ROMANIAN REVIEW OF SOCIAL SCIENCES

Romanian Review of Social Sciences (2012), No.3

rrss.univnt.ro

SUPPLY CHAIN PERFORMANCE: REVIEW OF EMPIRICAL LITERATURE

Santanu Mandal
Department of Operations & IT, IBS, Hyderabad, India
E-mail: shaan.nitw@gmail.com

Abstract
Last few decades has seen an increasing stress on obtaining optimal performance in the supply chain regime. In this context, managing supply chain operations effectively and efficiently has served for the success of firms. Accordingly, the importance of various supply chain performance metrics has been repeatedly underscored. All these have formed the platform to establish appropriate measure of supply chain performance has long been highlighted. The analysis of literature in the area of supply chain performance shows that different researchers have presented different metrics and measures to capture supply chain performance. The deeper analysis shows that till 2000, it was mainly the conceptual frameworks that dominated the allied territory but after that the area has witnessed significant empirical contributions. However, there has been no consensus on measuring supply chain performance and each measure has its own benefits and drawbacks. The current study reviews the empirical contributions in the supply chain performance literature.

Keywords: Supply chain performance, Supply chain risk, Supply chain modeling, Supply chain management.

1. Introduction

There exist several entities in a supply chain starting from manufacturers, transportation, distribution, wholesale, retail, and end customers. At each and every junction the supply chain partners expect timely, reliable and quality delivery of the right amount of products at low cost.

A supply chain is broadly defined as all of the linked individual organizations that, by direct or indirect means, lead to the delivery of a service or a good to a customer (Chopra and Meindl, 2004). Every product has its unique supply chain. For e.g. the supply chain for Cadbury's starts with cocoa beans growing on farms and ends with a hungry customer buying a bar of chocolate. The outcome is a network of organizations that are linked through upstream and downstream relationships in the different processes and activities that produce value in the form of products and services in the hands of the ultimate customer (Christopher, 1998).

In the supply chain context, continuous performance improvement has become a topic of serious concern for each and every supply chain partner. In practice, supply chain based companies (e.g., Dell, Wal-Mart, Samsung, Toyota, Lenovo, Gome, etc.) have used different performance management tools to support their supply chain strategies. The organizations are finding the activities of monitoring and improvement of supply chain performance as an increasingly complex task (Morgan, 2007).

In the supply chain literature, attempts to define supply chain performance have been rare. Srinivasan *et al*. (2011) defined supply chain performance for a firm as the performance of the various processes included within the firm's supply chain function. Examples of measures specifically used to assess supply chain performance of a firm include supplier performance (Davis, 1993), customer satisfaction (Christopher, 1994), inventory costs, number of on-time deliveries, product availability performance and customer response time (Beamon, 1999).

There exists several other performance measures that have been widely used in supply chain performance evaluation models for e.g. cost minimization (Cohen & Moon,1990; Lee & Feitzinger,1995),sales maximization (Hammel & Laura, 1993),profit maximization(Cohen & Lee,1989), inventory investment minimization(Lee & Billington,1993),return on investment maximization(Christopher,1994), stock-out probability minimization(Ishii *et al*., 1988), buyer-supplier benefit maximization(Christy & Grout, 1994) etc.

The several metrics of supply chain performance enable firms to have a benchmark to assess their supply chain performance including internal and external firm. The application of internal linkage performance metrics results in elimination of non-value added activities, reduction in order variation, faster product flows, more efficient use of time, material and human resources, and reduction of the bullwhip effect (Frohlich & Westbrook, 2001). Benefits of usage of external linkage performance metrics include the creation of end-customer value through closer integration activities and communication with other member firms along the supply chain (Bowersox *et al.,* 2000).

The supply chain performance literature has witnessed both conceptual and empirical contributions; though it was mainly the conceptual works that dominated the literature until 2000.Growing complexity in today's supply chain operations and increasing competitiveness has led the firms to look for key performance indicators (KPI's).In this backdrop, the present study attempts to review the empirical contributions in the field of supply chain performance so as to delve further with a view to find the existing lacunae and future research opportunities.

The paper has been organized in the following order. The next section deals with performance measurement in supply chain. The immediate section reviews the empirical contributions in the allied regime and finally the article concludes with future research opportunities.

