



Measuring the collaborative supply chain performance: a literature review

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ABSTRACT

Keywords

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supply chain management
Performance measures
collaboration

Inter-company competition explains the increased interest of researchers towards supply chain management, which is seen as a better way of managing logistics activities and processes from upstream to downstream. In fact, supply chain management aims to offer a better overall performance of the chain and a better return for its members by increasing consumer satisfaction. In addition, collaboration in the supply chain creates a strategy-based value creation process that allows members of the chain to coordinate and synchronize their efforts in order to optimize their activities and rationalize their resources. Hence, to reap the expected benefits of collaboration, there is a need for continuous assessment of collaborative practices in the supply chain. In this sense, the objective of this article is to raise the main models for assessing the performance of the supply chain and particularly the collaborative aspect. However, through the analysis of the literature we realized that, despite the focus of companies on collaboration, the number of research studies on this subject remains limited.

1. Introduction

Linked by upstream and downstream activities and processes, the supply chain is defined as a network of organizations, which delivers value to consumers (Chen & al., 2013). The concept has been developed by other researchers, including Mentzer & al. (2001). He proposed three degrees of supply chain complexity (direct, extensive, and ultimate) and qualified it as a phenomenon characterizing the business world. Thus, the existence of the supply chain does not necessarily imply its management (Gary Teng & Jaramillo, 2006). While the supply chain was designed to add value to the flow of materials and information, supply chain management manages the activities and processes of the logistics network from the supplier, through producers, retailers and wholesalers to the end user (Ramanathan, 2014). The latter is intended to provide better performance for members and overall chain performance, through increased consumer satisfaction as a consequence of developing a competitive advantage (Gary Teng & Jaramillo, 2006).

The supply chain transition to a philosophical approach of supply chain management pushed managers to seek the factors that influence their overall supply chain performance (Gary Teng & Jaramillo, 2006). The inter-firm competition transition, has given rise to a value-added process, flows planning and controlling, by offering higher service levels with reduced costs (Cooper & al., 1997; Ramanathan, 2014). Thus, an effective supply chain management strategy emerges, by focusing on the core goal of flow's integration and control. This emphasized the need of closed relationships among supply chain members and processes structure harmonious with these linkages (Tai & al., 2010).

Collaboration allows supply chain members to combine their efforts and coordinate their practices, by using their resources in a rational way and optimizing their planification and production (Ramanathan, 2013). While maintaining a competitive collaboration implies evaluating the performance of all supply chain processes on an ongoing basis (Ramanathan, 2014), and although this strategy has gained the focus of companies, measuring its performance has been the subject of limited

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research in this direction sens (Lambert & Pohlen, 2001; Simatupang & al., 2004). In this paper, we aim to identify some proposed performance measures for collaboration, answering our main question: which performance measure is suitable for evaluating the benefits of collaboration in a supply chain? To do so, we conducted a literature review on some of the methods for evaluating supply chain performance, and then focused on those that have been used by researchers to quantify the benefits of collaborative efforts.

2. From organizational performance to inter-firm performance

As part of supply chain management strategies, collaboration aims to reduce costs and increase the overall value of the entire supply chain. However, most of the research conducted on collaboration (activities and systems) has focused on its impact on the company's performance. . Thus, the majority have demonstrated its significant and positive impact on organizational performance (Cao & al.,2010; Solakivi, Töyli, & Ojala,2015; Cao & Zhang,2011; Panahifar& al.,2018; Afshan, Chatterjee, & Chhetri,2018; Adams & al.,2014; Haque & Islam,2018). Capturing firm performance in these cases has basically employed the following measures: sales growth, return on investment, and overall competitive position.

Organizational performance refers to how well a firm achieves its financial and market-oriented goals, compared to its main competitors (Cao & Zhang,2011; Panahifar & al.,2018; Pradabwong & al.,2017). While supply chain performance is related to the quality of the links between upstream and downstream members of the supply chain (Naspetti & al.,2011).

Improvements of supply chain performance are reflected in: : good delivery time, better quality, increased responsiveness, reduced prices and total costs (Kumar & Banerjee,2012). Although some researchers have limited it to firm's ability to achieve its financial goals in a supply chain relationship (Asree & Gopalan,2016). By recognizing the role of collaboration in improving the organizational performance, the researchers focus moved from identifying supply chain strategies gains, to assessing the collaboration effect on the supply chain efficacy and efficiency. The quest of firms to achieve

common goals and collective and sustainable benefits through maintaining inter-organizational relationships with their partners results into financial performance for each actor (Cao & Zhang,2011).Hence, recognizing that supply chain performance improvements are essential to achieve higher organizational performance (higher returns, more chain flexibility towards markets needs, more responsiveness to customer demands), which is translated into cost reductions, better quality and product deliveries (Pradabwong& al.,2017). Cao & Zhang (2011) supported this statement, by projecting the consequences of considering organizational performance instead of overall chain performance. They advocated that improving the overall partner's performance will strengthen their relationship and will result in collaborative benefits that overcome the individual benefits that isolated acting firms can make.

