Developing an Index System for Supply Chain Value Measurement: Adopting a Holistic View

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Abstract

Supply Chain Management has attracted a lot of interest from scholars in the recent years. Due to the fierce competition among supply chains in today's market, creating more value for stakeholders (i.e. customers, community. Shareholders, employees and suppliers) determines competitive advantage of a firm over its competitors. Since the satisfaction of all of the stakeholders affect the supply chain total value, every single stakeholder must be engaged in the value measurement process. This study strived to propose an index system with a holistic view considering all stakeholders, since the literature lacks a study offering a set of indices covering all stakeholders. Therefore, firstly a technical review of the articles related to supply chain performance measurement which has focused on vale, was conducted. Afterwards each index was classified in five categories, with respect to its direct influence on every group of stakeholders.

Keywords
Index system; performance measurement; stakeholders; supply chain; value

Introduction
Customer satisfaction is the predominant factor for retention of current customers and attraction of prospective ones. Therefore in order to survive in the competitive market, nowadays firms are obliged to strive for fulfilment of customers' expectations. However, customers' desires cannot be met unless every single process in the supply chain is enriched by adding value. A "value-added activity", as depicted in porter's (Porter 1985) value chain framework, is characterized as the value created by an activity with respect to its execution cost. Porter defined value as "the amount buyers are willing to pay for what a firm provides"; furthermore he stated that "value chain" is the combination of nine generic value added activities that are operating in a firm, i.e. activities which collaborate with each other to provide value for customers (Feller et al. 2006). Although both of the value chain and supply chain involve the same network of companies interacting to provide goods and services, it should be noted that value chains differ from supply chains in various aspects. Supply chain, emerging in the 1980s, is an internationally used term that encompasses every effort engaged in production and delivering of final products and services, from the suppliers' suppliers to the customers' customers (Khalifa 2004). While value chains focus mainly on value flows from customers to suppliers, supply chains concentrate on downstream flow of supplies and goods to the customers. It is evident that orders, cash and value in value chains flow in the opposite direction of supplies flow in supply chains (Walters & Rainbird 2004). The primary distinction between supply chains and value chains is a basic shift in concentration from the suppliers to the customers. The ultimate goals of supply chains are integration of suppliers and producers processes, as well as efficiency improvement and waste reduction, whereas value chains are aimed at creating value for customers (Feller et al. 2006). The creation of value is concerned with diverse groups of stakeholders like shareholders, customers, personnel, society and environment (Alvardo & Rabelo 2008). Nevertheless, customers are the predominant group among all of stakeholders in a way that if the supply chain is capable of creating the customers' expected value, creation of the other stakeholders' expected value is assured. In order to enhance supply chain value, Considering value from the stakeholders' point of view, at first it should be measured. Thus provision of a set of indices is needed for a comprehensive measurement of supply chain value. There are numerous studies proposing models and approaches to measure supply chain performance. Majority of these supply chain models focus primarily on speed maximization or cost minimization rather than value creation. In addition, the indices proposed in these models for measurement of supply chain performance are plentiful; nonetheless there isn't any well-designed model to measure supply chain value. Therefore, since the literature on supply chain management lacks a study proposing a framework as a comprehensive set of indices for value measurement, this study endeavoured to fill this gap. On the other hand due to concentration of most of the

studies on customer value, the consideration of all stakeholders for value measurement can be regarded as the other determinant of the uniqueness of this study.

Research Methodology

As the nature of research in supply chain measurement is difficult to confine to specific disciplines, the relevant materials are scattered across various journals. Therefore, in order to provide a comprehensive bibliography of the academic literature on supply chain value, Scopus --established by Elsevier-- was searched. Scopus is a vast online database, encompassing majority of online journal databases such as Science Direct, Springer, Taylor & Francis, Emerald Fulltext and IEEE Transaction to name but a few. The literature search was based on the descriptor, ‘‘supply chain”, ‘‘performance”, “value” and “evaluation/ evaluating/ measurement/ measuring/ assessment/ assessing” which originally produced approximately 561 articles. The full text of each article was reviewed to eliminate those that were not actually related value measurement. The selection criteria were as follows: Only those articles that had been published in journals linked to Scopus database were selected, as these were the most appropriate outlets for supply chain measurement research and the focus of this review. Only those articles which were clearly concerned with supply chain value were selected. Conference papers, dissertations, textbooks and unpublished working papers were excluded, since academics and practitioners frequently utilize journals to acquire information and disseminate new findings. Each article was rigorously reviewed and every single index found in the proposed models or frameworks was extracted to complement the proposed framework of this study for supply chain value measurement.