2. Performance Measurement in Supply Chain

The topic of performance measurement have been discussed widely across several disciplines but rarely defined. It can be defined as the process of quantifying action, where measurement is the process of quantification and action leads to performance (Neely *et al.,* 1995).

The marketing perspective entails that firms achieve their goals through a set of activities that they perform, by satisfying their customers with greater efficiency and effectiveness than their competitors (Kotler, 1984). The terms efficiency and effectiveness are very close yet different.

Basically performance measurement can be defined as the process of quantifying the efficiency and effectiveness of an action (Gunasekaran & Kobu, 2007). Effectiveness is the extent to which a customer's requirements are met and efficiency measures how economically a firm's resources are utilized when providing a pre-specified level of customer satisfaction (Sheperd & Gunter, 2006). This is an important

point because it not only identifies two fundamental dimensions of performance, but also highlights the fact that there can be internal as well as external reasons for pursuing specific courses of action.

Hence, performance measurement is essential for companies to improve supply chains' effectiveness and efficiency (Beamon, 1999). It is the responsibility of the decision-makers to develop metrics for evaluating performance (Beamon, 1999; Gunasekaran, 2004).

The development of metrics for evaluating supply chain performance is often followed by the identification of key performance indicators (KPI's).This is required as the main job of supply chain managers next is to devise strategies targeted at improvement of these critical KPI's. But practically decision makers face a tough challenge in figuring out the relationships among several KPI's and prioritize them for overall goal accomplishment (Cai *et al.,* 2009).

Finally, the usage of supply chain performance metrics and timely communication enables a firm to attract new customers. The emergence of new technologies has facilitated supply chain coordination to a greater degree.

There exist different steps of a complex performance management system for e.g. identifying measures, defining targets, planning, communication, monitoring, reporting and feedback. These processes have been embedded in most information system solutions, such as i2, SAP, Oracle EPM, etc. These system solutions measure and monitor key performance indicators (KPIs) which are crucial for optimizing supply chain performance (Cai *et al.,* 2009).

A performance measure is a set of metrics used to quantify the efficiency and/or effectiveness of an action (Neely *et al.,* 1995).The term ''metric'' refers to definition of the measure, how it will be calculated, who will be carrying out the calculation, and from where the data will be obtained (Neely *et al.,* 1995). The main challenge is to identify the key performance measures for value-adding areas of a supply chain.

Neely et al. (1995) identify a number of approaches to performance measurement, including: the balanced scorecard (Kaplan & Norton, 1992); the performance measurement matrix (Keegan *et al.,* 1989);performance measurement questionnaires (Dixon *et al.,* 1990); criteria for measurement system design (Globerson, 1985); and, computer aided manufacturing approaches.

There exist two broad set of studies. The first one emphasizes investigation and issues relating to performance measures in supply chain while the second one deals with issues relating to performance measurement systems in supply chains.

Performance Measures in Supply Chain

In the realm of performance measures, few attempts have been made to systematically classify the measures for evaluating the performance of supply chains. Moreover, there is disagreement over the most appropriate way to categorise them. For example, they have been grouped according to:

- Whether they are qualitative or quantitative (Beamon, 1999; Chan *et al.*, 2003).
- What they measure: cost and non-cost (Gunasekaran, 2001; De Toni & Tonchia, 2001);cost, quality, resource utilization, flexibility, visibility, trust and innovativeness (Chan *et al*., 2003); resources, outputs and flexibility (Beamon, 1999); supply chain collaboration efficiency; coordination efficiency and configuration (Hieber, 2002);and, input, output and composite measures (Chan & Qi, 2003).
- Their strategic, operational or tactical focus (Gunasekaran *et al.*, 2001).
- The process in the supply chain they relate to (e.g. Chan & Qi, 2003; Lockamy & McCormack, 2004).

Performance Measurement Systems in Supply Chains

There exist several discrepancies in performance measurement systems that are also found in the wider performance management literature.(e.g. Neely *et al.* ,2005).

They include:

- lack of connection with strategy (Beamon, 1999; Chan & Qi, 2003; Gunasekaran *et al*., 2004)
- focus on cost to the detriment of non-cost indicators (Beamon, 1999; De Toni & Tonchia, 2001)
- lack of a balanced approach (Beamon, 1999; Chan *et al*., 2003)
- insufficient focus on customers and competitors (Beamon, 1999)
- loss of supply chain context, thus encouraging local optimization (Beamon, 1999)and
- lack of system thinking (Chan *et al*., 2003; Chan & Qi, 2003).

