An Empirical Study on Supply Chain Management Performance Measurement through AHP

Ferdoush Saleheen [#1], Md. Mamun Habib[*2], Zurina Hanafi[#3]
[#]School of Quantitative Sciences, Universiti Utara Malaysia (UUM), Kedah, Malaysia
[*]BRAC Business School (BBS), BRAC University, Bangladesh
[1]ferdoushsaleheen@gmail.com
[2]mamunhabib@bracu.ac.bd
[3]h.zurina@uum.edu.my

Abstract **- Supply chain management (SCM) performance measurement has gained noteworthy considerations from researchers and practitioners in the manufacturing paradigms for improving organizational effectiveness that can be applied to pronounce and review the historical performance, as well as to set performance targets for the future. Precise diagnosis and analysis of SCM performance is imperative to attain and enhance organizational productivity and profitability through focusing strategic, tactical and operational planning as well as control. Enterprises scrutinize the best fit to evaluate the existing approaches of performance measurement framework including financial and operational. The researcher investigates a multi criteria decision analysis (MCDA) approach to demonstrate how analytic hierarchy process (AHP) is applied to select the best performance measurement framework and illustrates a decision model to structure the problem related to select the supply chain performance measurement system in a hierarchical form with substitutes to the decision maker. The study also determines that there are nine methods where supply chain performance could be evaluated. However, it is yet to establish and validate a comprehensive approach which can establish both qualitative and quantitative factors along with different decision making levels and rank the decision preferences which constitutes a gap between the theory and their potential application. Therefore, future contributions to the subject is indispensable through new innovation of a comprehensive supply chain performance measurement model.**

Keywords: Analytic hierarchy process (AHP); supply chain performance measurement system (SCPMS); Multi-criteria decision analysis (MCDA).

1.0 Introduction

Supply chain management (SCM) is a multi-disciplinary concept in the contemporary trade and research to bring organizational efficiency and profitability to manage the business with sustained competitiveness through delivering goods and services to the end customers [1]; [31].

Ref. [2]; [30] mentioned that firms have incorporated SCM concepts of innovation and new management thoughts to deal with competitors locally as well as globally ref. [2] noted that ideally SCM encompasses a flow of suppliers, manufacturing of raw materials, parts, subassemblies and final products composed with business process and customers [3]. Globally corporations have been encountering continuous proliferating customers' value expectations, global economic crisis, profound bloodthirsty compression and the cost of raw materials, component parts constitute the main cost of a product [4]. The expansion of an economy of any nation is sustained by the progress of its manufacturing industries which are transient through a stage of tough competition. In order to survive, industries endeavor to progress its throughput in all areas of its movement. What is essential is to develop new ways of refining manufacturing performance by optimally exploiting the resources. In this context, efficient supply chain management is fundamental to the competitiveness of manufacturing firms, as it directly influences their capability to assemble changing marketplace demands in a judicious and cost effective approach. A supply chain network intricacy could vary prominently from industry to industry and firm to firm in the circumstance of forceful worldwide rivalry, so supply chain performance has become a critical concern in various industries. The goal of supply chain management is to produce benefit in terms of customer service and cost over competitors. Hence, it is desired to measure the company's performance through benchmark. Given the intrinsic difficulty of the typical supply chain, choosing appropriate performance measures for supply chain analysis is particularly important, since the significance is mostly vast and multifaceted [5].

1.1 Determinants of supply chain performance measurement system

Three distinguished aspects of supply chain performance measurement system are: intra functional measurement system, inter functional measurement system and inter organizational measurement system.

A. Intra functional measurement system

A measurement technique which develops performance within each of its operating units such as manufacturing, marketing, or logistics etc. Most corporations have focused their performance measurement on achieving functional performance. Ref. [7] investigated the movement from functional performance towards external integration.

B. Inter functional measurement system

A measurement technique that advances excellence through its cross-functional procedures rather than within its individual functional divisions. Metrics for a business in this method would require to emphasis on cross-functional progressions. This comprises synchronized management of a company's internal operational undertakings such as production scheduling, labor distribution, inventory, job sequencing etc. [14].