3. Supply Chain Performance: Tools and Metrics

Supply chains that implement performance measures that provide data on how well they perform compared to their expectations, focusing on the goals of value creation for customers, and eliminating the unnecessary key functions costs, can only be successful by coordinating their processes effectively (Brewer & Speh 2000). In order to be meaningful, the measures assigned to the supply chain evaluation, must to be common among all its members (Simatupang& Sridharan, 2005b). On this basis, supply chain performance measures differ from traditional measures that focus on internal performance (Lambert & Pohlen, 2001). Traditional measures neglect the key activities of successful supply chains that focus on measuring their viability and the degree to which they are executing their principles (Caplice & Sheffi, 1994).

3.1. Traditional logistics measurements

The need to evaluate the effectiveness and efficiency of the company, emanates mainly from the field of management control. This motivates researchers to concretize this need in tools and models through the development of performance measurement systems (Papakiriakopoulos & Pramatar, 2010). These systems are processes for quantifying the effectiveness and efficiency of action (Neely & al., 1995). They also serve

to collect information for managers through financial and non-financial measures (Kaplan & Norton, 1996).

In particular, it is worth highlighting the interest in designing such systems, which are generally suggested to assist managers in their decision making and the evaluation of results, while improving the coordination and motivation of personnel (Kaplan & Norton, 1996). However, traditional logistics control systems often fail to address the need for evaluation, motivation and optimization of intra- and inter-firm performance, as they do not indicate how effectively members of a chain interact, how much value is lost in the production process along the chain, and how flexible the chain is in meeting customer demands, as well as how well the chain performs in comparison with more efficient chains (Brewer & Speh 2000). Thus these measures are criticized for not being able to provide information on the results of supply chain activities (Caplice & Sheffi, 1994).

Classical measures of logistics performance have typically revolved around three categories of: service (order fulfillment rate...), cost (cost per unit), and return on assets measures (degree of return on expected financial results as a function of the logistics asset invested) (Brewer et Speh 2000). Some authors have criticized these traditional methods for their limitations to financial measures that are appropriate for traditional supply chain management. In contrast to those required for supply chain management, which has evolved by integrating solutions and information systems giving rise to intangible benefits (Bhagwat & Sharma, 2007). Papakiriakopoulos et Pramatarı (2010) argue that the complexity of supply chains makes the measures proposed in the late 1990s limited, since they focused mainly on the performance of logistics and distribution networks.

3.2. Supply chain performance measurement indicators

Due to the researchers' awareness of the multidisciplinary nature of supply chain management, the research on supply chain performance measurement has shifted toward consideration of various management perspectives. Researchers have emphasized the importance of considering performance measurement

systems across firm boundaries to the supply chain level (Beamon, 1999).

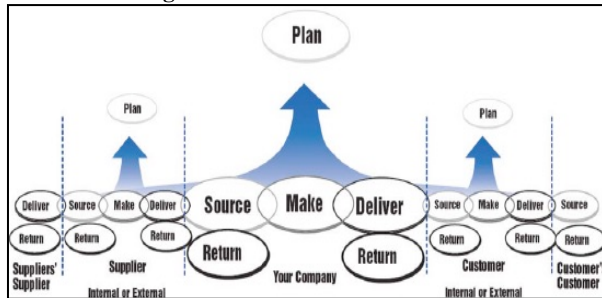
Beamon (1999) developed a set of suggested quantitative and qualitative performance measures under three categories: resources, outcomes and flexibility. He indicates that the availability of quantitative data and the common use of such conventional measures facilitated the use of quantitative indicators over hard-to-compute qualitative ones. He claims that the complexity of supply chains (several actors, and several levels), makes the choice of measures more critical. De Toni & Tonchia (2001) distinguished between financial and non-financial categories, integrating in the first one the costs of purchase, production and distribution as well as those of returns, and productivity. The second category included time, quality and flexibility. Gunasekaran & al., (2001) proposes measures by identifying three levels of supply chain performance: strategic, tactical and operational. His measures are aligned with the three basic links in the supply chain: plan, procure, produce and deliver. As well as considering indicators related to supplier relationships. Chan & al. (2003) clarify that despite the variety of supply chain activity areas, standardized measures can be developed but their importance will depend on the priority of each. Thus, several studies have developed supply chain performance measures, proposing both quantitative and qualitative measures (Bigliardi & Bottani, 2010). The ultimate focus on quantitative measures by researchers needs to be broadened, as they are limited to cost, which is related to profit, and is only one part of the results (Chan & al., 2003). Thus, performance systems increasingly incorporate non-financial measures (De Toni & Tonchia, 2001; Papakiriakopoulos & Pramatarı, 2010).

3.3. SCOR

The SCOR is a model developed in 1996 by the Supply Chain Council (SCC), which aims to analyze four dimensions: reliability of business performance, flexibility/responsiveness, supply chain cost, and turnover of capital employed (Estampe & al., 2013). The SCOR model, provides a methodology with several guidelines that can be used to analyze supply chain practices (Erkan, 2011). It categorizes processes into

actions to : plan, procure, produce, deliver, and return (Ramanathan, 2014):

Figure 1: The SCOR Model



Source: Erkan (2011).