In recent times, researchers have attempted to respond to these limitations by designing systemic and balanced performance measurements systems. Perhaps the most well-known of these is the supply chain operations reference (SCOR) model alluded to earlier. This was developed by the Supply Chain Council in 1997 and has been described as a "systematic approach for identifying, evaluating and monitoring supply chain performance" (Stephens, 2001). It rests on the principle that a balanced approach is crucial; single indicators (e.g. cost or time) cannot be adequately taken to measure supply chain performance, which must be measured at multiple levels(Shepherd & Gunter,2006).

Accordingly, Beamon (1999) also stressed that a single performance measure remains inadequate since "*it ignores the interactions among important supply chain characteristics and ignores critical aspects of organizational strategic goals."(*Beamon, 1999).Therefore a framework can be developed for performance measurement in supply chains consisting of three separate types of performance measures: (a) resource measures (e.g. manufacturing cost, distribution cost, inventory cost etc.)(b) output measures (e.g. sales, profit, on-time deliveries etc.) and (c)flexibility measures(volume flexibility, delivery flexibility etc.)(Beamon, 1999).Finally any performance measurement system must be linked with customer satisfaction (Beamon, 1999; Gunasekaran *et al.*, 2001).

Thus there exists great ambiguity among decision makers and practitioners regarding the usage of performance metrics in supply chain performance evaluation. To address this problem, some researchers have used Balanced Scorecard (BSC) and Activity Based Costing (ABC) methods to evaluate supply chain performance (Liberatore & Miller, 1998). Other researchers have also proposed similar balanced frameworks, such as Performance Measurement Matrix, results-determinants framework, performance pyramid, etc.(Neely *et al*.,2005).

3. Review of Empirical Contributions

Studies have investigated supply chain performance in several dimensions and perspectives. It is evident that as a supply chain is a network of several organizations; hence working in collaboration is essential for optimal performance. There are several constituents that affect the collaboration potential of a supply chain and any unmeasured changes in these can have adverse effects on performance. Angerhofer & Angelides (2006) investigated the impact of changes in the constituents and key parameters of a collaborative supply chain on its performance. With the help of underpinnings from extant literature, the study develops a model for collaborative supply chain comprising stakeholders, topology, enabling technology, levels of collaboration, business strategy and processes. The study contemplates three performance measures viz. resource, output and flexibility measures. To demonstrate the applicability of the model and the performance indicators, the study utilized a collaborative supply chain consisting of one supplier, two manufacturers, one wholesaler and one retailer. To simulate the collaborative supply chain and to implement the performance indicator, the

study used System Dynamics (SD) methodology. System dynamics is an approach, methodology and modeling technique for understanding the behavior of complex systems over a period of time and includes feedback loops and delay that affect the system behavior (Forrester, 1961; Edward, 1978).Adopting a systems thinking could have resulted in better performance for supply chain. Holmberg (2000) attempted to explain supply chain performance measurement problems from a systems perspective. The study also attempted to find how the problems are a result of insufficient systems thinking. The data was collected from six firms (a sales organization, a wholesaler, a product development organization, a purchasing organization, two key suppliers) composing part of a supply chain in the home furnishing business in Sweden. This was complemented with extensive literature review across disciplines such as management, quality and logistics. The study exhibited the presence of a weak link between strategy and actions, firms are still putting greater emphasis on financial measures causing reactive behavior and there exists several measures creating more confusion. Also it's extremely difficult to categorize firms within a supply chain as either having adopted systems thinking or not. Rather, both structured models indicating a high degree of systems thinking, and problems showing fragmentation, are present. In fact a systematic approach could really improve the over supply chain performance. Cai *et al*.(2009) developed a framework using a systematic approach to improve the iterative key performance indicators (KPIs) accomplishment in a supply chain context. KPI cost accomplishment transformation matrix (PCTM) methodology was used. The framework analyzed quantitatively the interdependent relationships among a set of KPIs. It can identify crucial KPI accomplishment costs and propose performance improvement strategies for decision-makers in a supply chain. A scenario of a large retail company is also discussed to explain the application of this framework. But there exists several limitations (1)environment where KPI's changing drastically could lead to a change in their interrelationships also; hence PCTM methodology accuracy will fail in such situations(2)the framework and PCTM approach can be applied only in firms where SCM is actively deployed(3)results of PCTM approach should be used only for supporting decision making. Supply chain performance has not been limited to system dynamics and PCTM approaches but has also witnessed the usage of interpretative structural modeling approach in depicting performance. Charan *et al. (*2008) aimed to determine the key supply chain performance measurement

