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CASE STUDY

SUPPLY CHAIN PERFORMANCE MEASUREMENT FOR SERVICES: An Operational level Framework

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Abstract:

Purpose

The purpose of the study is to propose a consolidated and comprehensive operational level framework of performance metrics to facilitate the supply chain integration in the service industry.

Design/methodology/approach

In order to do so, we rely on a systematic review procedure to delineate and thus integrate the measures into factors. This paper draws upon prior work done on performance measure in supply chain integration.

Findings

These measures will then be assigned by incorporating industrial practice to various factors that we believe are relevant to the measure of performance in the integrated supply chain system in the service industry.

Research limitations/implications

The manuscript is a conceptual paper so there is a need to test the generalizability of the framework in the broader service industry by conducting empirical study.

Practical implications

This analysis will enable the identification of the problems that surround outcome assessment within and across single supply chains and extend existing knowledge in the end-to-end supply chain performance measurement in the service industry. Further this analysis should provide some vital insights as to how service organizations can improve their performance evaluation systems to become more effective in supply chains.

Originality/value

This study aims to not only identify the gaps present in the service supply chain performance measurement at the operational level but tries to fill the knowledge gap to suggest operational level performance metrics in facilitating the supply chain integration in the service industry.

Keywords: Supply chain, Performance measurement, Services supply chain, Service supply chain, Conceptual framework, SCOR Model, Scorecard, KPI, Performance Measurement Methods, Performance metrics

Introduction

Supply chain integration has been a topical issue since the late 1980s (Stevens, 1989). It aims to integrate the supply chain partners through strategic collaboration of managing the intra and inter-organisation processes (Flynn et al, 2010). Since then, there have been research studies that have approached the subject from various aspects and to name a few, these are process integration (e.g., Serve et al., 2002; Wang et al, 2010), integration types (e.g., Frohlich and Westbrook, 2001)– vertical, horizontal, network and hierarchical integrations, information systems (e.g., Serve et al., 2002), as well as performance impacts (e.g., Flynn et al, 2010). However, there is a lack of models to assess the effectiveness of integrated supply chain, thus weakening the efficacy of integration. To this end SCOR model offers a few indicators that can help in this regard. Kaplan and Norton (1992) on the other hand have also proposed a well known tool, the Balanced Scorecard, in order to measure the performances of the supply chains involving not only the financial side of the supply chains but also suggesting KPIs to streamline the internal business process, the customer, learning and growth. The KPIs suggested in Balanced Scorecard help maintain an equilibrium between short term and long term objectives, financial and non-financial measures, lagging and leading indicators and between in-plant and out of plant performance outlook (Kaplan and Norton, 1992, 1993, 1996).

Other recent studies focusing on the issues of performance measurement and have attempted to provide theoretical frameworks to measure the integrated supply chain performances (e.g., Abu Bakar, Hakim, Chong, & Lin, 2010; Dey, Hariharan, & Clegg, 2006; Wang, Lai, & Zhao, 2008; Hofmann & Locker, 2009; Forslund & Jonsson, 2007). A few authors have made an effort to study performance in the light of service innovation, namely, (Wang et. al., 2015) also. However, majority of the research in this genre in general lack a holistic approach that could address the fundamental issue of integration of various components within a representative and generalizable performance model. Moreover, we note that most of the researches generally focus on the manufacturing sector with limited insights provided to the service sector supply chain management. These limits our insights for performance measurement in services supply chains and points to a major gap in our knowledge, in effectively managing the service supply chain system, and this apparent gap forms the basis of the present research work.

It seems that the reason for this lack of focus comes from the difficulty to identify the suppliers of the intangibles compared to the manufacturing industries. Literature emphasises the difference in product and service marketing focusing on the distinguishing characteristics of services. This distinctive characteristics of services has also been proposed in the context of managing supply chain by Fitzsimmons and Fitzsimmons (1998), who opine that services are strikingly dissimilar from manufacturing, with different managerial implications. This indicates that the empirical findings for manufacturing or product oriented supply chains should not be generalized to services supply chains, service is intangible in nature and it becomes difficult to account for the outcomes. Service outcomes usually tend to be heterogeneous because of heterogeneity of inputs. Moreover customer interaction in the operation of the service industry supply chain plays a critical role in performance evaluation that makes it difficult to measure.

The purpose of the study, therefore, is to propose a consolidated and comprehensive framework of performance metrics at operational level to facilitate the supply chain integration in the service industry.

