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A Study of Factors Affecting Indian Automotive Supply Chain

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Abstract

Supply chain management is the oversight of materials, information, and finances as they move in a process from supplier to manufacturer to wholesaler to retailer to customer or it is linked two or more parties by a flow of goods, information and funds. In this study we have taken five competitive factors affecting Indian automotive supply chain and the objective is to know which the important factors are. This study is based on experts' opinion of Indian automotive supply chain and academicians/researchers from related areas. In this paper, analytic hierarchy process (AHP) has been used to decide how buyers of automotive industries give importance to competitive factors to purchase automotive products. It has been found from the AHP multi criteria decision making techniques that the flexibility factor for automotive industries in India is more significant than other competitive factors for trading between buyers and suppliers. Although, quality is also the leading factor of automotive supply chain and innovation of the product is not a key factor. To find out the most important factor affecting supply chain, by taking sample size of 226 from Indian automobile industry and using ANOVA, quality factor has been found as the most important factor. However, innovation factor has received least importance using AHP and ANOVA. It is not only important for buyers but also important for suppliers to know which factors make better supply chain for their customers. The important factors provide an insight for supply chain managers or manufacturers to make the whole supply chain highly superior for automotive industries. They could also control these results to communicate with their customers in more efficient way. Finally, suppliers should concentrate on gathering information from customers to know which competitive factors are more important for them as well as for buyers in supply chain process.

Keywords: *AHP, ANOVA, Automotive, Competitive strategy, India, Performance measurement; Supply chain.*

Introduction

Supply chain management (SCM) is a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses and stores, so that merchandise is produced and distributed at the right quantities, to the right locations and at the right time, in order to minimize system-wide costs while satisfying service level requirements (Simchi Levi *et al.*, 2004). It is linked two or more parties by a flow of goods, information and funds or in other words SCM is the oversight of materials, information, and finances as they move in a process from supplier to manufacturer to wholesaler to retailer to customer. Supply chain also consists of all parties involved, directly

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or indirectly, in fulfilling a customer request. Supply chain includes not only the manufacturer and suppliers, but also transporters, warehouses, retailers, and even customers themselves (Chopra and Meindl, 2001). Supply chain management involves organizing and combining these flows both within and among companies. It is said that the ultimate goal of any effective supply chain management system is to reduce inventory. Ferguson (2000) attributed a range of benefits to supply chain management, including reduced costs, increased market share and sales, and solid customer relations. Moreover, it has been argued that measuring supply chain performance can facilitate a greater understanding of the supply chain, positively influence actors' behaviour, and improve its overall performance (Chen and Paulraj, 2004). Because, supply chain management flows can be divided into three main flows (i) the product flow (ii) the information flow (iii) the finances flow.

Based on mathematics and human psychology, it was developed by Thomas L. Saaty (Rangone, 1996) and has been extensively studied and refined since then. The analytic hierarchy process (AHP) is a structured technique for helping people deal with organizing and analyzing complex decisions. Rather than prescribing a correct decision, the AHP helps people to determine one. The AHP provides a comprehensive and rational framework for structuring a problem, for representing and quantifying its elements, for relating those elements to overall goals, and for evaluating alternative solutions. This research uses analytic hierarchy process (AHP) methodology as the theoretical foundation to support the proposed process of evaluation (Saaty, 1980). The required quantitative and qualitative criteria were analyzed and identified. Then the experts' opinions were sought as the tool to determine the progressing priorities for the all criteria, and

AHP to calculate the weights.

Methodology

2.1 Analytic Hierarchy Process (AHP) Methodology

Analytic Hierarchy Process is a multi-criteria decision making (MCDM) technique was developed by Saaty in 2000 year. Even, AHP is used to solve complex decision-making problems in different areas by choosing the best policy after finding a set of alternatives and setting priorities (Chang *et al*., 2007; Wu *et al*., 2007). As a decision method that decomposes a complex multi-criteria decision problem into a hierarchy (Saaty, 1980), AHP is also a measurement theory that priorities the hierarchy and consistency of judgmental data provided by a group of decision makers. AHP incorporates the evaluations of all decision makers into a final decision, without having to elicit their utility functions on subjective and objective criteria, by pair-wise comparisons of the alternatives (Saaty, 1990). Wu *et al.* (2007) applied AHP to determine the location of a hospital in a local region.