C. *Inter organizational measurement system*

A measurement technique that develops excellence in inter-organizational processes. Metrics for a firm in this system will emphasis on external and cross-enterprise metrics. This advocates the integration of all company activities across the supply chain. Successful SCM commands a change from managing individual roles to integrate key supply chain developments ref. [15] revealed that supply chain management has stimulated us from an intra functional notion of the channel toward an inter functional and even inter-organizational one. This entails three things: a new type of metrics beyond regular accounting techniques for seizing inter-organizational data and articulating them in terms that facilitate benefit analysis; an information sharing instrument for transmitting data about collaborative benefits between channel members; an allocation technique for re circulating the rewards of collaboration in a way that all parties benefit equally. Collaboration is the vital component to achieve external assimilation with other chain members ref. [7] thereby allows to benchmark from a single company level to an inter organizational level [8]. Supply chain collaboration necessitates a rational amount of exertion from all contributing members to warrant the accomplishment of prospective benefits [12]; [16].

2.0 Literature review

Supply chain management (SCM) performance measurement literature review emphases on the fundamental notions, progresses, transformation methods of performance measurement procedures, practices and its developments. The review originates with an overview of supply chain and its performance management including definitions and development and its applications in various manufacturing industries [6].

A. Performance measurement improvements

A firm measures a predetermined level of customer satisfaction which identifies on combine decision making levels with financial and non-financial criteria and apply "Balanced Score Card" perspective.

B. SCPM frameworks and its categorizations

Performance measurement is outlined as a sequential progress of quantifying effectiveness and efficiency of achievement that describes the overall set of factors used to quantify both the efficiency and effectiveness of action [9]. It also stipulates the syndicated decision making with financial and non-financial criteria and measures. The assessment process also explains on the basis of decision making capability which was classified ref. [10] noted deliberating the SC (supply chain) processes with regard to decision making levels in partnership from all stakeholders of supply chain system to evaluate the structure ref. [11] noted an inter-organizational atmosphere via two performance measurement frameworks: the structural extended enterprise balanced scorecard and the technical outline for the assortment and accomplishment measures.

2.1 SCPM approaches

The SCM performance can be divided into financial and non-financial measures. Top executive necessities financial measures while taking judgements, but mid management and workforces require operational measures for daily business. The framework with metrics of SC performance are as follows:

Type of Measurement System	Criteria of Measurement
1. Function-based Systems **(FBMS)**	Performance measures of ***functions*** within each process of the supply chain.
2. Dimension-based Systems **(DBMS)**	Performance evaluation of pre-determined ***key dimensions*** across the supply chain.
3. Hierarchical-based Systems **(HBMS)**	Performance measures identified on ***three levels of management***: Strategic, Tactical and Operational.
4. Interface-based Systems **(IBMS)**	Performance measures defined between supply chain ***linkages***, i.e. stages.
5. Perspective-based Systems **(PBMS)**	Performance measures on ***six perspectives*** of the supply chain: Operations Research, System Dynamics, Logistics, Marketing, Organization and Strategy.
6. Efficiency-based Systems **(EBMS)**	Performance measures to evaluate the supply chain ***efficiency***.
7. SC Operations Reference Model **(SCOR)**	Performance measures along the ***five main supply chain processes***: Plan, Source, Make, Deliver and Return.
8. SC Balanced Scorecard **(SCBS)**	Performances measures across ***four supply chain perspectives***: Financial, Customer, Internal Business Processes and Innovation and Learning.
9. Generic Systems **(GPMS)**	Performance measures are ***strategy*** aligned

Figure 1: Type of Measurement System [5]

A. Supply chain balanced scorecard (SCBS)

In 1992, ref. [17] pronounced Balanced Scorecard (BSC) as an authoritative performance management tool. Since then, it has been acknowledged as the principal instrument for performance measurement both in research and commerce. It allows administrators to detect a composed understanding on operational and financial measures at a glimpse. The authors recommended four basic perceptions that administrators could monitor and follow: financial, customer feedback, internal business processes & innovation and learning perceptions. A visual illustration can be uncovered in ref. [17]. Bearing these four perceptions in observance, managers can transform approaches into specific actions that can monitor the overall impact of a strategy on the enterprise. The objectives and measures in each perspective are unearthed from the enterprise strategy. Ref. [12] demonstrated how a supply chain management structure is connected to the balanced scorecard.