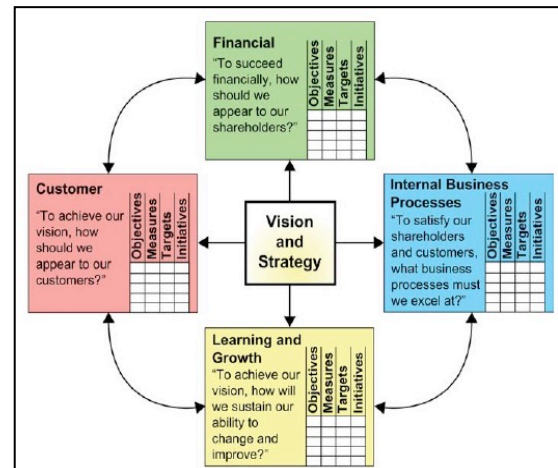
Introduced as the first proposed cross-industry model for assessing and improving supply chain performance, The SCOR can be applied to any industrial or service company and for all tactical (Simatupang & Sridharan, 2005b) and operational levels for implementation of strategic planning decisions (Estampe & al., 2013). This model covers all interactions with customers (from order entry to paid invoice) and all product transactions from supplier of suppliers to customer of customer, as well as interactions in the market (understanding the aggregate demand to the execution of each order). Therefore, based on the capture of an effective business process is made the reference of the standard process that adjusts according to the set goal, which will serve to obtain competitive advantages (Erkan, 2011).

3.4. The balanced Scorecard (BSC)

The need for performance measurement systems that cover the different levels of decision making is a need felt in many contexts and industries (Bhagwat & Sharma, 2007). To meet this need, the Balanced Scorecard was introduced by Kaplan & Norton (1992) to provide companies that want to develop their competencies with a set of measures. The financial measures inform the results of actions already taken, and the operational ones that complement them and that will be the drivers of future organizational performance. It is a system that integrates strategic and managerial measures for any organization that uses financial and non-financial measures to assess aspects of its internal (business processes, innovation and learning) and external (customers and stakeholders) (Chang, 2009). With a focus on strategy rather than control (Kaplan & Norton 1992),

Kaplan et Norton (1996) proposed in the structure of the dashboard, the vision (mission and goals) and strategy for each of the four perspectives (see figure below):

Figure 2: The balanced scorecard model



Source : Kaplan & Norton (1996).

The interpretation of business unit missions and strategies into concrete objectives and appropriate measures is one of the merits of the scorecard (Chang, 2009). By enabling the company to align its management processes with the defined strategy over the long term (Kaplan & Norton 1996). Furthermore, this balanced scorecard structure seems to be adequate as a tool for measuring the performance of the supply chain (Bigliardi & Bottani, 2010). In this sense Brewer et Speth (2000) proposed a set of supply chain performance measures by incorporating supply chain performance perspectives with the scorecard perspective. Their main suggestion is to incorporate into the internal operational perspective of the scorecard the cross-functional and cross-organizational nature of supply chains by recognizing the importance of the extent of coordination between business functions, and of external collaboration.

Park, Lee, & Yoo (2005) also proposed a dashboard suitable for supply chain metrics based on the organizational dashboard, and attempting to reconcile it not only with supply chain metrics, but also by integrating supply chain activities and solutions (EDI, CPFR, SRM). Their work resulted in a balanced scorecard dedicated to supply chain performance measurement, where the internal business process perspective is renamed the business process perspective to include external processes (B2B integration) and the demand chain performance

metrics have been incorporated into the customer perspective and the rest of the internal processes and supplier interactions have been placed in the business process perspective. Bhagwat & Sharma (2007) used a balanced scorecard model based on the four fundamental perspectives to measure supply chain management performance. Their considerations are to propose a dashboard approach, classified into three levels: strategic, tactical and operational, and into financial and non-financial measures. The sorted and classified performance measures are those proposed by Gunasekaran, Patel, & Tirtiroglu (2001). Their suggestions for the Balanced Scorecard as a model rather than a definitive system of supply chain management measures is that it should be used on a daily basis for the evaluation of supply chain management performance in order to simultaneously coordinate business processes. Bigliardi and Bottani (2010) developed a balanced scorecard model based on the work of Bhagwat and Sharma (2007) and the original model of Kaplan et Norton (1996), and adapted the proposed measures to the food supply chain. Their results validated most of the performance metrics used in their model. Chang & al. (2013) used the balanced scorecard based on the work of Kaplan and Norton (1996), Brewer & Speh (2000) and Bhagwat et Sharma (2007), to assess the impact of supply chain integration on firm performance. They found that supply chain integration is a useful tool for ranking performance measures according to the objectives of each of the organizations studied.

4. Performance of the collaborative supply chain

The merit of identifying areas for improvement in the chain quickly is due to managers' use of performance measures (Neely & al., 1995). If decisions are made that are inappropriate, it is the measures generated to assess performance that must be at the root of the inappropriateness, and as a result, the quality of information provided may not reflect actual performance if the reliability and quality of control processes are not taken into account (Papakiriakopoulos & Pramataris 2010). This said, managers may lose confidence, which is not in favor of adopting inter-organizational performance measures that require an advanced degree of confidence by default (Zaheer & al., 1998). Collaboration plays a role

in improving performance, through the expected benefits, if the barriers to its success are taken into consideration. The failure of some collaboration experiments has motivated researchers to propose models for measuring its performance. The challenge of making its chain competitive, rests in this sense on the development of an effective and efficient collaboration, through the evaluation of the processes of the chain in a permanent way (Ramanathan, 2014). Early work attempted to measure the performance of collaboration by assessing its degree through a measurement index (Simatupang & Sridharan, 2005a). Subsequent work has attempted to adapt some global performance measures applied to supply chain management.

