An Empirical investigation on the impact of supply effort management and supplier selection on business performance using SEM approach

*** P. Mathiyalagan - ** Dr. M. Punniyamoorthy - *** D. M. Sezhiyan - **** M. Meena**

ABSTRACT

The basic theme of the research is that "many organizations attempt several efforts to managing the supply chain. Such effort to manage the supply chain paves the way for an effective and positive impact on various practices of supplier selection and enhances the organizational performance. The application of such efforts to manage the supply chain and application of various management practices to enhance the system of supplier selection leads to augmentation in the overall business performance". The foremost initiative of this research paper is to empirically prove the proposed theme. A sample of 358 manufacturing and business units in auto, steel and engineering industries were taken for study. The factors that influenced the supply effort management, supplier selection and organizational performance were appropriately considered and incorporated in the model with due consideration of effective validation and reliability. The proposed model was tested with structural equation model (SEM) approach and the results proved that the proposed model has consistency and reflects the real world practices that is to say the efforts to manage the supply chain and the factors influencing the supplier selection augments the overall performance of the organization.

---

*Research Scholar, National Institute of Technology Tiruchirappalli Tamilnadu, India,
E-mail: mathis09051970@yahoo.co.in, Phone no: 9486363213

**Professor and Head, Department of Management Studies, National Institute of Technology, Tiruchirappalli – 620 015, INDIA. E-mail: punniya@nitt.edu, Phone no: 9443430246

*** Assistant Professor, Department of Management Studies, National Institute of Technology, Tiruchirappalli – 620 015, INDIA E-mail:sezhiyan@nitt.edu

**** Assistant Professor, Nehru College of Management, Coimbatore,
E-mail:meena_rosesankar@yahoo.co.in

Introduction

It's been evident from the recent literatures on Supply chain that the supply chain management becomes an inevitable magnitude importance for companies to mull over the effects of supply management issues to achieve the overall performance of the business due to competitive pressures. As the Supply chain management is becoming key function in an organization which involves various tasks and issues in administrating it. These tasks for managing supply chain are related to managing supplier and customer relationship, internal supply chain management, professionalism in supply administration, quality and standards, leaning the supplier base, achieving coordination from inter and intra organizational levels and improving information accuracy . Though there is copiousness of tasks are involved in managing the supply chain, this research focuses on the interrelated issues and the factors that influence the management of supplier selection, the efforts to manage the supply chain and the overall business performance.

Previous research ponders the decisive factors that influences supplier selection is *quality, delivery, price, production facilities and capacities, technical capability and financial position*. Earlier studies of supply chain management focused on various dimensions related to several aspects and tasks for managing the efforts of supply chain. The efforts to manage the supply chain involves these fundamental activities like *managing suppliers' relationship* , *supplier involvement in business process* , *emphasizing quality on supplier selection*, *leaning the levels of supplier base* and *augmentation of the information*. These activities are initially attempted by various organizations and further developed for managing the organization supply chain in effective manner. We operationally define it as *"Supply effort Management"*. The tasks of supplier selection and the efforts to manage the supply chain affect overall business performance. This research attempts to empirically prove with the causational issues of such factors by using structural equation modeling (SEM) approach.

Literature Review

Supply effort management

Managing the supply efforts involves the deeper understanding of the boundary spanning roles performed by the business processing and value creation teams in the organization. The supply effort management involves planning, implementation and regulating the overall functions related to supply chain which induces the value creation process in the organization as well. Managing the supply effort involves various decisions like (i) Developing and maintaining the supplier relationship in long term base and managing the strategic issue as well,(ii) involving

suppliers in business process, (iii) emphasizing quality on supplier selection, (iv) leaning the levels of supplier base and (v) augmentation of the information.

Supplier long term and strategic relationship

The relationship between the business networks has gone a paradigm shift in business scenario. The networks are based on the long-term relationship and that is strategically maintained for over time. Maintaining a healthy long term relationship fetches plenty of blessings. The long term perspective between the buyer and supplier increased the intensity of buyer-supplier coordination (Helpsr, 1991). In a well developed long-term relationship business, suppliers become part of a well-managed supply chain and it will have an everlasting effect on the competitiveness of the entire supply chain (Choi and Hartley, 1996). Moreover a high degree of trust is established through long-term relationships between buyer and supplier firms (Bensaou and Venkatraman, 1995). A close relationship among the supply-chain members' leads to share information, share risks and rewards, the firms can fully rely on each other and mutual maintain the better relationship intended for the long haul (Guimaraes et al., 2002; Cooper and Ellram, 1993; Landeros and Monczka, 1989). Firms are increasingly looking to their suppliers to help them achieve a stronger competitive position, and such a strong competitive position can be achieved only by developing a sustainable competitive advantage created through long-term relationships with their suppliers (Ganesan, 1994). The long term and close working relationships based on trust may form the basis of collaborative advantage (Kanter, 1994; Dyer, 2000) which leads a firm to manage strategically. Moreover the firms that foster close, cooperative relationships with their suppliers have reported substantial revenue gains and cost savings (Landeros and Monczka, 1989; Cooper and Ellram, 1993). Companies gain benefits when they place a larger volume of business with a limited number of suppliers using long-term contractual relationship (Helper and Sako, 1995; Krause and Ellram, 1997; Guimaraes et al., 2002). A lean supplier base and the long term relationship symbolize the Japanese way of managing their business operation for achieving JIT (Hahn et al., 1983; Waters-Fuller, 1995).

Supplier involvement

Supplier involvement is a critical aspect of Supply effort management. Supplier involvement and their participation is an imperative part of Supply chain quality management (Kuei and Madu ,2001). Supplier involvement is important in the fundamental design of product and its development process and logistical decisions (Levy, 1997: Michael Tracey and Mark A and et al 2000:

Rich and Hines 1997; Troyer 1997) Supplier involvement enhances communication and provides avenues for coordinating activities between the suppliers (Tracey 1998).Effective supplier involvement improves the well use of technology, reduces supply chain costs, and shortens the order cycle (Morgan 1997). A higher level involvement firm establishes a pattern of cooperation in continuous improvement efforts (Cooper and Ellram 1993; Epatko 1994; Leenders 1994; Towler 1996) Supplier involvement programs facilities to provide needed collaboration, which in turn would result in improved organizational performance (Chinho Lina, Wing S. Chowb, Christian N. Maduc, Chu-Hua Kueic, Pei Pei Yu, 2005).

Selection of quality suppliers

The literature on supplier selection adds major focus on the different aspects of quality as performance criteria for the selection of supplier (Dickson, 1966; Dempsey, 1978; Willis and Huston, 1989; Helper, 1991; Weber et al., 1991; Choi and Hartley, 1996) and (Dickson, 1966) states the important factors to be considered for supplier selection are to meet the requirements of quality standards, delivery time, the performance history. Supplier quality is a critical determinant of the over- all product quality and costs, the overall quality performance which helps supply chain managers to select right sources of supplies with due consideration of time, delivery and price (Manoochehri, 1984; Treleven, 1987; Baxter et al., 1989; etc). Selecting quality supplier in one of the supply effort management construct and this further improves supplier performance and business performance as well (Hojung Shin, David A. Collier, Darryl D. Wilson b, 2000).