Classification Method

In order to develop a holistic insight of the needed indices for evaluation of organizations value creation, firstly this section is aimed at building an appropriate framework of indices. Afterwards the classification process of indices will be described through an illustration of a flow chart.

Classification Framework

Every firm engages a wide variety of partners called stakeholders. In fact stakeholders are all those people who affect performance of the firm. Accordingly every stakeholder deserves considerable attention and satisfaction during provision of services or production. As (Murphy et al. 2005) stated “the ultimate objective of a business is to create value for all of its stakeholders beyond Kotler and Armstrong’s long-term value for just customers. Nowadays the concept of “value” has gone beyond the preliminary view of exclusive value generation just for shareholders. Therefore organizations must be evaluated by generation of not only economic value but also ecological and social value. In other words organizations should consider value creation for all stakeholders who are involved with the company and not only for shareholders. The business in comparison with the others (Elkington 1997). According to Jensen, (2001) the term stakeholder implies every individual or group who are able to greatly influence the welfare of the firm. With respect to the above definition, five groups of stakeholders can be recognized along the supply chain: Customers, Communities, Shareholders, Employees, Suppliers. Due to the fact that customer value is the salient value in business strategy model and in the success of companies in gaining competitive edge (simova 2009), the priority of supply chain value indices in totally in contrast to the priority of supply chain performance indices.

Classification Process

Each of the selected articles was reviewed and the extracted indices were classified in accordance with the classification framework by three independent researchers. The classification process comprises four phases which are as follows: Online database search; Initial classification by the first researcher; Independent verification of classification results by the second researcher; and Confirmation of classification results by the main researcher. If there was a failure in reaching a consensus on the classification results, each of these indices was then discussed till a settlement was achieved. After reviewing all of the articles, thirty seven articles were identified as the ones which were somehow related to the concept of value chain and supply chain value. Most of these articles have emphasized the significance of performance measurement. As stated by Milliken (2001) performance measurement process is the means for identifying and correcting short falls within the supply chain. Kaipia et al. (2007) have examined two case studies in grocery supply chains to increase added-value and improve total supply chain performance. They applied concept of 'time benefit analysis' to measure the impact of the change in grocery SC. Their proposed approaches can be utilized to measure performance and to analyse value in supply chain management. Jiang et al. (2003) have articulated that supply chain performance measurement is useful for continuous improvement of firms specially for business process reengineering. Reviewing the IDEF0 and IDEF3 methods, they have proposed the multi-level decomposition process

modelling with performance attributes (PMPA). Taking advantage of hierarchical structure method, they have defined the non-value added activities by using an "as-is" organization in their proposed model.

Establishing an comprehensive set of indices can be considered as a prerequisite for an effective performance measurement system. In this regard some articles tried to concentrate on index gathering or provision. Lambert & Pohlen (2001) have provided a seven-step process to establish supply chain indices across functional areas along the supply chain. These seven stages of their proposed process are: "(1) End-to-End mapping of the supply chain with key points identified; (2) Analyze each link and evaluate the potential value; (3) Develop financial metrics to assess the relationship on profitability and shareholder value of the two firms; (4)Synchronize processes and activities to achieve performance objectives; (5) Use non-financial performance measures to enable individuals to meet supply chain process objectives and financial goals; (6) Evaluate shareholder value and market capitalization across firms with supply chain objectives and revise measures as required; and (7) Copy successful processes throughout the supply chain." Silver, O. (2004) has suggested that instead of subjective opinions, performance can be evaluated based on objective opinions by means of creating indices. Estampe et al. (2010) have stated that supply chain management creates value for companies, customers and stakeholders who are interacting along the supply chain. Their study concerns diverse models for assessing supply chains through highlighting their special characteristics and applicability in different situations. Their study is grounded in analytical grid breaking models down into seven layers. They have defined supply chain by a second section specifying different levels of supply chain maturity. In order to identify indices, an initial analytical table focused on the dissimilarities between different models of supply chain evaluation was used in their study. Melnyk et al. (2004) have stated that an index system can link strategy, execution, and ultimate value creation in supply chain together. Their study has focused on identifying necessary indices and managing them in dynamic supply chain. They believed that metrics without a strategy are meaningless. According to their study it's very important to know what should be measured for delivering value to the customers. They noted that the most important challenge is better realization of the roles and impacts of indices in operating systems, and using this knowledge to design an index system and guidelines that provide clarity of purpose In accordance to their study, cross-entropy measure of product differentiation is an appropriate indicator for value creation in food supply chain.