B. Supply chain operations reference model (SCOR)

The original framework of SCOR was formed by the Supply Chain Council in 1996 ref. [18]; [19]. It is an outline to investigative the supply chain elaborately through outlining and classifying the procedures that construct the chain, conveying metrics to such progressions and appraising similar yardsticks. The SCOR model outline can be uncovered [19]. It is the only interconnected cross-functional framework that associates performance measures, best practices and software requirements to a detailed business process model.

The SCOR model states a supply chain as being constituted of five main assimilated processes: plan, source, make, deliver and return. Performance of most procedures is measured from five perspectives: reliability, responsiveness, flexibility, cost and asset. As the model stretches the chain from supplier's supplier to customer's customer affiliated with operational strategy, material, work and information flows, it is deliberated as a comprehensive method that necessitates a well-articulated set-up, entirely committed managerial resources and continuous business process re-engineering to affiliate the business with best practices.

C. Dimension-based measurement systems (DBMS)

DBMS notion is well-known on the principle that any supply chain can be measured on magnitudes [20]. Initially ref. [20] classified three types of methods which are essential mechanism in supply chain performance measurement systems: flexibility (F), resources (R) and output (O) and she considered that each of these are fundamental to reproduce the overall performance achievement of a supply chain and that results of each type affects the others. Cases of resource performance measures are inventory cost, manufacturing cost, and return on investment (ROI). Output measures include on-time deliveries, fill rate, total sales, whereas flexibility measurements measure new product introduction and volume changes.

D. interface-based measurement systems (IBMS)

IBMS was predominantly stated in 2001 ref. [25] noted a framework in which performance of each stage is connected within the supply chain. The structure commences with the associations at the principal business and travels outward one link at a time. This style produces a means for associating performance from point of origin to point of consumption with the objective of improving the stockholder value for the overall supply chain as well as business enterprise. The IBMS approach seems hypothetically perfect but in real business scenery, it needs openness and total visibility of information at every stage which is eventually challenging to execute [25].

E. Perspective-based measurement systems (PBMS)

PBMS outlooks at the supply chain in all the conceivable insights and brings measures to assess each of them. They were hypothesized in 2003 ref. [21] noted who accredited six core areas as follows: operations research, system dynamics, marketing, logistics, organization and strategy. The authors described six sets of metrics, one for each perception to assess performance of supply chains. PBMS is the logistics scoreboard ref. [16]; [22] noted that recommended only on logistical features of the supply chain that approaches into the following general classifications: logistics financial performance measures (ex: expenses and return on assets), logistics productivity measures (ex: orders shipped per hour), logistics quality measures (ex: shipment damage) and logistics cycle time measures (ex: order entry time). PBMS stipulates different perception to assess the supply chain performance. However, there could be a trade-off amongst measures of one perception with measures of other perceptions.

F. Hierarchical-based measurement systems (HBMS)

The developed HBMS concept which was classified as strategic, tactical or operational [22]. The main principle deals with by the appropriate management level to facilitate fast and appropriate judgements [22]. The metrics further elaborated as financial and non-financial matters that links together with the hierarchical interpretation of supply chain performance measurement and maps.

The performance measures precise to enterprise goals. However, in such methods, a clear direction cannot be stated to put the measures into different levels to reduce the conflict among the different supply chain partners.

G. Function-based measurement systems (FBMS)

FBMS combines to cover the different processes of supply chain which was originally developed in 2005 ref. [13]; [23] noted to cover the detailed performance measures. It is applicable at different linkages of the supply chain. Though it is easy to implement and targets can be dedicated to individual departments but it does not provide top level measures to cover the entire supply chain. FBMS are generally criticized for viewing the separate supply chain functions in isolation with the overall strategy and hence results in localized benefits that may harm the whole supply chain.

