Development of Decision Support System Towards Supply Chain Performance Assesment

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Abstract—Supply chain management (SCM) requires a practice tool to assess performance that able to measure, evaluate and improve the existing operations of supply chain. The research question is how to build a decision support system (DSS) for performance assessment of s-SCM. The author has designed a DSS for performance assessment of s-SCM. There are some elements in designed DSS namely existing achievement, standards, indicators achievement and priority, computation algorithm, and recommendation for improvement. Theoretical contribution of this study is the development of relationship between total and partial performance in mathematical formulation. The model that has been presented is still using generic indicators. If the particular company would like to apply model that additional indicators should change the encoding computer program. However, the modification is very easy to perform. DSS structure of this study is still able to accommodate any kind of particular requirement.

Keywords: Decision Support System (DSS), Supply Chain, Sustainable Supply Chain Management (s-SCM), Total Performance

I. INTRODUCTION

Many companies have been faced with conflict of interest between profit oriented and environment concerns. According to Blengini and Shields (2010), sustainable concept has been trusted to improve economy, social and environment in context of business strategy simultaneously. In macro perspective, it is a concept that can save current generation without ignoring the destiny of future generations to meet their needs. Sikdar (2003) has been argued that sustainable concept is a paradigm about harmonization between economic development, environmental security, and social equity. This concept is very suitable to be applied to solve various problems in the supply chain management (SCM). Sustainable supply chain management (s-SCM) is a paradigm of supply chain management that aimed to manage operations with environmentally inputs and transforming these inputs to achieve economic and social benefits simultaneously. SCM is an approach concerning overall operation to be performed efficient and effective. Strategy is formulated to denote achievement of targets. This is means that organizations need to establish suitable model of performance assessment for s-SCM. Performance assessment is needed to ensure sustainability process in supply chain operation. Assessment of s-SCM performance is complicated problem because of involving several actors in transversal process (Estampe et al., 2018). s-SCM is performed to achieve given operational, tactical and strategic objectives. Performance assessment can help decision makers to improve their operation in operational level, tactical as well as strategic level (Gunasekaran et al., 2018). s-SCM performance assessment is consisting of four phases that is design, measurement, evaluation and improvement. It can be applied to assess overall operations in terms of customers' satisfaction and costs incurred. There are two categories relating to previous studies about SCM performance assessment. First, studies that have been conducted in developing framework and metrics formulation. For examples, Hadiguna et al. (2017) proposed indicators and metrics for sustainable supply chain of automotive industry. Baghwat and Sharma (2017) developed framework using balanced scorecard that measures and evaluates supply chain operations. Gunasekaran et al. (2017) developed a framework for measuring performance the strategic, tactical and operational level performance in a supply chain. The emphasis of study is identifying performance measures dealing with suppliers, delivery performance, customer-service, and inventory and logistics costs. Kleijnen and Smits (2016) conducted a critical analysis of various metrics for SCM performance in particular manufacturing companies. Hervani et al. (2016) provided a green supply chain management performance measurement system that internally and business focused. Framework that developed was considering inter-organizational and environmental issues within a business context. Wu et al. (2019) investigated performance metrics of high-tech companies in term of improvement their weaknesses through partner relationship management to maximize their supply chain performance. Second, design of performance assessment tools that have been developed by applying mathematically and/or computer based modelling. For examples, Ganga and Carpinetti (2018) designed a supply chain performance model based on fuzzy logic to predict performance. They integrated causal relationships and Supply Council Operations Reference model (SCOR). Vanteddu et al. (2018) designed a new performance comparison tool with the novel application of MS Excel. Tool can facilitate decision making in aligning the respective business or functional strategy with the corresponding supply chain strategy. Olugu and Wong (2016) designed an expert fuzzy rule-based system for closed loop supply chain performance measurement in automotive industry. El-Baz (2019) proposed performance measurement tool based on combining fuzzy set theory and Analytical Hierarchy Process (AHP). Tool that designed is aimed to ensure the consistency of the designer's judgment when they are comparing importance of one factor over another to find the weight of each of supply chain activities. At this point, s-SCM requires a practice tool to assess performance that able to measure, evaluate and improve the

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existing operations of supply chain. The research question is how to build decision support system (DSS) for performance assessment of s-SCM. This idea is in line with Ganapathy and Narayanan (2019) that decision making orientation in supply chain models can be classified into prescriptive and descriptive. Prescriptive models are focused on the system, and descriptive models evaluate the performance of a system. This paper presents a decision support model that can be applied to facilitate assessment process by decision maker of supply chain manager. Carbal et al. (2011) explained that efficient and effective supply chain can be increased by performance assessment. Performance assessment is important part for decision maker to review s-SCM. The main role of DSS is to assist decision maker during their decision-making process. A DSS can ensure that historical performance recorded accurately and completely. A DSS can use internal information available in databases and it can use external information from such sources as experts. The main function of DSS is to save various data and to assess current performance the s-SCM.