Each of the selected articles has proposed a unique model or framework, benefiting from different tools and methods. For example, Christopher et al. (1937) have proposed an integrated framework for supply chain performance measurement. Alvarado et al. (2008) have proposed a value mapping framework with the aim of improving supply chains performance. In essence, their study presents a unique value mapping framework that embodies the effective involvement of stakeholders for enhancement of supply chain performance. Estampe et al. (2010) have stated in their study that supply chain management is capable of creating value for companies, customers and stakeholders who are interacting throughout a supply chain. In their study various models, assessing supply chains, are analyzed by stressing their specific characteristics and applicability in different situations. Their study also presents an analytical grid which breaks these models down into seven layers, in the hope that this grid will help managers evolve towards a model that suits their unique situation well. Saranga & Moser (2010) have noted that nowadays purchasing and supply management (PSM) is rapidly becoming more prominent to senior management since it has a potential to strategically affect not only operational performance outcomes but also financial performance outcomes. As their study demonstrates the cross-functional nature of numerous PSM activities caused inadequate data collection and performance measurement which has led to weak performance evaluation methodologies and mixed outcomes. Utilizing an external assessment survey methodology complementing the internal measures of PSM performance, they have proposed a comprehensive performance measurement framework by means of the classical and two-stage Value Chain Data Envelopment Analysis models. Mondragon et al. (2011) have proposed some measures for assessing performance and integration in closed-loop supply chain. In their study they've concentrated on reverse component. They addressed reverse components of supply chain as well as forward components. They also have emphasized the importance of identifying the level of existing integration between parties, since it is totally related to supply chain performance. Taking advantage of literature review, they have provided a set of measures that can be utilized to achieve purposes like the forward supply chain; product returns and reverse logistics; flows of materials and information and integration between supply chain tiers. Their study also has shed light on links between product returns (faulty and non-faulty) to operations in the forward component of the supply chain (design, sourcing, manufacturing and forecasting). On the basis of literature review and analysis of Chinese enterprises Song et al. (2008) have proposed a performance value index model. By using SEM (Structural Equation Model), the model demonstrates the correlation between process, relational, and operational performances, financial benefits and potential competitive benefits. The result of their model has indicated that while process performance and relational performance have positive influence on competitive potential, operational performance has great effect on both financial benefit and competitive potential. It also implied that