The way this is being approached is by asking ourselves “how can we measure and control supply chain performance in the service sector” and secondly “are there metrics / performance measures that are relevant to the industry”.

In order to do so, we rely on a systematic review procedure to delineate and thus integrate the measures into factors. This paper draws upon prior work done on performance measure in supply chain integration. These measures will then be assigned by incorporating expert opinion to various factors that we believe are relevant to the measure of performance in the integrated supply chain system in the service industry.

Before explaining the prior work selection procedure and our analysis, we would like to briefly discuss models which have gained currency in the broader field of supply chain performance measure and attempt to demonstrate the gaps therein with relation to their application to the service supply chains.

Supply chain performance models: A literature review

Prior to discussing what is said by the authors with regard to the supply chain performance measurement in service industries, it is important to first reflect on supply chain itself and its implications in service industry. A supply chain in general comprises of all business entities involved, directly or indirectly, in satisfying a customer's request. The supply chain not only includes the manufacturer and suppliers, but also transporters, contractors, warehouses, manufacturing plants, vendor plants, retailers, and customers themselves and thus indicates a network of systems and processes. On the other hand, supply chain management in the recent years has been defined as:

"The management of a network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction." (Stock and Boyer, 2009, page, 707)

Managing supply chains involve coordination of all business activities making the supply chain end product more networked. Concept of supply chain is applicable in both manufacturing and services organizations as the prime focus revolves around integration of the end-to-end organization i.e. involving suppliers, suppliers of the suppliers, customers and customers of the customers, thereby allowing supply chain principles to be applied in the services context too.

Nevertheless a distinction between manufacturing and services has to be made to enable us to set the stage for discussing the supply chain within the service industry and we rely on Sampson (2000) description of services.

Services are intangible products that may or may not be difficult to store, they are also produced and consumed concurrently at the time when demand arises and not before. This is a necessity in most of the cases and not a choice. Further, if at the time of customer demand, the service provider is not able to produce the service then he / she might lose the order. Unlike tangible products, most services are frequently available for offering and would not be depleted on getting sold. Moreover, to meticulously identifying and evaluating the contribution of all the relevant suppliers in the upstream is theoretically and practically difficult given the involvement of customers at that end. This fact is highlighted by Sampson (2000), while introducing the bi-directional supply chains. In that he highlights the duality of producing and consuming services which is specific to service oriented businesses. Services are, on the whole, labor intensive actions and highly dependent on managing the employees and knowledge efficiently. In line with this proposition, it is important to note that customers do not only sit downstream of the service supply chain but also manage many of the inputs in upstream part of the supply chain. Sampson (2012) also has explained the translation from inventory to capacity as far as service industries are concerned. Sampson and Spring (2012) has tried to relate the design and development process in the manufacturing supply chains

with the ones in the service supply chains. In addition to this, service customers according to Sampson and Spring (2012) are component suppliers of their minds, bodies, belongings and information. Therefore, information also acts as a raw material of service supply chains. There are a few other authors who have tried to analyze the effect of introduction of services into traditional manufacturing firms, namely, (Bustinza et. al., 2013 and Darkow et. al., 2015), while (Chahal and Kaur, 2014) took banking sector for their studies in organizational performance. A service dominant logic approach was used to study supply chain performance by (Maas et. al., 2014). One unique study conducted by Wang et. al. (2013) stressed on the comparison of various key performance indicators for sustainability of the earth performance, which also gives an overview of how one can measure the services supply chains and what else can be the indicators to focus on in the future.

With regard to the service performance aspect of the supply chain outcomes in service industry, we find very few researches i.e. (Seth, Deshmukh, & Vrat, 2006; Gomes, Yasin, & Lisboa, 2004), which is perhaps an indicator of the difficulty in assessing the outcomes at various levels of deliverables in the service oriented organization. Many writers however, have proposed various tools in this regard, for example, a performance management system has been developed for medical service authority (De Toni, Fornasier, Montagner, & Nonino, 2007), but the system could not be applied in a more generalized manner. Nevertheless a shortage of studies in this area indicates a gap in the knowledge where supply chain integration for service industry and its performance measures are concerned.

In the next section the paper will present a few models for supply chain performance measures that are more popular in their relevance to application in service industry, however they do lack in comprehensiveness.

