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Full Length Research Paper

Developing a framework for supply chain value measurement based on value index system: Real case study of manufacturing company

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Due to the fierce competition among supply chains in today's market, creating more value for stakeholders (that is, 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 focused on value has been conducted. Afterwards each index has been classified by expert managers in five categories, with respect to its direct influence on every group of stakeholders. Finally, we have developed a framework for measurement of value in supply chain by using an actual value index system gathered by observation and in-depth interviews with all supply chain stakeholders in a manufacturing company. Application of the proposed framework as a decision support system helps managers to perform gap analysis between value creation level for their stakeholders and the desired one and also provides reliable information for decision making.

Key words: Supply chain, stakeholders, value measurement, value index.

INTRODUCTION

According to chopra and Meindl (2004) the objective of the supply chain is to maximize the overall value generated. The value a supply chain generates is the difference between what the final product is worth to the customer's request. In most of the commercial supply chain, value is correlated with the profitability.

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', and customers (Khalifa, 2004). Zhou et al. (2002) mentioned that the integration key business process from end-users through original suppliers that provide products, services, and information and add value for customers and other stakeholders.

The creation of value is concerned with diverse groups of stakeholders like shareholders, customers, personnel, society and environment (Alvardo and 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.

Murphy et al. (2005) mentioned that the seven

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stakeholder groups have a vital stake in the operation of a business: customers provide patronage and revenue support, employees provide human talent resources support, suppliers provide materials and services resources support, community, human – provide legal sanction, natural – provide ecological sanction, shareholders – provide financial sanction.

According to Donovan et al. (1997), Doorley III and Donovan (1999), Hillman and Keim (2001), Kothari and Lackner (2008), and Salter (2006), the major stakeholders of an organisation are shareholders, customers, employees, suppliers, community residents, governments, and the economy. It can be concluded that the stakeholders are value perspectives in the supply chain and affect the total value creation. Therefore measuring value focusing on stakeholder's perspectives can help managers to evaluate supply chain performance comprehensively.

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 is no any well-designed model to measure supply chain value. On the other hand, due to concentration of most of the studies on customer value and shareholder value, the consideration of all stakeholders for value measurement can be regarded as the other determinant of the uniqueness of this study.

In the preparatory phase of our study, we extensively reviewed the recent studies on value achievement, and a noticed missing link is that there is no study to measure value in supply chain comprehensively. To fill this gap, therefore, the objective of this study is to develop a framework based on index system to evaluate value creation in supply chain.

The remainder of this study proceeds as follows: Subsequently, the study depicts how past studies have been reviewed. Then, the key stakeholders and the linkage between them and supply chain performance metrics have been identified by expert in five categories. The sample used in the study in the expert managers in home appliance manufacturing industries that have good understanding of their company's performance.

Finally, a framework for measuring of value in supply chain have been proposed by using an actual value index system gathered by observation and in-depth interviews with all supply chain stakeholders in a manufacturing company. The proposed framework helps firms to monitor their supply chain performance for creating more value via supply chain operation.

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 and 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:

1. 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.
2. Only those articles which were clearly concerned with supply chain value were selected.
3. 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.

In order to develop a holistic insight of the needed indices for evaluation of organizations value creation, this section is aimed at building an appropriate system of indices. Afterwards the classification process of indices is described. To identify the main value perspectives, a Delphi technique has been used. The sample included 30 expert managers including customer relationship manager, sales managers, marketing managers, engineering manager, human resource manager, quality control and insurance manager, purchasing manager, financial manager, planning manager, R&D manager, strategic manager and some executives who have good understanding of company’s performance. With respect to the result, five groups of stakeholders have been recognized along the supply chain: customers, communities, shareholders, employees and suppliers (Figure 1).

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. In order to treat all of these groups equally, their needs and expectations should be firstly identified and then met by the firm.

Customers should be satisfied personally by provision of high value in their products and services in a continuous manner.