potential competitiveness relates to financial benefit in a positive manner. Feng & Gan (2007) have proposed a dynamic appraisal model for supply chain performance based on extension theory. Their dynamic appraisal model was based on matter-element method and extension analysis in extension theory. they have depicted the range of index value by classic region and segment region. Finally in order to do level measuring they have used relation function. Lee et al. (2007) have discussed the relationship between supply chain linkages and supply chain performance, including cost-containment and reliability of supply chain partners. Through application of multivariate regression models, they have identified the determinants' characteristic of linkages among the supply chain stakeholders namely suppliers, internal stakeholders and customers. Their study has shown that internal integration makes the greatest contribution to cost-containment and integration with the supplier is the greatest strategy on the achievement of supply chain reliable performance. Their study has also yielded in other conclusions, such as: a prominent strategy in cost-containment is availability of electronic ordering systems for customers; regarding performance reliability, Fast and easy ordering is the best strategy for customer. In order to link with suppliers, reliable delivery with supplier collaboration in managing a wide variety of supply chain operations is the best way. Accessibility to the inventory information creates the most desirable atmosphere in internal integration. The most notable contribution of Their study is the presentation of an overall view of each linkage determinants affecting supply chain performance. Yilmaz & Bititci (2006) have compared the performance measurement of manufacturing and tourism industries from a value chain point of view. Their study demonstrated that in contrast to tourism industry, the recent thinking in supply chain management as well as value chain management has facilitated the development of performance measurement frameworks for the whole supply chain (e.g. the SCOR model). In order to manage and measure the value chain processes, they have benefited from SCOR model in the tourism industry in their study. Focusing on end-to-end value chain oriented measuring performance management, they proposed a framework whereby all players can communicate and coordinate in their processes and activities. Shin et al. (2010) have presented a multi-objective policy design on the basis of simulating system dynamics which is able to model explicitly the feedback loops of decision rules as well as evaluating the dynamics of complicated processes and systems. From their point of view performance cannot be measured by just a single value; on the contrary performance measures are optimized on the basis of their trajectories, like the degree of inventory oscillation and the amplification ratio between the order rates of two parties over time. In order to generate a set of non-dominated solutions they have derived benefit from A multi-objective genetic algorithm termed NSGA-II. Soni & Kodali (2010) have proposed a methodology for internal benchmarking with the aim of variability reduction in performance between supply chains which are similar in economical, political, and social conditions. They benchmarked three supply chains in different countries against each other with regard to political and social conditions. They took advantage of performance value analysis and strengths, weaknesses, opportunities and threats (SWOT) to analyse the supply chains. Finally they have concluded that managers can overcome globalization challenges through using their model. Li et al. (2009) have proposed a strategic performance measurement system (SPMS) across supply and demand chains(SDC) that integrates economic, biological and human systems by analogy with ecological succession. They believed that supply chain can be observed as a community. According to their study, monetary value flow in business follows the first and second laws of thermodynamics. Including output accounting and traditional cost accounting, their model puts forward a general monetary value flow. They have linked economic, social and ecologic system in their proposed model. According to the result of their study, their proposed model is an effective strategic tool to achieve better ecology of commerce. In order to provide a holistic system of indices, a proportion of articles have utilized balanced scorecards (BSC). For instance Kleijnen & Smits (2003) have employed some critical indices in SCM measurement, taking advantage of balanced scorecards. These indices can be used when a supply chain is redesigned and simulation is probably needed. They have suggested spreadsheet simulation, system dynamics, discrete-event simulation, and business games as the four major types of simulation for SCM which can explain bullwhip effect, predict fill rate values, and train users. According to yu, (2005) performance measurement and strategic management should focus on the value creation process. They stated that balanced scorecard (BSC) is an useful strategic model applied in business processes. In their study they have identified values and strategies for facilitation of strategic management activities. In addition they have proposed an integrated framework that links the BSC to e-business models. In their application of BSC market, supply chain, customer, enterprise, and product and service are factored in and therefore the adapted value-based BSC framework contains market, supply chain, customer.

Furthermore, Fuzzy methods helped a huge amount of articles in terms of reasonable performance measurement. With respect to the shortcomings of existing fuzzy comprehensive evaluation models, Jiang (2009) has eliminated the data redundancy in index membership for object classification through defining distinguishable weight and extracting valid values in order to compute object membership and apply the new algorithm in the fuzzy evaluation on supply chains' total performance. Results of examples demonstrated the validity of his proposed model which achieved the dynamic evaluation of supply chains' total performance. Huang et al. (2010)

have stated that “In the operational level of supply chain, however, integration of corporate resources is required and the development of a growth and profit assessment model can result in the most value for the shareholders, the employees, the society and the nation.” Adopting the fuzzy logic approach, they have proposed an assessment model for evaluating the performances of Taiwan's industrial PC companies. Their model consists of six dimensions i.e. including potentiality, capital structure, solvency, corporate performance, profitability, and cash flow. It also incorporate 20 assessment factors to provide the needed criteria for assessment. According to Zheng et al. (2009) “Supply chain is a dynamic system and it needs dynamic performance measurement methods”. In order to construct the decision table of dynamic performance measurement, they considered the rough set theory and fuzzy evaluation. Their proposed method can play a significant role in the reduction of data processing scale and computation complexity of measurement models. Applying the combined evaluation method for dynamic performance measurement and forecasts in an example, they have demonstrated the feasibility and efficiency of their method. Some other articles have derived benefit from Economic Value Added (EVA) as a useful framework for performance measurement. EVA, as stated by stewart (1991), is not only a specific performance measure but also a basis for a larger performance measurement framework. As its creators elucidated, EVA is a financial performance index which is mainly related to the shareholders’ value creation over time. Likewise Camerinelli & Alessandra (2006) have presented a framework, linking operational indices with income statement, balance sheet items and also shareholder value in the shape of the economic value added (EVA) and with supply chain processes. Hofmanna & Locker (2009) have studied performance measurement concept based on value in packaging industry. In their proposed concept operational supply chain activities and shareholder value creation can be created and linked in accordance with the Economic Value Added (EVA). The purpose of their method is to compare the operative key performance indicators directly by means of value drivers to the ultimate measure of the value generation in a firm.