Fitzgerald service performance dimensions

Fitzgerald et al. (1991) suggest six service performance dimensions, that make services different from manufacturing and these dimensions include the following:

- 1- Competitiveness (with a focus on customer)
 - a. Ability to win new customers.
 - b. Customer loyalty.
- 2- Financial performance (with a focus on asset management)
 - a. Asset turnover
 - b. Control of labour and capital costs
 - c. Profit per serve
- 3- Flexibility (with a focus on functional strategy)
 - a. Building volume, delivery speed and specification flexibility into service design in the long term
 - b. Use of level design in the long term
 - c. Employment of part time and floating staff
 - d. Use of price and promotion strategies to smooth demand
- 4- Resource utilisation (with a focus on resource)
 - a. Utilisation of facilities, equipment and staff
- 5- Innovation (with a focus on growth)
 - a. Measurement of the success of the innovation process and the innovation itself
- 6- Quality of service (with a focus on customer services)
 - a. Relationship between customer and organisation
 - b. Setting of clear customer expectations
 - c. Measurement of customer satisfaction

SCOR Model

SCOR model is a reference tool to benchmark distinct supply chains across multiple industries. To achieve this, SCOR suggests a standardization of the processes and activities of a supply chain(mainly manufacturing supply chain) into five processes i.e. plan, source, make, deliver and return. “Plan” processes are the ones that balance aggregate demand and supply to develop a course of action which best meets sourcing, production and delivery. “Source” processes are related to procuring goods to meet demand. “Make” processes transform products to a finished state. “Deliver” processes provide finished goods to meet demand and “Return” processes are the ones that return products from the downstream to the upstream stages of the supply chain.

Each of the higher level process is sub-divided into three further levels that theoretically explain the strategic, tactical and operational activities that exist to integrate the supply chain operations. The processes of an organization’s suppliers and customers are also considered in SCOR Model and integrated, thus providing an overall supply chain outlook. After mapping with SCOR terminology, the standardized processes can be analysed with the help of specific KPIs that still lack comprehensiveness with regard to their application in the service industries.

Attribute	Level-1 Metric
Reliability	Perfect Order Fulfillment
Responsiveness	Order Fulfillment Cycle Time
Agility	Upside Flexibility
	Upside Adaptability
	Downside Adaptability
	Overall Value-at-Risk
Cost	Total Cost to Serve
Asset Management Efficiency	Cash-to-Cash Cycle Time
	Return on Fixed Assets
	Return on Working Capital

Fig. 1 SCOR performance attributes and associated level 1 metrics. (Version 11.0)Source: www.supply-chain.org

SCOR MODEL, (abbreviated as: Supply Chain Operational Reference MODEL) has four major components that act as reference points to help companies, when designing and implementing supply chain integration. These components are (SCC, 2008):

- Performance Metrics (Key Performance Indicators): Standard metrics to measure process performance by identifying the value specifics of how good a company is progressing
- Processes: Standard descriptions of
 - a) management processes and
 - b) a framework of process relationships
- Practices: Management practices that produce best-in-class performance
- People: Training and skills requirements aligned with processes, best practices, and metrics.

The lack of adapted performance metrics and best practices for services supply chains make SCOR model an inadequate model for the management of service supply chains (Giannakis, 2011). The current loaded range of performance metrics however may guide us to the development of new performance measurement frameworks for service supply chains.

Balanced SCORECARD

It was Kaplan and Norton (1992, 1993, 1996), who formulated the concept of Balanced ScoreCard (BSC), that is principally a multi-dimensional performance measurement framework. The balanced scorecard is unique in a sense that it incorporates the non-financial in addition to the financial perspective for measuring organizational performance and has four different areas including financial, customer, internal business processes as well as learning and growth. Mainly this scorecard not only covers the strategic dimensions of the organizations but also operational dimensions thereof and is presented in Figure 2.

Based on their further research on intangible assets, (Kaplan and Norton, 2004) have graded intangible assets under three broad categories, namely, human capital (consisting of employees' skills, talent and knowledge), information capital (that includes databases, information systems, networks and technology infrastructure) and organization capital (encompassing culture, leadership, employee alignment, teamwork and knowledge management).

With the strength of the model acknowledged it has to be noted that, the balanced scorecard approach has not dealt with the requirements of all the stakeholders. The soft issues related to employees have not been considered, despite the fact that the employees' skills and knowledge, as an intellectual asset, have been described as part of the learning and growth perspective. This perspective in the opinion of the authors deserves a separate treatment given that they are so significant in the implementation of the management strategies.