4.1. Collaboration to improve performance

Unlike supply chain management, which is practiced in many companies and has been the subject of much research, collaboration is a developing field in the literature is increasing. Researchers have studied its performance and failure, to deduce the benefits and barriers that constrain its success (Ramanathan, 2014).

4.1.1. Supply chain collaboration benefits

Early studies of collaboration did not reveal the key success factors for collaboration. However, they have helped to highlight its benefits. (Stank & al., 2001) demonstrated the impact of collaborative activities in improving performance, particularly in the logistics services of the actors who aimed to maximize profits. VICS (2002) asserts that collaboration through the CPFR solution can lead to cost savings and competitive advantage. In addition to its contribution to improve the visibility of consumer demand by coordinating the activities of the supply chain (Barratt & Oliveira, 2001).

4.1.2. Collaboration constraints

Fawcett & al. (2012) identified the pressures of competition, to reduce costs, as well as the incessant variation in consumer demand as two main driving forces (keep the firm going and adapt to change). For the resisting forces (can block the effect of change and return the company to its original state), he comes out with a set of factors collected through his qualitative study, such as:

cross-functional and cross-organizational conflict, unaligned actions, lack of willingness to change, misused power, limited information sharing, and lack of leadership (Fawcett & al. 2012). Delays in information sharing and inter-firm conflict, as well as the failure of collaborative experiences in general, are certainly due to a set of barriers raised: lack of transparency, capital investment, length of partnership relationship, and the adequate number of chain partners to involve in a collaborative relationship (Asree & Gopalan, 2016). As a result, the firm needs to develop dynamic collaborative capabilities that can foster promising transformations in order to cope with the constraints and rapid changes in its environment and the processes of agile competitors. The need for companies to cope with the changing environment, and to reconcile cost reduction with the superior quality demanded by consumers, is indicated to be possible through collaborative relationships (Fawcett & al., 2012). Furthermore, of the identified barriers, one of the major difficulties is attached to the existence of the willingness and desire to collaborate in each member of the supply chain and its degree of assimilation of how to collaborate effectively (if it shares with its partners the same perception of the concept of collaboration) (Richey & al., 2012).

4.2. Collaborative supply chain measures

Among the challenges raised when assessing supply chain performance, Li, Abtahi, & Seyedan (2019) highlight the multitude of chain actors (producers, sellers, distributors, and retailers) that increases the complexity of assigning results to many elements.

Assessing collaborative performance is part of measuring supply chain performance. Improving performance at the unit level of the supply chain means improving overall performance. This being justified by the need to make judgments about the performance of not only activities but also relationships (Li & al., 2019).

The development of performance measures, adapted to the objectives of supply chain management, aimed mainly at detecting areas of improvement to increase the efficiency of the chain, but also, to identify the applicability of the activities and practices of collaboration (Ramanathan, 2014). Through the design of metrics dedicated to capturing the performance of the

collaborative chain, members engage in understanding collaboration, in terms of its challenges, and how to achieve them (Simatupang & Sridharan, 2008).

4.2.1. Initial measures of collaborative chain performance

Early performance measurement systems were restricted to directly quantifiable indicators, following accounting principles (Bigliardi & Bottani, 2010). However, such measures were not suitable for evaluating the benefits of supply chain management strategies, especially in the presence of multiple control subjects (Bhagwat & Sharma, 2007). The complexity of supply chains requires that multiple benefits, especially of an intangible nature, be provided to consumers (Bigliardi & Bottani, 2010). Therefore, most of the proposed performance systems follow a fragmented approach, which is at odds with the philosophy of supply chain management. The latter denotes the overcoming of the company boundaries towards the search for the optimization of the supply chain as a whole (Papakiriakopoulos & Pramataris, 2010).

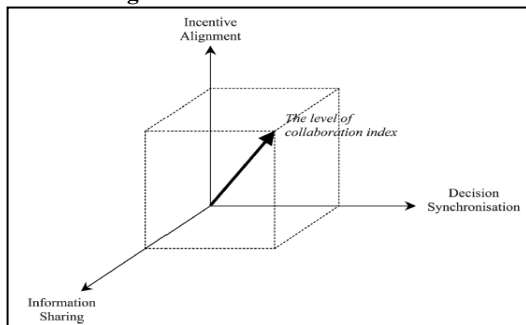
The literature on supply chain performance has been divided into two categories: one that has dealt with the identification of performance measures (Gunasekaran & al., 2001; Lambert & Pohlen, 2001) and the other category that has focused on the evaluation of the success of supply chain collaboration (Fawcett & al., 2008; Papakiriakopoulos & Pramataris, 2010). In the same vein, research that has addressed collaboration performance has focused on either: decision making frameworks or performance measurement models. As well as some models being conceptual (Chen & Paulraj, 2004; Simatupang, 2004) and others based on mathematical models and simulations with practical cases (Ramanathan, 2014), in addition to questionnaires measuring the performance of the collaborative chain.