system (SCPMS) implementation variables, on which the top management should focus, so as to improve the effectiveness and efficiency of supply chain (SC). The study used interpretive structural modeling (ISM)-based approach to model the SCPMS implementation variables. Those variables have been categorized under "enablers" and "results." The enablers are the variables that help boost the SCPMS implementation variables, while results variables are the outcome of good SCPMS implementation. The study portrayed the variables involved with the implementation of SCPMS. An important finding of this modeling approach was that awareness about performance measurement system (PMS) in supply chain is a very significant enabler. For better results, top management should focus on improving the important such as awareness of PMS in SC, commitment by the top management, consistency with strategic goals, funding for PMS implementation, and effective information systems.

But only a systems approach may not be enough to so far measurement issues in supply chains are concerned and may call for more better approaches than can look at a strategic level like using the balanced score card. Chia *et al.* (2009) attempted to empirically examine what senior supply chain executive's measure and how they perceive performance measurement from a balanced scorecard (BSC) perspective. The study was the first in line to use BSC in the paradigm of supply chain performance measurement. The survey population for this study includes organizations in logistics (the logistics service providers), manufacturing, IPOs and retailing spread across Singapore, so as to capture a snapshot of performance measurement as perceived and practiced by these different clusters of entities

within the supply chain. The survey was designed from the four perspectives of the BSC framework viz., financial perspective, customer perspective, internal business perspective and innovation and learning perspective. The findings clearly indicate that despite of the need of a balanced approach the firms are still dependent on traditional financial measures gross revenue, profit before tax, and cost reduction).Customer satisfaction is one of the non-tangible measures that is measured most from a supply chain perspective. Other key logistics performance indicators include on-time delivery, and customer satisfaction. While Chia et al.(2009) used a survey to validate the study findings; Bhagwat & Sharma (2007) developed a balanced score card for supply chain performance measurement by reviewing and classifying several available metrics in the literature four perspective. The balance score card thus developed is further supported by three case studies each illustrating ways in which BSC was developed and applied in small and medium sized enterprises (SMEs) in India. This is one of the important studies in the realm of supply chain performance measurement in that it lays the foundation for the development of a tool for supply chain performance measurement considering all the perspectives.Basically supply chain performance can also be measured along the four dimensions of the supply chain operation reference model developed by the Supply Chain Council in 1996.Lockamy & McCormack(2004) investigated the relationship between supply- chain management planning practices and supply chain performance based on the decision areas provided in SCOR Model Version 4.0 (PLAN , SOURCE , MAKE, DELIVER) and nine key supply-chain management planning practices derived from supply-chain management experts and practitioners. The study utilized a sample consisting of practitioners from the supply chain council. Based on factor analysis and unit linear regression analysis, the findings show that planning processes are important in all SCOR supply chain planning decision areas. Collaboration was found to be most important in the Plan, Source and Make planning decision areas, while teaming was most important in supporting the Plan and Source planning decision areas. Process measures, process credibility, process integration, and information technology were found to be most critical in supporting the Deliver planning decision area. Based on a mailed survey of 150 large companies in the British context, Gunasekaran *et al*. (2004) developed a supply chain performance framework incorporating four basic links of an integrated supply chain (Steward, 1995): (a)plan (b) source (c) make (d)deliver along the operational, tactical and strategic dimensions.

Like other methodologies, supply chain performance literature also encountered case study as a basis for many studies in different contexts. Even today's built to order supply chains also experienced case study applications. Sharif *et al.*(2007) aimed to address the growth and importance of build-to-order (BTO) supply chains, which allow consumers and supply chain participants to select, configure, purchase and view order delivery status. They used an interpretivist case study research strategy that exploits multiple research methods. The study presented an overview of supply chain management (including BTO-centric approaches) and performance management and then focused on a case study in which an aerospace components company was attempting to become a BTO enterprise. Thenceforth, the study analyzed key business drivers of using performance management systems (PeMS), and how supply chain-oriented organizations can best leverage IT and PeMS solutions in this regard The case study highlighted the need for the evaluation of PeMS implementation solutions regardless of their typology; wholly vendor-based, best of breed or combination of vendor solution and in-house development, but also an internal audit of processes and existing IS that would aid the implementation of such a concept. Furthermore, the intra- and inter-company political/social/commercial tensions (e.g. relating to anxieties about measuring and highlighting relative business performance) need to be recognized acknowledged in an open/honest manner and addressed in order that such tensions do not outweigh the concept justifiers which drive systems improvements. Education, ownership, responsibility, sponsorship, openness and collaboration between and amongst the supply chain participants will aid in overcoming these barriers. Actual understanding of current supply chain