2.1.1 Establish the Hierarchy Structure

It can be decomposed the hierarchy structure dealing with a complex issue. AHP helps decision makers find one that best suits their goal and their understanding of the problem. It is very difficult to compare more than seven kinds of things at the same time, so we must assume each element of the hierarchy not suitable exceeds seven elements. Under this limited condition, AHP may carry on the reasonable comparison and ensure consistency (Saaty, 1980). The first hierarchy of the structure is the goal which will be achieved. Choices of projects or replacement alternatives are the end of the hierarchy. In the each middle of the hierarchy are the evaluation factors or criteria. But this paper does not include alternatives at the end of hierarchy. There are only two-steps in hierarchy process, first is the goal and the last one is evaluation factors or criteria.

2.1.2 Various Hierarchies' Elements Weight Computation

There are followings hierarchies' elements weight computations.

2.1.2.1 Establishment of Pair-Wise Comparison Matrix (A): Based on an element of the upper hierarchy is an evaluating standard, going on the pair-wise comparison to each element. If has the n elements must make $n(n-1)/2$ elements of the pair-wise comparison. Let $C_1, C_2, ..., C_n$ denote the set of elements, while a_{ij} represents a quantified judgment on a pair of elements C_i, C_j. The relative importance of two elements is rated using a scale with the values 1, 3, 5, 7, and 9, where 1 = Equally Preferred, 3 = Moderately Preferred, 5 = Strongly Preferred, 7 = Extremely Preferred, 9 = Absolutely Preferred; 2, 4, 6, and 8 indicate intermediate value for compromise and reciprocals for inverse judgments and even using decimals to compare homogeneous elements whose comparison falls within one unit. This yields an $n \times n$ matrix A as follows:

$$A = [a_{ij}] = \begin{array}{c} \\ C_1 \\ C_2 \\ \vdots \\ C_n \end{array} \begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \cdots & C_n \end{array} \\ \begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ 1/a_{12} & 1 & \cdots & a_{2n} \\ \vdots & \vdots & & \vdots \\ 1/a_{1n} & 1/a_{2n} & \cdots & 1 \end{bmatrix} \end{array} \quad (1)$$

Where $a_{ij} = 1$ and $a_{ij} = 1/a_{ji} = 1, 2, ...n$. In matrix A, the problem becomes one of assigning to the n elements $C_1, C_2, ... C_n$ a set of numerical weights $W_1, W_2, ... W_n$ that reflects the recorded judgments. If A is a consistency matrix, the relations between weights W_i and judgments a_{ij} are simply given by $W_i / W_j = a_{ij}$ (for $i, j = 1, 2, ...n$) and matrix A as follows:

$$A = [a_{ij}] = \begin{array}{c} \\ C_1 \\ C_2 \\ \vdots \\ C_n \end{array} \begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \cdots & C_n \end{array} \\ \begin{bmatrix} w_1/w_1 & w_1/w_2 & \cdots & w_1/w_n \\ w_2/w_1 & w_2/w_2 & \cdots & w_2/w_1 \\ \vdots & \vdots & & \vdots \\ w_n/w_1 & w_n/w_2 & \cdots & w_n/w_n \end{bmatrix} \end{array} \quad (2)$$

