Supply chain performance measurement systems: Benefits and drawbacks

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Abstract: In today's fickle market environment, Supply chain management is a primordial cornerstone for Business to improve a sustainable competitive advantage and to remain within the vanguard of the worldwide competitive market through enhancing organizational effectiveness and higher reaching strategic business goals such as enhanced competitiveness, extended profitability, ensured financial sustainability and improved customer retention. Due to this fact, Supply chain performance measurement plays a vital role in effective supply chain management. Over the past decades, various frameworks and systems have been proposed and developed to study the lack of research on this topic by reviewing the current literature of models and tools in the field of supply chain performance measurement for the last two decades. The paper provides a comprehensive overview of SCPMS and emphasizes the drawbacks highlighted in existing SCPMS to improve supply chain visibility. Findings show the inability of existing SCPMS such as BSC to provide fast decision making and highlight the under-performed criteria as well as the disability to evaluate overall SC performance. Lastly, this study suggests some steps to help decision-makers to evaluate overall SC performance from all angles.
Keywords: Supply Chain performance measurement systems, Supply Chain evaluation, balanced scorecard, Supply Chain Operations Reference Model (SCOR), literature review.

I. Introduction

In today's world, Supply Chain Management is becoming increasingly challenging due to fierce competition, globalization, pressures from stakeholder groups, and variations in customer demand patterns. Due to this fact, academics and practitioners have recognized the need for measuring and monitoring Supply Chain Performance to help companies survive with continuous pressures and achieve their strategic goals [1]. Therefore, Companies have recognized that Supply Chain excellence is one of the key factors of competitive advantage and Business performance [2][3]. Correspondingly, Performance measures and metrics are required to measure and enhance SC efficiency. Performance measurement systems (PMSs) are becoming a fundamental management tool that allows managers to manage the SC efficiently, i.e., effectively. It provides the support needed to improve performance in pursuit of SC excellence [4]. Thus, every SC or business success is related to the effective performance measurement system PMS; for that to be achieved, PMSs for the whole SC are needed [5].

An effective performance measurement system (PMS) requires the adoption of suitable metrics able to capture the whole essence of the SC process [6]. Kaplan and Norton stated: ''No measures, No improvement''. In this respect, Performance metrics should be based on business objectives, provide information for internal and external needs to support the decision-making process, and enable continuous performance improvement. Hence, the success of SC performance evaluation relies on the identification of key performance measures as well as the selection of appropriate PMS. Accordingly, the performance measurement results reveal the impact of strategies and potential opportunities in SCM [7]. On the other hand, there are several purposes for developing PMSs in SC, such as to identify customer needs fulfillment, have a comprehensive overview of business processes, ensure and track progress, and identify bottlenecks, waste, problems, and improvement opportunities [8].

Due to the complexity of the SC network, it is fairly difficult to develop a relevant Supply Chain performance measurement system (SCPMS). To this extent, the issue of SCPMS has been broadly debated in literature in the last couple of decades. However, most of the research focused on measures as a part of PMS. Through a structured overview of the previous literature, SCPMSs are significant because they are the central managerial mechanisms for effective and efficient SCM. It is an appropriate way to improve SC governance by making it more timely, conscious, and valuable decisions [1] [9] [10] [11].

In completion of previous works, the proposed paper is exploring the evolution of this theme; understand through refereed articles how existing PMS evaluate SC as a whole, as such as recognize gaps and shed light on future research. In addition, non-referred articles and book reviews were excluded from the analysis.

II. Overview of Existing Scpms

Measuring the current corporate performance of a system is needed to improve its processes. Correspondingly, the systems cannot be improved since firms cannot quantify their performance. To this extent, performance can be considered to produce valid results. This indicates that performance is measured by calculating outcomes [12].Therefore, Performance measurement is followed by Performance Management. According to Neely [13], PMS is generally defined as the process or set of metrics used to quantify the efficiency and effectiveness of action. Thus, an effective and efficient PMS is needed; because it describes the feedback on operations or activities to reach customer satisfaction, strategic decisions, and objective and reflects the need for improvement in areas with poor performance [14].

The literature on performance measurement systems (PMS) in the supply chain context is extensive. Firstly, works focused on developing an integrated framework, classifying measures along decision-making levels based on their nature (Financial, non-financial), using a Balanced Scorecard (BSC). However, over time, interest has moved to other areas, such as identifying KPIs and implementing measures for green SCs [4], [8], [10], [15]. Nonetheless, the concept is not changed from one period to another, as it depends on the supply chain performance researcher's view.[4] Many authors have classified SCPMS into: [1], [4], [5], [16], [17]

- ✓ Processed-based approaches, whereby the frameworks focus on integrating processes and activities from supplier to end customer within the PMS; examples are Bullinger et al.[14] Gunasakeran et al. [10] Venkatesh et al.[18]
- ✓ Perspective-based approaches were developed by Otto and Kotzab [15] in 2003. They have proposed a goal-oriented approach considering six perspectives of SCM along with a set of KPIs. These perspectives are system dynamics, operations research/IT, logistics, marketing, organization, and strategy. However, some of the proposed metrics are not applied in business practice. Generally, the approach considers all SC possible perspectives and provides measures and metrics to assess each perspective. Therefore, perspective is a unique vision of what SCM is about. Moreover, there could be a trade-off between one perspective measure to another perspective measure. The authors have classified it into two sub-categories, the BSC model and Supply Chain Operations Reference (SCOR) model. examples of these are Bhagwat et al [14], Frederico et al [19],Rodriguez et al [16], Nouri et al [20], Sellito et al [21].
- ✓ Hierarchy-based approaches are applied to measure the performance of an SC at different decision-making levels, namely, strategic, tactical, and operational. Examples of these are: Gunasakeran et al. [22], Bhagwat et al. [23], and Khan et al. [24].