The individuality of each employee should be respected and an environment whereby employees’ creativity and productivity can be fostered, appreciated and rewarded should be provided. Suppliers should be considered as partners who play a prominent role in the achievement of firm’s goals such as highest quality standard and greatest consistent level of service. Firms can create the value of community by striving to be caring and supportive

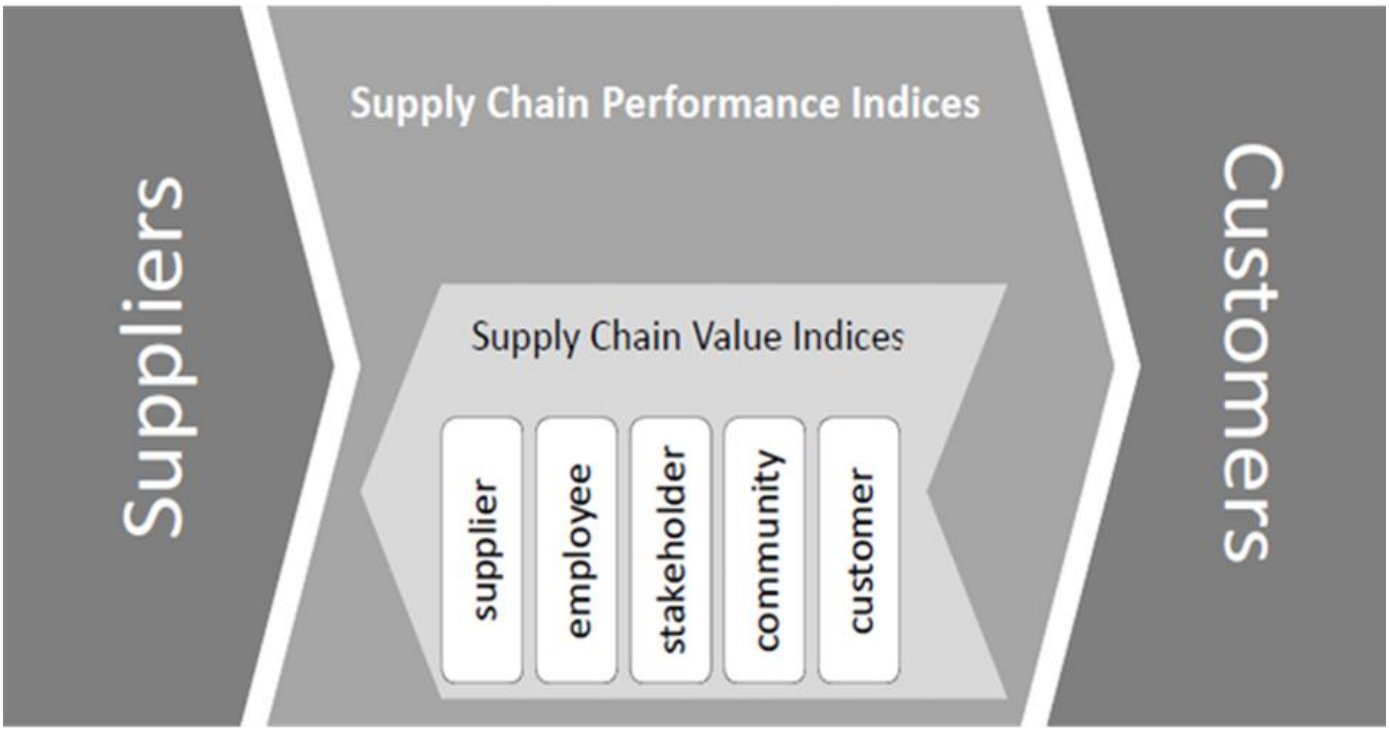

Figure 1. Classification framework for indices concerning supply chain value.

corporate citizens among the global communities. Finally, by enhancement of return on investments, the value concerning shareholders and financial communities should be augmented (Rosabeth, 1988).

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.

ARTICLE REVIEW TO CLASSIFY PERFORMANCE INDICES FOCUSED ON VALUE

Most of 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 a 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 and 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 (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

rs 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 the different models of supply chain evaluation 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 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 is 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.

Based on the cross-entropy of two distributions, Donnet et al. (2009) have developed a differentiation measure by using a case study on coffees. Using their proposed measuring method, managers can monitor product differentiation in the agri-food supply chain. Their method was based on the cross-entropy measure of information theory, since they believed that quality ratings are the basis of information sharing in the coffee supply chain. 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.

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 and 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 structural equation model (SEM), 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 and 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 and 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 and 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 analyze 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 and Smits-Pefformance (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 a 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.

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 that is, including potentiality, capital structure, solvency, corporate performance, profitability, and cash flow. It also incorporates 20 assessment factors to provide the needed criteria for assessment.