2.1.2.2 Eigen Value and Eigen Vector Calculation: Matrix A multiply the elements weight vector (x) equal to nx, that is $(A - nI)x = 0$, the **x** is the Eigen value (n) of Eigen vector. Owing to a_{ij} be makers' subjective judgment give comparison and appraisal, with the truly value have the some level degree difference, so that $Ax = nx$ can not to be set up. Saaty (1990) suggested that the largest Eigen value λ_{max} be:

$$\lambda_{max} = \sum_{j=1}^{n} a_{ij} \frac{W_j}{W_i} \quad (3)$$

If A is a consistency matrix, Eigen vector X can be calculated by:

$$(A - \lambda_{max} I)X = 0 \quad (4)$$

2.1.2.3 Consistency Test: The essential idea of the AHP is that a matrix A of rank n is only consistent if it has one positive Eigen value $n = \lambda_{max}$ while all other Eigen values are zero. Further, Saaty (1990) proposed consistency index (CI) and consistency ratio (CR) to verify the consistency of the comparison matrix:

$$CI = \frac{\lambda \max - n}{n - 1} \tag{5}$$

$$CR = \frac{CI}{RI} \tag{6}$$

The consistency ratio (CR) is introduced to aid the decision on revising the matrix or not. Random index (RI) represents the average consistency index (CI) over numerous random entries of same order reciprocal matrices. In other words, CR is the ratio of the CI to the so-called random index (RI) which is a CI of randomly generated matrices. If CR d" 0.1, the estimate is accepted otherwise a new comparison matrix is solicited until CR d" 0.1. For n = 3, the required consistency ratio (CR^{goal}) should be less than 0.05, for n = 4 it should be less than 0.08 and for n e" 5 it should be less than 0.10 to get a sufficient consistent matrix. Random index values were already given by Saaty where (for n=1; RI=0), (n=2; RI=0) (n=3; RI=.52) (n=4; RI=.89) (n=5; RI=1.11) (n=6; RI=1.25) (n=7; RI=1.35) (n=8; RI=1.4).

2.1.3 Overall Hierarchy Weight Computation

After weight computation for the various hierarchies and elements, then compiles the overall hierarchy weight computation, and finally to decide our goal of the most suitable plan.

2.2 Analysis of Variance (ANOVA) Methodology

A one-way analysis of variance (ANOVA) tests the hypothesis that the means of several populations are equal. The method is an extension of the two-sample t-test, specifically for the case where the population variances are assumed to be equal. The most important statistics in the analysis of variance table are the P-value, S, R^2 and R^2(adj) values. Collectively, these values tell if the level means are significantly different from each other and how well the model fits the data. If P is less than or equal to the level whatever is selected, one or more means are significantly different. If P is larger than the level whatever is selected, the means are not significantly different. If the ANOVA results indicate that there are significant differences, we can look at the individual statistics and confidence intervals to find out more about the differences. For this methodology, the sample size is 226 and the responses were collected from the different clusters of the automotive hub. Responses were collected from the managerial levels of the companies from the different departments. From this method we tried to explain that how much difference in results or which method is giving better result to select competitive factors for automotive industries. Simply, we applied ANOVA and the mean of all five factors were taken.

S, R^2 and R^2(adj) are usually used to measure how well the model fits the data. These values can help to select the model with the best fit. S is measured in the units of the response variable and represents the standard distance data values fall from the fitted values. For a given study, the better the model predicts the response, the lower S is. R^2 describes the amount of variation in the observed response values that is explained by the predictor(s). R^2 always increases with additional predictors. For example, the best five-predictor model will always have a higher R^2 than the best four-predictor model. Therefore, R^2 is most useful when comparing models of the same size. Adjusted R^2 is a modified R^2 that has been adjusted for the number of terms in the model. If there is included any unnecessary terms, R^2 can be artificially high. Unlike R^2, adjusted R^2 may get smaller when added any term to the model. Thus, adjusted R^2

is used to compare models with different numbers of predictors. Here, the sample size was 226 from the different sectors of automotive industries in India. Samples were taken from the managerial levels of the automotive industries' expert.

Analyses of Supply Chain Performance Measurement of Automotive Industries

3.1 Evaluation Process using AHP

Supply chain performance of automotive industries is being measured by 5 categories in the proposed evaluation model as shown in Figure 1.