operations and issues sometimes can be better understood by investigating real life scenarios quite often demonstrated by case study research, particularly when it comes to issues relating to a large scale project. Wickramatillake *et al.* (2007) attempted to understand the performance of the supply chain of a large scale project (London Heathrow Airport Terminal 5 construction project) through a case study of the performance measurement methodology used by Vanderlande Industries Ltd. Since the main objective was to gain insight of the actual functioning and supply chain performance measuring of a large-scale project, the experiences gathered in the study could be shared and employed with other large scale projects. The findings demonstrate eight key areas of concerns relating to supply chain performance measurement of a large-scale project: performance measurement requirements, with forecasting and progress reporting not owned by suppliers; lack of detailed planning causing regular changes to baseline; detailed work breakdown structure causing unnecessary complications to performance analysis; organizational structure; performance measurement tool; data capture; timing of progress and cost capture affecting the analyzing process; and scope change and traceability. Case study approach facilitates easy comparison of several related but distinct performance measures. Cuthbertson & Piotrowicz (2008) attempted to compare several supply chain performance measures and benefits listed in literature-based case studies that were named as "best practices". The study employed iterative triangulation method to analyze the collected case studies. Iterative triangulation was used as a structured framework to build theories from existing case studies. Instead of data collected directly from organizations, selected case studies were analyzed to develop theories. The study applied various applies various approaches to classifying supply chains as well as identifying the difference between measures proposed in the literature and those used by case companies. The findings indicated stress on measures related to economic aspects and to operational level activities. There is a lack of shared supply chain measures at the inter-organizational level, while social and environmental aspects are largely ignored. While the social and environmental aspects are the ignored paradigm, but recently they are one of the most important areas a firm should consider while making strategic decisions and planning. Case study approach has also helped to integrate works in supply chain management, environmental management, and performance management into one framework for measuring green supply chain performance with a focus on controls/pressures, inputs, tools, and outputs as major categories for evaluation and review (Hervani *et al.*, 2005). Being a normative framework, it would have been better if the study could have been validated with empirical evidence. Apart from the regime of green supply chain, there have been investigation in specific sector performance also such as in the SME sector and tomato supply chains. Thakkar *et al.* (2009) proposed an integrated supply chain performance measurement framework for small and medium scale enterprises (SMEs) using set of qualitative and quantitative insights gained during the case study research. The significance of the study lies in the development of a framework based on supply chain operations reference model and balanced score card. Also the framework can be used as a basis for the development of SME specific computer package. Though the study surveyed ten SME case organization from a set of manufacturing SMEs, the outcomes can be extended to other contexts as well. Aramyan *et al*. (2007) evaluated a novel conceptual framework of supply chain performance measurement in a Dutch-German tomato supply chain. The study initially reviewed existing literature on supply chain performance measurement and categorized agro-food supply chain performance indicators into four main categories (e.g. efficiency, responsiveness, flexibility, food quality).Case study research was adopted in the aforesaid study and for data collection they employed focus interview in accordance with the protocol developed by Yin(2003).The findings of the case study advocates that the four main categories of performance measures (i.e. efficiency, flexibility, responsiveness, and food quality) are identified as key performance components of the tomato supply chain performance measurement system. Moreover, the concept is the first step in

developing an integrated performance measurement system that contains financial as well as non-financial indicators combined with the specific characteristics of agro-food supply chains.