- Simulation models: Despite the emergence of collaboration over the past decade or so, the development of collaborative performance measures is constrained by barriers. Among these barriers: economic performance measures in collaboration are difficult to design, due to the sharing of resources that results from collaboration, and the difference in cost centers between partners in the chain. Also, most managers of collaborating firms are interested

in determining the extent of alignment between the joint goals set by the members and the results achieved in this sense (Papakiriakopoulos&Pramatari, 2010). The use of simulations is an approach answered in the literature, due to its usefulness in estimating the benefits of collaboration, without, however, investing huge amounts of money in measuring applied collaboration (Ramanathan, 2014).

- Measuring the degree of collaboration: in order to measure the degree of collaboration, Simatupang (2004) proposed three performance elements of supply chain collaboration: decision synchronization, information sharing, and incentive sharing. Based on these dimensions, Simatupang& Sridharan (2005a) proposed an index to measure the degree of collaboration that allows members to define the most meaningful collaborative practices by scoring high in the collaboration index. Thus, a high score indicates the involvement of chain members in an advanced level of collaboration and its value is simply the summation of the values of the three dimensions.

Figure 3: Collaboration Index



Source: Simatupang& Sridharan (2005a)

Ramanathan (2014), proposed a calculation of degree of collaboration (see figure) as a function of: number of partners, investment in the collaboration, and duration of collaboration. His results indicated that increasing the number of partners and the volume level of investment does not necessarily imply collaboration performance, and that the duration of partnership if it is long can materialize into financial and operational benefits. He concludes by highlighting the importance of the degree of collaboration in understanding the important factors of collaboration, which can help top management in their decisions.

Figure 4: Formula of collaboration degree

$$\text{Degree} = \frac{\text{Number of SCC partners}}{\text{Number of supply chain members}} \times \frac{\text{Collaborating years}}{\text{Duration in business}} \times \text{Level of Involvement}$$

Level of Involvement
 (Collaborative investment (on training and technology) per year)

Source :Ramanathan (2014).

- Questionnaires: Simatupang & Sridharan (2005a) were among the first researchers to measure collaboration performance in the supply chain, particularly operational performance. Their research confirmed the validity of their proposed collaboration measurement index, and supported the positive impact on operational performance.

4.2.2. *BSC: to measure supply chain collaboration performance*

The adaptation of the Balanced Scorecard perspectives to the objectives of supply chain management resulted in performance measures of firms' collaboration with their supply chain partner. These measures were integrated into the business process perspective of the Balanced Scorecard after integrating the external perspective. Within this framework, the proposed measures are presented below:

Table1:External process perspective of the balanced scorecard applied to supply chain management

objectives	Mesures
Improve collaboration with partners	Order informationsharing
	Inventory Information Sharing
	Forecast sharing information
	Trust with partners

Source: Park, Lee, &Yoo (2005).

Simatupang& Sridharan (2008) indicate that the Scorebord allows the translation of strategy into strategic objectives, measures and initiatives. This, in turn, can facilitate intra- and inter-firm collaboration, thanks to the strategy-oriented representation of the dashboard proposed by (Kaplan & Norton, 1996).

4.2.3. *Other measures*

Papakiriakopoulos and Pramatarari (2010) revealed in their research that performance measurement, by partners who reevaluated their collaboration goals, prompted a focus on information quality instead of timely information sharing,

and incorporated new business processes into the evaluation. Similarly, while early studies of collaboration performance focused on logistics department performance, such as Stank, Keller, and Daugherty (2001) who evaluated internal and external collaboration performance, or forecast and inventory accuracy (Ramanathan & al., 2011). Other work has considered performance measures such as utilization capacity and supply chain flexibility (Angerhofer & Angelides, 2006). Ramanathan, Gunasekaran, and Subramanian (2011) highlighted the need to incorporate into collaboration performance, measures related to flexibility (ability of the supply chain to adapt to changes) and technology usage, which has become an integrated part of recent collaboration practices. Information quality has also become an important measure for performance, and the importance of considering technology is argued by its role in improving collaboration (Richey & al., 2012) and information quality. Other suggestions have indicated that the adequate performance measures to be chosen for collaboration, should be based on its stage. Ramanathan, Gunasekaran, and Subramanian (2011) also proposed measures based on the initial stage, and the advanced stage of collaboration. This distinction is essential for evaluating and judging collaboration in its pilot stage, as success at this level may encourage further effort in this direction (Cassivi, 2006).

5. Discussion

The goal behind measuring performance diverges from traditional measures to supply chain and collaboration performance systems. Traditional metrics seek to measure performance through financial indicators. However, supply chain performance measurement, requires both financial and non-financial indicators, in order to identify the improvement areas. Prior measurement approaches, were based on accounting principles (cost measurement), unlike the holistic approach of supply chain that is based on systematic management (Ramanathan, 2014).

While early measures of supply chain performance are said to be insufficient to capture the benefits of supply chain management strategies. Other researchers, have enriched the field of measures by integrating those that capture non-financial performance (Beamon, 1999).

While, others have contributed by proposing measures for all levels of logistics: strategic, tactical and operational (Gunasekaran & al., 2001).

As for the models that have emerged to serve in the evaluation of logistics performance, the comparison between the two models of the Balanced Scorecard and the SCOR, shows that: if the two models are designed (SCOR) or adapted (BSC) to evaluate the performance of the supply chain, they present limitations in their category of intervention and their difficult implementation.

The BSC has been recommended and classified in a category of models dedicated to measuring the internal performance of each chain member. It is targeting companies with an inside and outside organizational maturity levels. As for the SCOR, it integrates the category that aims to measure the performance of all actors (from the supplier of the supplier to the customer of the customer) of the chain whose maturity has reached advanced levels, or that wish to reach it Estampe & al. (2013).