One other factor that is generally overlooked in balanced scorecard approach is the conscientiousness of the organisation for the society in which it works and relates to the social and stakeholders perspective. We know that in reality organisations do not function in isolated spaces but are liable to the society as a whole.

Perspectives		Typical Objectives	Typical Measures
Financial		<ul style="list-style-type: none">• Become industry cost leader• Maximize use of existing assets	<ul style="list-style-type: none">• Cost per unit (vs. competitors)• Annual reduction in cost per unit• Sales/asset ratio• Free cash flow
Customer		<ul style="list-style-type: none">• Lower customer's cost• Deliver zero-defect products• Provide on-time delivery	<ul style="list-style-type: none">• Customer's cost of ownership• Defect rate• Number of warranty claims• Percentage of on-time deliveries
	Develop supplier relationships	<ul style="list-style-type: none">• Lower total cost of ownership• Achieve just-in-time capability• Develop high-quality suppliers• Achieve supplier partnership	<ul style="list-style-type: none">• Activity-based cost of acquisition• Percentage of orders direct to production• Percentage of late orders• Percentage of suppliers qualified to bypass inspection• Percentage of suppliers serving customer directly
	Produce products and services	<ul style="list-style-type: none">• Lower cost of producing• Continuously improve processes• Improve process responsiveness• Improve fixed-asset utilization• Improve working-capital efficiency	<ul style="list-style-type: none">• Cost per unit of output• Total cost of quality• Number of processes with substantial improvement• Cycle time• Process efficiency• Capacity utilization• Inventory turnover

Internal Process	Distribute products and services to customers	<ul style="list-style-type: none">• Deliver responsively• Lower cost to serve• Enhance quality	<ul style="list-style-type: none">• Lead times (order to delivery)• Percentage of on-time deliveries• Activity-based cost of storage and delivery• Customer complaints
	Provide postsales (ongoing) service	<ul style="list-style-type: none">• Respond to customer feedback• Enhance postsales value	<ul style="list-style-type: none">• Time to resolve complaints• Percentage of queries satisfied on first call• Revenue/margin from postsales service
	Manage risk	<ul style="list-style-type: none">• Manage financial risk• Manage operating risk• Manage technological risk	<ul style="list-style-type: none">• Bad debt percentage• Losses from interest rates, currencies• Inventory obsolescence• Order backlog• Process technology ranking (vs. competition)
Learning & Growth	Human capital	<ul style="list-style-type: none">• Develop quality/process improvement skills	<ul style="list-style-type: none">• Percentage of employees trained in quality management• Number of Six Sigma "black belts"
	Information capital	<ul style="list-style-type: none">• Provide technology that facilitates process improvement	<ul style="list-style-type: none">• Percentage of employees receiving immediate feedback• Percentage of customers who can track orders
	Organizational capital	<ul style="list-style-type: none">• Create a culture for continuous improvement	<ul style="list-style-type: none">• Performance improvement from employee suggestions• Percentage of ideas shared across organization

Figure No. 2: Balanced scorecard template

Holistic SCORECARD

The holistic scorecard approach presented by Sureshchandar and Rainer Leisten in (2005) and in an opinion can be considered as an extension of the balanced scorecard approach. In their method, 2-3 dimensions have been added to the balanced scorecard in order to make it more holistic and balanced in spirit.

This holistic scorecard not only describes the financial perspective, customer's perspective but also deals with business process, employee, intellectual capital and social perspectives, thus covering for the apparent shortcoming in the scorecard mentioned previously. Further, the authors in their discussion on KPIs observe that these vary from industry to industry and managers must adopt them according to the needs and requirements of the industry or organization. Even with these additional considerations, this scorecard model does not deal with the service industry in particular; although a case of IT industry has been written by these authors in order to validate the model for service industry. Figure 3 shows the schematic detail of Holistic Scorecard.

Figure No. 3: Holistic scorecard

In the above section, we described some of the known models and have also highlighted the fact that these have generally dealt with manufacturing industries and with a very minute focus on the service industry.

Methodology

As stated earlier, the objective of the paper is to propose a model of KPIs for measuring performance in an integrated supply chain for the service industry. The following section will detail the process of systematic review of literature and the form adopted to develop a comprehensive integrated framework for measuring performance in the service industry.