There has not been only frameworks based on case study or on conceptual level for judging the importance of performance metrics; but studies have also developed measuring instruments for supply chain performance. Lai *et al.* (2002) investigated supply chain performance in the realm of transport logistics and attempted to develop a measurement instrument for the same. The study based its conceptual background on the supply chain operations reference model and various established measures. Subsequently it developed a measurement model and a measurement instrument for SCP in transport logistics. The measurement instrument for SCP constituting of 26 items reflected dimensions such as service effectiveness for shippers, operations efficiency for transport logistics service providers, and service effectiveness for consignees. Based on a survey of 924 companies in the Schednet Asian Logistics Directory (Schednet, 2001), in which all the companies involved in transport logistics in Hong Kong are listed; the empirical findings suggest that the measurement instrument is reliable and valid for evaluating SCP in transport logistics. The limitations of the study are (1) low response rate (2) one informant per company; hence there may be presence of response bias (3) the scale may not be applied to SCP measurement in any other sectors. Still considering the lack of scale development efforts in supply chain performance literature, the value of this study is immense as it shows a way to develop a measurement instrument for SCP in several individual contexts. In the context of developing countries there has been attempts at developing supply chain performance metrics. Saad & Patel (2006) investigated the relevance and importance of supply chain performance in developing countries like India through a combination of qualitative and quantitative methods. The study attempted to identify and discuss the main motives and determinants for the adoption and implementation of supply chain management concepts. Primary data were collected through semi-structured interviews and an exploratory survey. Performance measure sets were identified through factor analysis. The findings reveal that the Indian companies are predominantly using financial, productivity-based measures and less of the intangible measures. The main emphasis remains on productivity and cost related measures. There exists several difficulties like operationalization of intangible measures specificity of the Indian business and operating environment, management practices and culture in implementing intangible measures in the Indian context. In addition, in most cases the efforts to measure performance were confined to organizational boundaries rather the whole supply chain. The above study lays the foundation for studying green supply chain performance measurement in other Indian industry contexts.Supply chain performance has also not much researched in context of supply chain performance except Wagner & Bode (2008) and Srinivasan et al.,(2011). Wagner and Bode (2008) investigated the impact of various types of supply chain risk on supply chain performance. The study classified supply chain risks into supply side risk, demand side risk, regulatory, legal and bureaucratic risk, infrastructure risk and catastrophic risk. The findings indicate supply side risk and demand side risk as the only significant predictors of supply chain performance and hence suggest supply chain managers to keep these two risks as contextual variables during strategic decision making in the organization.Srinivasan *et al*. (2011) investigated the relationship between buyer-supplier partnership quality and supply chain performance along with the moderating role of demand side risk, supply side risk and environmental uncertainty on this relationship. The findings clearly establish the presence of a positive relationship between buyer-supplier partnership quality and supply chain performance. The study also indicated that this positive relationship is moderated significantly by the presence of demand side risk and environmental uncertainty thereby implying the need for supply chain managers to form close relationships with their suppliers based on mutual trust and transparency as the same will enable to ward of the demand side risk and will also lead to better preparation for any meeting any contingency arising from the environment.

4. Conclusions

The study has reviewed the empirical contributions in the field of supply chain performance. There arise several implications and avenues for future research from the above review. Firstly, there exist few studies employing structural equation modeling as a methodology while investigating supply chain performance from various perspectives (Lai *et al*., 2002;Saad & Patel, 2006). Secondly, maximum studies on supply chain performance are anecdotal or case study based (Sharif *et al.*, 2007; Wickramatillake *et al.*, 2007). This calls for further empirical research in supply chain performance context. Thirdly, large scale research investigating various relationships of supply chain performance with other allied constructs is very rare. Therefore there exists huge scope for further empirical research in the domain of supply chain performance. Thus future study should attempt to investigate the following questions largely using empirical evidence:

(1) What is the scope of system dynamics as a methodology in explaining supply chain performance in the face of different types of supply chain risks and uncertainties?

(2) What is the relation of supply chain performance with several related but distinguished concepts of supply chain risk management: supply chain flexibility, agility, robustness, resilience and security?

(3) What is the scope of theories in explaining the impact of several relational components like trust, cooperation, adaptation, communication and commitment on supply chain supply chain performance and how this varies in the face of risk and uncertainties?

(4) Delivery reliability, customer satisfaction etc. have long been utilised as supply chain performance metric. Is there any behavioural metrics on the buyer/supplier side to measure supply chain performance?

(5) What is the scope of structural equation modelling in linking and explaining the relationships of supply chain performance with different concepts of risk management?

(6) There exist several key performance indicators. Can there be a dominant/single indicator for measuring/ representing supply chain performance across multiple perspectives?