Leaning the levels of supplier base

Reduced supplier base is a unique characteristic of contemporary buyer supplier relationship and enhanced business model (Kekre et al. 1995), but the arguments for the traditional practice of multiple sourcing paves lot of benefits to the organization in terms of creating a good basis of economic system, not to become a few source dependent, such reasons reduces risks (New- man, 1989). With the limited number of suppliers, the firms can emphasize a close relational contracting with a smaller number of dedicated suppliers (Kekre et al., 1995; Bozarth et al., 1998; Shin et al., 2000). There are few arguments supports for leaning the sources of supply that the multiple sources of supply as that this could not achieve the economies of scale based on order volume and learning curve effect (Hahn et al., 1986), moreover, the multiple supplier system can be more expensive than a single supplier system and also argues that multiple sourcing lowers overall quality level because of the increased variation in incoming quality among suppliers (Treleven, 1987), whereas a reduced supplier base helps to eliminate the mistrust

between buyers and suppliers due to lack of communication (Newman, 1988), the concurrent worldwide competition forces firms to find the best suppliers in the world. So, coordinating the supply chain in different geographic regions becomes more imperative (Monczka et al., 1983) today which leads to leaning the supply source. Supply base reduction policies are positively related to the buyer supplier product design relationship (De Toni and Nassimbeni, 1999). (Kale et al., 2000; Leenders et al., 2002) argues that the strategic purchasing contributes to the development of one such supply effort management capability is fostering the close working relationships with a limited number of suppliers. Close working relationships with a limited number of suppliers will have a positive effect on customer responsiveness (Injazz J. Chena, Antony Paulraja, Augustine A. Ladob, 2004). When limited number of suppliers are properly and selectively used the firms were achieved the direct link to customer responsiveness (Stanley and Wisner, 2001) and enhanced its financial performance (Carr and Pearson, 1999). Many companies have achieved substantial cost savings by reducing the number of suppliers in their supplier base and deepening the relationships with remaining suppliers (Guimaraes et al., 2002). In line with the same, companies gain benefits when they place a larger volume of business with a limited number of suppliers using long-term contracts (Helper and Sako, 1995; Krause and Ellram, 1997; Guimaraes et al., 2002).

Communication

It's been evident that the effective communication contributes to the development and maintenance of inter-organizational routines that enhance a firm's capability for effectively managing strategic alliance (Zollo et al., 2002). In managing the supply relation and its efforts, the direct communication with suppliers is inevitable to solve problems (Levy, 1997). Integrated inter-organizational communication brings closer relationship among the supply chain members in sharing information, risks and returns, moreover it indirectly makes a amicable level of compactness among the networks which promotes a comforting level of long term relationship(Guimaraes et al., 2002; Cooper and Ellram, 1993; Landeros and Monczka, 1989), and to add on, the different modes of communication platforms like the open source of communication to informal channel of communication paves way for developing and leveraging the tacit knowledge among the channel partners which enables the whole network to gain strategic advantage (Nonaka and Tekeuchi, 1995). By frequent communication, the firm and its suppliers can swell up their knowledge capabilities and enhances their understating to solve the complex competitive issues by the way of developing innovative solutions and disclosure of information. It's been evident that the members in the supply chain forms strategic allies for sharing their business time, critical and sensitive

information are more successful than the others (Mohr and Spekman, 1994), moreover, the frequent exchange of information on strategic and operational matters fosters greater confidence and reduces dysfunctional conflict between the exchange partners (Dwyer et al., 1987; Anderson and Weitz, 1992).

Supplier selection

Supplier selection decision criteria have immense impact on the every task of operational decisions to strategic decision and its process of supplier selection is usually devised with multi criteria decision problem (Liu et al. 2000). In many number of research that has been conducted in the area of supplier selection protracts several supplier selection criteria are used. Basically the supplier-selection is the process by which suppliers are reviewed, evaluated, and chosen to become part of the company's supply chain. The supplier-selection criteria are important for the organizations that apply various criteria that enable them to choose vendors (Fawcett and Fawcett 1995; Mason 1996; Morgan 1996). Turning the pages of the contribution of supplier selection, (Howard Lewis, 1943) states that the important aspect a procurement officer can look all the above is sourcing of the suppliers. Decision related to vendor selection process is complicated with that of many criteria to be considered (C.A.Weber et al, 1991). The pioneering work by (Dickson, 1966) had provided a comprehensive view of the 23 criteria that both the academician and the purchasing practitioners felt the importance of vendor selection decisions. After his contribution, much research has been emerged in the field of supplier

selection. Among all the research is been conducted so far states that the researchers often revered to a very few criteria for selecting the vendor. This research has intensely probed with tangle background investigation related to the most often used supplier selection criteria. They are (i) Quality – (ii) Delivery (iii) Production facilities and capacities (iv)Price (v) Financial position (vi) Technical capacity vii) Management and Organization and the snap shot of related literature review on these parameter is portrayed in Appendix-I

Business performance

The firm performance inducted based on many tasks of organizational effort and how it's been oriented to the overall supply chain management. The firm performance is usually effected by various number of activities and the firms' achievement are evidently measured as Return on investment, Return on assets, Return on sales, Overall quality of the product, Customer satisfaction level, Delivery performance, flexibility performance, Overall competitive position of the firm among the

