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**Review Article**

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# A Systematic Review on the Approach of the Supply Chain Management

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**Abstract** The movement and storage of raw materials, work-in-process inventory, and finished commodities from point of origin to site of consumption are all part of supply chain management. In supply chain management, interconnected networks, nodes, and channels businesses combine in the provision of products and services required by end customers. "Design, planning, execution, monitoring, and regulating of supply chain activities with the goal of creating value, leveraging global logistics, constructing a competitive infrastructure, adjusting supply to demand, and measuring performance" is how supply chain management is defined.

**Keywords** Supply, Chain, Management, Demand, Performance

## 1. Introduction

In today's competitive environment, assessing a supply chain is critical for every industry. Through upstream and downstream linkages, the supply chain is a network of firms involved in various processes and complex activities such as planning, design, distribution, selling, support, usage, and recycling of the product to produce value in the form of products and services delivered to ultimate customers. Plan, sourcing, production, and delivery have all been key concerns for all stages involved, directly or indirectly, in satisfying a customer service and satisfaction request. However, as time goes on, the supply chain and variable supply conditions cause inconsistent performance and matrices to be delivered.

"Supply chain management," according to Christopher (1998), "is the management of upstream and downstream connections with suppliers and customers in order to provide higher customer value at a lower cost to the supply chain as a whole." Supply Chain Management, according to Johnston (1995), is the process of strategically managing the movement and storage of materials, parts, and finished goods from suppliers to customers through the firm. The administration of the flow of goods, services, information, and money between these interconnected and interdependent organisations is known as supply chain management. To increase supply chain performance, interdependencies must be coordinated. A performance measuring system is a collection of indicators that are used to assess the efficiency and effectiveness of actions.

This has compelled supply chain management gurus to include performance assessment and variable supply conditions while designing and developing efficient supply chains and maximising total supply chain profitability. To achieve this goal, supply chain management experts have developed various approaches and models to deal with setting targets to maximise total supply chain profitability and productivity at an early stage, resulting in improved supply chain profitability and overall customer service and satisfaction through consistent performance measurement and matrices. Understanding and modelling a system's performance measurement process can aid in capturing its true value under particular supply conditions. According to the literature review, existing balance models, quality models, questionnaire-based models, hierarchical models, support models Supply Chain Operations Reference (SCOR), and model models for integration in Supply Chain Performance

Measurement System (SCPMS) are powerful tools for design performance measurement under the set of metrics used to quantify both the efficiency and effectiveness of actions, productivity issues in Norwegian manufacturing in the year 2000. According to Christopher, the goal of SCOR is to establish a standard way to monitor supply chain performance and to utilise common metrics to benchmark against other enterprises (1998). However, due to the evaluation of supply chain efficiency and profitability over the usage duration and its effects on supply chain performance, they rarely consider performance measurement.

## 2. Research Motivation

In supply chain performance measurement, a successful organisation knows that the supply chain connects the plan, source, production (service), delivery, and customer service and satisfaction. When a successful strategy is implemented correctly, it will result in a long-term competitive advantage. However, if you look at how an organization's strategy is developed, you'll notice that it's all about choice. In this sense, making the best selections, selecting the best options, and optimizing your choices on a regular basis as the organisational environment evolves is what choice entails.

## 3. Background Information

Cengiz Kahraman, et.al. presented multi-criteria supplier selection using fuzzy AHP. Supplier selection for the Dickson Company was evaluated. The Analytic hierarchy process was used for the supplier selection in the Dickson Company which was established in Turkey, Europe. The supplier, product performance, service performance and cost were considered as the selection criteria of the supplier for the Dickson Company. The final weight of the subcategories was calculated and alternative priority weight for the weight alternatives EXB, DXR, FMX were found 0.21, 0.10 and 0.69. The FMX found as the best alternative/supplier for the Dickson Company cause having the greater weight priority than others.

Ihsan Yuksel, et.al. 2007 discussed use of analytic network process in a SWOT analysis. The research was done for the SWOT analysis in a textile manufacturing firm established in Istanbul, Turkey. Author focused on the both analytic network approach and analytic hierarchy approach for the SWOT analysis of the textile manufacturing firm. The ANP approach was used because of the dependencies on the sub-factors. The weight of the alternatives/strategies Strength-opportunities (SO), weakness- opportunities (WO), Strength-threats (ST) and Weakness-threats (WT) were found 0.366, 0.276, 0.271, 0.086. With the help of ANP analysis the SO found as the best strategy with an overall priority value 0.366.

