Decision Support System of Performance Assessment for Sustainable Supply Chain Management

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ABSTRACT

Sustainable supply chain management (s-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), Partial Performance, Supply Chain, Sustainable Supply Chain Management (s-SCM), Total Performance*

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 man-

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age 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., 2010). 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., 2011). 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. (2011) proposed indicators and metrics for sustainable supply chain of automotive industry. Baghwat and Sharma (2007) developed framework using balanced scorecard that measures and evaluates supply chain operations. Gunasekaran et al. (2011) 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 (2003) conducted a critical analysis of various metrics for SCM performance in particular manufacturing companies. Hervani et al. (2005) 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. (2011) 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 (2011) 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. (2006) 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 (2012) designed an expert fuzzy rule-based system for closed loop supply chain performance measurement in automotive industry. El-Baz (2011) 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 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 (2003) 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.

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. (2004). Organization has to evaluate performance in order to aid fast decision-making process in order to agility and responsiveness principles Nudurupati et al. (2011). Evaluating supply chain performance is involving several actors cooperating to achieve given logistical and strategic objectives Estampe et al. (2010). According to Searcy et al. (2008), 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. (2010) 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), ASsociation française 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 (2005), 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, 2009), green supply chain management (Shang et al., 2010), green marketing (Papadopoulos at al., 2010) etc.

Seuring & Müller (2008) 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 (2009) 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, standardize

operations 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.

MODELING APPROACH

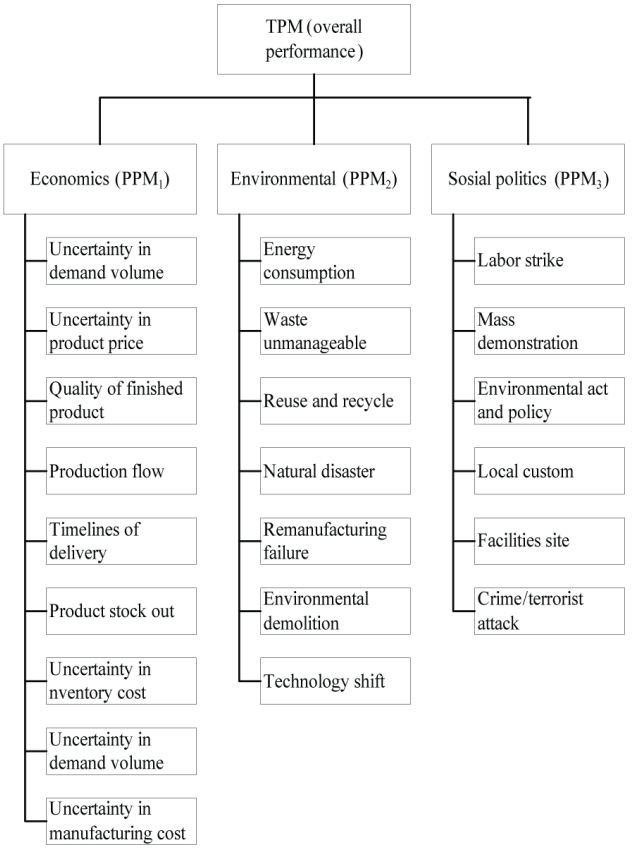
The Proposed Formulation and Algorithm

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 different contribution that describes each priority in the assessment of supply chain performance.

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 can only be assessed with a particular procedure. We propose mathematical formulation and algorithm to assess performance. Specifically, we introduce particular assessment namely partial performance measurement (PP_i) and total performance measurement (TOP). PP_i used to measure each aspect. It is aimed to assess contribution of each aspect in supply chain operations. TOP is value to represent overall performance. Some important parameters in proposed model such as weight of indicator j-th and perspective i-th (b_{ij}), score of indicator j-th and perspective i-th (s_{ij}), perspectives index (i), indicators index (j). The formulations as follows:

Figure 1. Indicators structure



$$PP_i = \sum_j b_{ij} s_{ij} \forall_i \quad (1)$$

$$TOP = \sum_i \sum_j b_{ij} s_{ij} \quad (2)$$

The above formulation should be solved that called as model solution. We develop an algorithm to solve the formulation. It is described logically the computation process. Algorithm is specified in some steps namely:

Step 0: Set score rule of indicators;

Step 1: Set weight of perspective *i*-th and indicator *j*-th;

Step 2: Get measures score each indicator for period *t* and save in data base:

a. Entry achievement of each indicator and save in data base;
b. Get indicators score referring to rules base;
c. Save in data base;