To start with, 57 articles and research papers from the literature of supply chain performance measurement were drawn. The research papers and articles were selected using keywords of “supply chain” , “performance measurement” , “service”, “models”, “framework” as well as using Boulleian operators withinand by rearranging the sequences. The journals that are mostly related to the field of supply chain management, operations management, logistics management, production and operations management, strategice management, supply management and distribution management were chosen from multiple research repositories i.e. Emerald, Ebsco host, Science Direct and Wiley. Articles available in journals related to other management fields were ignored. Table I shows the summary of the list of KPIs that have been taken from literature from 1995 to 2015 related to the supply chain performance measurement field. A total of 34 authors from 23 articlesand research papers were selected whose contribution to the field of supply chain performance measurement is proven. Table I further segregates the KPIs on the basis of its application to the manufacturing industry or both the manufacturing and services industries. An effort has also been made to further categorize the KPIs on the basis of their supply chain position i.e. whether the KPI is mostly used at the supplier, company, or the customer level

Table 1

References	Performance Indicators	Categorization based on Application	Categorization based on position in the supply chain
Stewart, (1995)	11 KPIs proposed	6 Mnfg & 5 (Mnfg + Services)	4 co., and 7 (co. + supp.)
Lockamy and Spencer, (1998)	11 KPIs proposed	9 Mnfg & 2 (Mnfg + Services)	7 co. + 3 supp. + 1 cust.
Beamon, (1998)	19 KPIs proposed	13 Mnfg & 6 (Mnfg + Services)	13 co. + 4 (co. + supp.) + 2 cust.
Jouenne, (2000)	10 KPIs proposed	5 Mnfg & 5 (Mnfg + Services)	8 co. + 2 cust.
Gunasekaran et al., (2001)	23 KPIs proposed	3 Mnfg & 20 (Mnfg + Services)	10 co.+9 (co. + supp.)+3 cust.+1 supp.
De Toni and Tonchia, (2001)	31 KPIs proposed	18 Mnfg & 13 (Mnfg + Services)	26 co. + 1 cust. + 4 supp.
Milgate, (2001)	11 KPIs proposed	5 Mnfg & 6 (Mnfg + Services)	7 co. + 4 supp.

GCI, (2001)	5 KPIs proposed	2 Mnfg & 3 (Mnfg + Services)	3 co. + 1 (co. + supp.) + 1 supp.
		1 Mnfg & 3 (Mnfg + Services)	4 co.
Dutta, (2002)	4 KPIs proposed		
	1 KPIs proposed	1 (Mnfg + Services)	1 (co. + supp.)
Farris and Hutchison, (2002)			
Sengun Yenyurt, (2003)	24 KPIs proposed	6 Mnfg & 18 (Mnfg + Services)	20 co. + 4 cust.
Carlo Rafele, (2004)	29 KPIs proposed	13 Mnfg & 16 (Mnfg + Services)	29 co.
Huan et al., (2004) (SCOR model)	12 KPIs proposed	8 Mnfg & 4 (Mnfg + Services)	7 co. + 5 (co. + supp.)
Simatupang and Sridharan, (2004)	15 KPIs proposed	6 Mnfg & 9 (Mnfg + Services)	13 co. + 1 (co. + supp.) + 1 cust.
Webster et al., (2004)	6 KPIs proposed	6 (Mnfg + Services)	6 co.
Dft, 2006 b; Dft, 2004, Dft, 2005; Dft, 2006c; Dft, 2006a	39 KPIs proposed	28 Mnfg & 11 (Mnfg + Services)	37 co. + 2 cust.
ABB, (2005)	9 KPIs proposed	4 Mnfg & 5 (Mnfg + Services)	8 co. + 1 supp.
Framework, (2005)	5 KPIs proposed	2 Mnfg & 3 (Mnfg + Services)	5 co.
Sigurd, (2005)	2 KPIs proposed	2 Mnfg.	2 co.
Bukk and Sigurd, (2005)	8 KPIs proposed	4 Mnfg & 4 (Mnfg + Services)	8 co.
		3 Mnfg & 1 (Mnfg + Services)	4 co.
Mumby, (2006)	4 KPIs proposed		
Blinge and Swensson, (2006)	5 KPIs proposed	3 Mnfg & 2 (Mnfg + Services)	5 co.
Sxelerski, 2007: kuchnia and Damogala, (2007)	8 KPIs proposed	3 Mnfg & 5 (Mnfg + Services)	8 co.