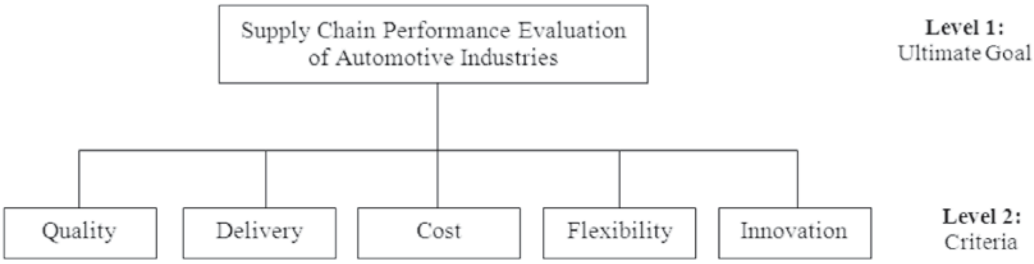

Figure 1: Hierarchical Structure to Evaluate the Supply Chain Performance Evaluation of Automotive Industries

3.1.1 Define the Evaluative Criteria to Select the Supply Chain Performance Evaluation of Automotive Industries

The modified Delphi method has been applied to define evaluation criteria through literature review and then summarized by opinion of experts belonging to automotive industries and academia. It has been recommended that the modified Delphi method must summarize expert opinions on a range from 10 to 30 (Murry and Hammons, 1995). To summarize these criteria; 16 experts (eight industries and eight academia) were included. How these factors affect the performance of supply chain is shown in Figure 2.

Various researchers (Skinner, 1969; Hill, 1987; Gerwin, 1993; De Toni and Tonchia, 1998) elaborated on customer expectations on attributes such as quality, delivery, cost, flexibility and innovation, which are popularly termed as competitive priorities or manufacturing performance goals. Dangayach and Deshmukh (2001) defined these competitive priorities –

Factors/(Criteria)	Adapted Factors by Author (s)
Quality (C_1)	(Dangayach and Deshmukh, 2001)
Delivery (C_2)	(Dangayach and Deshmukh, 2001), (Slack, 2005)
Cost (C_3)	(Dangayach and Deshmukh, 2001), (Kekre *et at.*, 1995), (Hahn *et al.*, 1986), (Trevelen, 1987)
Flexibility (C_4)	(Dangayach and Deshmukh, 2001), (Slack, 2005), (Sanchez and Perez, 2005), (Vickery *et al.*, 1999)
Innovation (C_5)	(Dangayach and Deshmukh, 2001)

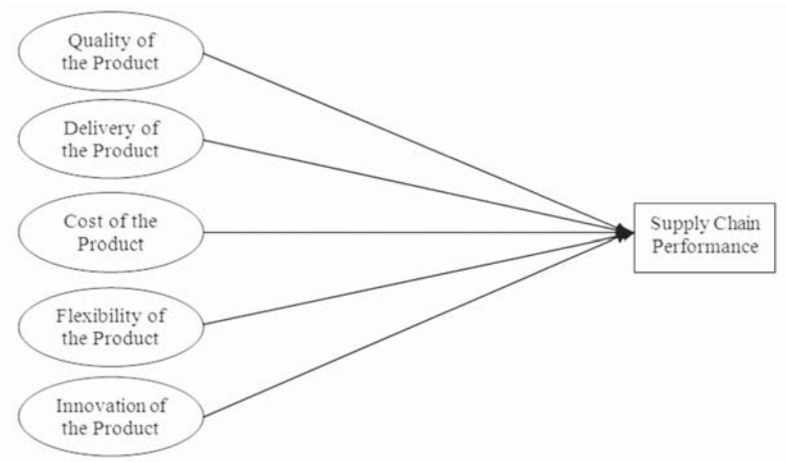

Figure 2: Supply Chain Performance Model

Indian industry is facing tough competition both from imports and multinational companies in the domestic markets. Thus, the new competition is in terms of reduced cost; improved quality, products with higher performance, a wider range of products and better services, and all delivered simultaneously (Dangayach and Deshmukh, 2001). The important thing is that quality should be in process control if it is under control then inspection is not essential. Indian companies are based in the quality stage that was reported a survey of manufacturing companies (Chandra and Sastry, 1998). However, quality is most competitive priority factor for Indian companies. According to Chikan and Demeter (1995) described that Hungarian companies are now pursuing quality as top most competitive priority after transition from planned economy to market economy. Quality is defined entirely by the customer or end user; also it is based upon that person's evaluation of their entire customer experience. It focuses on the important factors to make more efficient for buyers as well as suppliers.