industry, Employee satisfaction level. (i)The parameter of "Return on investment" is a simple and powerful tool to analyze the firm performance. This parameter of ROI is widely used in research to measure the relationship of efficiency of the supply chain by various authors (Brian Fynes, Chris Voss 2002, Injazz J. Chena, Antony Paulraja, Augustine A. Ladob, 2004, Zhang Fu-jiang, Titan Ye-zhuang,SUN Xiao-lin 2006). (ii) Return on asset is the measure of how profitable a company's assets are used in generating revenue for the firm. It is a straightforward tool to measure the carrying value of the firm. The measure of ROA has been used in the following mentioned researches (Vijay R.Kannan, Keah Choon Tan, 2005,Vijay R.Kannan, Keah Choon Tan, 2006, Zhang Fu-jiang, Titan Ye-zhuang, Sun Xiao-lin 2006). (iii) Return on sales (ROS) is a firm's "operating profit margin" and it measures how much profit is being produced per dollar of sales. This measure is widely employed in SCM research (Michael Tracey and Chong L eng Tan 2001, Injazz J. Chena, Antony Paulraja, Augustine A. Ladob, 2004).(iv)Over all product quality is inferred as product that contribute to its ability to meet given requirements of manufacturer, quality system followed in the firm and by the end user. Such related studies has been carried out (Vijay R.Kannan, Keah Choon Tan, 2005, Vijay R.Kannan, Keah Choon Tan, 2006, Wing S.chow, Christian N . Madu, Chu-Hua Kuei,Min H.Lu, Chinho Lin, Hojung Tseng 2008. (v)Overall customer service level of the firm is primitively probed in this research based on how the products and services are supplied by the company and how it meets or surpasses the customer expectation at various service encounters and different levels. Similar kind of work has been depicted in such researches (Chinho Lina, Wing S. Chow, Christian N. Madu , Chu-Hua Kuei, Pei Pei Yu,2005, Vijay R.Kannan, Keah Choon Tan, 2006, Wing S.chow, Christian N . Madu, Chu-Hua Kuei,Min H.Lu, Chinho Lin, Hojung Tseng 2008). (vi)Overall performance on delivery is mean by the delivery of product and the services that happen in the moment of truth without failure which are indicated in terms of time, quantity, customer services, etc., and such measure is carried out by the various research (Carol Prahinski, W.C.Benton,2004, T A S Vijayaraghavan ,B Raju ,2008). (vii)Overall performance on flexibility is connote as the flexibility to adopt to new and turbulent situations like immediate sourcing, production, delivery, technology upgrading and this measure has been portrayed in the following studies (Carol Prahinski, W.C.Benton,2004, T A S Vijayaraghavan).(viii)Over all competitive position of the firm is embedded with the overall industry structure, attractiveness of the industry, the intensity of the competition among the competitors and the firm's ability to meet the challenges. This factor has evidently seen in many related research (Michael Tracey, Mark A.Vonderembse, Vijay R.Kannan, Keah Choon Tan,

2006, Wing S.chow, Christian N . Madu, Chu-Hua Kuei,Min H.Lu, Chinho Lin, Hojung Tseng 2008). ix) The variable of Employee satisfaction is incorporated in this research is been widely used to measure the efficiency of organizational performance. (Chinho Lin et al 2005) proves that employee satisfaction leads to positive growth in organizational performance.

The extensive review of literature laid concrete on further development of constructing latent variables (Supplier selection, supply effort management, Business performance) and their respective observed variables. This tortuously paves for development of content validity and its associated scale formulation, subsequently, the hypothesis of causal model is also developed based on the conceptual framework.

Conceptual framework and the research hypothesis

It's been found in past research that substantial evidences are quite available to portray efforts to manage supply chain, criteria for selecting the supplier selection and its interaction effect in business performance but such research are in theoretical in nature and only few are proved with empirical investigations and some research has addressed the issues only related to the effect of criterion related to Supply effort management with supplier selection (Monezka 1983, Davis 1993, Levy 1997, Ellran 1981, Baster 1989, Choi and Hartely 1996, Benton and Krajewski 1990), Supply effort management with the organizational performance (Carr and Pearson 1999, Shin 2000, Tracey 1998, Narasimhan et al. 1998, Wong 1999, L.J.Chen 2004, Kuei and Madh 2001, C.Lin 2005), Supplier selection with organizational performance (Cooper and Ellram 1993, Das and Goyal 1989, Quinn 1997, Krause 1997, Tracey and Vonderempse 1998, Ittner 1999, Krause 2000,).

An integrated, unified and comprehensive approach of keeping all factors (buyer-supplier relationship, supplier selection and organizational performance) in single solidarity form is rarely found in the literature**.** The previous researches related to (i) supply effort management, (ii) supplier selection and (iii) organizational performance has considered the observed variables such as (i) supplier long term and strategic relationship, supplier involvement, quality on supplier selection, leaning the levels of supplier base, and communication. (ii) Quality, delivery, production facilities and capacity, price, financial position, management and organization and technical capability and (iii) return on investment, return on asset, return on sales, overall quality of product, overall customer satisfaction level overall performance on delivery, overall performance on flexibility, over all employee satisfaction level and overall competitive position of the firm respectively. Logical integration of all such factors cascaded to the conceptual model and it's hypothesizes. The conceptual model is shown in Appendix-II.

The concept model indicates, the endogenous dependent latent variables are (i) Supplier selection (η_1) and (ii) Business performance (η_2), and the endogenous dependent observed variables related to Supplier selection (η_1) are Quality (y_{11}), Delivery (y_{12}), Production facilities and capacities (y_{13}), Price (y_{14}), Financial position (y_{15}), Technical capacity (y_{16}), Management and Organization (y_{17}) and the endogenous dependent observed variables related to Business performance (η_2) are ROI (y_{21}), ROA (y_{22}), Overall quality of the product (y_{24}), Customer satisfaction level (y_{25}), Delivery performance (y_{26}), Flexibility performance (y_{27}), Overall competitive position (y_{28}), Employee satisfaction level (y_{29}). The exogenous independent latent variable is Supply effort management (ξ), and the exogenous independent observed variables related to Supply effort management (ξ) are Communication (x_1), Long term relationship(x_2), Supplier involvement(x_3), leaning the supplier base(x_4), Quality on supplier selection(x_5). The Measurement error of endogenous dependent observed variables related to supplier selection and organizational performance are mentioned as (ε_{11} to ε_{17}) and (ε_{21} to ε_{29}) respectively. The Residual error term of exogenous independent observed variables is represented as (δ_1 to δ_5). The factor estimates of the endogenous dependent observed variables related to Supplier selection are (λ_{11} to λ_{17}) and the factor estimates of endogenous dependent observed variables related Business performance are (λ_{21} to λ_{29}). The factor estimates of exogenous independent observed variables related to Supply effort management are (λ_1 to λ_5). The gamma (γ_{11} and γ_{12}) estimates and the beta (β) estimates are also mentioned. The (ζ_1 and ζ_2) are the residual terms of endogenous variables.

And the related hypothesizes are:

H1: The organizations practicing Supply effort management style (ξ_1) will have positive relation to supplier selection (η_1)

H2: The organizations practicing the tasks of supply effort management (ξ_1) will have positive Business Performance (η_2)

H3: Organizations that emphasis on supplier-selection (η_1) will have positive business Performance (η_2)

Research Design

The instrument aimed to develop the items that should tap the theoretical construct related to supply effort management, supplier selection and business performance. Turning back the pages of the previous researches conducted based on supplier selection criteria, supply effort management and the influences of such parameters on business performance generated initially 87 items all together. To clearly state 21 items on supplier selection criteria, 29 items on

supply effort management and 37 items on business performance. All 87 items are initially measured at seven point Likert scale with anchoring range from strongly disagree (1) to strongly agree (7) were pre-tested with an in-depth interview conducted with 5 Vice-presidents / Chief General Managers of operations management, 7 Procurement Managers, 7 Chief financial officers, 5 Business Consultants and 8 elite academicians in top b-schools in India. They were evaluated on all the 87 items on how they understand, interact and respond to the content and structure, wordings and ease of answering as well as the time taken to complete the questionnaire in all respect. Suggestion through feedback regarding the format and the content of the questionnaire were considered and changes were made to the questionnaire to reflect respondents' recommendations. During this process the items were reduced to 58. Then a pilot study conducted with 30 samples to further test the inter correlation among the items. The squared phi correlation (φ^2) score of each inter items are estimated and the score which are less than 0.5 are summarily deleted from the constructs and finally 21 items were selected.