Step 3: Calculate PP_i for period *t* and save in data base:

a. Get weight each indicator of perspective *i*-th;
b. Get score each indicator of perspective *i*-th;
c. For *j*, calculate multiply b_{ij} and s_{ij};
d. Sum the multiply result;
e. Save in data base;

Step 4: Calculate *TOP* for period *t* and save in data base:

a. Get weight each perspective from data base;
b. Get PP_i;
c. Calculate multiply b_{ij} and s_{ij};
d. Save in data base;

Step 5: If a weighted perspective is not changed, repeat [Step 2] and otherwise, repeat [Step 1]. Stop.

DSS FRAMEWORK

Essentially, 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 knowledge-based 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.

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. The main component of DSS model can be depicted as follows:

1. Main menu consists of input/edit, scoring, result and exit. It is designed to make easy user in completing assessment process. The proposed design can be seen in Figure 3;
2. A feature that functioned as input of achievement is raw data of indicators. User must fill out based on standard data that has been stated precisely. Input is saved in particular period in accordance with user preference, e.g. quarterly. Inputs are saved in raw data base. Design can be seen in Figure 4;
3. Weighting input is a feature that functioning as display of weight input each indicator and aspect. This feature is needed to accommodate changing preference of decision makers. Weight is show prior-

Figure 2. DSS framework

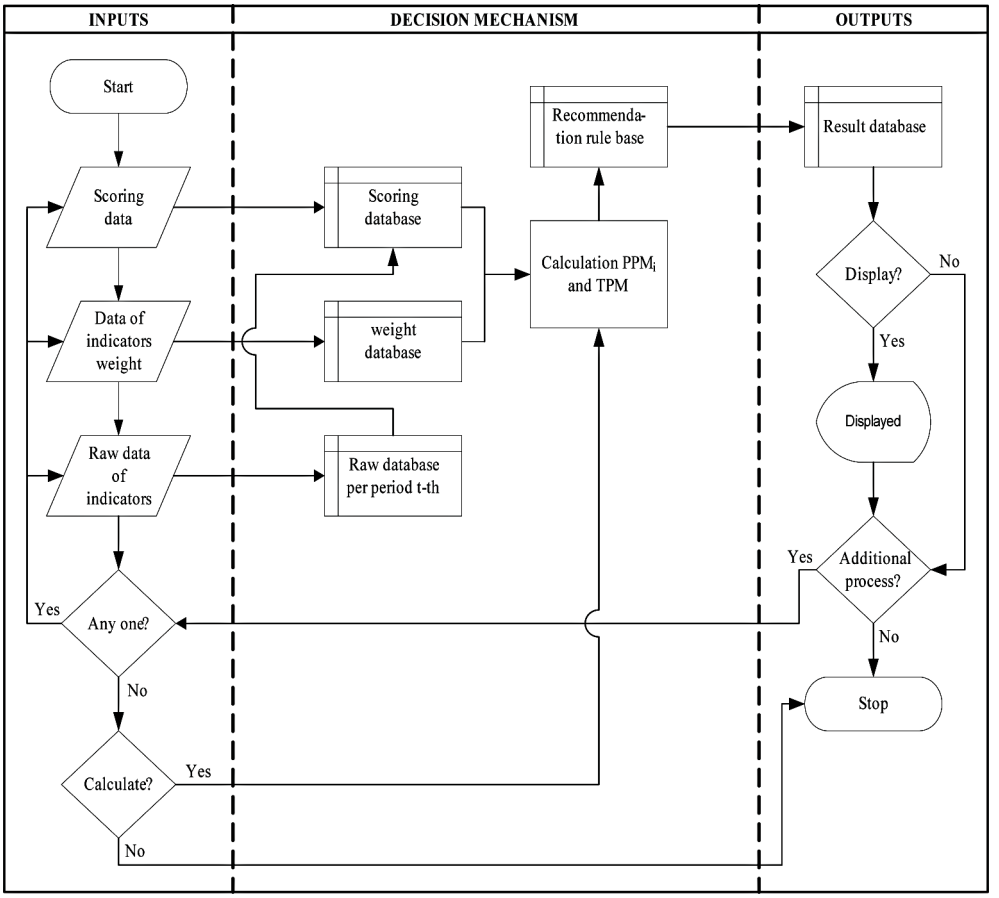


Figure 3. Main menu

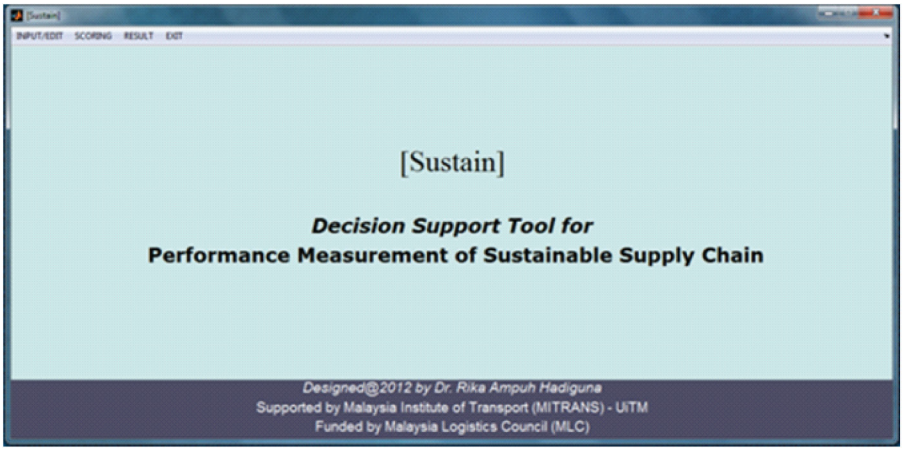
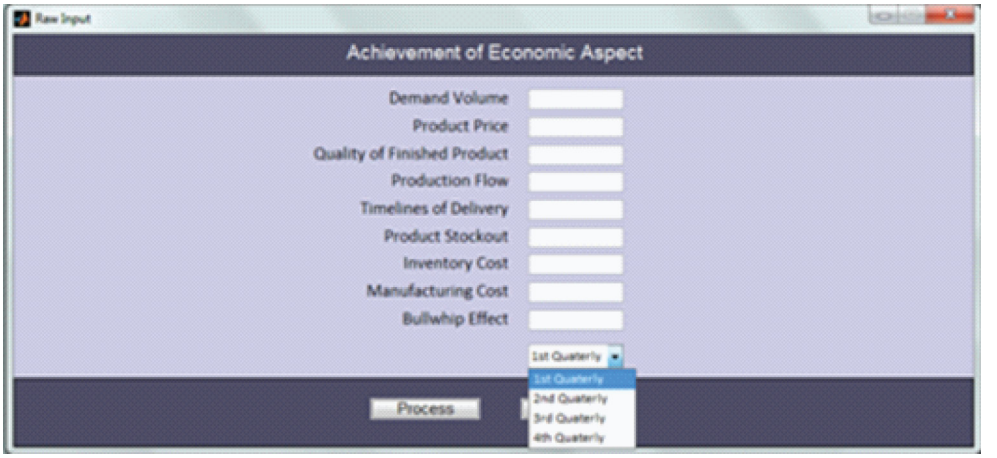


Figure 4. Input/edit option and entry form



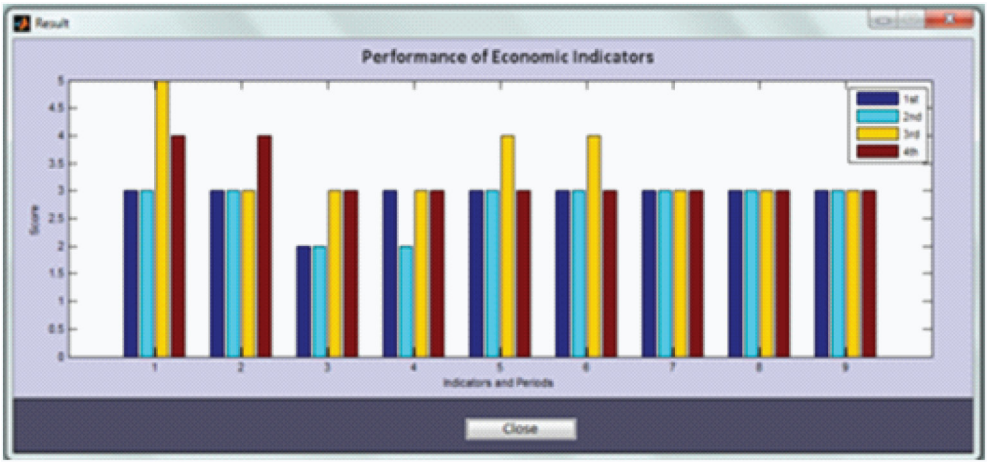
ity of indicators and aspects. Weight can be changed because there is encouraged business dynamics. Proposed design can be seen in Figure 5;

4. Scoring system is a feature to convert raw data become score value. Input will be saved in scoring database and linked to weighting database to calculate performance. The feature can be seen in Figure 6;
5. Computation feature is element of computation processing for all period. Computation result is saved in data base. Result can be reported in accordance with user requirement. User interface has prepared several of reports that consist of partial performance, total performance and recommendation for indicators. Examples of output can be seen in Figure 7, Figure 8, and Figure 9.