Delivery is also a very important factor for manufacturing industries and it can be an important competitive weapon in some contexts. Few companies are totally based on delivery performance such as UPS and Federal Express in other words firms base their primary competitive position on delivery speed. On the other side, Delivery reliability is also a very essential point to deliver products or services whatever supplier promised. Delivery should be on time with full of reliability and quickly to customers because manufacturers are measured on several dimensions that they can deliver on time or not. Rohr and Correa (1998) notified that competitive priorities for Brazilian companies are cost, delivery and flexibility. Furthermore, Indian companies perceive that survival of manufacturing is critically dependent on quality of design and time of delivery (Dangayach and Deshmukh, 2001).

Manufacturers and researchers argued that dealing with a limited number of suppliers leads to better quality and lowering of product cost (Kekre *et al.*, 1995). Sheridan (1988) revealed that automobile companies such as General Motors and Ford have stated that they have obtained improvements in quality and costs after adopting single sourcing. There are some competitive priorities of the factors for manufacturing companies these are quality, delivery, cost, flexibility, and innovation (Hayes and Wheelwright, 1984; Hill, 1987; Gerwin, 1993). Further these were expanded into volume changes and low cost, delivery speed and into other competitive factors (Dangayach and Deshmukh, 2001). Importance of SC is convincing companies to tie their competitive existence to supply chain management (Zuckerman, 2002). The accuracy comes from buyer-supplier's integration and this will reduce total costs in SC and will satisfy customers' demand (Simchi and Kaminsky, 2000). The integrating supply chain activities involves supporting sourcing decisions achieves any manufacturing goals in terms of reliability, flexibility, cost and quality (Mohaghar and Ghasemi, 2011). Finally, It is more important that the customer must not only be satisfied with a product when bought, but must have confidence that the firm will stand behind its guarantees by supplying efficient and cost-effective service after a sale is made.

Flexibility has different meanings for different managers and several perfectly legitimate alternative paths exist towards flexible manufacturing (Slack, 2005). Flexibility means offering a wide range of products and being able to adjust to unexpected changes in the demand of the product mix offered. As, many companies are facing a highly volatile and uncertain environment like unpredictable changes in demand basically in volume. Flexibility as a management objective, Slack (1983) concluded that there was no single measure of flexibility due to its multidimensional definitions and applications. Ramasesh and Jayakumar (1991) also attempted to quantify flexibility empirically basis. Broad reviews of manufacturing flexibility can be found in Sethi and Sethi (1990) and Hyun and Ahn (1992) in which they discovered that most of the literature focussed only on the classification of flexibility (Lau, 1999). If the production is in small lots and if buyers' requirement is high then manufacturers should be able to improve their volume flexibility to customers demand.

Innovation is the creation of better or more effective products, processes, ideas, or technologies that are accepted by markets and society etc. Abernathy and Wayne (1974) make the dispute that when manufacturing strategy is based on cost reduction, innovation is stifled. The return on innovations will be lost if new products are dumped after development. When any product is produced and sold properly then the return can come for any research and development sector. Moreover, manufacturing naturally leads to innovation.

3.1.2 Establish a Hierarchical Framework

A common consensus among experts of industries and academicians can be reached to set up a hierarchical structure that was based on Delphi method. Finally, the supply chain performance evaluation of automotive industries can be selected based on five evaluation criteria (Figure 1).