After developing the instrument, further a pilot test was conducted to estimate the sample size with the measures related to the 21 attributes of supply effort management, supplier selection and business performance, which were measured on a 7-point Likert-type scale. The ratings range from 1 to 7 (1- strongly disagree, 7 – strongly agree). The estimated confidential interval from the pilot study is 4.8 and maintaining the confidential level at 95% as arbitrary value, the population size estimated to near 2600 firms, the estimated sample size is 358. The data collected through interview schedule. The target respondents for the survey are middle and top level managers who actively take decisions related to procurements and supplier selection decision in the organization which ranges from 125 to 5000 employees.

After determining the face validity through the experts and further to ensure convergent and discriminant validity, the confirmatory factor analysis was performed and respective factors are taken for item analysis to measure the reliability of the scale items. The factor loading and the respective items' Cronbach alpha scores has gained high loadings, which indicate a good convergent validity and reliability. Moreover, the factor estimate and its respective t-values prove that all the variables attained significance level at p $\leq$ value d" 0.05 and this is shown in Appendix-III and the CFA model is portrayed in Appendix-IV.

And, further to prove the same with the goodness of fit indices (which is shown in Appendix-V). The test of the model has achieved a reasonable fit. Though the $\chi 2$ test is highly significant ($\chi 2$ = 1222.49/186, RMSEA = 0.125, $p < 0.01$), other fit indices indicated a good fit.

Analysis and Results

The conceptual model was tested by SEM (causal model), which is performed in LISREL 8.8 v. The x and the y model includes the endogenous dependent observed variables(Y) related to Supplier selection (y_1 to y_7) and Business Performance (y_8 to y_{17}) and the exogenous independent observed variables (x) related to Supply effort management(x_1 to x_5). The Appendix-VI shows results of x and y models. In overall, the x model and the y model has resulted that the variables are valid due to its indicators' parameter estimates and their statistical significance. The t – value of all the x and y model variables ranges from 7.48 to 18.92 with attained levels of significance at 0.05.

The results of structure model exhibits that all the path coefficient values are positive; all the t-values of the variables are statistically significant at $p < 0.05$ (shown in table - 5). Thus, the structure model supports all the three hypotheses of the proposed model which is shown in Appendix-VII and the structure model is mention in Appendix-VIII which represents along with the values of error variance (ζ), and the R^2 of the structural equations.

The structural equation of the model is

Supplier Selection (η_1) = 0.78* (Supply effort management) + ζ_1 [Error variance= 0.38 , R^2 = 0.62]

Business Performance (η_2) = 0.75* (Supplier selection) + 0.18* (Supply effort management) + ζ_2 [Error variance = 0.19, R^2 = 0.81]

The result further proves the fitness of the proposed model with the goodness of fit indices (Table - 6). The $\chi 2$ test is significant ($\chi 2$ = 1222.49/186, RMSEA = 0.125, $p < 0.01$), other fit indices indicates a good fit which is shown in Appendix-IX. Thus, the measurement model and the structural model ensure that the proposed model has consistent and gains acceptable level.

Discussion and Conclusions

There are few interesting observations that need to be addressed based on this empirical investigation. Primarily, the variables that are related for developing the construct of supply effort management, supplier selection; business performance has consistent and proven evidences in the literature review. All the observed variables used for survey instrument has proved with high level of reliability, validity and the estimate loadings of these variables also shown with high values which proves the variables selected for developing the construct holds good. To the next, related to the discussion on hypotheses of the model, the causal relation between the SPEM to SS, SPEM to BP, and SS to BP are statistically significant and moreover it provides logically sound.

The causal model states that there is positive relationship exist between the supply effort management to supplier selection which regains evidences from such previous studies (Monezka 1983,Baxter 1989,Ellrem 1991,Levy 1997,Tan et

al 2001.C.Lin et al 2005) further to ponder, its evidently proves that the supply effort managements have positive effects on business performance and the past related such studies reports finds similar conclusions (Carr et al 1999,Quein et al 1997) and finally, the organization which has the practices of good supplier selection procedures and standards have achieved greater business performance which also has the support of previous empirical evidences(cooper et al 1993,Das et al 1989,Tracey et al 1999,Krause2000) . Though, supply effort management has the direct influence over business performance, this research also indicates that the business performance has intrinsic effect of supplier selection on supply effort management and the value of interaction effect is 0.585 (that is 0.78 X 0.75). Thus, the organizations which practices the styles of supply and value chain management orientations in all their tasks of business process will necessarily achieves and meets the good and high levels of supplier selection standards and the organizational performance have direct impact of the practices of supply effort management and also the business performance has the indirect and interaction influences of supplier selection on supply effort management. To supplement further on the model, the SEM model confirms with acceptable level of goodness of fit indices.

Directions for future research

This research is not without limitation which can be addressed in further research. Primarily, the new dimensions of construct related to professional way of managing supply chain like supplier certification, supplier integration can be included in supply effort management criteria. The issues related to globalization, digitalization, social responsibility and green supplier management can be included in the construct of supplier selection. The concerns related to strategic issues like system dynamics, business process, organizational culture and dynamics can be incorporated in the construct of business performance. As this research has much concentrated on first tier supplier, the future research can address the secondary level of suppliers and further the issues related to the interaction effects of both primary and secondary level of suppliers can also be addressed. The future research can compare this model with the other different types of (i) industry, (ii) business process and (iii) product and services, so that useful insights can be triggered for various business situations.