Figure 5. Input/edit option for weighting of indicators

Figure 6. Scoring system

Figure 7. Output in graph form



DISCUSSION

After the proposed DSS has been designed, we conducted a pilot test in a number of settings. Basically, this phase is primarily aimed to review the drawback of model. We want to ensure that the requirements are clearly defined, consistent, and complete. The review focuses on the intended use, configuration management, and fidelity to be developed. The purpose of this test was primarily to identify potential drawbacks in the prototype and process descriptions. Discussion with colleagues has been performed to review the proposed DSS. If there have felt less, they will provide comments. Computer programs testing carried out by *guestimate* data by colleagues. It is done to ensure that DSS can perform according with algorithm. Then,

Figure 8. Output of assessment

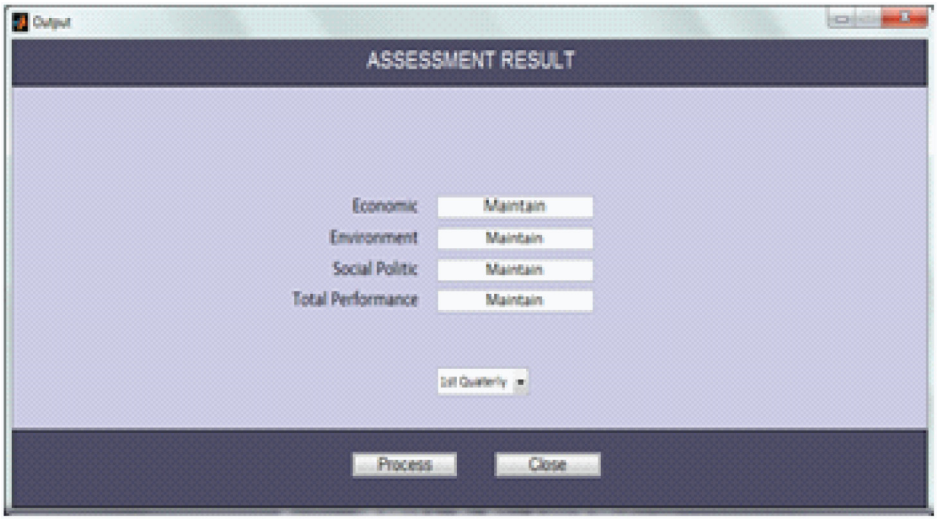


Figure 9. Output of recommendation

running the program is checked to ensure that program has been working in accordance with the built assumptions and logic earlier.

The proposed DSS involved many indicators. Consequently, implementation of DSS will include some unit in entire supply chain. Organization need to train personal who are involved in data collection and entry process. It is important manner to ensure that DSS can operate correctly. They are persons who believed capable and well understanding with indicators in term of s-SCM. Harmony principle in Group decision-maker in this framework is necessary. It is aimed to accommodate the culture because many companies are involving to discuss and make decisions in problem solving of entire s-SCM. Certainly, everyone has own tendencies to solve the problem. These tendencies will compose the conflicts of opinion. DSS cannot replace the role of humans by computer.

Model provides the structural technique that applicable to recognize the processes and the dynamics of s-SCM. We selected the judgment method for assessment process. In proposed DSS, we assume that the decision-makers usually make the work plan collectively, face to face, and share the information. Performance assessment of s-SCM is assessment process to avoid insufficient or wrong information. For example, when facing complex situation in the logistics, a logistics manager can make decision rapidly. Manager who has made decision cannot articulate how he made the decision whereas his decision is correct. It is prove that decision knowledge consists of one's experiences, wisdom, intuition, etc. It is usually called as tacit knowledge. Zhong (2008) described characteristic of organizational decision knowledge namely:

- Purpose is serve the decision making (especially semi- and unstructured decision making);
- Carrier is tacit decision knowledge that stored in one's brain;
- Types is know-how knowledge that takes a large proportion;
- Focuses is reducing or removing cognitive biases, improve mental models, supporting and improving decision making.

