Abstract

Introduction

Low Voltage switchgear consists of products which are used for controlling and protecting low voltage devices used at factories, shops, homes and farms. These are standard products which are sold by manufacturers through their distribution channel.

Distribution channel refers to the medium of transfer of goods from manufacturers to end users and consists of intermediaries, called distributors, who perform a variety of functions such as buying, promoting, stocking, selling, order fulfillment and servicing. This research is about adoption of Internet for enhancing the operational effectiveness of distribution channels by the Indian Low Voltage Switchgear Industry.

Indian LV Switchgear industry has been a growing industry. Frost & Sullivan forecasts that the market revenues are expected to grow at a compounded annual growth rate of 14.7 % from 2008 to 2015 (Frost & Sullivan report 2008). The major players in the industry are Larsen & Toubro, Siemens and Schneider Electric who together account for over 55% of the market share.

Justification for Research

Critical success factors for low voltage switchgear distribution are availability of products in the market and efficient use of working capital. The manufacturers have been exploring the opportunities for improving these two factors. Adoption of Enterprise Resource Planning (ERP) by the manufacturers has improved the availability of their products up to the distribution channel and reduced their inventory levels. Linking of distributors to their ERP/website through Internet offers the opportunity to the manufacturers for carrying forward these benefits into their distribution channels.

Distributor is a critical link between the manufacturer and the customers. During the last decade some manufacturers have adopted internet for enhancing the
operational effectiveness of their distributors. The adoption of internet for management of distribution channel is relatively a recent development in the Indian switchgear industry and hence there is a lack of literature in this area. The research findings in this area will benefit the Indian industry in developing and implementing appropriate strategies for adopting internet for enhancing the operational effectiveness of their distribution channels. The findings would also be applicable for distribution of similar industrial products in the country.

Research Objective

The objective of the research is to study the Indian low voltage switchgear industry regarding the adoption of internet by the manufacturers for enhancing the performance of their distribution channels. Adoption of internet for distribution is defined as the use of internet for establishing connectivity between the manufacturer and the distributors either for exchange of information or products or both. The research focuses on the following two main issues:

- The facilitating factors for adoption of internet by the distributors.
- The impact of adoption of internet on the performance of distributors.

Literature Review

Electronic Business commonly referred to as “e-business” may be defined as the application of information and communication technologies (ICT) in support of all the activities of business (Beynon-Davies, 2004). There is consensus amongst academics and practitioners that the success of an e-business enabled supply chain depends on two major factors:

- Collaboration between partners (Norris et al., 2000) and integration of supply chains through linking information systems (Cigolini et al., 2004; Zank and Vokurka, 2003) which is also seen as a major source of competitive advantage;
- Information visibility (Kehoe and Boughton 1998; Garcia-Dastugue and Lambert 2003) including the ability to share accurate data and information
from a wide range of operating areas across the supply network (Lancioni, et al., 2000).

There is however little empirical research into the type and degree of integration that is taking place and how this can be measured in order to evaluate the impact on information flows and relationships between and within supply network partners. (Tassabehji, et al., 2007)

Emergence of electronic commerce has created a new business paradigm, one that presents marketers with noteworthy opportunities and challenges. Introduction of internet as additional channel into an already complex multi-channel distribution system creates serious conflicts from the perspective of the supplier firm (Webb, 2002).

For tangible goods, internet channels are estimated to reduce distribution cost by more than 25%. These savings can be attributed to variety of factors: Transaction processing is eased, thereby reducing paperwork, human errors, and customer disputes; inventory costs may be reduced as intermediaries are bypassed; and some marketing function are shifted to the customer (Geyskens, et al, 2002).

Technology Acceptance Model (TAM) introduced by Davis (1989) postulates that Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) are the primary determinants for computer acceptance behavior. Extension of Technology Acceptance Model (TAM2) developed and tested by Venkatesh and Davis (2000) explains Perceived Usefulness and Usage Intentions in terms of social influence processes (Subjective Norm, Voluntariness, and Image) and cognitive instrumental processes (Job Relevance, Output Quality, Result Demonstrability and Perceived Ease of Use).

