Adjusted R square
Inter-Organization communication C1	0.273	1.917	0.074	0.072	0.048
Inter-Organization Relationships C2	0.313	2.121	0.041	0.092	0.072
Organization flexibility C3	0.047	0.312	0.739	0.003	-0.021

Product quality C4	0.054	0.384	0.706	0.004	-0.02
Product innovation C5	0.084	0.542	0.594	0.007	-0.017
Customer influence level C6	-0.003	-0.012	0.993	0.001	-0.024
Outsourcing level C7	0.128	0.864	0.384	0.016	-0.005
Number of product suppliers C8	0.093	0.613	0.558	0.007	-0.016
Number of international suppliers C9	-0.011	-0.072	0.947	0.001	-0.022
Information co-ordination degree with Suppliers C10	0.311	2.116	0.042	0.091	0.072
Information co-ordination degree with Customers C11	0.261	1.821	0.091	0.064	0.044
Supply Chain Co-ordination degree C12	0.494	3.764	0.001	0.245	0.214
Relative Size C13	-0.009	-0.07	0.966	0.001	-0.024
Customer Service C14	0.356	2.549	0.019	0.132	0.112
Product Delivery C15	-0.312	-2.32	0.023	0.112	0.092
Return on investment C16	-0.007	-0.045	0.968	0.001	-0.024
Cost C 17	-0.274	-1.912	0.067	0.074	0.054

The Relationships and communications effect between three of Organizations characteristics viz Inter-organization communication, Inter-organization relationships and Organization flexibility and the overall level of IT Adoption were tested under C1, C2, and C3. As shown in the Table2 ,only one of the constructs C2 was supported which means only Inter-Organizational relationships showed significance in explaining IT adoption level ($\beta=0.313$, $t= 2.121$, and $p=0.041$). It may be confirmed that Inter-organization communication was positively related to IT adoption level if the chosen significance level was 0.1 rather than 0.5 ($\beta=0.273$, $t=1.917$ and $p=0.074$). Therefore to some extent C1 was supported. The reason that Organization flexibility C3 was not significantly related to overall IT Adoption level was probably because of lack of IT infrastructure. Each item of the answers for the questions regarding organization performance was created as a dependent variable and one-way ANOVA analysis was performed to test whether using each strategy effects IT Adoption level. The results

presented in Table 2 shows that both the Constructs C4 and C5 were rejected. This means that Organizations which offer fewer seasons for their products might use IT Adoption tools as much as more than those that offers in many seasons. Several supply chain integration characteristics were tested with regard to relationships between Organization supply chain structure and its overall IT adoption level including Pantaloon retail sector and its customers (customer influence level, C6) Organization outsourcing level strategies (outsourcing level, C7; number of product Suppliers, C8; number of international suppliers, C9) and Organization Supply chain Integration level (degree of information co-ordination with suppliers, C10; degree of information co-ordination with customers, C11; Supply chain Co-ordination degree, C12). As the table shows among these constructs, C10 and C12 are supported. Degree of information sharing between Organization and its suppliers were confirmed as positively related to the overall IT adoption level ($\beta=0.311$, $t=2.116$ and $p=0.042$) and Supply chain Co-ordination degree ($\beta=0.494$, $t=3.764$ and $p=0.001$) showed a significant and positive relationship with the overall IT Adoption level. As proposed Supply Chain Integration level was an important factor in explaining IT adoption in an Organization except for one of the following constructs C11 where the degree of information sharing between an Organization and its customers has shown little significance. The remaining five Constructs from C13 to C17 were tested with overall IT adoption level and C13, C16 and C17 were rejected. C14 and C15 were confirmed at 0.05 significance level both Customer service and product delivery using IT adoption showed significant positive relationship with Organization performance. Customer service (C14) is positively related to the overall IT adoption level in Organization ($\beta=0.356$, $t=2.549$ and $p=0.019$) and thus shows positive significant relationship.

6 IMPLICATIONS AND DISCUSSIONS

The present study offers several theoretical implications. The results have suggested various forms of Supply Chain co-ordination levels viz co-ordination with Suppliers, co-ordination with Customers are successful in explaining IT adoption. All these forms have shown significant positive relationship with organization performance, in this case Pantaloon Retail sector. The findings from the study offered empirical evidence to confirm the validity and importance of Diffusion of Innovations theory and also contributed to the emerging literature on Information technology adoption and supply chain integration levels among the partners to the organization. In particular Supply chain integration levels showed significant positive relationships with overall IT adoption levels in the organization. The study further recommends at each specific time high innovation technology plays a prominent role in the organization quest for sustainability in competitive environment. Several limitations needs to be considered in the present

study in view of the specific time period and factors considered as part of the study in retail sector.

IT adoption as an innovation evolves through different stages of its life cycle. At these stages the perception of these characteristics does change with respect to implementation in Organization environment. This study was conducted only at a fixed time period at Pantaloon retail and the results provide a snapshot of IT adoption. Therefore the results need not necessarily apply to other industries in other countries. The sample for the study was selected partly on convenience; therefore the findings cannot be generalized without caution. The average sample of 110 completed questionnaires prevented a more comprehensive statistical and in-depth analysis of the data collected during the study. The actual respondents for the study may have perceived IT Adoption and supply chain co-ordination in different ways. The present study on IT Adoption was exploratory which leaves more scope for further research in the area. Future research needs to study how significant key partners to the organization perceive IT adoption within a very specific external environment and at early stage of diffusion of innovations. The adopters for IT are most likely to be the early adopters if not first adopters to technology. Therefore in future a time series analysis fits the gap to find out the changes in IT adoption, supply chain co-ordination levels in enhancing the performance of organization.

7 CONCLUSION

The present study proposed IT adoption for Supply chain Integration in Retail sector is based on Innovation adoption literature with various influential factors. In the future it is inevitable for Organizations to adopt IT innovations to survive and sustain in competitive world. The study further highlights supply chain integration at each level in the organization and the importance of supply chain co-ordination in enhancing organization performance. However, these results should not be interpreted to mean that other weaker predictor variables in specific performance should be ignored. These variables may be further interacted with or moderated so that the magnitude of its effect is changed. Future research should consider explaining such interactions and moderations in different supply chain integration practices. The results of the study provide managerial insights about specific supply chain co-ordination strategies which are effective in improving organization competitive position and performance.

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