Among the selected articles, some authors have chosen a blend of tools and methods for performance measurement. Hongxia, & Zhipeng (2007) have introduced Value Engineering (VE) to develop new index systems of performance evaluation of supply chain. Afterwards, in order to analyze them, they have adopted AHP-multistage fuzzy comprehensive appraisal method. To effectively involve stakeholders in IT implementation projects. Yang (2009) has intended to analyze the efficiency and benefits of supply chain from a scientific point of view and also validate the usability of methods on performance evaluation index system. Based on balanced scorecard, he has taken advantage of the enhanced balanced scorecard for the performance evaluation index. In his study, with respect to society environment and future development, the construction of performance evaluation index system incorporates five aspects, i.e. finance, customer service, intra-flow process, learning and development, and society development within SC. To achieve their practical application, the indices of performance evaluation system are all quantified. In order to evaluate the integrative performance evaluation index system he has derived benefit from the logarithm triangular fuzzy number-analytic hierarchy process (AHP) method expanding from fuzzy environment and developing from traditional AHP method in his study. Yang et al. (2009) have articulated that “Efficient performance evaluation on reverse supply chain (RSC) is the basis of optimizing RSC”. They have added that an integral performance evaluation index system is designed based on BSC and RSC structure characteristics which comprise a set of finance, customer, internal business process, learning and developing. Afterwards they have applied the triangular fuzzy number AHP to evaluate the comprehensive RSC performance and to discover the value-added effect in RSC. Baozhu (2009), applying three first-level indices and nine second-level indices, has constructed a supply chain management performance evaluation index system based on both domestic and international research on supply chain management. In order to model a multi-criteria supply chain management performance evaluation index system with dependence and feedback, he has applied indices in Analytic network process (ANP) approach. Due to ability of fuzzy ANP method to effectively solve problems in an uncertain condition, it was used to calculate the weights of factors and sub-factors of the model in his study. Lu, Y et al. (2010) have proposed a multi-dimensional indicators systems which embodies twenty four indices and is constructed with respect to six perspectives, i.e. products' competitiveness, partners' ability, financial value, supply chain operations, customer satisfaction, and sustainable development. Believing that the combination of quantitative and qualitative index along with the application of fuzzy-number make the evaluation systems more reasonable, they have used the method of FAHP to evaluate supply chain performance. Looking at the problem form a knowledge discovery and data mining perspective, Shi & Ji (2008) have proposed a manufacturing supply chain performance evaluation model based on heuristic attribute reduction and neural network. Accordingly they have designed performance decision-making table and discernable matrix as well, and the BP neural network and BP algorithm were put forward. Firstly they have reduced the balanced scorecard index system and then put it into neural network for intelligent training; next the evaluated sample was put into the trained network and consequently the supply chain performance evaluation value was gained. Since the evaluation result was consistent with the actual result, the model can be considered as a valid model. Investigating the proposed models, this study has endeavoured to discover every possible index which was concerned with the evaluation of value creation

process along supply chains. It should be noted that although all of the offered indices within selected articles are suitable, they lack a holistic view for value creation assessment from all stakeholders' point of view. Thus, it is strived in this study to establish an index system whereby value creation throughout supply chain can be evaluated with respect to every prospective stakeholder. Due to lack of an order or category for the extracted indices, every single index is classified in a category which is directly associated with one group of stakeholders Table 1.

Table 1. The proposed classified index system with a holistic view of all stakeholders