Mentzer (2004) argued that competitive advantage can be obtained not just through the products sold, but also through the way in which we manage the flows in a supply chain. For companies to take competitive advantages, prime requirement among other things, is to have intra-organization and inter-organization information flows and all those activities which will create satisfaction to customers (Verma and Seth, 2010). According to a study of firms conducted by Teo and Pian (2007), the level of internet adoption had a positive relationship with competitive advantage.
Industrial distributors face many challenges in an environment characterized by increasing globalization, competitiveness and consolidation. Central to the competitive edge of distributors’ achievement is ability to consistently provide added values, both to manufacturers and to customers (Mudambi and Aggarwal, 2001).

Manufacturers are increasingly using internet to communicate better with their partners and improve customer service with online information, ordering and high quality fulfillment (Joachim, 2000).

Organizations will find emerging internet based technologies easier to implement and to use, but this will not necessarily mean that they will improve performance as a result. Performance will still be determined by effective strategy formulation, a clear understanding of the knowledge of the technologies, appropriate application and prudent change management (Power, 2005)

SAP- LAP Analysis of Indian Low Voltage Switchgear industry

There is a gap in existing literature regarding adoption of internet in low voltage switchgear industry, particularly in the Indian context. Hence a case study of the Indian switchgear industry has been undertaken with a view to identify the key issues for the industry in the light of the findings of the literature review. The case study covers the three leading players of the industry and the cases have been analyzed by adopting SAP-LAP (Situation, Actor, Process - Learning, Action, Performance) framework (Sushil, 2001)

The three manufacturers studied have implemented ERP. They have also linked their distributors to the company’s ERP and website through internet, whereby distributors can carry out online order entry and access information pertaining to order status, accounts, performance and products.

Adoption of internet by the distributors has impacted their critical operational parameters. It has enhanced their order execution capability, improved their working capital management and their responsiveness. The case study has also highlighted the factors which facilitate adoption of internet by distributors. These factors can be stated as enablers, motivators and order entry benefits. This understanding was the basis on which the researcher identified the constructs and defined their measured
variables which enabled him to develop a conceptual frame work for the research. The seven constructs identified are: Adoption of Internet, Enablers, Motivators, Order Entry Benefits, Enhanced Order Execution Capability, Improved Working Capital Management and Improved Responsiveness.

Conceptual Framework

The theoretical inputs generated out of literature review have been blended with the empirical findings of the case study to develop the conceptual framework for the research.

The case study has revealed that Indian Low Voltage Switchgear industry has neither adopted e-commerce nor used internet as independent distribution channel. It has used the internet for establishing connectivity with their channel partners for sharing of information and enhancing communication. Internet connectivity with the manufacturers has enabled the distributors to carry out on line order entry and also access information on products, orders, accounts, inventory and performance.

In view of multiple constructs involved regarding the other two research issues, there is a need to develop conceptual models to explain the relationship among the constructs. The first research issue is concerning the factors facilitating adoption of internet. The underlying principle of this conceptual model is based on Technology Acceptance Model (Davis, 1989) and Extension of Technology Acceptance Model (Venkatesh and Davis, 2000), which postulate that Perceived Ease of Use (PEOU) and Perceived Use (PU) are the primary drivers of technology adoption. The conceptual model is built around the premise that Enablers are PEOU and Motivators & Order Entry Benefits are PU which facilitate Adoption of Internet by the distributors.

The second research issue is about the impact of adoption of internet. The internet and e-business technology provide opportunities for the industry to create integrated business practices to lower transaction costs across value chain, increase company’s responsiveness, decreasing inventories, and increase quality of customer services to enhance customer satisfaction (AT Kearney, 2000; Majumdar and Gupta, 2001). Conceptual model for this issue is built around the premise that adoption of
internet positively impacts order execution capability, working capital management and responsiveness of the distributors.

The hypotheses derived out of these two conceptual models are stated below.

Research Issue No.1: What are the factors which have facilitated adoption of internet by the distributors?

Hypothesis H1: Enablers are positively related to the adoption of internet by the distributors

Hypothesis H2: Motivators are positively related to the adoption of internet by the distributors

Hypothesis H3: Order Entry Benefits are positively related to the adoption of internet by the distributors.

Research Issue No.2: What is the impact of adoption of internet on the operational parameters of the distributors?

Hypothesis H4: Adoption of internet is positively associated with enhancement of order execution capability of distributors.

Hypothesis H5: Adoption of internet is positively associated with improved management of working capital by the distributors.

Hypothesis H6: Adoption of internet is positively associated with improved responsiveness of the distributors.