3.1.3 Establishment each Factors of the Pair-Wise Comparison Matrix

The pair-wise comparisons are made for each criterion by taking into consideration the goal to be achieved. In this paper, the purposive sampling study (also known as judgmental, selective or subjective sampling) has been applied to sixteen experts representing managerial level from automotive industries and academician. Purposive sampling has also been applied in previous research by taking ten and twelve respondents from various companies and academician. (Wu *et al*., 2008a; Wu *et al*., 2008b). Pair-wise inter-criteria comparisons were made to find out their relative importance on the basis of a 1-9 scale. This scale is applicable to criteria that may be defined both numerically as well as non-numerically. For this reason, a questionnaire was developed to find out the expert's opinion in the form of pair-wise comparisons. Using the developed questionnaire, each expert specified her/his judgments on the relative importance of each criterion towards achieving the overall goal. The relative weights of each of these criterion (at level 2) was determined using the relative importance score given by the experts during pair-wise comparison for the entire group of sixteen experts who participated in this exercise. The relative scores provided by the sixteen experts have been aggregated using geometric mean method. The pair-wise comparison matrix of respondent 1 for all criteria and corresponding scores for various performance measurements are presented in Table 1. Similarly, we can apply this process for remaining respondents.

Table 1: Pair-wise Comparison Matrix of Respondent 1 for all Criteria

Gaol	C_1	C_2	C_3	C_4	C_5
C_1	1	3	1	1/3	9
C_2	1/3	1	1/3	1/5	6
C_3	1	3	1	1/4	7
C_4	3	5	4	1	8
C_5	1/9	1/6	1/7	1/8	1

3.1.4 Determine the Eigen Value and Eigen Vector

After determining the comparison matrix (as shown in Table 1) has been used to calculate the Eigen values and Eigen vectors. Further, Table 2 summarizes the results of Eigen values and Eigen vectors for five criteria of each respondent.

Table 2: Eigen Values and Weights (Eigen Vectors) for Criteria of all Respondents

Respondents (R)	Eigen Value	Weights (Eigen Vector)				
		C_1	C_2	C_3	C_4	C_5
R_1	5.3010	0.2070	0.0936	0.1885	0.4817	0.0292
R_2	5.3194	0.2674	0.0952	0.1987	0.4098	0.0290
R_3	5.2745	0.2228	0.1187	0.1390	0.4867	0.0328
R_4	5.3686	0.2065	0.1448	0.1248	0.4879	0.0361
R_5	5.3554	0.2624	0.1297	0.0823	0.4898	0.0358
R_6	5.3638	0.2960	0.1788	0.0660	0.4230	0.0362
R_7	5.4447	0.2255	0.0726	0.4614	0.0490	0.1915
R_8	5.4146	0.3889	0.1141	0.3887	0.0329	0.0753
R_9	5.3345	0.1559	0.3374	0.2329	0.2053	0.0686
R_{10}	5.2741	0.3079	0.1627	0.0777	0.4142	0.0376
R_{11}	5.1311	0.3292	0.2067	0.0817	0.3436	0.0389
R_{12}	5.3221	0.4146	0.1957	0.0770	0.2742	0.0386
R_{13}	5.4010	0.4060	0.2080	0.0660	0.2796	0.0404
R_{14}	5.3423	0.3784	0.3113	0.0639	0.2117	0.0347
R_{15}	5.1955	0.2982	0.4136	0.0810	0.1696	0.0375
R_{16}	5.3877	0.3327	0.4090	0.1225	0.0993	0.0365

3.1.5 Consistency Test

To check the consistency of each criterion, comparison matrix has been calculated on the basis of equations (5) and (6) as shown in Table 3. These results show that the consistency ratio of the previous comparison matrix of respondents is below 0.1, which indicates consistency.