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 and Cantu (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 and 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 and 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.

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 et al. (2010) have proposed a multi-dimensional indicator system which embodies twenty four indices and is constructed with respect to six perspectives, that is, 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 and 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 with the classification framework in a category which is directly associated with one group of stakeholders by 30 expert managers including customer relationship manager, sales managers, marketing managers, engineering manager, human resource manager, Quality control and insurance manager, purchasing manager, financial manager, planning manager, R&D manager, strategic manager and some executives who have good understanding of company's performance (Table 1).

According to classification indices, most discussions about supply chain index focused on value are about internal logistics performance measures and the internal supply chain levels. Measuring all these indices is difficult for managers and maybe some of them do not have important affect on actual supply chain value index from the standpoint of supply chain stakeholders.

The study comprised semi-structured interviews to define the effectiveness of using proposed framework. Interviews were considered the most suitable method to provide answer to the research questions. Interviews were semi-structured, lasted from 1 to 2 h and were all tape-recorded. The key question addressed is the following: Is the proposed framework increase value creating in supply chain? All the experts interviewed believed that focusing on stakeholders affect on supply chain performance positively. They mentioned that stakeholder's value metrics correlated with each others. To satisfy one group can conclude the satisfaction of others. However, the most of experts expressed willingness to identify value indices by using interviews with stakeholders and define real value indices. They mentioned that implementing the proposed framework has meant adopting new measures that were not used earlier in their companies.

Most interviewees stated that this framework has forced them to select the most important measures from the existing ones and helped them to focus their attention.

Actual value index system to measure supply chain value

This paper provides a framework for measuring supply chain value focusing on stakeholders' value index.

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

Stakeholders	Indices	References
Customers	Cost reduction, quality, delivery time, flexibility, waste reduction.	Stern (1991)
	Customer rate, innovation, internal business processes.	Jack et al. (2003)
	Forecast accuracy, intra-manufacturing replan cycle time non identified, 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, and Bititci (2006)
	Confirmed fill rate.	Enrico and Alessandra (2006)
	Wasting degree of energy sourcing, recycle rate of call back, 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, implementation rate of orders, advance phase of orders time, support degree of production, answer speed, information share, order rate of distributive business, cost of logistic	Jin and Chang (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 (2009)
	Quality rating, price,	Laura (2009)
	Degree of inventory oscillation, amplification ratio between the order rates	Shin et al. (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 contribution of top 20% SKUs and customers, Volume flexibility, forecast error, forecast error, forecast horizon, frequency of update (in days) , ratio of demand variability to order variability ,seasonal factors ,Variance from plan (in percentage), average inventory (in no. of units per month), average replenishment batch size (in no. of units), average safety inventory (in no. of units), Fill rate (in percentage), fraction of time out of stock, Inventory obsolescence (in no. of units/year) , products with more than a specified number of days of inventory (in nos), seasonal inventory (in no. of units), average order size (in no. of units), Average sales price (in $), days sales outstanding (in no. of days), incremental fixed cost per order (in $), incremental variable cost per unit (in $), profit margin (in percentage), range of periodic sales (in no. of units), range of sale price (in $), delivery flexibility, responsiveness to urgent deliveries, shipping errors (in percentage)	Gunjan and Rambabu (2010)
	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.	Mondragon (2011)
	product returns and reverse logistics, accurate forecast	
Community	Waste reduction,	Stern (1991)
	Wasting degree of energy sourcing, environmental status,	Jin and Chang (2007)
	Environment protection efficiency, raw material and resource usage rate, product recycle interest	Jianhua (2009)

Table 1. Contd.

	Financial benefits, net profit margins, increase in revenues, financial performance	Stern (1991)
	Financial benefits	Jack and Martin (2003)
	Supply chain finance costs, forecasting and demand MIS costs none identified, Supply Chain capacity planning systems,	Yilmaz, and Bititci (2006)
	Stock price, percentage of revenues or cost of fulfilment per case ordered, total supply chain costs,	Enrico and Alessandra (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 and Chang (2007)
	SC capital return ratio, cash velocity, new product sale ratio,	Jianhua (2009)
Shareholders	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 et al. (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 and Rambabu (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 et al. (2011)
	Learning abilities, innovation abilities, time compression	Stern (1991)
	Internal business processes, innovation	Jack and Martin (2003)
Employees	Supply chain advanced planning systems, supply chain integration systems, integration between supply chain 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	Yilmaz and Bititci (2006)
	Cost of manpower resources	Jin and Chang (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 (2009)
	Expansion capability	Gunjan and Rambabu (2010)

Table 1. Contd.