(7) How behavioural uncertainty affects supply chain performance at various levels of risk?

(8) How supply chain operations can be made sustainable without affecting optimal performance?

The above is only an indicator for researchers and academicians for future research in supply chain performance and not an exhaustive one. Researchers must address different issues and problems relating to supply chain performance and other dominant aspects of supply chain management viz. supply chain risk management and supply chain sustainability.

References

Alberto, D., T. & Stefano, T.,(2003).Strategic planning and firms' competencies: Traditional approaches and new perspectives. International Journal of Operations & Production Management, 23(9), 947 - 976.

Angerhofer, B. J., & Angelides, M.C. (2006). A model and a performance measurement system for collaborative supply chains.Decision Support Systems, 42(1), 283-301.

Aramyan, L.H., Lansink, A., van der Vorst, J. & Van Kooten, O. (2007). Performance measurement in agri-food supply chains: a case study. Supply Chain Management: An International Journal, 12(4), 304-15.

Beamon, B. (1999). Measuring supply chain performance. International Journal of Operations and Production Management,19(3),275–292.

Bhagwat, R. & Sharma, M.K. (2007).Performance measurement of supply chain management: a balanced scorecard approach. Computers & Industrial Engineering,53(1), 43-62.

Bowersox, D, J., Closs, D. J., & Cooper, B. M. (2007).Supply Chain Logistics Management.McGraw-Hill/Irwin, New York.

Cai, J., Liu, X., Xiao, Z., & Liu, J. (2009). Improving supply chain performance management: a systematic approach to analyzing iterative KPI accomplishment. Decision Support Systems, 46(2), 512-21.

Chan, F.T.S. & Qi, H.J. (2003). An innovative performance measurement method for supply chain management. Supply Chain Management: An International Journal, 8(3), 209-23.

Chan, F.T.S., Qi, H.J., Chan, H.K., Lau, H.C.W. & Ip, R.W.L. (2003).A conceptual model of performance measurement for supply chains. Management Decision, 41(7), 635-42.

Charan, P., Shankar, R., & Baisya, R. (2008).Analysis of interactions among the variables of supply chain performance measurement systems. Business Process Management Journal, 14(4), 512-29.

Chia, A., Goh, M. & Hum, S.H. (2009).Performance measurement in supply chain: balanced scorecard perspective. Benchmarking: An International Journal, 16(5), p. 605.

Chopra, S., & Meindl, P. (2004). Supply Chain Management, 2nd ed., New Jersey: Prentice-Hall

Christopher, M. (1998). Logistics and supply chain management: strategies for reducing cost & improving service.(2nd ed.). London: Financial Times Publishing.

Christopher, M. (1994). Logistics and supply chain management, Richard D. Irwin.Financial Times, New York, NY.

Christy, D., P., & Grout,J.,R. (1994). Safeguarding Supply Chain Relationships, International Journal of Production Economics, 36, 233-242.

Cohen, M.A. & Lee, H.L. (1989). Resource deployment analysis of global manufacturing and distribution networks. Journal of Manufacturing and Operations Management, 2, 81-104.

Cohen,M.A. & Moon,S. (1990). Impact of production scale economies, manufacturing complexity, and transportation costs on supply chain facility networks. Journal of Manufacturing and Operations Management, 3,269-92.

Cuthbertson, R., & Piotrowicz, W. (2008). Supply chain best practices – identification and categorisation of measures and benefits. International Journal of Productivity and Performance Management, 57(5), 389-404.

Davis, T. (1993). Effective supply chain management. Sloan Management Review,35, 46-47.

Dixon, J.R., Nanni, A.J. & Vollmann, T.E.(1990).The New Performance Challenge. Measuring Operations for World-class Competition, Dow Jones- Irwin, Homewood, IL

Forrester, Jay W. (1961). Industrial Dynamics. Pegasus Communications.

Frohlich, T., M., & Westbrook, R. (2001).Arcs of integration: an international study of supply chain strategies.Journal of Operations Management,19, 185-200.

Globerson,S.(1985). Issues in developing a performance criteria system for an organization. International Journal of Production Research,23(4), 639-46.

Gunasekaran, A. & Kobu, B. (2007).Performance measures and metrics in logistics and supply chain management: a review of recent literature (1995-2004) for research and applications. International Journal of Production Research, 45(12), 2819-40.