Wan Lung Ng, et.al. 2007 presented an efficient and simple model for multiple criteria supplier selection problem. The DEA approach was used for the supplier selection according to the priority not the weight. Supply variety, quality, distance, delivery and price were considered as the criteria for the supplier selection for the firm manufacturing agricultural and construction equipment. The ranking of the 18 suppliers were calculated by the DEA approach. The score of the supplier 8 was found 0.72 and the normalized transformed measures of the criteria variety, quality, reciprocal of distance, delivery and reciprocal of price were 0.44, 1.00, 0.13, 0.85 and 0.00 respectively. According to the results, supplier 8 is found as the optimal solution if the supplier could increase the supply variation by 1 or shorter the distance by 620 miles.

Farzad Tahiri, et.al. used AHP approach for supplier evaluation and selection in a steel manufacturing company. An AHP based supplier selection model was formulated and then applied to a real case study for a steel manufacturing company in Malaysia. Product development capability, manufacturing capability, quality capability, cost and delivery were selected as the criteria for the supplier selection. The total score of the suppliers A, B, C and D with respect to the criteria were found 0.2726, 0.1920, 0.3950 and 0.1397 respectively. According to the score supplier C was found as the best supplier.

Mohammad Marufuzzaman, et.al. presented a methodology supplier selection and evaluation method using analytical hierarchy process. By using AHP the weighted values of each sub-index were computed to measure the relative weight put the manufacturer against each sub-index. General information, organizational profile, financial status, manufacturing capability, quality system, service facilities and supplier name were considered as the key indexes which were used to find out the desired output. The overall score of the supplier A, supplier

B and supplier C was found 0.341, 0.316 and 0.339 respectively. According to the score the supplier A was selected as the best supplier.

Martina Hudymacova, et.al. proposed an approach for supplier selection based on multi-criteria AHP method. First-level criteria were compared between each other depending on importance given by ES Company. A pair-wise reciprocal matrix was created and weights of criteria were calculated. Quality, cost, delivery, equipment, flexibility, documentation and cooperation were taken as the process parameters. Weight of suppliers for proving S.R.O., Locker S.R.O., NOBtecGmbh were found 0.4285, 0.3369, 0.2346 respectively. The AHP was used for supplier selection. The rank of suppliers according to performance/price for proving S.R.O, Locker S.R.O., NOBtec GmbH 1 were found 1.0426, 1.0249, 0.9012. From the viewpoint performance/price, the best supplier company was found Proving S.R.O.

Mehmet Sevkli, et.al. discussed an application of fuzzy TOPSIS method for supplier selection. The research was done in a manufacturing firm, Akkardan for the supplier selection. The company was the leading supplier of the propeller shafts and steering columns in Turkey. Delivery performance, quality performance, price/cost and financial strength were considered as the selection criteria for the supplier selection. The crispy TOPSIS and Fuzzy TOPSIS were used to find the best supplier. The score for the supplier A, B and C by the Crisp TOPSIS and fuzzy TOPSIS were found 0.592, 0.340 & 0.564 and 0.569, 0.332 & 0.584 respectively. Using the crisp TOPSIS approach the supplier A was found as the best supplier and when fuzzy TOPSIS approach was employed, supplier C was identified as the most suitable supplier.

Adnan Aktepe, et.al. used fuzzy analytic hierarchy process model for supplier selection and a case study. A fuzzy AHP model was designed for supplier selection in supply chain management. The goal and objectives were clearly stated. Problem had to be decomposed into a hierarchical structure. Relative weight was compared of each element and found WCost= 0.406, Wreputation= 0.156, Wdelivery= 0.378, Wquality=0.060. Supplier selection was done by calculating the final weight of supplier WA= 0.645, WB=0.355. Alternative A was determined as the best supplier which had highest priority according to final weights.

Ozcan Kilincci, et.al. used fuzzy AHP approach for supplier selection in a washing machine company. The total cost of working with each supplier was calculated and the cheapest one was selected. The research was done on a washing machine company established in Turkey, Europe. Supplier, product performance, service performance, cost were considered as the selection criteria for the supplier selection. The author aimed to select the best supplier from three by the Fuzzy Analytic hierarchy process. The weight of the supplier matrices were calculated with respect to the supplier and the one supplier was selected having greatest weight than others. The alternative priority weight for the Supplier A, supplier B and supplier C were found 0.48, 0.39, 0.13 respectively. According to final score, Supplier A was found as the most preferred supplier because it had highest priority weight.