Similarly, Estampe & al. (2013) compared these evaluation models and shows that the SCOR largely exceeds the BSC in terms of: decision level (strategic for BSC and tactical and operational for SCOR), flows type (information and financial flows for BSC, augmented by physical flows for SCOR), maturity level (multi-chain and intra-organizational for BSC, but also inter-organizational and societal for SCOR), and the type of benchmarking allowed (internal and external for SCOR, and limited to internal for BSC).

In addition, while the BSC integrates human capital measures, the SCOR model integrates the quality factors that are neglected by the first model. However, both models converge in the way that they can be applied in all sectors (SME, Distributors, Industry, Service).

Many studies praise the merits of the supply chain BSC. For instance, Chang (2009) has used this latter to assess the supply chain integration, his results revealed a positive correlation relying each dimension of the balanced scorecard to the supply chain. They based their study on the model proposed by Brewer & Speh. (2000). however, the SCOR model integrates different chain actors (Estampe & al., 2013) and remains superior due to the

systematic approach (supply chain processes description followed by their evaluation) (Erkan, 2011),

While collaboration is an integral part of supply chain management strategies, it requires integrative systems that capture overall chain performance (financial and non-financial) in the development of its performance tools. Collaborative performance measures share the need to adopt a systems approach involving the performance of all members, but advocate measuring intangible performance and benefits. Many researchers have emphasized the importance of quantifying costs and service levels (Lee & al., 1997). For today's collaboration and supply chain, the merit of performance measurement is often constrained by data management and data quality. Hence, the usefulness of the data and the appropriate use of technology and information systems are also important in assessing the success of the collaboration (Danese, 2007). By ranking the supply chain collaboration performance measures, Papakiriakopoulos & Pramataris (2010) presented the motivations behind the collaborative supply chain performance evaluation: to understand the success of the collaboration implemented, and that the measures used should be non-financial in nature. Also, Ramanathan (2014) studied different degrees of collaboration, and indicates that the success of collaboration for any company depends on its ability to change its degree of collaboration towards the achievement of business objectives.

That said, capturing the performance of collaboration must take into account the flexibility of its members.

6. Conclusion

The measurement of supply chain collaboration performance among some researchers has focused on assessing the degree and/or extent of firm collaboration with its partners. Also, some measures are proposed to define practices that enhance collaboration in order to improve them. Understanding the essential activities and factors that make collaboration effective and efficient, and assessing its potential benefits, will help managers understand the required level to gain its benefits. The performance of the collaborative chain involves the adoption of a systems approach. This latter's design is

based on information sharing through technology, requiring the quality of information between collaborating parties. However, the number of measures remains minimal and advocates the focus on the so-called non-financial ones. This entails that operational performance should be evaluated by measuring the flexibility of chain members. Nevertheless, our work is the result of a literature review that shed light on the research about supply chain performance measurement. Other future work can be done in the sense that can further enrich this field, by applying a performance measure on a specific supply chain, especially in the Moroccan context. Hence, this will bring more appropriate, and a valid measurement model that captures the specification of the Moroccan industrial context.

References

- Adams, F. G., Richey, R. G., Autry, C. W., Morgan, T. R., & Gabler, C. B. (2014). Supply Chain Collaboration, Integration, and Relational Technology: How Complex Operant Resources Increase Performance Outcomes. *Journal of Business Logistics*, 35(4), 299-317. <https://doi.org/10.1111/jbl.12074>
- Afshan, N., Chatterjee, S., & Chhetri, P. (2018). Impact of information technology and relational aspect on supply chain collaboration leading to financial performance: A study in Indian context. *Benchmarking: An International Journal*, 25(7), 2496-2511. <https://doi.org/10.1108/BIJ-09-2016-0142>
- Angerhofer, B. J., & Angelides, M. C. (2006). A model and a performance measurement system for collaborative supply chains. *Decision Support Systems*, 42(1), 283-301. <https://doi.org/10.1016/j.dss.2004.12.005>
- Asree, & Gopalan. (2016). The impact of cultural intelligence on supply chain collaboration. 18.
- Barratt, M., & Oliveira, A. (2001). Exploring the experiences of collaborative planning initiatives. *International Journal of Physical Distribution & Logistics Management*, 31(4), 266-289. <https://doi.org/10.1108/09600030110394932>
- Beamon, B. M. (1999). Measuring supply chain performance. *International Journal of Operations & Production Management*, 19(3), 275-292. <https://doi.org/10.1108/01443579910249714>
- Bhagwat, R., & Sharma, M. K. (2007). Performance measurement of supply chain management: A balanced scorecard approach. *Computers & Industrial Engineering*, 53(1), 43-62. <https://doi.org/10.1016/j.cie.2007.04.001>
- Bigliardi, B., & Bottani, E. (2010). Performance measurement in the food supply chain: A balanced scorecard approach. *Facilities*, 28(5/6), 249-260. <https://doi.org/10.1108/02632771011031493>