H. Efficiency-based measurement systems (EBMS)

EBMS systems measure the supply chain performance in terms of efficiency ref. [24]; [25] noted that deliver outline to examine supply chain performance by developing a data envelopment Analysis (DEA) model for the internal supply chain performance efficiency using case study applications.

I. Generic Performance Measurement Systems (GPMS)

Quite a few generic performance measurement models and frameworks have been developed since 1980 which has its benefits and limitations.

i Performance prism

The performance prism advocates that performance should be assessed throughout five diverse scopes of performance as suggested ref. [25]: strategies, processes, capabilities, stakeholder satisfaction and stakeholder contributions. This model has broader views of different stakeholders than other frameworks. The core focus of this theoretical structure is that it cross-examines the business's present strategy before the progression of choosing methods which eventually warrants the root foundation of the performance measures with the organization. The process also reflects new stakeholders (such as workforces, suppliers, associated partners or agents) who are mostly ignored when performance measurement process starts. However, the main disadvantage is that it guides less about how the performance measures would be acknowledged and chosen [26].

ii. Performance Pyramid

Performance pyramid knots an organization’s strategy with its operations by transforming the assigned objectives at a top down approach (based on customer urgencies) and quantifies from the bottom up approach ref. [27]. This structure contains four stages of objectives that adopts an organization’s peripheral effectiveness (left side of the pyramid) and its inner efficiency (right side of the pyramid) as validated ref. [25]. The growth of a company’s performance pyramid turns with outlining an inclusive corporate concept at the first level, which is then transformed into separate SBU (strategic business unit) wise objectives. The second-tier focuses on the profitability, cash flow, longstanding growth and concentrates on market position. The operating system links the crack between highest level and operational procedures such as productivity, customer satisfaction and business flexibility. Lastly, four key performance measures: delivery, quality, cycle time and waste are used at departments and work centers on a daily basis. Ref. [24] concluded that this approach also does not deliver any instrument to classify key performance indicators nor does it unambiguously assimilate the impression of continuous improvement.

iii. Medori and Steeple’s Framework

Ref. [26] outlined cohesive structure for auditing and enhancing performance measurement methods which comprises six phases that begins with describing manufacturing tactic and achievement factors. In the following phase, the principal job is to balance the company’s strategic necessities from the preceding period with competitive urgencies and choose the most appropriate procedures. After the selection process is made, the existing performance measurement system is audited to recognize which existing measures would be kept. The last stage is based on the periodic appraisal of the business performance measures. A significant advantage is that it can be used both to design a new structure and to improve a prevailing one. It also includes an exclusive description of how performance measures should be designated.

A. AHP

Introduced in 1970, the Analytical Hierarchy Process (AHP) has become one of the most efficient methods for multiple criteria decision making analysis (MCDA) to assist in the solution of complex multiple criteria problems [29]; [32]. This performs as a problem-solving framework in a flexible and organized method that also represents the elements of a compound problem, hierarchically [30]. AHP is regarded as a fundamental tool for both practitioners and academic researchers to compare the overall performance of production and manufacturing, evaluating supplier assessment and overall supply chain performance measurement [31].

B. Advantages of AHP

AHP is an appropriate technique for undertaking quantifiable as well as non-quantifiable investigation. The technique differs from other multiple criteria as an individual conclusion that are readily encompassed and the appropriate inconsistencies are handled [29]; [28]. The final result of the AHP is an optimum preference among decision substitutes. Ref. [29] synopses of the subsequent benefits of using AHP. It approves and builds methodical what is primarily an individual judgmental process and thereby simplifies "accurate" decisions. As a default of the process, management gains information about the appraisal of the cost drivers' and actions' indirect weights; and its outcomes are value-added communication, that leads to greater acceptance and harmony among decision makers and hence a better reassurance to the selected decision.