References

- Anderson, E. and Weitz, B. The use of pledges to build and sustain commitment in distribution channels. J. Marketing Res., 1992, 29, 18–34.
- Carol Prahinski, W.C.Benton, 2004, supplier evaluations: communication strategies to improve supplier performance, Journal of operations management, 22, 39-62

- Carter,J.R. Miller ,J.G 1989, The impact of alternative vendor/ buyer communication structures on the quality of purchased materials , Decision sciemces, 20 (4) 759-776
- Carr, A.S., Pearson, J.N., 1999. Strategically managed buyer–seller relationships and performance outcomes. Journal of Operations Management 17, 497–519.
- Choi, T.Y., Hartley, J.L., 1996. An exploration of supplier selection practices across the supply chain. Journal of Operations Management 14, 333–343.
- Choi, T.Y. and Hartley, J.L. (1996),"An exploration of supplier selection practices across the supply chain", Journal of Operations Management, Vol. 14, pp. 333-43.
- Dwyer, F.R., Schurr, P., Oh, S., 1987. Developing buyer–seller relationships. Journal of Marketing 51 (2), 11–27.
- Dyer, J.H., 2000. Collaborative Advantage: Winning Through Extended Enterprise Supplier Networks, Oxford University Press, New York, NY.
- De Toni, A., Nassimbeni, G., Tonchia, S., 1994. New trend in the supply management. Logistics Information Management 7 (4), 41–50.
- Dempsey, W., 1978. Vendor selection and the buying process. Industrial Marketing Management 7, 257–267.
- . Dickson, G.W., 1966. An analysis of supplier selection systems and decisions. Journal of Purchasing 2, 5–17.
- Epatko, E. 1994. Suppliers can help meet customer desires. Purchasing 117(8):9-11.
- Ganesan, S., 1994. Determinants of long-term orientation in buyer–seller relationships. Journal of Marketing 58 (2), 1–19.
- Ghoshal, S., Moran, P., 1996. Bad for practice: a critique of the transaction cost theory. Academy of Management Review 21(1), 13–47.
- Hahn, C.K., Kim, K.H., Kim, J.S., 1986. Costs of competition: implications for purchasing strategy. Journal of Purchasing and Materials Management, 2–7, fall.
- Hahn, C.K., Pinto, P.A., Brag, D.J., 1983. Just-in-time production and purchasing. Journal of Purchasing and Materials Management, 2–10, fall.
- Helper, S., "How much has really changed between US automakers and their suppliers?", Sloan Management Review, Vol. 32 No. 4,1991, pp. 15-28
- Hartley. J. and T.Y. Choi, 1996. Supplier development: Custolners as a catalyst of process change, Business Horizons 39, 37 44.
- Helper, S.R., Sako, M., 1995. Supplier relations in Japan and the US; are they converging? Sloan Management Review, 77–82, spring.
- Ittner, D.C., Larcker, F.D., Nagar, V. and Rajan, V.M., Supplier selection, monitoring practices and firm performance. J. Acc. Public Policy, 1999, 18, 253–281.

- Injazz J. Chen, Antony Paulraj, Augustine A.Lado, 2004, Strtegic purchasing, Supply management and firm performance, Journal of operations management 22,505-523
- Krajewski, L.J., Ritzman, L.P., 1996. Operations Management:Strategy and Analysis. 4th edn. Wesley, Addison.
- V. R. Kannan and K. C. Tan, "Supplier selection and assessment: Their impact on business performance," J. Supply Chain Manage., vol. 38, no. 4, pp. 11–21, 2002.
- V. R. Kannan and K. C. Tan, "Buyer-Supplier relationships, the impact of supplier selection and buyer –supplier engagement on relationship and firm performance" , Int, Journal of physical distribution & logistics management ,Vol 36,10,2006,755-775
- Kannan VR, Tan KC. Just in time, total quality management, and supply chain management: understanding their linkages and impact on business performance. Omega 2005; 33(2):153–62.
- Kanter, R.M., 1994. Collaborative advantage. Harvard Business Review 74 (4), 96–108.
- Krause, D.R., Ellram, L.M., 1997. Critical elements of supplier development. European Journal of Purchasing and Supply Management 3 (1), 21–31.
- Kuei, C., Madu, C.N., Lin, C., 2001. The relationship between supply chain quality management practices and organizational performance. The International Journal of Quality& Reliability Management 18 (8), 864–872.
- Krause, D.R. 1997. Supplier development: current practices and outcomes. *International Journal of Purchasing and Materials Management* 33(2):12-19.
- Landeros, R., Monczka, R.M., 1989. Cooperative buyer-seller relationships and a firm's competitive posture. Journal of Purchasing and Materials Management, 9–18, fall.
- Leenders, M.R., Fearon, H.E., Flynn, A.E., Johnson, P.F., 2002. Purchasing and Supply Management, McGraw-Hill/Irwin, New York, NY.
- Liu, J.Ding, F.Y.and Lall, Y. U sing data envelopment analysis to compare suppliers for supplier selection and performance improvement. Int.J.Supply Chain Manage, 20005(3) 143-150
- Lin C, Chow WS, Madu CN, Kuei C, Yu P. A structural equation model of supply chain quality management and organizational performance. International Journal of Production Economics 2005;96(3):355–65.
- Levy, D.L., 1997. Lean production in an international supply chain. Sloan Management Review, 94–102, winter.
- Manoochehri, G.H., 1984. Suppliers and the just-in-time concept. Journal of Purchasing and Materials Management, 16–21, winter.

- Monczka, R.M. and R.J. Trent. 1991. Evolving sourcing strategies for the 1990s. International Journal of Physical Distribution & Logistics Management 21(5):4-12.
- Morgan, J. 1996a. Supplier integration: a new level of supply chain management. Purchasing 120(1):110-113.
- Morgan, J. 1996b). Good may not be good enough. Purchasing 120(7):38-41.
- Morgan, J. 1997. Integrated supply chains: How to make them work. Purchasing 121(5):
- Monczka, R M, Trent, R J, and Callahan, T J (1983). Supply base strategies to maximize supplier performance. *International Journal of Physical Distribution and Logistics Management, 23 (4),* 42-54.
- Mason T. Getting your suppliers on the team. Logistics focus 1996, 4 (1), 10-2
- Nonaka, I., Tekeuchi, H., 1995. The Knowledge Creating Company: How Japanese Companies Create the Dynamics of Innovation, Oxford University Press, Oxford, UK.
- Newman, R.G., 1988a. The buyer–supplier relationship under just-in-time. Production and Inventory Management Journal, 45–49, Third Quarter.
- Newman, R.G., 1988b. Single source qualification. Journal of Purchasing and Materials Management, 10–17, summer.
- Newman, R.G., 1989. Single sourcing: short-term savings versus long-term problems. Journal of Purchasing and Materials Management, 20–25, summer.
- Shin, H., Collier, D.A., Wilson, D.D., 2000. Supply management orientation and supplier–buyer performance. Journal of Operations Management 18 (3), 317–333.
- Stanley, L.L., Wisner, J.D., 2001. Service quality along the supply chain: implications for purchasing. Journal of Operations Management 19 (3), 287–306.
- Treleven, M (1987). Single sourcing: a management tool for the quality supplier. Journal of Purchasing and Materials Management (spring), 19-24.
- Treleven, M., 1987. Single sourcing: a management tool for the quality supplier. Journal of Purchasing and Materials Management, 19–24, spring.
- Tracey, M., A., Vonderembse, M.A., 1998. Building supply chains: A key to enhanced manufacturing performance. Proceedings of the Decision Science Institute, pp. 1184–1186.
- Tracey, M., A., Vonderembse, M.A., 2000," building supply chains: a key to enhancing manufacturing performance" , mid-americon journal of business. Vol 15, 2, 11-20