Research Methodology

The conceptual framework identified manufacturers' perspective about adoption of internet by the distributors, both with regards to adoption issues as well as how adoption of internet impacted operational parameters of the distributors. These empirical findings needed to be tested and validated by administering a quantitative study on the distributors. The researcher adopted survey method, developed and administered a questionnaire on the distributors. The data collected from the distributors has been collated and analyzed using Structural Equation Modeling.
A questionnaire was developed as an instrument of survey for getting the feedback of distributors on the constructs. The constructs are measured by indicators. The perception of distributors on these indicators was taken on seven point Likert scale. The initial questionnaire was subjected to a process of validation by focused group discussions by a panel consisting of representatives of manufacturers and distributors for developing the final questionnaire.

A few selected sales executives from the industry were coached by the researcher to administer the questionnaire on the distributors of three manufacturers in their respective regions. Since the researcher was unable to get the complete list of distributors of the manufacturers, the respondents were selected from the market at random based on the convenience of their availability for the survey. Data collection was carried out in all the four regions of the country. 193 filled in questionnaires were received out of which 187 were found complete in all aspects and eligible for analysis. The respondent was either the proprietor or the partner of the firm. The average number of years of distributorship of the firm was ten years with an average business turnover of Rs. 40 Millions. The respondents are evenly distributed over all the four geographical regions of the country.

The data was collated using the statistical package SPSS. This research has used a two stage Structural Equation Modeling approach. In this approach, SEM comprises of the measurement model and the structural model. In the first stage, confirmatory factor analysis is used for evaluating the measurement models for the relationship between the constructs and their indicators. The measures for evaluating confirmatory factor analysis of the measurement models are composite reliability, convergent validity and discriminant validity.

Reliability is defined as internal consistency of a scale which assesses a degree to which the items are homogenous. The Composite Reliability ($\rho_c$) proposed by Werts, Linn and Jöreskog (Jöreskog & Sorbom, 1988) has been used to test the reliability.

Convergent Validity is a measure of construct validity and occurs when multiple indicators operate in a consistent manner to form a single construct.
Evidence of convergent validity was examined by Average Variance Extracted (AVE).

Discriminant Validity estimates the degree to which a measure does not converge or correlate with constructs from which it is supposed to be different. Standardized Regression Weights (Beta) was used as measure of discriminant validity.

Estimates for confirmatory factor analysis of measurement models: Composite reliability is considered high if \( \rho_c \) proposed by Werts, Linn and Jöreskog (Jöreskog & Sorbom, 1988) is above 0.7, moderate between 0.4 to 0.5 and poor below 0.4 (Holmes-Smith 2002).

Convergent and discriminant validity of the measurement models are evaluated by using the criteria for constructs’ Average Variance Extracted, which should be greater than 0.5 (Fornel & Larker 1981) and the standardized factor loadings (or standardized regression weights in AMOS) having a value greater than 0.3 were considered acceptable (Churchill 1979). The corresponding Critical Ratio was greater than 1.8 to be considered acceptable.

Structural equation modeling program AMOS 18.0 has been used to obtain estimates for the regression coefficients, variance and the error variances to arrive at the composite reliability, convergent and discriminant validity of the measurement models.

In the second stage, the structural model is evaluated by structural equation modeling using the various goodness of fit criteria and the relationship between the latent variables in the structural model is used for testing of hypotheses.

Estimates for evaluating Goodness of Fit criteria of Structural Models:

One of the measures of absolute fit is the chi-Square \( (\chi^2) \) in association with its degrees of freedom \( (df) \) and probability \( (p) \) of significant difference (Hair et al 1998). It represents the amount of discrepancy between the unrestricted sample covariance matrix and the restricted covariance matrix (Byrne 2001). An insignificant
(p>0.05) $\chi^2$ suggests a satisfactory fit of the model (Holm-Smith 2002) and higher the probability closer the model is to a perfect fit.

This research has used normed chi square ($\chi^2$/df) to reduce the sensitivity of chi square statistic to sample size. The minimum acceptable value is 1, where as the maximum value should be less than or equal to 3.0 (Kline 1998).

The structural model is sometimes accepted to provide justified fit even when the normed chi square ($\chi^2$/df) value is statistically significant. In such a situation, the judgment is supported by additional goodness of fit criteria viz. RMSEA, NFI, TLI and CFI which are explained below.

**RMSEA**

This research has used Root Mean Square of Approximate Error (RMSEA), which is an index on non-centrality and compensates for the chi square statistic in large samples (Hair et al 1998). Values up to 0.08 can represent reasonable errors in population (Byrne 2001, Holmes-Smith 2002).