C. Limitations of AHP

Classifying the related appearances of the problem and describing their relative importance in decision-making procedure needs wide conversation and thinking. It needs controls and improvement pair-wise decision matrices; therefore, a thorough footstep of matrices and pair-wise judgements of qualities is essential. The pair-wise contrast of characteristics under consideration can only be personally achieved, and hence their accurateness of the results depends on the user's skill knowledge in the area concerned.

Supply Chain Performance Measurement Analysis through AHP

A graphical representation of the AHP model and decision environment is shown in Fig. 2

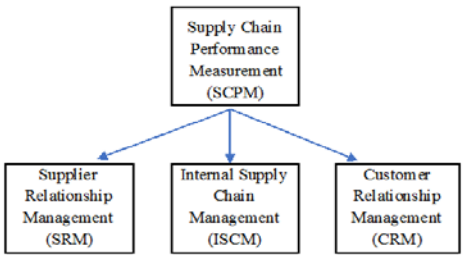

Figure 2: AHP-based framework for selecting supply chain performance measurement system [33]

2.2 Model expansion and analysis

The AHP model that is represented in this study has been assessed in the manufacturing industries to evaluate the priorities and rank the needs of supplier relationship management (SRM), internal supply chain management (ISCM) and customer relationship management (CRM).

In a table of pair-wise comparison, the cells of the matrix have been filled in with the subjective judgments using 1 to 9 pair-wise comparison scales from a survey questionnaires filled by 140 respondents and based on the preference and perception of the criteria for the overall performance measurement. For example, when asked the respondents with respect to all three supply chain macro processes, what is the importance of performance measure at supplier relationship management (SRM) to performance measure at internal supply chain management (ISCM)? If the SRM was slightly important than the ISCM, then the integer 2 was entered in the corresponding cell; its reciprocal or 1/2 was automatically entered for the reverse comparison. In the same way, other cells of the matrix were also filled in such as with respect to all three supply chain macro processes, what is the importance of performance measure at supplier relationship management (SRM) to performance measure at customer relationship management (CRM)? If the CRM was slightly important to the SRM, then the integer 2 was entered in the corresponding cell; its reciprocal or 1/2 was automatically entered for the reverse comparison; and what is the importance of performance measure at internal supply chain management (ISCM) to performance measure at customer relationship management (CRM)? If the ISCM was slightly important to the CRM, then the integer 2 was entered in the corresponding cell; its reciprocal or 1/2 was automatically entered for the reverse comparison. According to the respondent's feedback in the survey question, different ranks are entered in the table.

Next, the weight calculation is reckoned. In Table of weight calculation, the value in each cell from the pair-wise comparison table was divided by the sum of value from all cells in the same column. For example, in cell SRM (row) and SRM (column), 0.500 came from 1 divided by 2 (the sum of SRM's column that came from 1+5+4). In the same way, other cells of the matrix were also filled in such as in cell SRM (row) and ISCM (column), 0.571 came from 2 divided by 3.5 (the sum of ISCM's column that came from 2+1+0.5); and in cell SRM (row) and CRM (column), 0.040 came from 2 divided by 5 (the sum of CRM's column that came from 2+2+1). 5.0.

Then, the result of the priorities with respect to supply chain macro processes was calculated. For SRM, the priority weight was 0.490 that calculated from the average value of row SRM in column SRM, ISCM and CRM (value in column SRM plus value in column ISCM plus value in column CRM then divided by the number of column (0.500+0.571+0.0400) / 3. The sum of the priorities

of SRM, ISCM, and CRM comes 1.00 (0.490+0.312+0.198).

Then priority factors of SRM, ISCM, and CRM which are 0.490, 0.312 and 0.198 are placed as a Weight Criteria, Weighted Sum is calculated for SRM, ISCM and CRM as 1.51, 0.952 and 0.599 (0.490+0.624+0.395= 1.510).

Finally, the consistency is checked. If the consistency ratio (CR) is greater than 10 percent, then the pair-wise is not consistent in making the comparison. The pair-wise comparison should review and make the adjustment. In this case, the CR is 4.63%.

It is observed that **Supplier Relationship Management** (SRM) (0.490) factor is found to be most important followed by Internal Supply Chain Management (ISCM) ((0.312) factor and Customer Relationship Management (CRM) factor (0.198). And the Consistency Ratio is 4.63 %. It means the pair-wise is comparable.