*(Mnfg. = Manufacturing, Co. = Company, Cust. = Customer, Supp. = Supplier)

Analysis and comments

Following the research methodology, various gaps related to the field of supply chain performance measurement in services industry were revealed starting with the fact that the performance metrics for supply chain integration is currently an under researched topic. This observation is supported by Lambert & Pohlen (2001) who points to the lack of empirical evidences of performance metrics and operation control at the general supply chain level. Although SCOR model has also suggested an approach for performance evaluation of supply chain integration to be followed at various levels (as defined in SCC (2008), where there are 3 levels of integration – supply chain, cross functional, and functional levels), it requires some very complicated tasks to follow, (Shepherd & Guenter, 2006). For example, level 1 defines key supply chain metrics such as perfect order fulfilment, order fulfilment cycle time, cost of goods sold, total supply chain cost, supply chain adaptability, supply chain flexibility, cash to cash cycle time, return on supply chain fixed assets and working capital show the overall aggregate performances of companies. These metrics are connected further to level 2 and onwards. SCOR suggests the trading partners to adapt these performance metrics in each level of the supply chain integration in order to ensure the whole supply chain operations is being controlled in an integrated manner. However, the level 1 metrics suggested by SCOR are not actually measurable as most of them have been proposed at the conceptual level and not quantified. Moreover, adapting the SCOR metrics needs major surgery of business processes within the trading partners but there is no suggestion how it could be achieved in the SCOR framework. This weakness has been recently noted by Wang, et al (2010) who suggested that the investigation of easier approaches than provided by SCOR framework is becoming necessary.

Previous literature has mainly focused on manufacturing industries when providing the empirics of supply chain integration, particularly the study of performance metrics (e.g., Chow, Heaver, & Henriksson, 1994; Esper, Defee, & Mentzer, 2010; Andersen, Henriksen, & Aarseth, 2006; Carlucci, 2010; Chae, 2009). One of the few examples adopting other sample industries is Hong et al (2010) who investigate the supply chain integration and the practices for manufacturers as well the distributors and other services providers. In their study, performance metrics are explored and discussed as the benchmarking tool for various products and services in the supply chain. Likewise, Kumar & Markeset, (2007) conducted a study with the service sector of oil and gas industry. Given the above, it can be proposed that there is visible gap in proposing cross-functional metrics for supply chain integration in the service industry, where the concept of intangible comes into play. As stated earlier, the customers in service industry may also be the suppliers that forms a bi-directional supply chain which could be very difficult to evaluate (Sampson, 2000).

One of the researcher, Ellram et al. (2004) has tried to propose a service SCM framework, which estimates the usefulness of existing SCM models and have adapted seven processes of the global supply chain forum framework (Cooper et al., 1997) for application to a service supply chain. These are demand management, customer relationship management, supplier relationship management, service delivery management, cash flow, information flow, capacity and skills management. They basically view capacity management as a key to knowing the service, by considering the process of providing a service as the transmitting of capacity for the purposes of providing value to the customer.

Roadmap for the development of Operational Framework

According to Melynk et al. (2004), metrics and measures provide essential links between strategy, execution and ultimate value creation. There are several factors that have contributed to the requirement for measures and metrics to manage a supply chain (Chan and Qi, 2003; Lambert and Pohlen, 2001) which need to go beyond internal measures and metrics and look at the supply chain as a whole. It should also link the supply chain performance and

corporate objectives while expanding the “line of sight” within the supply chain. Further benefits should be allocated and burdens shifted resulting from functional shifts within the supply chain. Additionally, it should encourage co-operative behavior within the supply chain, enhance motivation, improve communication, and diagnose problems within the supply chain; and lastly it should try to improve the performance of the supply chain and thus providing competitive advantage. These factors indicate that one must look at all the dimensions of the application in order to measure the performance. In doing so, one must look not only at the tangible asset side but intangible also including the behavioural and cultural aspects. The KPIs mentioned in the annexure I are the ones that are mostly used by the manufacturing industry managers and have less application in the service sector. Some of these KPIs are also applicable to services industries but the application and the nature of the formula will have to be fine tuned, which is a cumbersome process. In order to do it effectively, one has to carefully observe the rationale of the KPI and its formula and also have to keep in mind the point in the industry where it is going to be applicable. During the application of the KPI, one needs to remember that the service industry environment is more dynamic compared to manufacturing environment therefore a margin to continuously revise the formula should also be kept in mind.