II. LITERATURE REVIEW

Supply chain operations must be assessed based on a set of standards. Assessment must performance in order to improve the performance or re-align the monitored value to the defined value Gunasekaran et al. (2015). Organization has to evaluate performance in order to aid fast decision-making process in order to agility and responsiveness principles Nudurupati et al. (2017). Evaluating supply chain performance is involving several actors cooperating to achieve given logistical and strategic objectives Estampe et al. (2017). According to Searcy et al. (2015), organization must consider operations that have been done and how infrastructure will impact the design and implementation performance assessment system. Supply chain performance assessment or measurement has been widely published by many authors. Estampe et al. (2014) have been report various methods of performance assessment of supply chain which is exciting to be referenced among others Activity Based Costing (ABC), Framework for Logistic Report (FLR), Balanced Scorecard (BSC), Supply Chain Operation Reference (SCOR), Global Supply Chain Forum (GSCF), ASsociationfrançaise pour la LOGistique (ASLOG), Strategic Audit Supply Chain (SASC), logistics evaluation (EVALOG), World Class Logistics (WCL), Efficient Customer Response (ECR), Excellence model (EFQM), Supply Chain Advisor Level Evaluation (SCALE), Strategic Profit Model (SPM). According to Bloemhof (2016), the area of sustainable supply chain management was divide the area in two fields: firstly, the triple-P concept, optimizing profit (economic aspect), people (social aspect) and environmental performance of a traditional forward supply chain, and secondly, the Closed-Loop Supply Chain management (CLSC) concept, combining forward and reverse supply chains by closing material flows to limit emissions and residual waste. It is similarly related with terms of reverse logistics (Pokharel &Mutha, 2009), closed-loop supply chain management (Guide & van Wassenhove, 2016), green supply chain management (Shang et al., 2010), green marketing (Papadopoulos at al., 2010) etc. Seuring& Müller (2017) have been taken a broad look at sustainable supply chain management and the issues emerging in this field with point of view in environmental perspective. Pukharel&Mutha (2015) have been reviewed many papers with reverse logistic perspective. Sarkis et al. (2011) have been reviewed the literature on green supply chain management with a focus on identifying applicable and explanatory organizational theories that have been utilized to expand understanding and knowledge of this research field. Carter & Easton (2011) have been provided a systematic review of the evolution of sustainable supply chain management over the past twenty years. They have been argued that the sustainable supply chain management research has become more theoretically rich and methodologically rigorous; there are numerous opportunities for further advancing theory, methodology, and the managerial relevance of future inquiries. Benefits of sustainable supply chain management can be defined to decrease cost and add the value to operations, increase utilization of key assets, mitigate risks (environmental, social, and market), be a catalyst for supplier innovation, product differentiation, standardizeoperations and allow for improve customer service, continuous improvement, and enhance company reputation. Many benefits will obtained by companies when sustainable supply chain management has implemented. A DSS has function to assist managers during their decision-making process. A DSS can use internal information available in corporate databases or external information. DSS has benefited from advances in software and hardware technology. The data, model and interface components are components of DSS that needed more sophisticated and powerful. A primary objective of DSS is to help the decision maker make effective decisions by identifying what should be done and ensure that the chosen criterion is relevant (Fazlollahi et al., 1997). DSSs have been applied to help decision maker in managing supply chain including the operational and strategic levels. Most of the literature on DSS focuses on developing optimization models such as Yang et al. (2009), Meng et al. (2009), Du et al. (2010), Wenbo et al. (2010) and Eskandari et al. (2010). DSS for performance measurement is interesting problem because many studies have been investigated indicators of supply chain. DSS aided performance measurement is become one of important factors because it is involving various data, measure method and rules.

III. MODELING APPROACH

The Proposed Formulation and Algorithm The initial step in development of performance assessment model is determining indicators and formulating indicators judgment. Indicator is a measure that representing operations of supply chain. In this modeling, we refer to Hadiguna (2012) that has been formulated indicator for s-SCM. Indicator has multiple roles, namely measure the operations achievement and standard of achievement. Indicators should be quantitative. In addition, indicators have Indicators that have been formulated by Hadiguna (2012) can be structured hierarchically as seen in Figure 1. Indicators of this study have considered the product, processes, and information flow. Three aspects that involved in this model are economics, environmental and social politics. Economics aspect is a paradigm that associated with maximizing revenue. Economic orientation is required by company to survive its business in market competition. Therefore,

supply chain operational involve resources such as money, material, energy, etc. in processing input to deliver products. Consequently, processes and operations can generate unintended output that unexpected. The particular output like this will inflict environmental impact. Environment issues have become attention by stakeholder in entire supply chain operation. Managing environmental aspect is difficult because it relates to the cost issue. Company have to make tradeoffs between economic benefits and environmental impact through managing resources utilization and saving energy policies. In addition, social politics aspect needs to be noted in managing supply chain. This is relates to the regulation issued by local governments and belief at particular region. This aspect should be complied because of the specific cost impact that would burden the company. Indeed, the company's image will be influenced caused consumers and other stakeholder's response. Furthermore, indicator different contribution that describes each priority in the assessment of supply chain performance.