Tables of pair-wise comparison and weight calculation

Pairwise comparison matrix with intensity judgements

	SRM	ISCM	CRM
SRM	1.00	2.00	2.00
ISCM	0.50	1.00	2.00
CRM	0.50	0.50	1.00

Column addition

	SRM	ISCM	CRM
SRM	1.000	2.0000	2.0000
ISCM	0.500	1.0000	2.0000
CRM	0.500	0.5000	1.0000
Sum	**2.000**	**3.5000**	**5.0000**

Normalized Matrix

	SRM	ISCM	CRM
SRM	0.500	0.571	0.400
ISCM	0.250	0.286	0.400
CRM	0.250	0.143	0.200

Calculation of priorities: row averages

	SRM	ISCM	CRM	Priority
SRM	0.500	0.571	0.400	**0.490**
ISCM	0.250	0.286	0.400	**0.312**
CRM	0.250	0.143	0.200	**0.198**

Presentation of results: original judgments and priorities

	SRM	ISCM	CRM	Priority
SRM	1.000	2.000	2.000	**0.490**
ISCM	0.500	1.000	2.000	**0.312**
CRM	0.500	0.500	1.000	**0.198**
				1.000

Prioritization results

	SRM	ISCM	CRM	Priority
SRM	1.000	2.000	2.000	**0.490**
ISCM	0.500	1.000	2.000	**0.312**
CRM	0.500	0.500	1.000	**0.198**
				1.000

Priorities as factors

	SRM	ISCM	CRM	
Criteria Weights	***0.490***	***0.312***	***0.198***	
SRM	1.000	2.000	2.000	
ISCM	0.500	1.000	2.000	
CRM	0.500	0.500	1.000	

Calculations of weighted columns & sums

	SRM	ISCM	CRM	Weighted Sum
SRM	0.490	0.624	0.395	**1.510**
ISCM	0.245	0.312	0.395	**0.952**
CRM	0.245	0.156	0.198	**0.599**

Calculation of Amax

Weighted sum	Priority			
1.510	0.490			**3.078**
0.952	0.312			**3.053**
0.599	0.198			**3.030**
			Total	**9.161**
Divide by 3 to obtain Lambda max =				**3.054**

RI	**0.58**
CI = (Amax -n) / (n-1)	**0.027**
n = **3**	
Consistency ratio (CR) = CI/RI	**0.046329166**
	4.63%

3.0 Research Methodology

An extensive overview of the practices of Supply Chain Performance Measurement (SCPM) is investigated using published research papers and some major SCM practices were uncovered. Widespread research papers and conference papers have been appraised from International Journals such as PROQUEST, EMERALD, EBSCO, IEEE, ACM, JSTOR etc. These classified practices are then associated to explore the relationships relationship between them for better understanding and application.

3.1 Sampling and Data collection

This is an empirical research therefore the study engaged in quantitative method and collection of information from the respondents through a survey research technique filled by the 140 respondents. The target population was the top executives, academicians of the manufacturing companies and All stakeholders, representing professionals, researchers, academicians, consultants, corporate executives including CEO/ GM etc. where the precision error is considered 7%. A non-probability sampling technique was used with a closed ended question having 9 point Likert Scale. An operational research component of Multi Criteria Decision Analysis (MCDA), particularly, Analytical Hierarchy Process (AHP) was applied.

4.0 Findings & Discussions

The analysis unlocks SCPM through AHP and explains how the technique can be used to envisage the influence of numerous determinants in the arrival of the final solution. For the research undertaken in this study, the result indicates that Supplier Relationship Management (SRM) is the highest priority for the manufacturing company,

followed by the Internal Supply Chain Management (ISCM), and Customer Relationship Management (CRM). This study also unlocks enormous future potentials and the application of AHP techniques with an integrated model to measure supply chain performance measurement for manufacturing environment.