Appendix -I

Table 1: Summary of literature support of supplier selection criteria

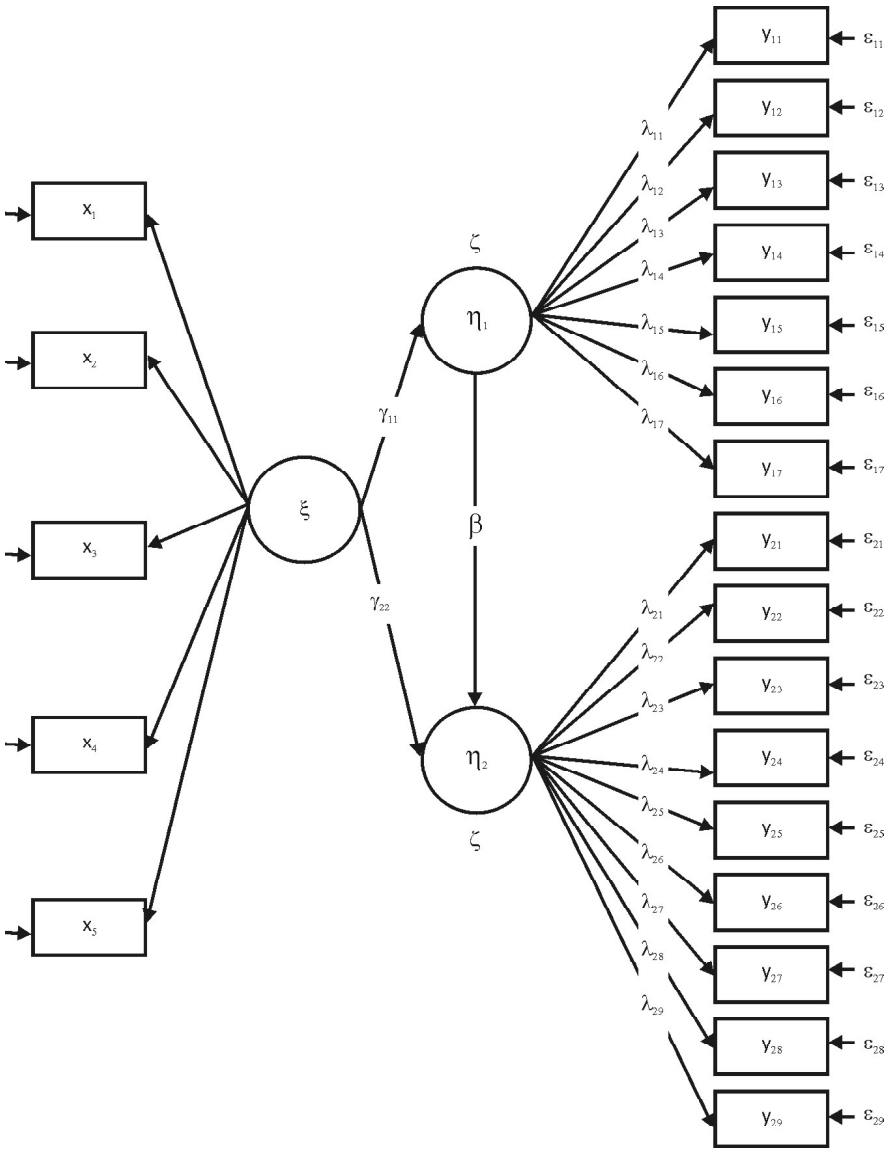
Authors	Quality	Price	Delivery	Technical capacity	Financial position	Production facilities and capacities	Management Organization and
Dickson 1966	✓	✓	✓	✓	✓	✓	✓
Hinkle et al., 1969	✓	✓	✓	✓			
Payne 1970					✓		
Cardozo and Cagley 1972	✓	✓	✓				
Moore and Fearon 1973	✓		✓				
Sheth 1973	✓	✓	✓	✓		✓	
Roberts 1973			✓				
Gaballa 1974		✓				✓	
Hakansson and Wootz 1975	✓	✓				✓	
Lamberson et al. 1976	✓	✓	✓	✓	✓	✓	✓
Wieters 1976				✓	✓	✓	✓
Cooper 1977			✓				
Dempsey 1978	✓	✓	✓	✓	✓	✓	✓
Croell 1980	✓		✓				
Monczka et al. 1981	✓	✓	✓		✓	✓	
Shore 1981	✓	✓	✓				
Benton and whybark 1982		✓					
Bragg and Hahn 1982			✓			✓	
Jackson 1983	✓		✓				
Benton 1983		✓					
Hahn et al. 1983	✓	✓	✓			✓	
McFillen et al. 1983	✓	✓	✓				
Narasimhan 1983	✓		✓			✓	
Browning et al. 1983		✓	✓	✓		✓	
Kraljic 1983	✓		✓	✓		✓	
Buffa and Jackson 1983	✓	✓	✓				

Monahan 1984		✓					
Manoochehri 1984	✓	✓	✓				
Mazurak et al. 1985	✓	✓	✓				
Levy et al. 1985		✓					
LaForge 1985		✓					
Benton 1985		✓					
Bender et al. 1985	✓	✓	✓			✓	
Gregory 1986	✓	✓	✓	✓		✓	
Hahn et al. 1986	✓	✓	✓	✓		✓	
B anerjee 1986		✓	✓				
Kingsman 1986		✓					
B anerjee 1986		✓					
Timmerman 1986	✓	✓	✓	✓			
Narasimhan and Stoynoff 1986		✓				✓	
Goyal 1987		✓					
Jacobson and Aaker 1987	✓						
Anthony and Buffa 1987		✓	✓				
Dada and srikanth 1987		✓					
Soukup 1987	✓	✓	✓	✓	✓	✓	✓
Jordan 1987		✓					
Treleven 1987	✓	✓	✓			✓	
Ansari and Modarress 1988	✓	✓	✓				
Frazier et al. 1988	✓	✓	✓	✓			✓
Chakravarthy and martin 1988		✓					
Markowski and Markowski 1988		✓					
Newman 1988	✓						
Ronen and Trietsch 1988		✓	✓				
Newman 1988	✓	✓	✓	✓		✓	
Ho and Carter 1988						✓	
Lamm and Vose 1988		✓					