Parthiban Palanisamy, et.al. presented a model for supplier selection using analytic network process in order to find the best supplier in automotive components manufacturing industry. An expert team was formed which consists of Deputy General Manager-works, Manager-Materials and Senior-Quality assurance was formed and brain storming discussion was conducted. Selection was made on the basis of the criteria. The pair wise matrices were made by taking opinion of the team. Calculations were performed by super decision software. Benefits, opportunities, cost and risk were the process parameters in the ANP-BOCR method. Ranks of the alternatives are obtained and suppliers were selected. The ranking of the suppliersV1,V2,V3,V4 were found 1, 0.3376, 0.1432, 0.0991 respectively. By ANP-BOCR method, Supplier V1 was found as the best supplier on the basis of the benefits merit followed by V2, V3 and V4.

David Asamoah, et.al. used AHP approach for supplier evaluation and selection in a pharmaceutical manufacturing firm in Ghana. The AHP approach was used to carry out an analysis of strategic supplier selection and evaluation in a generic pharmaceutical firm supply chain. The researcher developed a model to aid them in the evaluation and selection of the important criteria and hence the best supplier for a pharmaceutical manufacturing firm. The selection criteria for the evaluation were regulatory compliance, quality, cost, supplier profile and risk. The overall API‟s supplier score for the supplier Clonoose, Indukern and S&D were found 0.1234, 0.3876 and 0.4891 respectively. Based on the overall scores for API suppliers, S&D was found as the

overall best supplier of the API‟s for Ernest Chemists Limited having the highest overall ranking with a score of 0.4891.

Ehsan Eshtehardian, et.al. proposed an approach for using ANP and AHP for the supplier selection in the construction and civil engineering companies. The research was done on an Iranian Construction company. Accordance with order, same quality, possibility of rapid delivery, on time delivery and low number of defective parts were considered as the criteria for the supplier selection. The score of the supplier A, supplier B and supplier C for the given criteria were found 1, 0.44 and 0.19 respectively. According to the weight of the alternatives supplier A was found as the best supplier.

Tamal Ghosh, et.al. presented an effective AHP based meta-heuristic approach to solve supplier selection problem. The research was done on an eminent construction firm operating in Kolkata, India. There was to found the best supplier out of 6 suppliers. Cost, quality and delivery were considered as the selection criteria for the supplier selection from the 6 suppliers. The composite score of the each supplier by the AHP approach was found 0.2733, 0.1319, 0.1026, 0.4099, 0.0496 and 0.0315 respectively. Supplier 4 was found as the appropriate supplier.

Lixin Shen, et.al. used fuzzy multi criteria approach for evaluating green supplier‟s performance in green supply chain with linguistic preferences in an automobile company. Fuzzy approach was used to select the optimal supplier fulfilling the green or environmental condition. Pollution production, resource consumption, Eco-design, green image, environmental management system, commitment of GSCM from managers, use of environment friendly technology, use of environmental materials, staff environmental training were considered as the criteria. The environmental and industrial experts were asked to give score these criteria in linguistic preference according to their importance for green supplier evaluation in seven linguistic terms. In the sensitivity analysis term, suppliers A1, A2, A3 got the CC score 0.401, 0.423, and 0.440 respectively. According to the score supplier A3 was found as the best suitable supplier for the company.

Asilata M. Damle, et.al. presented an approach for selection of best supplier in furniture manufacturing company by using analytic hierarchy process. The purchasing managers needed to periodically evaluate the performance of the suppliers in order to retain those who meet their requirements. The supplier selection was done from the supplier Dongwa, Robin and Finsa from the countries Vietnam, Malaysia and Europe. Technical parameters, credit terms, shipping time were taken as the criteria for the supplier selection. The weight/score were calculated for each supplier according to the criteria. The score of supplier Dongwa, Robin and Finsa were found 0.3060, 0.2720 and 0.0940 respectively. According to the score, supplier Dongwa was found as the best supplier.