- Brewer, P. C., & Speh., T. W. (2000). Using the balanced scorecard to measure supply chain performance ., *Journal of Business logistics*, 21(1), 75.
- Cao, M., Vonderembse, M. A., Zhang, Q., & Ragu-Nathan, T. S. (2010). Supply chain collaboration : Conceptualisation and instrument development. *International Journal of Production Research*, 48(22), 6613-6635. <https://doi.org/10.1080/00207540903349039>
- Cao, M., & Zhang, Q. (2011). Supply chain collaboration : Impact on collaborative advantage and firm performance. *Journal of Operations Management*, 29(3), 163-180. <https://doi.org/10.1016/j.jom.2010.12.008>
- Caplice, C., & Sheffi, Y. (1994). A Review and Evaluation of Logistics Metrics. *The International Journal of Logistics Management*, 5(2), 11-28. <https://doi.org/10.1108/09574099410805171>
- Cassivi, L. (2006). Collaboration planning in a supply chain. *Supply Chain Management: An International Journal*, 11(3), 249-258. <https://doi.org/10.1108/13598540610662158>
- Chan, F. T. S., Qi, H. J., Chan, H. K., Lau, H. C. W., & Ip, R. W. L. (2003). A conceptual model of performance measurement for supply chains. 8.
- Chang, H. H. (2009). An empirical study of evaluating supply chain management integration using the balanced scorecard in Taiwan. *The Service Industries Journal*, 29(2), 185-202. <https://doi.org/10.1080/02642060802294961>
- Chang, H. H., Hung, C.-J., Wong, K. H., & Lee, C.-H. (2013). Using the balanced scorecard on supply chain integration performance—A case study of service businesses. *Service Business*, 7(4), 539-561. <https://doi.org/10.1007/s11628-012-0175-5>
- Chen, & Paulraj, A. (2004). Towards a theory of supply chain management : The constructs and measurements. *Journal of Operations Management*, 22(2), 119-150. <https://doi.org/10.1016/j.jom.2003.12.007>
- Chen, Sohal, & Prajogo. (2013). Supply chain operational risk mitigation : A collaborative approach. *International Journal of Production Research*, 51(7), 2186-2199. <https://doi.org/10.1080/00207543.2012.727490>
- Cooper, M. C., Lambert, D. M., & Pagh, J. D. (1997). Supply Chain Management : More Than a New Name for Logistics. *The International Journal of Logistics Management*, 8(1), 1-14. <https://doi.org/10.1108/09574099710805556>
- Danese, P. (2007). Designing CPFR collaborations : Insights from seven case studies. *International Journal of Operations & Production Management*, 27(2), 181-204. <https://doi.org/10.1108/01443570710720612>
- De Toni, A., & Tonchia, S. (2001). Performance measurement systems—Models, characteristics and measures. *International Journal of Operations & Production Management*, 21(1/2), 46-71. <https://doi.org/10.1108/01443570110358459>
- Erkan, T. E. (2011). SUPPLY CHAIN PERFORMANCE MEASUREMENT: A CASE STUDY ABOUT APPLICABILITY OF SCOR MODEL IN A MANUFACTURING INDUSTRY FIRM. 3(1), 10.
- Estampe, D., Lamouri, S., Paris, J.-L., & Brahim-Djelloul, S. (2013). A framework for analysing supply chain performance evaluation models. *International Journal of Production Economics*, 142(2), 247-258. <https://doi.org/10.1016/j.ijpe.2010.11.024>
- Fawcett, S. E., Fawcett, A. M., Watson, B. J., & Magnan, G. M. (2012). PEEKING INSIDE THE BLACK BOX : TOWARD AN UNDERSTANDING OF SUPPLY CHAIN COLLABORATION DYNAMICS: Peeking Inside the Black Box. *Journal of Supply Chain Management*, 48(1), 44-72. <https://doi.org/10.1111/j.1745-493X.2011.03241.x>
- Fawcett, S. E., Magnan, G. M., & McCarter, M. W. (2008). Benefits, barriers, and bridges to effective supply chain management. *Supply Chain Management: An International Journal*, 13(1), 35-48. <https://doi.org/10.1108/13598540810850300>
- Gary Teng, S., & Jaramillo, H. (2006). Integrating the US textile and apparel supply chain with small companies in South America. *Supply Chain Management: An International Journal*, 11(1), 44-55. <https://doi.org/10.1108/13598540610642466>
- Gunasekaran, A., Patel, C., & Tirtiroglu, E. (2001). Performance measures and metrics in a supply chain environment. *International Journal of Operations & Production Management*, 21(1/2), 71-87.
- Haque, M., & Islam, R. (2018). Impact of supply chain collaboration and knowledge sharing on organizational outcomes in pharmaceutical industry of Bangladesh. *Supply Chain*, 21.
- Kaplan, Robert S, & Norton, D. P. (1996). Using the Balanced Scorecard as a Strategic Management System. *Harvard Business Review*, 14.
- Kaplan, R.S., & Norton, D. P. (1992). The balanced scorecard measures that drive performance. *Harvard Business Review*, 70(1), 71-79.
- Kumar, G., & Banerjee, R. N. (2012). An implementation strategy for collaboration in supply chain : An investigation and suggestions. *International Journal of Services and Operations Management*, 11(4), 407. <https://doi.org/10.1504/IJSOM.2012.046077>
- Lambert, D. M., & Pohlen, T. L. (2001). Supply Chain Metrics. *The International Journal of Logistics Management*, 12(1), 1-19. <https://doi.org/10.1108/09574090110806190>
- Lee, H. L., Padmanabhan, V., & Whang, S. (1997). The Bullwhip Effect in Supply Chains. *SLOAN MANAGEMENT REVIEW*, 11.
- Li, Y., Abtahi, A.-R., & Seyedan, M. (2019). Supply chain performance evaluation using fuzzy network data envelopment analysis : A case study in automotive industry. *Annals of Operations Research*, 275(2), 461-484. <https://doi.org/10.1007/s10479-018-3027-4>
- Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). DEFINING