	Integration between supply chain tiers	Mondragon (2011)
	Supplier performance Internal business processes, Cash-to-Cash cycle,	Stern (1991) Jack and Martin (2003) Enrico and Alessandra (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 and Bititci (2006)
	Rate of credit, delivery of supply business,	Jin and Chang (2007)
Suppliers	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 fulfilment 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, delivery flexibility	Gunjan and Rambabu (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 (2010)
	Synchronisation of units received matching shipments, receipts,	Mondragon (2011)

The framework focuses on stakeholders' value index. The method of qualitative observation and in-depth interviews was applied in the research to explore and identify stakeholders' perspective of values. Data has been gathered through observation and in-depth interviews with stakeholders' home appliance company located in Iran.

Parskhazar Company is the largest home appliance manufacturing company in Iran. Qualitative in-depth interviews were an explore research technique with the ability of giving well-grounded, rich descriptions and explanations (Arksey and Knight, 1999; Gordon and Langmid, 1988). Indeed, these methods permit concepts and meaning to be explored in greater than questionnaires.

Furthermore, the concept of partial differential equations is applied on explored attributes to build qualitative a dynamic attribute value model based on Keeney's (1999) and Ma et al. (2001) approaches.

Data were gathered through observation and in-depth interviews with each group of stakeholders in manufacturing company. The selected stakeholders were contacted by telephone and invited to participate in the study. Thirty stakeholders in each group agreed to participate, and interviews were scheduled over a period of three months.

To define customer value index, we used observation method too. We monitor their attitude at home appliance fairs and at company's brand shops located in Tehran. The observation method applied for identifying employee value index at company too. Each of the interviews lasted from 20 to 30 min and was open-ended although structured by interview guides to ensure coverage of issues relevant to the researchers.

During interviews, case study participants were encouraged to "think aloud" and provide why they selected specific values to be important. According to the method of Schoenfeld, the researcher should interact with each subject by encouraging, guiding, questioning, and searching during interviews. The interview situations

included classification of the subject's meanings by the researcher and reflections from the subjects. The purpose was to help subjects express their ideas more clearly.

The interview guide was composed of three parts. In the first part, participants were asked to explain what they mean by the value to participate with the company. The second part was designed to identify the value dimensions. Respondents were asked to describe how company creates value for them and to illustrate the different directions of value creation through examples from the specific companies under consideration. The proposed framework and the result of observation and interviews for five perspectives are presented in Figure 2.

DISCUSSION

There are many supply chain performance indices in literature that some of them focused on value creation. But there is no research to discuss value creation via supply chain comprehensively. The literature studies focused on one or two groups of stakeholders such as customers or shareholders to discuss supply chain value and missed others stakeholders that can affect on total value in supply chain. This study proposes an index system whereby all stakeholders are considered simultaneously for the process of value measuring.

It is difficult to monitor all supply chain performance index for managers in supply chain. It is necessary to identify actual value index for all supply chain stakeholders and define correlation between supply chain value index and supply chain performance index. There is the lack of definition for supply chain value index to create value for all stakeholders. Managers usually continue to pursue supply chain metrics as a means to increase value without attention on what really mean value in supply chain. We defined actual supply chain value indices according to proposed framework.

In most researches in past studies, value indices have been identified by experts in companies, but this research proposes a framework by using real value indices concluded from in depth interview method. So all five group of stakeholders participate on create proposed framework. Using the real value indices focusing on supply chain stakeholders is the main contribution of this study.

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 internal supply chain performance indices or supply chain index that 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 proposed framework and their direct influence on each stakeholder by expert managers in manufacturing company. The proposed framework focused on all supply chain stakeholders was applied in a manufacturing company. Stakeholders' value index gathered from observation and in-depth interviews with all stakeholders a supply chain in a home appliance manufacturing company.