A list of KPIs is given in the Table II that are recommended for manufacturing and services environment both. The total no. of KPIs come out to be 117. There is still a huge gap left even if we use all KPIs for service industries. The gap is due to various dimensions of service industries that are not yet fully explored and measured. These 21 dimensions are related to time, cost, quality and further connected to safety, innovation, growth, organizational culture, document handling, flexibility, reliability, trust, communication, adaptability, relationship management, partnership, social capital, intellectual capital, human capital measurement, uncertainty evaluation, return process evaluation and asset utilization. The road map to develop the operational level framework based on the information retrieved so far would look like this:

Figure No:4: Road map to develop operational Framework for Service Supply Chain Performance Measurement

Table II

KPIs those are applicable to both manufacturing and service industries

% of late deliveries	Forecast accuracy
Accident impact	Forecast reliability
Accident severity rate	Fuel costs
Administration and management cost	Growth

Average lateness	Harmfulness
Back orders	Health issues
Breadth of supply base	impact on strategy
Buyer-vendor cost saving initiatives	Improved planning process
Capacity utilization	Inbound quality
Cash to cash cycle time	Indirect labor productivity
Claims management	information availability
Clean data	Infrastructure cost
Communication	Labor cost
Costs associated with assets	less stressful work for planners
Customer complaints statistics	Level and degree of information sharing
Customer perception of service	Lost sales
Customer query time	Margin
Customer retention	Market orientation
Customer satisfaction	Market share
Customer services levels	No. of back orders
Data security	No. of client contacts
Days of sales outstanding	No. of faultless notes invoiced
Delivery lead time	No. of orders delivered on time
Delivery reliability	No. of process innovations
Delivery to commit date	No. of promotions
Delivery to request data	No. of urgent orders
Distribution of internal competencies	On time delivery
Document management	Operating costs
Early warnings of anticipated supply problems	Operational flexibility
Ease of ordering	Order advancement state
Effectiveness of scheduling techniques	Order fulfillment lead time
Efficiency	Order management cost
Employee satisfaction index	People costs
Employee training hours	Perceived quality
Employee turnover rate	Personal efficiency
EVA	Personnel cost

Extent of mutual assistance in problem solving efforts	Post transaction measures of customer service
Extent of mutual cooperation leading to improved quality	Potential access to wider customer base
Extent of outsourcing	Profit per employee
Fixed capital productivity	Punctuality
Flexibility of delivery systems to meet customer needs	Supply chain responsiveness
Quality system cost	the entity and stage at which supplier is involved
Range of products and services	Time keeping
Reduction of staff	Time to market
Regularity	Total cash flow time
Repeat sales level	Total costs
Response against changes in the customer order	Total order cycle time
Responsiveness	Total savings
Return on investment	Total Supply Chain Cost
Customer returns / rejections	Value added employee productivity
Revenue	Value added productivity
Risk index	Vendor quality rating
ROA	Waiting time percentage
ROCE	Web site completeness
Sales	Working capital productivity
Sales per employee	Working environment index
Supplier lead time	Working time
Supplier on time delivery	
Supplier outgoing quality level	
Supplier reliability	

Conclusion

The research topic is contemporary. The prospective research output would provide relevant managerial implications and will potentially contribute to the existing body of knowledge as follows:

This analysis will enable the identification of the problems that surround outcome assessment within and across single supply chains and extend existing knowledge in the end-

to-end supply chain performance measurement in the service industry. Further this analysis should provide some vital insights as to how service organizations can improve their performance evaluation systems to become more effective in supply chains. A set of supply chain enablers is also suggested across various business entities, portraying the performance of the supply chain suitable for needs of companies along with filling gaps that become identifiable.

This study aims to not only identify the gaps present in the service supply chain performance measurement but tries to fill the knowledge gap to suggest performance metrics in facilitating the supply chain integration in the service industry. These gaps are summarized as follows:

- KPIs not provided at the SCM level
- KPIs are not measurable
- Lack of empirical evidences for KPIs
- SCOR KPIs require very complicated tasks to follow
- SCOR framework for services industry requires major business process reengineering
- KPIs are focused on manufacturing
- BSC not useful for IT industry
- BSC not dealt with the requirements of all stakeholders
- BSC doesn't deal with soft issue
- BSC ignores the social perspective

Through the exploring of 21 dimensions of service industries, further KPIs could be proposed and finally this output will be reviewed on continuous basis so as to ensure improvement.

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