5.0 Conclusion

The main impact of this study lies for selecting supply chain performance measurement system. The proposed AHP model in this article, not only guides the decision makers in the selection of the supply chain performance measurement system but also enable them to visualize the impact of numerous determinants in the arrival of the final solution. Future research could be conducted on supply chain performance measurement for manufacturing industry where AHP could be used in order to apply the best methods to take decisions where qualitative as well as quantitative factors may arise to connect the vision and mission of the company aligning the profit & loss accounts as well as balance sheet of the company. This study also unlocks the frontier, particularly model development for the perspective researches in the area of supply chain performance measurement.

References

[1] Gunasekaran, A., Patel, C. & Mc Gaughey, R. E, *"A Framework for Supply Chain Performance Measurement,"* International Journal of Production Economics, 87(3), 333-347, 2004.

[2] Dangayach, G.S., & Deshmukh, S.G., *"Evidence of manufacturing strategies in Indian industry: a survey"*, International Journal of Production Economics, Vol. 83, No. 3, pp. 279-298, 2003.

[3] Srinivasan, M., Mukherjee, D. and Gaur, A.S. "*Buyer–supplier partnership quality and supply chain performance: Moderating role of risks, and environmental uncertainty"*, European Management Journal, Vol. 29, pp. 260– 271, 2011.

[4] Brown, J., "*How the Global Recession Has Altered the Raw Materials Industry*", available at: https://www.pcb-solutions.com/pcb-market-monitor/how-the-global-recession-has-altered-the-raw-materials-industry/, 2018.

[5] Nedaa Agami, Mohamed Saleh and Mohamed Rasmy, "*Operations Research Department, Faculty of Computers and Information, Cairo University, Cairo, Egypt IBIMA Publishing."* Journal of Organizational Management Studies http://www.ibimapublishing.com/journals/JOMS/joms.html Vol. 2012 Article ID 872753, 20 pages DOI: 10.5171/2012.872753, 2012.

[6] Simatupang, T.M., & Sridharan, R, "*Benchmarking supply chain collaboration": An empirical study. Benchmarking*: An International Journal 11(5), 484-503, 2004.

[7] Simatupang, T.M., Sridharan, R., "*A benchmarking scheme for supply chain Collaboration. Benchmarking":* An International Journal 11(1), 9-30, 2004a.

[8] Gunasekaran, A., Patel, C., and McCaughey, R.E. *"A framework for supply chain performance measurement", International Journal of Production Economics"*, Vol. 87, No. 3, pp 333-347, 2004.

[9] Gunasekaran, A., Patel, C., and McCaughey, R.E. *"A framework for supply chain performance measurement", International Journal of Production Economics"*, Vol. 87, No. 3, pp 333-347, 2004.

[10] Yeh, D.Y., Cheng, C.H., and Chi, M.L., *"A modified two-tuple FLC model for evaluating the performance of SCM: By the Six Sigma DMAIC process, Applied Soft Computing"*, (JOURNAL), Vol. 7, pp. 1027-1034, 2007.

[11] Gunasekaran, A., Patel, C., and McCaughey, R.E. *"A framework for supply chain performance measurement"*, International Journal of Production Economics", Vol. 87, No. 3, pp 333-347, 2004.

[12] Folan, P., & Browne, J., *"A review of performance measurement: Towards Performance Management Computers in Industry"*, Vol. 56, pp. 663-680, 2005

[13] Thakkar, J., Kanda, A., and Deshmukh, S.G.,*"Supply chain performance measurement framework for small and medium scale enterprises"*, Benchmarking: An International Journal, Vol.16 No. 5, pp.702-723, 2009.

[14] Copacino, W.C., "*Supply Chain Management: The Basics and Beyond"*, St. Lucie Press, Boca Raton, Florida, 1997.

[15] Lambert, D.M., & Cooper, M.C., "*Issues in Supply Chain Management"*. Industrial Marketing Management 29, 65-83, 2000.

[16] Ballou, R.H., Gilbert, S.M., and Mukherjee, A. "*New Managerial Challenges from Supply Chain Opportunities"*. Industrial Marketing Management 29, 7–18, 2000.