- SUPPLY CHAIN MANAGEMENT. JOURNAL OF BUSINESS LOGISTICS, 2, 25.
- Naspetti, S., Lampkin, N., Nicolas, P., Stolze, M., & Zanoli, R. (2011). Organic Supply Chain Collaboration : A Case Study in Eight EU Countries. *Journal of Food Products Marketing*, 17(2-3), 141-162. <https://doi.org/10.1080/10454446.2011.548733>
- Neely, A., Gregory, M., & Platts, K. (1995). Performance measurement system design : A literature review and research agenda. *International Journal of Operations & Production Management*, 15(4), 80-116. <https://doi.org/10.1108/01443579510083622>
- Panahifar, F., Byrne, P. J., Salam, M. A., & Heavey, C. (2018). Supply chain collaboration and firm's performance : The critical role of information sharing and trust. *Journal of Enterprise Information Management*, 31(3), 358-379. <https://doi.org/10.1108/JEIM-08-2017-0114>
- Papakiriakopoulos, D., & Pramataris, K. (2010). Collaborative performance measurement in supply chain. *Industrial Management & Data Systems*, 110(9), 1297-1318. <https://doi.org/10.1108/02635571011087400>
- Park, J. H., Lee, J. K., & Yoo, J. S. (2005). A framework for designing the balanced supply chain scorecard. *European Journal of Information Systems*, 14(4), 335-346. <https://doi.org/10.1057/palgrave.ejis.3000544>
- Pradabwong, J., Braziotis, C., Tannock, J. D. T., & Pawar, K. S. (2017). Business process management and supply chain collaboration : Effects on performance and competitiveness. *Supply Chain Management: An International Journal*, 22(2), 107-121. <https://doi.org/10.1108/SCM-01-2017-0008>
- Ramanathan, U. (2013). Aligning supply chain collaboration using Analytic Hierarchy Process. *Omega*, 41(2), 431-440. <https://doi.org/10.1016/j.omega.2012.03.001>
- Ramanathan, U. (2014). Performance of supply chain collaboration – A simulation study. *Expert Systems with Applications*, 41(1), 210-220. <https://doi.org/10.1016/j.eswa.2013.07.022>
- Ramanathan, U., Gunasekaran, A., & Subramanian, N. (2011). Supply chain collaboration performance metrics : A conceptual framework. *Benchmarking: An International Journal*, 18(6), 856-872. <https://doi.org/10.1108/14635771111180734>
- Richey, R. G., Adams, F. G., & Dalela, V. (2012). Technology and Flexibility : Enablers of Collaboration and Time-Based Logistics Quality: Technology, Flexibility, Collaboration, and Time. *Journal of Business Logistics*, 33(1), 34-49. <https://doi.org/10.1111/j.0000-0000.2011.01036.x>
- Simatupang. (2004). Supply chain collaboration. *New Zealand*, 246.
- Simatupang, T. M., & Sridharan, R. (2005a). The collaboration index : A measure for supply chain collaboration. *International Journal of Physical Distribution & Logistics Management*, 35(1), 44-62. <https://doi.org/10.1108/09600030510577421>
- Simatupang, T. M., & Sridharan, R. (2005b). An integrative framework for supply chain collaboration. *The International Journal of Logistics Management*, 16(2), 257-274. <https://doi.org/10.1108/09574090510634548>
- Simatupang, T. M., & Sridharan, R. (2008). Design for supply chain collaboration. *Business Process Management Journal*, 14(3), 401-418. <https://doi.org/10.1108/14637150810876698>
- Simatupang, T. M., Wright, A. C., & Sridharan, R. (2004). Applying the theory of constraints to supply chain collaboration. *Supply Chain Management: An International Journal*, 9(1), 57-70. <https://doi.org/10.1108/13598540410517584>
- Solakivi, T., Töyli, J., & Ojala, L. (2015). Supply chain collaboration and firm performance in manufacturing. *International Journal of Integrated Supply Management*, 9(4), 343. <https://doi.org/10.1504/IJISM.2015.070538>
- Stank, T. P., Keller, S. B., & Daugherty, P. J. (2001). SUPPLY CHAIN COLLABORATION AND LOGISTICAL SERVICE PERFORMANCE. *Journal of Business Logistics*, 22(1), 29-48. <https://doi.org/10.1002/j.2158-1592.2001.tb00158.x>
- Tai, Y.-M., Ho, C.-F., & Wu, W.-H. (2010). The performance impact of implementing Web-based e-procurement systems. *International Journal of Production Research*, 48(18), 5397-5414. <https://doi.org/10.1080/00207540903117915>
- Zaheer, A., McEvily, B., & Perrone, V. (1998). Does trust matter? Exploring the effects of interorganizational and interpersonal trust on performance source. *Organization Science*, 9(2), 141-159.