Table 3: Consistency Index (CI) and Consistency Ratio (CR) of all Respondents

Respondents	CI	CR	Respondents	CI	CR
R_1	0.07749	0.06918	R_9	0.08364	0.07467
R_2	0.07986	0.07131	R_{10}	0.06853	0.06119
R_3	0.06862	0.06127	R_{11}	0.03277	0.02926
R_4	0.09214	0.08227	R_{12}	0.08052	0.07189
R_5	0.08884	0.07933	R_{13}	0.10024	0.08950
R_6	0.09095	0.08120	R_{14}	0.08556	0.07640
R_7	0.11118	0.09927	R_{15}	0.04887	0.04363
R_8	0.10366	0.09255	R_{16}	0.09692	0.08653

3.1.6 Calculation each Levels Relative Weights of the Criteria

Relative weights and global priority for all five criteria are tabulated in Table 4. These weights were calculated for each criterion from the mean average of weights (eigen vector) of each respondent. The following weights of criteria are (C_1=0.2937; C_2=0.1995; C_3=0.1533; C_4=0.3036; C_5=0.0499). Table 4 also presents global priority of five criteria which impact supply chain performance. Table 4 and Figure 3 respectively show the highest evaluation weights of criteria in which flexibility is high. Finally, Figure 4 shows the importance of five supply chain performances measurement criteria in which flexibility and quality are most important criteria i.e. 30% each and remaining three criteria; delivery, cost and innovation are having 20%, 15% and 5% respectively.

Table 4: Relative Weights of the Criteria and Global Priority

Criteria	Weights of Criteria	Rank
Quality = C_1	0.2937	2
Delivery = C_2	0.1995	3
Cost = C_3	0.1533	4
Flexibility = C_4	0.3036	1
Innovation = C_5	0.0499	5

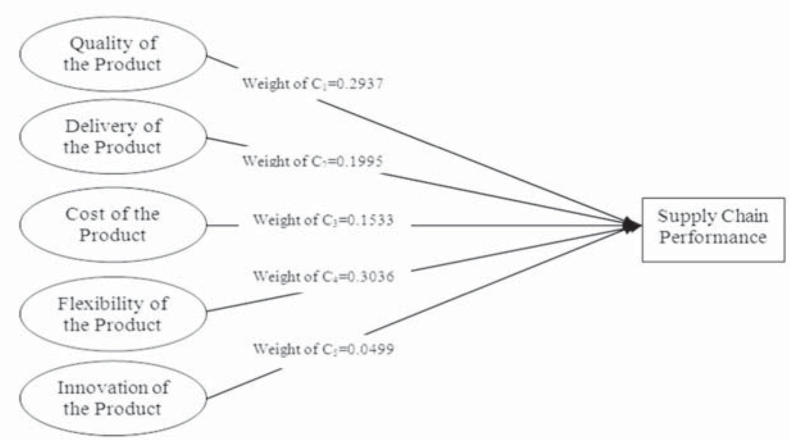

Figure 3: Weights of all Criteria Model to Measure Supply Chain Performance

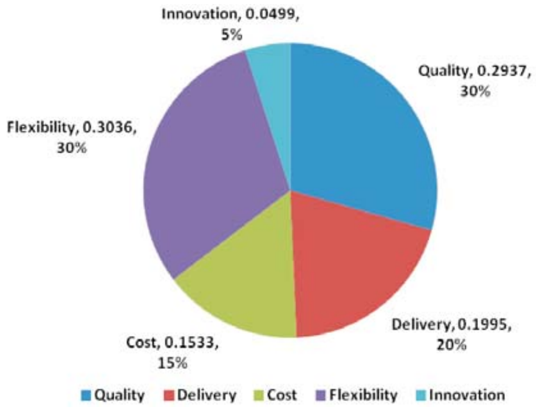

Figure 4: Pie Diagram of Supply Chain Performance Measurement Criteria

3.2 Evaluation Process using ANOVA

3.2.1 Table 5 shows the analysis part from the ANOVA method which shows the value of p i.e. 0.000 indicating the significant difference. R-Sq value is 65.43% and the R-Sq(adj) value is 65.31%. For all five factors the mean values are shown in Table 6 for quality (C_1), delivery (C_2), cost (C_3), flexibility (C_4), innovation (C_5) are 4.7124, 3.4115, 3.3496, 2.1239, and 1.4027 respectively.