Turner 1988		✓				✓	
Burton 1988	✓	✓	✓	✓		✓	✓
Chapman 1989	✓		✓			✓	
Pan 1989	✓	✓	✓				
Wagner et al. 1989	✓	✓	✓				
Bernard 1989	✓		✓				✓
Hwang et al.1990		✓					
Sharma et al. 1990	✓	✓	✓				
Benton and Krajewski 1990	✓		✓				
Chapman and Carter 1990	✓		✓				
Thomas Y.Choi et al. 1996	✓	✓	✓	✓	✓		
Siying Wei et al. 1997	✓	✓	✓				
Hojung Shin et al. 2000	✓	✓	✓				
Vrijhoef and Koskela 2000			✓				
Michael Tracey et al 2000	✓	✓	✓				
Kuei and Madu, 2001	✓	✓					
Michael Tracey and Chong Leng Tan 2001	✓		✓			✓	
Tan, Keah Choon 2002	✓	✓	✓	✓	✓	✓	
Chinho Lin et al. 2005	✓	✓					
Pi & Low 2005	✓	✓	✓				
Wing S. Chow2005	✓	✓					
Christian N. Madu 2005	✓	✓					
Kreng & Wang 2005	✓	✓	✓				
Chu-Hua Kuei, Pei Pei Yu,2005	✓	✓					
Vijay R,Kannan et al. 2006	✓		✓	✓			
ZHANG Fu-jiang et al. 2006	✓	✓	✓			✓	
G.kannan et al. 2006	✓	✓	✓	✓	✓	✓	
I.H.YIGIN et al. 2007	✓	✓	✓	✓			
Chang, Wang et al.,2007	✓		✓	✓			
TAS Vijayaragan et al. 2008	✓	✓	✓	✓		✓	

Appendix-II

Figure 1: Conceptual Model



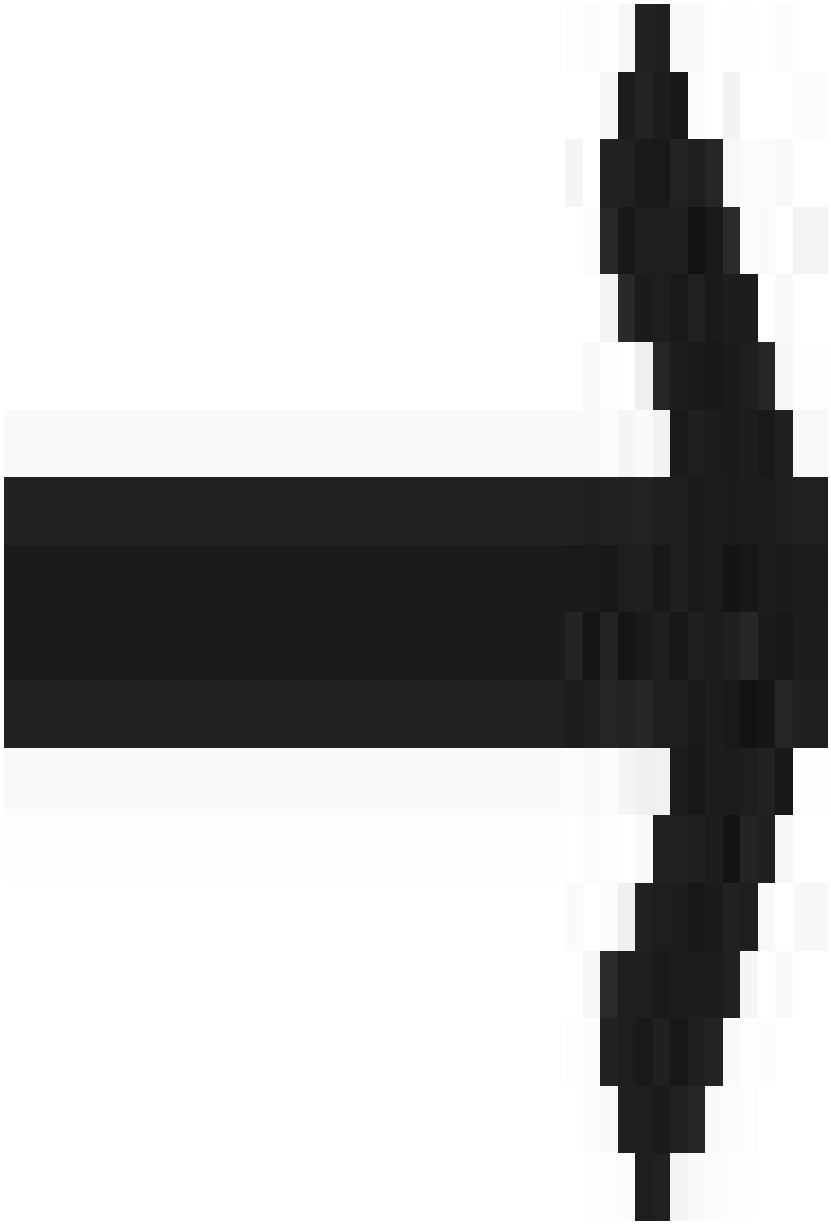
Appendix-III

Table 2 : Reliability and convergent validity

Variable	Factor estimate	t-value	Error variance	R^2	Coefficient alpha	Cronbach's Alpha	Std. Cronbach's Alpha
Supplier selection(η_1)							
Quality(y_{11})	1.26	17.80*	0.94	0.63	0.9525		
Delivery (y_{12})	1.34	20.10*	0.64	0.74	0.9527		
Production facilities and capacities (y_{13})	1.35	20.66*	0.58	0.76	0.9506		
Price (y_{14})	1.29	17.74*	0.65	0.72	0.9491	0.958806	0.958985
Financial position (y_{15})	1.24	18.39*	0.80	0.66	0.9510		
Technical capacity (y_{16})	1.22	18.41*	0.78	0.66	0.9520		
Management and Organization (y_{17})	1.17	16.92*	0.96	0.59	0.9576		
Total	0.9588						
Business Performance(η_2)							
ROI (y_{21})	1.23	17.29*	0.97	0.61	0.9035		
ROA (y_{22})	1.27	19.72*	0.66	0.71	0.9007		
ROS (y_{23})	1.26	19.03*	0.71	0.69	0.8983		
Overall quality of the product (y_{24})	1.28	17.90*	0.93	0.64	0.9017		
Customer satisfaction level (y_{25})	1.02	12.86*	0.61	0.39	0.9104	0.915840	0.914634
Delivery performance (y_{26})	1.07	14.26*	1.33	0.46	0.9077		
flexibility performance (y_{27})	1.06	14.41*	1.28	0.47	0.9040		
Overall competitive position(y_{28})	1.00	14.01*	1.22	0.45	0.9068		
Employee satisfaction level(y_{29})	0.63	07.60*	2.06	0.16	0.9215		
Total					0.9158		
Supply effort management(ξ)							
Communication (x_1)	0.64	08.12*	1.78	0.19	0.9016		
Long term relationship(x_2)	0.93	12.48*	1.34	0.39	0.8723		
Supplier involvement(x_3)	1.18	16.63*	0.99	0.59	0.8411	0.891681	0.890543
Leaning the supplier base(x_4)	1.24	18.92*	0.60	0.72	0.8496		
Quality on supplier selection(x_5)	1.15	15.88*	1.03	0.56	0.8699		
Total					0.8917		