Stakeholders	Indices	Authors	Year
customers	cost reduction, quality , delivery time, , flexibility, waste reduction.	Stern stewart	1991
	Customer rate, innovation, internal business processes.	Jack PC Kleijnen and Martin T Smits	2003
	Forecast accuracy ,features none identified, Supply Chain advanced planning systems, Supply Chain integration systems, planning and ERP execution systems, Supply Chain capacity planning systems, B2B integration and application server systems, Real-time exchange of supply chain information, internet trading exchanges, B2B integration and application server systems , Standards based, B2B integration tools and systems, Advance planning and scheduling system, Supply Chain event management software,	Yilmaz, Y., Bititci, U.	2006
	Confirmed fill rate.	Enrico Camerinelli and Alessandra Cantu	2006
	Wasting degree of energy sourcing., recycle rate of callback, rate of delivery on time, rate of eligible product, answer time of complaint, quality after services, , rate of product capability and price, security costs, rate of credit, implemention rate of orders time, support degree of production, answer speed, information share, order rate of distributive business, cost of logistic	Jin Hongxia, Chang Zhipeng	2007
	SC stock level, time flexibility, target cost, information share ratio, order cycle period, client retaining, client response time self-identity, client value ratio,	Jianhua Yang	2009
	quality rating, price,	M. Laura Donnet, Dave DWeatherspoon and Charles B. Moss	2009
	degree of inventory oscillation, amplification ratio between the order rates	Shin, K.H., Kwon, I.-H., Lee, J.-H., Kim, C.O.	2010
	Cost, quality, and service level, flexibility mix, New product flexibility, percentage of wrong products manufactured, Product variety, Production flexibility, Production service level, Time required to produce new product mix, Use of new technology, Volume flexibility, Forecast error, Forecast error, Forecast horizon, Frequency of update ,Ratio of demand variability to order variability ,Seasonal factors ,Variance from plan , Average inventory , Average replenishment batch size, Average safety inventory, Fill rate, Fraction of time out of stock, Inventory obsolescence, Products with more than a specified number of days of inventory, Seasonal inventory, Average order size , Average sales price, Days sales outstanding, Incremental fixed cost per order, Incremental variable cost per unit, Profit margin, Range of periodic sales, Range of sale price, Delivery flexibility,	Gunjan Soni and Rambabu Kodali	2010

	Responsiveness to urgent deliveries, Shipping errors		
	Total units received in period, Total units shipped in period, Average units received/day, Average units shipped/day, Average stock held per day, Synchronisation of units received matching Shipments, Average units returned,Total returns, Total faults.product returns and reverse logistics, accurate forecast	Mondragon, A.E.C., Lalwani, C., Mondragon, C.E.C.	2011
community	waste reduction	Stern stewart	1991
	Wasting degree of energy sourcing, environmental status,	Jin Hongxia, Chang Zhipeng	2007
	Environment protection efficiency, raw material and resource usage rate, product recycle interest,	Jianhua Yang	2009
shareholders	financial benefits, net profit margins, increase in revenues, financial performance	Stern stewart	1991
	financial benefits	Jack PC Kleijnen and Martin T Smits	2003
	Supply chain finance costs, forecasting and demand MIS costs none identified, Supply Chain capacity planning systems,	Yilmaz, Y., Bititci, U.	2006
	stock price, percentage of revenues or cost of fulfilment per case ordered, total supply chain costs,	Enrico Camerinelli and Alessandra Cantu	2006
	rate of benefit, yield rate of investment, velocity of fixed assess, productivity on time, information share, rate of mind assets, revenue rate of new product sell, cost of manpower resources, cost of logistic, cost of assests, cost of information,	Jin Hongxia, Chang Zhipeng	2007
	SC capital return ratio, cash velocity, new product sale ratio,	Jianhua Yang	2009
	Cost of products sold/Total net revenues, (Total costs and expenses−Cost of products sold) /Total net revenues , (Total costs and expenses−Cost of products sold) /Total net revenue), operating income / total net revenue, Cost saving amounts, Annual saving of purchase cost, Annual saving of purchase cost / Cost of products sold, Purchase cost / Cost of products sold, Cost of non-purchase/Total net revenues	Xiao Li , Xin Jian Gu , Zheng Gang Liu	2009
	Capacity unit per day, Capacity flexibility, Capacity utilization as incoming stock level, work in process (WIP), scrap level, finished goods in transit, Storage costs per unit of volume, Volume flexibility, Forecast error, Average inbound transportation cost (in $ per year), Average inbound transportation cost per shipment (in $), Average outbound shipment size (in no. of units per month) ,Average outbound transportation cost (in $ per year), Average outbound transportation cost per shipment (in $), Average incoming shipment size (no. of units per month),	Gunjan Soni and Rambabu Kodali	2010
	Stock held in day, Value of stock, Days analysed, Value of unit, Current average stock held per day, Backorders, Costs associated (returned and processed), Comparing return rates in other sectors, Costs associated to that return rate, Reverse logistics costs per device dispatched, Reverse logistics costs per device returned and Processed,	Mondragon, A.E.C., Lalwani, C., Mondragon, C.E.C.	2011
employees	learning abilities, , innovation abilities, time compression,	Stern stewart	1991
	internal business processes, innovation,	Jack PC Kleijnen and Martin T Smits	2003
	Supply Chain advanced planning systems, Supply Chain integration systems, Integration between supply chain	Yilmaz, Y., Bititci, U.	2006