[17] Kaplan, R.S., & Norton, D.P. "*Using the balanced scorecard as a strategic management system"*. Harvard Business Review, Vol. 74, No.1, pp.75-85.315, 1996.

[18] Brewer, P.C., & Speh, T.W. "*Using the balanced SCOR card to measure e supply chain performance"*. Journal of Business Logistics 21(1), 75–93, 2000.

[19] Huang, S.H., Sheoran, S.K., and Keslar, H., *"Computer-assisted supply chain*

configuration based on supply chain operations reference (SCOR) model", (journal) Computers & Industrial Engineering, Vol .48, pp. 377-394, 2005.

[20] Beamon, B.M., & Balcik, B., 2008. *"Performance measurement in humanitarian relief chains"*. International Journal of Public Sector Management 21 (1), 4–25, 2008.

[21] Otto, A., & Kotzab, H., *"Does supply chain management really pay? Six perspective to measure the performance of managing a supply chain"*. European Journal of Operational research 144 (2), 306-320, 2002.

[22] Gunasekaran, A., Patel, C., and Tirtiroglu, E., *"Performance measurement and metrics in a supply chain environment"*. International Journal of Operations & Production Management 21(1/2), 71-87, 2001.

[23] Chan, F.T.S., Qi, H.J., Chan, H.K., Lau, H.C.W. and IP, R.W.L., *"A conceptual model of performance measurement for supply chains"*, Management Decision, Vol.45, No.7, pp. 635- 642, 2003.

[24] Yeh, D.Y., Cheng, C.H. and Chi, M.L., *"A modified two-tuple FLC model for evaluating the performance of SCM: By the Six Sigma DMAIC process, Applied Soft Computing"*, (JOURNAL), Vol. 7, pp. 1027-1034, 2007.

[25] Kurien, G.P & Qureshi, M.N, "*Study of Performance Practices to Supply Chain Management and Social Sciences"*, International Journal of Business management, Vol. 2, No. 4, p. 19-24, 2011.

[26] Robb, D.J., Xie, B. and Arthanari, T, "supply chain and operations practice and performance in Chinese furniture manufacturing", International Journal of Production Economics, Vol.112, pp .683-699, 2008.

[27] Tan, K.C., Lyman, S.B. and Wisner, J.D.*"Supply chain management: a strategic perspective"*, International Journal of Operations & Production Management, Vol. 22 No. 6, pp.614-631, 2002.

[28] Hafeez, K., Zhang, Y., and Malak, N., "*Determining key capabilities of a firm using analytic hierarchy process"*. International Journal of Production Economics 76 ,39– 51, 2001.

[29] Saleheen, F., Habib, M., & Z. Hanafi, *"Supply Chain Performance Measurement Model: A Literature Review:"* International Journal on Supply Chain Management, August, ISSN 2050-7399 (Online), 2051-3771 (Print), 2018.

[30] Saleheen, F., Habib, Mamun., Pathik, BB., and Hanafi., Zarina., "Demand and Supply Planning in Retail Operations", International Journal of Business and Economics Research. Special Issue: Supply Chain Management: Its Theory and Applications (Scopus), vol. 3, no. 6-1, 2014, pp. 51-56, 2014.

[31] Saleheen, F., Miraz, M.H., Habib, Mamun., and Hanafi, Zurina., "*Challenges of Warehouse Operations: A Case Study in Retail Supermarket"*, International Journal of Supply Chain Management (IJSCM) (Scopus), vol.3, no.4, pp 63-67, 2014.

[32] Saleheen, F., Miraz, M.H., Habib, Mamun., and Hanafi, Zurina., "Performance measurement framework of supply chain management: A multi criteria decision analysis (MCDA), AHP approach": International Conference on Business and Management (ICBM), ISBN-978-984-34-2360-3-Online-Version in Dhaka, Bangladesh, 21-22 September, 2017.

[33] Rajat, K. Baisya., "*Selection of Supply Chain Performance Measurement System Using AHP Approach"*: POMS 18th Annual Conference, Dallas, Texas, U.S.A, 4-7 May, 2007.