IV. DSS FRAMEWORK

Approximately, a DSS is an information system that created using computer. Raw data will be processed into useful information to support business or organizational decision-making activities. The main role of DSSs serve person or people in strategic, tactical, and operational levels of an organization and help to make decisions, which may be not easily specified situation and rapidly changing in advance. We are proposing a DSS that include knowledgebased system. It is important element because designed DSS is an interactive software-based model intended to help decision makers compile useful information. Information will be obtained from a combination of raw data, standard, and personal knowledge to solve problems and make decisions. DSS framework may be designed as inputs, user knowledge, outputs and decisions as seen in Figure 2. Inputs are indicators that show reality or achievement and standard to be analyzed. User Knowledge and Expertise is inputs requiring manual analysis by the user. The proposed model has set weight of indicators by prioritized that performed personal. Moreover, we facilitate user to input and edit scoring that needed to transform raw data into outcome. Outputs are results from data transformation which decisions are generated. A decision is outcomes generated by the DSS based on user indicators. In this study, we have created algorithm that process data into decision.

V. INTERFACE DESIGN

The proposed model is a tool that used by humans for decision-making process. That is, the communication between users and computers require an intermediary which is called as interface. The user interface in term of human–machine interaction is a space where humans and machines can perform interaction. The goal of interaction is effective operation and control of DSS. User interface may give feedback from DSS which aids decision maker in making decisions. The proposed design is disregard ergonomics and psychology consideration. User interfaces is supported various systems and provide a means of: input that allowing the users to manipulate a system, and output that allowing the system to indicate the effects of the users' manipulation. We able to create a user interface which makes it easy and enjoyable to operate DSS in the way which supports the performance assessment. Generally, user needs to provide only indicators achievement to calculate the desired output. Computer will avoid undesired outputs to the user.

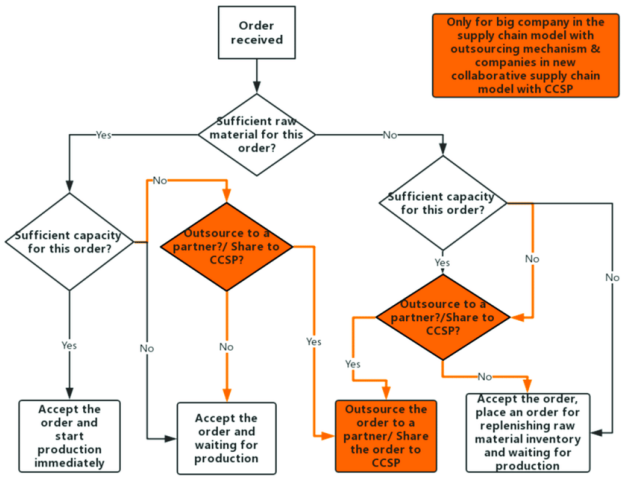

Fig.1 Supply chain management system indicator structure

VI. CONCLUSION

We have designed a DSS for performance assessment of s-SCM. There are some elements in designed DSS namely existing achievement, standards, indicators achievement and priority, computation algorithm, and recommendation for improvement. The designed DSS has included period to facilitate decision maker in evaluating supply chain performance. Model base in designed DSS has been supported mathematical formulation. This is another advantage model that is able to calculate the total and partial performance. DSS can aid decision maker to calculate partial and total performance period to period. This capability is a manifestation of evaluation phase in the performance assessment. In this connection, implementation of DSS needs to be supported skill, integrity, and other important capabilities relating to human resource. Performance assessment is success key in decision making process of s-SCM. The other of performance assessment role is able to satisfy requirement of s-SCM effectively. Implementations of performance assessment in s-SCM need to be manifested using a great computer model. Computer aided performance assessment of s-SCM can provide a powerful foundation to assist and make decisions that are the best for the system. Decision makers can view overall and get recommendation by system. In addition, decision makers may browse indicators that have contributed against increasing or decreasing performance of s-SCM. The main benefit of this DSS is to demonstrate that when the s-SCM operation as a system and the supply chain network members work together to improve efficiency of supply chain operations. DSS also shows the benefits of incorporating electronic commerce both in terms of vendors' management, distribution system and production control system. Theoretical contribution of this study is development of relationship between total and partial performance in mathematical formulation. Both measures are calculated through an algorithm. A further contribution is rule based recommendation to convey status of performance achieved. Although the recommendation of system are not detailed, but it will encourage decision

makers to follow up more focused. Software design of this study has been built with considering user friendly interface so that interactive

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