*variables significant at $P \leq 0.05$

Appendix-IV



Appendix-V

Table.3 – Fit Indices table of CFA

Index	Suggested Value	Fit Indices of CFA Model
RMSEA	$\leq$ 0.10	0.12*
Standard root mean square residual	$\leq$ 0.10	0.058
Normed Fit Index (NFI)	$\geq$ 0.90	0.94
Non-normed fit index (NNFI)	$\geq$ 0.90	0.95
Comparative fit index (CFI)	$\geq$ 0.90	0.95
Root Mean Square Residual (RMR)	$\leq$ 0.08	0.14*

* indicated the model is fit at accepted level

Appendix - VI

Table 4: Results of X and Y model

Variables	Constructs	Estimate	t-Value	Error term	R^2
Supplier Selection(η_1)	Quality(y_1)	1.26	-	0.94	0.63
	Delivery (y_2)	1.34	18.76*	0.64	0.74
	Production facilities and capacities (y_3)	1.35	19.20*	0.58	0.76
	Price (y_4)	1.29	18.46*	0.65	0.72
	Financial position (y_5)	1.24	17.35*	0.80	0.66
	Technical capacity (y_6)	1.22	17.36*	0.78	0.66
	Management and Organization (y_7)	1.17	16.10*	0.96	0.59
Business Performance(η_2)	ROI (y_8)	1.23	-	0.97	0.61
	ROA (y_9)	1.27	17.64*	0.66	0.71
	ROS (y_{10})	1.26	17.35*	0.71	0.69
	Overall quality of the product (y_{11})	1.28	16.48*	0.93	0.64
	Customer satisfaction level (y_{12})	1.02	12.30*	1.61	0.39
	Delivery performance (y_{13})	1.07	13.51*	1.33	0.46
	Flexibility in performance (y_{14})	1.06	13.64*	1.28	0.47
	Overall competitive position(y_{15})	1.00	13.30*	1.22	0.45
	Employee satisfaction level(y_{16})	0.63	07.48*	2.09	0.16
Supply effort management (ξ)	Communication (x_1)	0.64	08.12*	1.78	0.19
	Long term relationship(x_2)	0.93	12.48*	1.34	0.39
	Supplier involvement(x_3)	1.18	16.33*	0.99	0.59
	Leaning the supplier base(x_4)	1.24	18.92*	0.60	0.72
	Quality on supplier selection(x_5)	1.15	15.88*	1.03	0.56

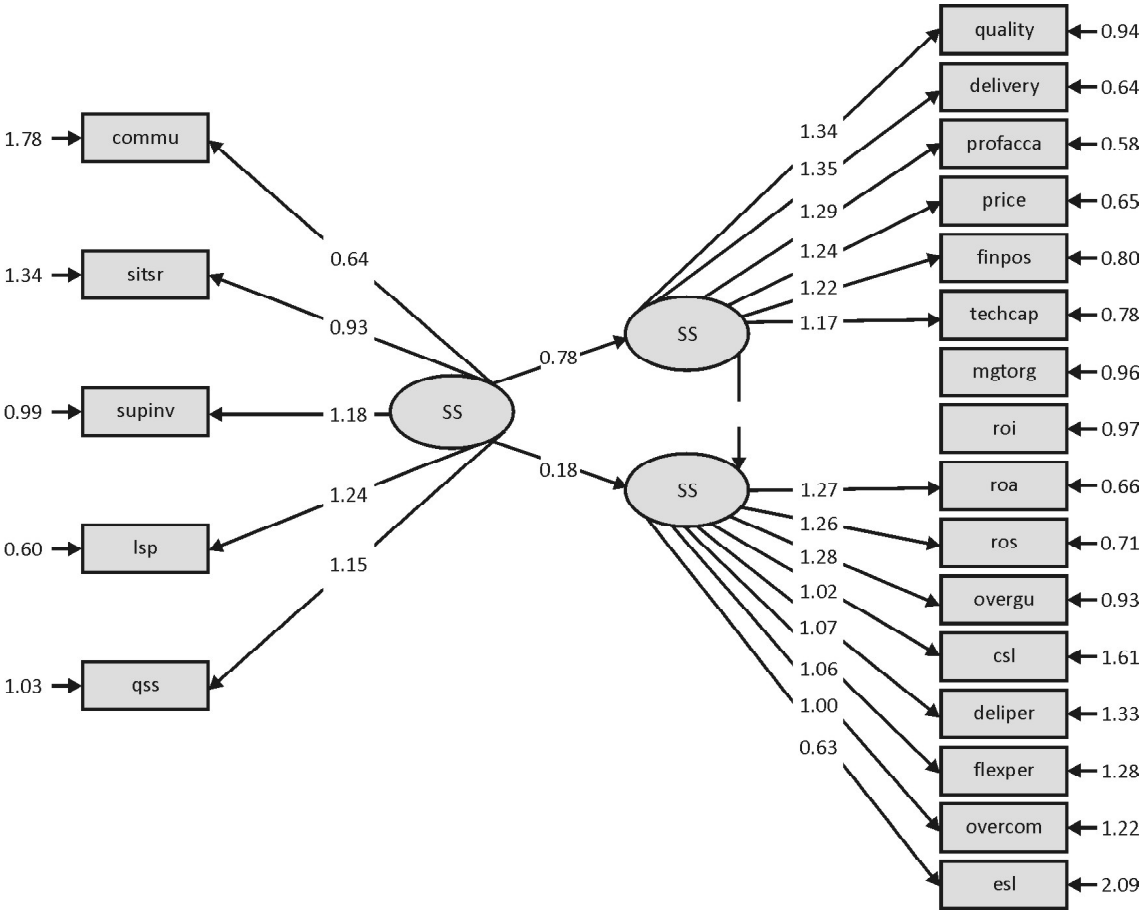
*variables significant at P $\leq$ 005

Table -5 – Results of Hypothesis Table

Causal Path	Hypothesis	Point estimate	t-Value	Hypothesis support
SPEM→SS	H1	0.78	13.60*	Yes
SPEM→BP	H2	0.18	2.938*	Yes
SS→BP	H3	0.75	10.45*	Yes

Appendix - VIII

Fig 3 - Structural equation model



Appendix-IX

Table.6 – Fitness Indices of SEM Model

Index	Suggested Value	Fit Indices of SEM Model
RMSEA	$\leq$ 0.10	0.125*
Standard root mean square residual	$\geq$ 0.90	0.94
Normed Fit Index (NFI)	$\geq$ 0.90	0.95
Non-normed fit index (NNFI)	$\geq$ 0.90	0.95
Comparative fit index (CFI)	$\leq$ 0.08	0.14*
Root Mean Square Residual (RMR)	$\leq$ 0.10	0.058*

* indicated the model is fit at accepted level