Future research

Further research is necessary to test reliability of value indices by using questioner and develop a dynamic models specially based on knowledge management to generate index system and quantify value index by using different methods for measuring value in supply chain. Identifying the relationship within value indices and between supply chain value indices and supply chain performance indices is an issue for future research. Due to the fact that the significance of every group of stakeholders differs from each other in every specific firm, future works could focus on the prioritization of stakeholders in diverse industries. Furthermore, one more subject for future work can be utilization of a model or framework to link value indices to operational supply chain indices as well as quantifying them.

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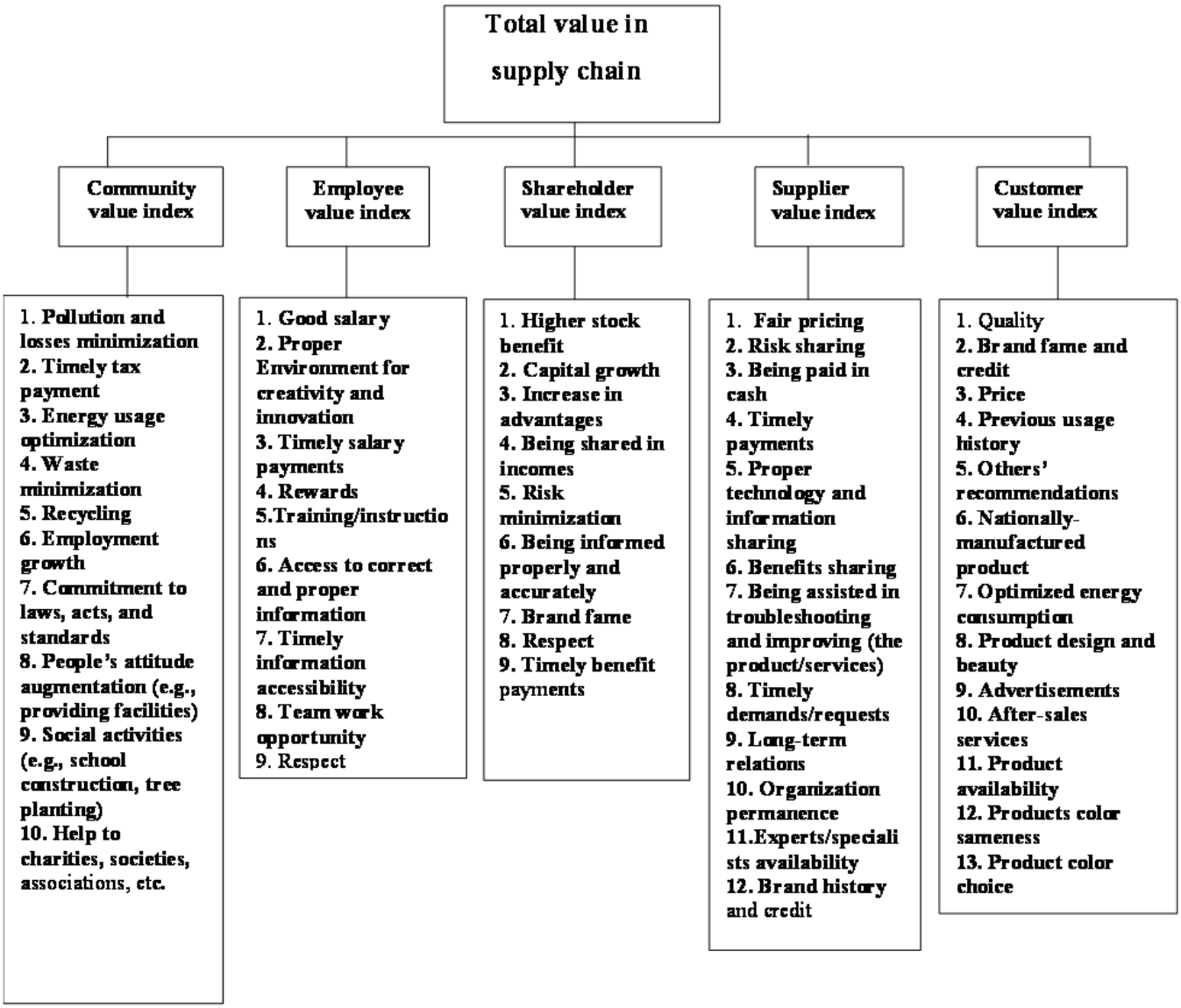

Figure 2. Proposed framework to measure supply chain value based on value index.

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