## 4. Methodology Adopted in Literature

AHP is a method for organising and analysing complex decisions that is structured. It was created in the 1970s by Thomas L. Saaty and has been widely explored and enhanced since then. It is based on mathematics and psychology. It's especially useful for group decision-making, and it's employed in a wide range of decision-making scenarios around the world, including government, business, industry, healthcare, and education. Rather than prescribing a "right" answer, the AHP assists decision-makers in identifying the option that best fits their aim and understanding of the problem.

T. Saaty (1977, 1980, 1988, and 1995) established the Analytic Hierarchy Process (AHP), which is one of the most well-known and commonly used MCA techniques. It allows users to intuitively weigh the relative importance of many criteria or numerous options against a set of criteria. In the absence of quantitative assessments, policymakers and assessors can nevertheless choose which criterion is more significant than the others. As a result, users prefer pair-wise comparisons. The AHP turns these judgments into numerical values that may be analysed and compared across the problem's whole spectrum. This feature sets the AHP apart from other decision-making methods. For each of the choice alternatives, numerical priority are computed in the final phase of the procedure. These figures show the alternatives' relative capacity to meet the decision goal, allowing for a quick comparison of the various options. Several companies offer computer tools to help in the procedure.

Thousands of complex choice situations have been studied, yielding comprehensive results in problems requiring planning, resource allocation, priority setting, and alternative selection. Forecasting, overall quality management, business process re-engineering, quality function deployment, and the balanced scorecard have all been mentioned. Saaty introduced the Analytic Hierarchy Process (AHP), which is a multi-criteria decision-making approach (1977 and 1994). The AHP has piqued the interest of many academics, owing to the method's appealing mathematical features and the ease with which the essential input data may be obtained. The AHP is a decision-making aid that can be used to solve difficult decisions. It employs a hierarchical multi-level structure of objectives, criteria, sub-criteria, and alternatives. A collection of pairwise comparisons is used to extract the relevant data. These comparisons are used to determine the relative performance measures of the alternatives in terms of each individual choice criterion, as well as the weights of relevance of the decision criteria. It provides a performance for enhancing consistency if the comparisons are not fully consistent.

The truth values of variables in fuzzy logic can be any real integer between 0 and 1, making it a type of many-valued logic. It's used to deal with the concept of partial truth, where the truth value can be somewhere between true and false. The truth values of variables in Boolean logic can only be the integer numbers 0 or 1. These degrees may be handled by certain language factors when they are used.

**5. Key Conclusion**

- The combination of AHP and Fuzzy gives more accurate performance analysis rather than single Analytic Hierarchy Process (AHP) or Analytic network process. (Ehsan Eshtehardian, 2012)
- The strength of analytic hierarchy process is “it can be used where there is no relation between the criteria/parameters and it breaks the problem in some sub- categories that make the performance analysis easy. (Alptekin Ultuas, 2015)
- The Analytic Network Process (ANP) can calculate or give priority to performance criteria when there is interrelation between criteria. (Parthiban, 2011)
- Fuzzy approach gives the weight to the performance with the help of the linguistic variables that is more easier than the numeric calculation.
- More numbers of survey give the exact value of the supply chain performance index. (David Asamoah, 2012)
- AHP method is based on breakdown of a complex situation into simple components, where hierarchical system of the problem and pair-wise comparisons are made in order to ensure the quantification of qualitative judgments. (Lixin Shen, 2013)
- As for the integrated approaches, integrated AHP approaches are fairly popular for their simplicity and ease of use. (Asilata M. Damle, 2014)
- There is no any performance measurement or supplier selection with the help of combination of the Analytic Hierarchy Process (AHP) and Analytic Network Process (ANP). (Ehsan Eshtehardian, 2012)
- Hierarchies in AHP do not represent relationship among the levels, this shortcoming is removed in research papers having analytic network process as the solution approach. (Tamal Ghosh,2012)
- In AHP importance of criteria determines the importance of the alternatives but does not represent importance of alternatives may have impact on importance of the criteria. Therefore linear structure of top to bottom is not applicable for a complex system. (Nisha Bhatt, 2015)
- The researchers have generally collected the data from the specific persons of particular company. The solution could be more accurate if the data could be collected from more related industries.
- Green performance factors need to be considered in performance criteria as much as possible.
- The performance could be measured using analytic hierarchy process and fuzzy mathematical approach with the 100 and above numbers of performance measurement questionnaire to get the more accurate performance analysis.
- Most of the proposed models focused on manufacturing environments and a few papers have been allocated for service industries.

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