Gunasekaran, A., Patel, C., & Tirtiroglu, E. (2001). Performance measures and metrics in a supply chain environment. International Journal of Operations & Production Management, 21(1/2), 71-87.

Gunasekaran, A., Patel, C., & Mc Gaughey, R.,E. (2004). A framework for supply chain performance measurement. International Journal of Production Economics,87(3),333-47.

Hammel, T, R., & Laura,R. K. (1993). Tightening the Supply Chain.Production and Inventory Management Journal, 34(2), 63-70.

Hervani, A., A., & Helms, M.M. (2005). Performance measurement for green supply chain management. Benchmarking: An International Journal,12(4),330-53.

Heiber R. (2002).Supply chain management: a collaborative performance measurement approach, Hochschulverlag AG, USA, p 32.

Holmberg, S. (2000). A system perspective on supply chain measurement. International Journal of Physical Distribution & Logistics Management, 30(10),847-68.

Ishii, K., Takahashi,K., & Muramatsu, R.(1988). Integrated production, inventory and distribution systems. International Journal of Production Research, 26(3), 473-82.

Kaplan, R., S.,& Norton, D.,P. (1992). The balanced scorecard – measures that drive performance. Harvard Business Review, 70(1), 71-9.

Keegan, D.P., Eiler, R., G., & Jones, C., R. (1989). Are your performance measures obsolete? Management Accounting, 45-50.

Kotler, P. (1984) Marketing Management: Analysis, Planning, and Control. Prentice-Hall, Englewood Cliffs, New Jersey

Lai, K.-h., Ngai, E.W.T. & Cheng, T.C.E. (2002). Measures for evaluating supply chain performance in transport logistics. Transportation Research E: Logistics & Transportation Review, 38, 439-56.

Lee, H., L., & Billington, C.(1993). Material management in decentralized supply chains. Operations Research,41(5),835-47.

Lee, H., L., & Feitzinger, E. (1995). Product configuration and postponement for supply chain efficiency, Institute of Industrial Engineers, Fourth Industrial Engineering Research Conference Proceedings,43-8.

Liberatore, M.,J.,& Miller, T.(1998). A framework for integrating ABC and the BS into the logistics strategy development and monitoring process. Journal of .Business Logistics,19(2),26-38.

Lockamy, A. III & McCormack, K. (2004). Linking SCOR planning practices to supply chain performance: an exploratory study. International Journal of Operations & Production Management, 24(11/12),1192-218.

Morgan, C. (2007). Supply network performance measurement: future challenges? International Journal of Logistics Management, 18(2), 255-73.

Neely, A., Gregory, M. & Platts, K. (1995). Performance measurement system design. InternationalJournalofOperations&ProductionManagement,15(4), 80-116

Roberts, Edward B. (1978). Managerial Applications of System Dynamics. Cambridge: MIT Press.

Saad, M., & Patel, B. (2006).An investigation of supply chain performance measurement in the Indian automotive sector. Benchmarking: An International Journal, 13(1-2), 36-53.

Sharif, A.M., Irani, Z., & Lloyd, D. (2007).Information technology and performance management for build-to-order supply chains. International Journal of Operations & Production Management, 1235, p. 1236-53.

Shepherd, C., & Gunter, H. (2006). Measuring supply chain: current research and future directions. International Journal of Productivity and Performance Management, 55(3/4), 242-58.

Srinivasan, M., Mukherjee, D. and Gaur, A. S.(2011). Buyer–supplier partnership quality and supply chain performance: Moderating role of risks, and environmental uncertainty. European Management Journal, 29, 260– 271.

Stephens, S. (2001). Supply chain operations reference model version 5.0: a new tool to improve supply chain efficiency and achieve best practice. Information Systems Frontiers, 3(4),471-6.

Thakkar, J., Kanda, A., & Deshemukh, S. (2009). Supply chain performance measurement framework for small and medium scale enterprises. Benchmarking: An International Journal, 16(5), 702-6.

Wagner, S. M. and Bode, C. (2008). An empirical examination of supply chain performance along several dimensions of risk. Journal of Business Logistics, 29(1), 307–325.

Wickramatillake, C.D., Koh, S.C.L.& Gunasekaran, A. (2007). Measuring performance within the supply chain of a large-scale project. Supply Chain Management: An International Journal, 12(1), 52-9.