Overall, it helps firms to (a) satisfy the stakeholder expectation (customers, government, and non government organization) to implement sustainable issue in supply chain operations; (b) ensure the focused improvement in term of business growth and profitability; and (c) increase customers' loyalty by formulating proper supply chain strategies. Firms can easily evaluate different supply chain strategies using the assessment result. The assessment model will help them to anticipate failure in the long-term return on investment of tentative business strategies. In addition, it recommends direct improvement so that losses potential can be eliminated and reduced.

Information and computer technology has been applied in many areas including supply chain management. Application artificial intelligence and the internet for decision support can greatly increased the flexibility and expansion ability to assess performance of s-SCM. This is also the main development mode of the framework when implemented for particular supply chain. The proposed DSS has become an interactive human-machine system that has a strong learning ability and adaptation.

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 increas-

ing 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.

On the other hand, the presented model has limitations like any research project that can be overcome in further research. 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.

Recommendations for future study are application of artificial intelligence in response of input data and predict outcomes in future periods. This idea is relevant to followed up because DSS of performance assessment for s-SCM is involving many data that collected in data base structure. Fuzzy set theory is very suitable to aggregate score. Further, neural network is applicable to predict outcome next period. Forward, the proposed framework will be embryo for intelligent decision support system for risk and performance assessment of s-SCM.

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Description

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The **International Journal of Green Computing (IJGC)** provides managers, academicians, scientists, and researchers in various government, public, and private sectors coverage of topical issues like green strategy, green transformation, green technology, green revolution, ecology system, sustainability supply chain, green and sustainable innovation, global warming, energy efficient system, recycling and reuse systems, product usability, reverse supply chain, closed loop supply chain, environmental issues, carbon footprints, renewable energy, applied ergonomics, and climate change. This journal offers research contributions, constructive debates, and investigations on new legislations on green IT, green processes, healthcare informatics, and applications in terms of environmental and climate issues for both manufacturing and service industry.

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Mission

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The mission of the **International Journal of Green Computing (IJGC)** is to serve as an interdisciplinary source of green knowledge for researchers and practitioners in information technology and business. The goal of the journal is to provide academicians, research scholars, business entrepreneurs, practitioners, managers, and policymakers coverage of strategic green issues and best practices for competitive advantage and cost savings in modern organizations and business sectors. The journal highlights the critical steps needed for green transformation, which help organizations and businesses reach their environmental goals.

Reviews and Testimonials

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"Green computing and environmental sustainability are evolving doubtlessly to key factors in global businesses of the 21st century. Their implementation changes the negative impact on the planet's environment and simultaneously affects business costs. The *International Journal of Green Computing* (IJGC) offers here an excellent scientific stage for sharing and discussing these promising topics. It is a great source not only for students and researchers but also for entrepreneurs and CEO's in the industries."

– Markus Heck, SAP AG, Germany, and Günter Schmidt, University of Liechtenstein, Liechtenstein

I was drafting the plans for a collaborative Industry-Academia research on Transportation Planning and Scheduling when my thoughts veered to the *International Journal of Green Computing* (IJGC). Our major goal is to address the challenges of greener transportation and logistics - a major global challenge. I think the IJGC is creating the right support for such Green initiatives. Several of the papers in recent volumes have made remarkable contributions to the general theme of innovations in design and resource utilization. In

particular they address both IT for Green and Green IT, subjects that we work on.

– Siddhartha SenGupta, Tata Consultancy Services Limited, Mumbai, India

In the present day, environmental issues have gained prominence because of the recent recognition of the roles they play in the growth process. *International Journal of Green Computing* (IJGC) provides an important avenue for researchers and practitioners to present and evaluate theoretically and/or empirically, issues relating to the environment in a concise manner relevant to the global economies. I have no reservation in recommending the journal to all economic scholars.

– Funso Ayadi, University of Lagos, Nigeria.

My research area include topics in the Reverse Logistics and Sustainability. Due to the interesting papers published in the IJGC I have recommended strongly to my PhD students to consult it in order to improve and update their literature review with the very relevant scientific papers that are available in this important Journal.

– Fernando Augusto Silva Marins, Sao Paulo State University - Brazil

Environmental thinking and sustainable development are increasingly important issues in manufacturing and service industries both globally and locally. The International Journal of Green Computing (IJGC) provides a platform for research contributions, constructive debates, and investigations–IJGC opens new perspectives to these topics. I am convinced that IJGC will add great value for academic audience, intermediary organizations, and managers in the industries.