Table 5: One-way ANOVA: C1, C2, C3, C4, and C5

Source	DF	SS	MS	F	P
Factor	4	1478.690	369.673	532.29	0.000
Error	1125	781.310	0.694		
Total	1129	2260.000			
S = 0.8334 **R-Sq** = 65.43% **R-Sq(adj)** = 65.31%					

Table 6: Mean value of all five factors

Level	N	Mean	Standard Deviation
C_1	226	4.7124	0.5824
C_2	226	3.4115	0.9351
C_3	226	3.3496	1.0185
C_4	226	2.1239	0.7790
C_5	226	1.4027	0.7842

Individual 95% CIs For Mean Based on

Pooled StDev

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Level  N    Mean    StDev   ------+--------+--------+--------+--
C1     226  4.7124  0.5824                          (*)
C2     226  3.4115  0.9351                (*)
C3     226  3.3496  1.0185               (*-)
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C4 226 2.1239 0.7790 (*)

C5 226 1.4027 0.7842 (*)

———+————+————+————+—

2.0 3.0 4.0 5.0

Pooled StDev = 0.8334

Tukey 95% Simultaneous Confidence Intervals

All Pairwise Comparisons

Individual confidence level = 99.36%

Conclusions

Supply Chain Performance Evaluation Is One Of The Most Important Tasks For Buyer-Supplier Relationship. There Are Not Only Quantitative But Also Qualitative Criteria Could Be Used To Solve This MCDM Problem. This Paper Adopts The Modified Delphi Method To Construct The Framework And Analytic Hierarchy Model To Design An Estimation Method Of Supply Chain Performance Evaluation For Automotive Industries. From The Analysis, It Has Been Found That The Flexibility Competitive Factor Is The Most Important Than Other Factors Of Supply Chain Performance Evaluation For Automotive Industries. It Has Also Been Found That The Delivery, Cost And Innovation Are Not Closely Following Flexibility And Quality Factors. Evidently, Innovation As A Criterion Is Not So Much Important In The Perspective Of Both Buyers As Well As Suppliers. Thus, Automotive Industries Will Have To Focus On Both Quality And Flexibility Related Issues In Order To Meet Their Customer's Demand. Both Parties Could Leverage These Results To Communicate With Their Customers In More Efficient Way. Suppliers Should More Concentrate On Flexibility And Quality Factors As These Two Factors Received Higher Weightage. Buyers Should Also Be More Focused On Flexibility And Quality Factors. Moreover, These Two Criteria May Become Principal Indicator To Use When Automotive Companies Trade Their Products To Their Customers.

From The Analysis Of ANOVA, It Has Been Found That There Is A Significant Difference Because The P Value Is 0.000. Finally, It Has Been Found That From The ANOVA Analysis That The Quality Competitive Factor Is The Most Important Factor Than Remaining Others. Thus, From Both Analyses Part (AHP And ANOVA) Show That The Quality Is The Most Significant Factor For Automotive Industries And In Both Cases It Has Also Been Seen That Innovation Is Not Having Much Importance For Buyers As Well As Suppliers In Indian Automotive Sectors.

This Paper Suggests Supply Chain Managers Of The Automotive Industries And Academicians/ Researchers Who Attempt To Understand The Complex Relations Among Supply Chain Performance Evaluation Criteria Can Also Establish Their Own AHP Decision Model For Selecting Important Criteria Like Flexibility. However, The Overall Process Appears To Depend On The Personal Judgment Of The Buyers. Quality Is Also The Leading Factor Which Is Following To Flexibility From The AHP Method. Furthermore, This Paper Presents A Framework Of Measurable Supply Chain Performance Where AHP Was Employed To Find Out The Important Competitive Factors Of Automotive Supply Chain Performance Evaluation. Similar, From The ANOVA Method, Quality Is The Most Key Factor For Buyers As Well As Suppliers. Finally, Some Other Tools And Techniques Can Also Be Applied To Measure The Highest Crucial Factor Than Others And This Method Can Also Be Applied For Other Manufacturing Or Service Industries.

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