In a recent study by Reddy et al. [5] and Khan et al. [24], the Balanced Scorecard (BSC) and SCOR model are identified as the most widely used performance measurement systems. As a supply chain management model widely used by decision-makers, the SCOR model has been investigated to measure the processes performed within SC. The first version of the model was created by the supply chain council (SCC) in 1996. Hence, many manufacturing industries have used the latest model version (SCOR12.0) to aid firms in increasing the effectiveness of their SC [25]. It includes five performance criteria (reliability, responsiveness, agility, cost, asset management efficiency) and metrics based on six integrated processes (plan, source, make, deliver, return, enable). Thus, The SCOR 12.0 model is organized in a 5x6 matrix. However, many researchers have stated that the SCOR model is the only integrated cross-functional SC framework that relies upon performance metrics, best practices, and software requirements for a detailed business process model [1], [4], [5], [12], [17], [25], [26]. Moreover, the SCOR model is efficient for benchmarking and best practices with other firms, as it explains measures that develop on one another and procedures to be measured. However, the model highly stresses information flow, does not consider all SC processes, and is less flexible if you alter measures [12], [24], [25], [27].

Furthermore, the Balanced SCORECARD (BSC) model is also recognized as a leading tool to evaluate long-term corporate performance from multiple perspectives, including financial, internal business process, learning and growth, and customer perspectives [1], [5], [28]. Kaplan and Norton coined the BSC concept in 1992 to reflect the company's actual performance better and select and combine performance metrics from a balanced view. The BSC model includes traditional financial measures reflecting past performance and operational standards (Non-financial) representing the future performance drivers. It also helps decision-makers rapidly and widely to improve their activities and operations and aims to enhance internal and external corporate functions.[14].Otherwise, Metrics within the BSC perspectives are chosen based on the firm's strategic objectives. Consequently, decision-makers can translate strategies into a set of measures that can monitor the overall impact of a strategy on the enterprise [17].

Though several studies have investigated supply chain performance evaluation via a balanced scorecard (BSC) approach, the BSC is powerful for evaluating SC and providing real-time information. However, previous studies have not focused on cause-effect relationships between BSC perspectives[29]. Moreover, it does not capture the competitive market perspective and is ineffective for SMEs that require skills and expertise in management [30]. Also, the cause-effect relationship between performance and decisions (long-term and short-term) is not supported [12], [17], [24], [29].

III. Discussion

In this section, we have shed light on the several drawbacks of existing SCPMS and identified the gap between SCPMS and the current trend of SCM. Firstly, the Balanced Scorecard (BSC) and SCOR model have been recognized as powerful tools to evaluate SC performance. Still, as we mentioned, several gaps and limitations have been found. The holes are as follows:

A- Balanced Scorecard (BSC):
- It cannot evaluate the overall performance and highlight the under-performed KPI criteria [12], [17], [24]
- BSC is devised as a monitoring tool instead of an improvement tool that stresses direction for strategic level rather than functional or operational level.[27], [33]
- The cause and effect relationship between different functions at different DM levels (short-term and long-term) is not supported.[17], [24]
- The relationship between short-term and long-term decisions and SC performance criteria (short-term and long-term) for accurate overall SC performance evaluation is absent [17], [24].
- It does not reflect the competitive market perspective and is ineffective for SMEs requiring skills and expertise in management [30].
- It cannot provide fast decision-making and highlight the under-performed criteria and the disability to evaluate overall SC performance [24].
- BSC mainly includes the internal corporate perspective; external factors like risk issues, uncertainty, collaborations, and sustainability are not considered [27], [33].

B- Supply Chain Operation Reference (SCOR model):
- It does not include all the processes and SC functions that are generally present in many firms. Therefore, overall performance cannot be evaluated in the same manner, and it has less flexibility to modify measures. [12], [17], [24].
- The model highly stresses information flow and does not consider all SC processes.[17], [24], [25], [27]
- It does not consider global perspectives on market uncertainty [27].

After reviewing the state-of-art of above mentioned SCPMS, the following step is to identify the gap between existing SCPMS and the new trend of SMS. The following SCPMS gaps are as follows: [12], [24]

- Financial and non-financial measurements are not balanced in the current SCPMS.
- Existing SCPMSs cannot efficiently establish links between short-term and long-term decisions and decision criteria.
- Fuzzy information/data is used in assessing overall SC performance.
- Lacking in evaluating overall SC performance.
- Underperforming KPIs/criteria are not highlighted.

IV. Conclusion

In our present paper, we have addressed existing SCPMS and several drawbacks to help future research design an effective SCPMS framework aligned with the new SCM trends, aiming to enhance supply chain visibility, help companies gain competitive advantage, and improve customer retention. As mentioned below, BSC and SCOR models are the leading models to quantify SC effectiveness. Still, due to technological advancements, these models cannot evaluate real-time SC performance. Therefore, Existing supply chain (SC) performance models cannot cope with the potential of intensive SC digitalization and establish a link between decisions and decision criteria, as well as cannot allows decision-makers to make decisions rapidly and see the cause-effect relationship between short-term, long-term decisions and overall SC performance. Hence, we have suggested some recommendations for future direction: [24]

- Incorporate knowledge and experience of experts and decision-makers in future SCPMS
- Integration between SC decision criteria (attribute) at each level of decision-making to provide a link between long-term (strategic and tactical) and short-term (operational) decisions and decision criteria, as well as know the impact of decisions and decision criteria on overall SC performance.

SCPMS and benchmarking: SCPMSs should be able to evaluate SC performance and be considered as benchmarking tools because highlighting the underperforming criteria at different decision-making levels and SC functions are evident to make a fast decision at the right time.

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