– Matti Muhos, Oulu Southern institute, Finland.

International Journal of Green Computing is a novel venture that resolves to bring the key issues in environment due to the changing Global scenario to the forefront. This journal strives to bring out the latest advances in the ecological issues in the domain of environment. The quality of the language used in this IJGC is of Global Standards. I have great pleasure in recommending this IJGC to the researchers and scholars who are very much inclined to comprehend the latest trends in the field of Green Computing.

– Lee, Tzong-Ru (Jiun-Shen), National Chung Hsing University, Taiwan

Green computing is rapidly evolving to accommodate computing projects in variety of new technologies including Carbon foot printing, Solar, Lead-Free product development, toxic waste reduction, Energy efficiency etc. The International Journal of Green Computing is serving the global audience with latest developments and up to date research information in this emerging field. Also, the journal provides a platform for the students, academia and research community in sharing and promoting the dialogue in the need of the hour technology in Green computing.

– Professor Immanuel Edinbarough, The University of Texas at Brownsville, And Texas Southmost college, USA

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K. Ganesh is working as Knowledge Specialist in Supply Chain Management - Center of Competence, McKinsey Knowledge Center, McKinsey & Company, Gurgaon, Haryana, India. He has graduated in Mechanical and Production Engineering from Annamalai University, TamilNadu, India with the university first rank. He pursued his Masters' degree in Industrial Engineering at National Institute of Technology, Tiruchirapalli, TamilNadu, India and secured college first. He then moved to Indian Institute of Technology Madras, Chennai, TamilNadu, India where he obtained his doctoral degree in Logistics and Supply Chain Management. He was a half-time teaching and research assistant at IIT Madras awarded by MHRD research fellowship for 4 years. He then joined the supply chain management department of Lakshmi Machine Works Limited, Coimbatore as Research Analyst and worked for 2 years. He served as project leader for the five major consulting assignments namely business transformation, balanced score card, business optimization by supply chain synchronization, strategic cost reduction and knowledge management. He then joined as Assistant Consultant at Integrated Supply Chain, Manufacturing Industry Solutions Unit, Tata Consultancy Services Limited, Mumbai and worked mainly in the areas of supply chain network design and optimization for 2 years. Later he joined as Senior Consultant in Global Business Services-Global Delivery of IBM India Private Limited, Mumbai, India and worked in Supply Chain Transformation projects for various industries for the span of 2 years. He worked as visiting professor for DJ Academy for Managerial Excellence, Coimbatore, India (1st Jan 2006 to 30th July 2007), Sree Saraswathi Thyagaraja College, Pollachi, Coimbatore, India (1st July 2006 to 30th December 2006), Sardar Vallabhai Patel Institute of Textile Management, Coimbatore, India (2nd Jan 2007 to 30th June 2007), Amrita Deemed University, Coimbatore – India (Adjunct Faculty of Research from 2006) and Swayam Siddhi College of Management and Research, Mumbai – India (12th July 2008 to Till Date). He is having 6 years consulting experience in top consulting companies and cumulative of 14 years of research, teaching and consulting experience in the supply chain domain for manufacturing, process and chemical industry. He has published 66 papers in leading international research journals such as the *European Journal of Operational Research* and *Expert Systems with Applications* and 4 papers in leading national journals. He has presented and published 51 papers in the reputed international conferences and 8 research articles in the national conferences. He has written a chapter for six books. He is Editor-in-Chief for 3 international journals (IJLSCM, IJDMSCL, IJOSHRM and AJMS), Editor for IJENM and associate editor for IJLEG, AJCST and IJISSCM. He is in the editorial board for various international journals. He is referee for 12 reputed international journals. He has been honored with 3 awards for his bachelor degree and one award for his master's degree for academic excellence. He has obtained 4 awards from Tata Consultancy Services Limited and received 5 appreciation awards from IBM India Private Limited. Dr. K. Ganesh is expertise in areas such as Supply Chain (SC) Transformation, Strategic SC Network Design and Optimization, Production Planning Optimization, Inventory optimization, Demand Planning and Forecasting, Product Flow Optimization, Production Scheduling and Transportation Optimization. Among his other interests are music, counseling, website designing, interior decoration and photography. He is himself a lyricist and has written several poems in both English and Tamil.

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