	advanced, planning and ERP execution systems, Supply Chain capacity planning systems, Real-time exchange of supply chain information, Collaborative planning systems, Advance planning and scheduling system, Supply Chain event management software,		
	cost of manpower resources,	Jin Hongxia, Chang Zhipeng	2007
	Efficiency ratio of period ahead of schedule, new product sale ratio, flow (product ultimate assembly line), information share ratio, group participation degree, employee number per ten thousand capital	Jianhua Yang	2009
	Expansion capability,	Gunjan Soni and Rambabu Kodali	2010
	integration between supply chain tiers	Mondragon, A.E.C., Lalwani, C., Mondragon, C.E.C.	2011
	supplier performance,	Stern stewart	1991
	internal business processes,	Jack PC Kleijnen and Martin T Smits	2003
	Cash-to-Cash cycle,	Enrico Camerinelli and Alessandra Cantu	2006
	Supply Chain integration systems, Integration between supply chain advanced, planning and ERP execution systems, Real-time exchange of supply chain information, Collaborative planning systems, internet trading exchanges, B2B integration and application server systems , Standards based, B2B integration tools and systems, Advance planning and scheduling system, Supply Chain event management software,	Yilmaz, Y., Bititci, U.	2006
	rate of credit, delivery of supply business,	Jin Hongxia, Chang Zhipeng	2007
	Expansion capability, Average purchase price (in $), Average purchase quantity (in no. of units), Extent of mutual assistance leading in problem solving efforts, Extent of mutual planning cooperation leading to quality, Percentage of on-time deliveries , Horizon of business relationship, Order flexibility, Order fulfillment time in (no. of weeks), Order lead time (in no. of weeks), Quality and frequency of exchange of logistics information between supplier and customer, Range of purchase price (in $), Satisfaction with supplier relationship, Supplier ability to respond to quality problems, Supplier assistance in solving technical problems, Supplier cost-saving initiatives, Suppliers booking in procedures, Supply lead time (in no. of days), Supply quality, Days payable outstanding (in no. of days), Delivery flexibility,	Gunjan Soni and Rambabu Kodali	2010
	Number of strategic PSM managers and buyers, number of transactional buyers, number of suppliers covering 80% of the managed sourcing volume as well as the PSM performance outcome, cost saving, cross functional collaboration, supplier performance management, average % of EBITDA margin over 3 years (measures as % sale).	Saranga, H., Moser, R.	2010
	Synchronisation of units received matching Shipments, Receipts,	Mondragon, A.E.C., Lalwani, C., Mondragon, C.E.C.	2011

Conclusion

Supply chain management should be more noted by senior managers, due to the fact that value creation through supply chain activities plays an important role in the competitive market. In contrast to the traditional supply chain management, nowadays there is a fierce competition among supply chains rather than among firms. In addition, it should be noted that satisfaction of all categories of stakeholders leads to the total value of supply chain. Accordingly, it is the amount of value created for all the stakeholders in a supply chain which determines the competitive edge of a firm over its competitors. To increase value created through activities, it is needed to measure supply chain performance. There are many methods, frameworks and techniques, utilized in the literature, which took advantage of a wide variety of indices identified by experts and executives to measure supply chain performance. Since usually the applied indices concern just a specific group of stakeholders such as customers or shareholders, the literature lacks a study proposing an index system whereby all stakeholders are considered simultaneously for the process of value measuring. In order to fill this gap, firstly a review of studies concerning evaluation of supply chain from a value perspective was conducted; afterwards, all of the indices extracted from the selected articles were classified with respect to their direct influence on each stakeholder. Finally, since all the stakeholders throughout a supply chain can be divided into five distinct group (i.e. customers, community, shareholders, employees and suppliers), this study proposes an index system incorporating five groups of indices.

Acknowledgments

The authors would like to thank editors to review and express their comment to improve quality this paper.

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