**NFI, TLI & CFI**

Bentler-Bonnet Normed Fit Index (NFI) values indicate the proportion of improvement of the overall fit of the model over the null model (Kline 1998, Shumaker & Lomax 1996). Values above 0.8 and close to 0.9 indicated acceptable fit for this research (Baumgartner & Homburg 1996 ; Hair et al 1998 ).

The Tucker Lewis Fit Index (TLI) is another measure of comparison between the proposed models to the null model. It expresses fit per degree of freedom and hence is unaffected by model complexity. (Baumgartner & Homburg 1996, Kline 1995). TLI used in this research is 0.8 to 0.9 for acceptable model fit. (Rao 2002).

Bentler comparative fit index (CFI) estimates the comparative difference between the proposed and base line models (Shumaker & Lomax 1996). It is interpreted the same way as NFI but prevented underestimation of fit in small sample.
Testing of Hypotheses, Analysis and Interpretation

First, Structural Equation Modeling (SEM) is used for testing the measurement models by confirmatory factor analysis. Then SEM is used for testing of hypothesis by evaluating the structural models. Confirmatory factor analysis has validated the constructs' reliability and validity of the measurement variables of all the seven constructs. Out of the six hypotheses, five have been supported and the hypothesis (H3) regarding Order Entry Benefits has been rejected. Both the structural models have met the goodness of fit criteria.

Results and Discussions

The interpretation of the results of confirmatory factor analysis has validated the measurement models of all the seven constructs used in the research. This has also validated researcher's understanding of the constructs related to adoption of internet.

The interpretation of results of Structural Equation Modeling and testing of hypothesis has provided the answers to the two research issues concerning the factors influencing the adoption of internet and the impact of adoption of internet. Enablers and Motivators facilitate adoption of internet. Adoption of internet improves the relationship quality between the manufacture and distributor by positively impacting the order execution capability, working capital management and responsiveness of the distributors.

Conclusions

This study fills the research gap related to adoption of internet for distribution in the Indian industry, with special reference to Indian switchgear industry. Indian switchgear industry has adopted internet only for exchange of information and communication. It has neither used e-commerce models nor separate internet channels.
This research has validated the basic concepts of TAM and TAM2 for technology adoption and also identified the antecedents of Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) for adoption of internet for distribution by Indian switchgear industry. Ease of connectivity and navigation are the antecedents of PEOU, while convenience of accessing the latest and accurate information are the antecedents of PU.

Operational parameters such as order execution capability, working capital management and responsiveness impact the quality of relationship, trust and commitment between the manufacturers and distributors. By validating the positive impact of adoption of internet on these operational parameters of distributors, this research has confirmed the theory that internet improves the relationship quality between manufacturers and distributors.

Indian low voltage switchgear industry is characterized by strong role played by the distributors in terms of relationship with the customer as well as manufacturers. Switchgear products need technical selling based on features and require strong pre and after sales services. This calls for close personal contact between the distributors and customers. Hence disintermediation has not taken place and the industry has not ventured into adopting eCommerce models or internet as distribution channels.

The research has given evidence to the factors influencing the adoption of internet by the distributors. By addressing these factors, manufacturers would be able to create proper systems and infrastructure to enable the distributors to adopt internet.

Increased adoption of online order entry by the distribution channel would benefit the manufacturers in terms of faster turnaround times and reduction in order processing costs. Hence manufacturers should create a pull for online order entry by making it simple to use for standard as well as project orders and offering incentives to distributors.

There is a need for the manufacturers to publicize the benefits of adoption of internet amongst their distributors to increase adoption level. Other members of the Indian switchgear industry also can benefit from the experience of these pioneers.
The total number of manufacturers of LV switchgear industry in India is around twelve which is a small number. Out of this only three manufacturers have adopted the internet for their distribution channels. This small population has limited the researcher’s scope to broaden the study. Since the list of distributors who have adopted the internet was not available from the manufacturers, the researcher has used his industry experience in identifying the sample for the questionnaire survey. Hence strict probability sampling could not be adopted for this research.

Since the adoption of internet by Indian switchgear industry is still evolving, the findings of this research need further validation through a longitudinal study. The relevance of the research findings for distribution of other discrete industrial products need to be validated by taking up studies for other similar industries.

In conclusion, adoption of internet has enabled the manufacturers to enhance the operational effectiveness of their distribution channels.