

# Barriers Analysis In Effectiveness Of Automotive Supply Chain By Using Analytical Hierarchy Process

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**Abstract:** The automotive sector is one of the biggest and most persuasive sector for the economy of any country and it comprises of the assortment of associations and enterprises participating in the plan, advancement, assembling, advertising, and selling of items, the car inventory network contains a forward progression of materials and in reverse progression of data. However there are several boundaries that will be the reason for aggravation in the store network. Moreover, the purpose to highlight barriers is to prevent companies to apply a successful supply chain. Supply chain management is considered a crucial area in the automotive sector and plays a vital role for a firm to stand competitive in the market. Many industries, focusing on supply chain issues and their causes to gain a competitive advantage. This paper is based on a quantitative analysis of barriers in the supply chain of the automotive sector, which are identified through literature review, brainstorming, and the expert's opinion. A model is developed further, containing barriers and their major causes that are analyzed by using Analytical Hierarchy Process (AHP). This study will prioritize those barriers according to their weights and quantify the most influential barriers in the automotive sector.

**Index Terms:** Automotive Industry, supply chain, Barrier analysis, Analytical Hierarchy Process

## 1 INTRODUCTION

The supply chain is an important factor which deals with money, material, and information of the material. The supply chain management has been focused for more than four decades [1]. Sustainable supply chain management (SSCM) is an important factor in order to reduce the complexity faced by organizations [2]. Different strategies in the supply chain adopted by industries as a method to attain sustainability, effectiveness and to gain competitive advantage [3]. Industries, managers, and scholars develop new methods to overcome barriers and to increase the effectiveness of the supply chain. The main barrier to the effectiveness of the supply chain is inadequate information system because the network of the supply chain requires collection and analysis of a large amount of data and this barrier falls under managerial complexity. Management also lacks in the vision of supply chain integration and resistance to change which can lead to ineffectiveness of the supply chain [4].

Quality and regulation adoption increase reliability and acceptance of the automotive parts. Due to the increase in the market of cars and changes in their specifications and different components per specific type, it is a requirement to establish an excellent network between recycling industries to establish regulation centers for quality analysis. Representative quality regulations are still missing in the recycling of automotive

parts. The primary emphasis is on setting standards and procedures for improving quality measurement like vehicle bodies, engines, transmissions, steering gears, and other parts of the vehicle that are lacking in the automotive sector as defined per standard [5]. Recycling practices can benefit economically but without a sound market it is not economical to recycle material and besides this many materials have high disposal costs in the automotive sector [6]. In contrast to developed countries, China has a restricted and limited recycling system for effective and economical re-manufacturing [7]. The supply chain contains many challenges, both for authority and as a subject for practitioners, such as the complexity of the product because each car has different specifications and demand seasonality in the automotive sector [8]. The barriers that affect the automotive supply chain which causes market breakdowns and failures include financial barriers because this sector lack access to finance, technical barriers because the automotive sector lack access to efficient technologies, managerial and organizational barriers because of lack of vision and incentives in business. Despite these barriers, the progress to improvement in the automotive sector is slow in different countries [9]. Surveying across the Swedish manufacturing firms indicated that sharing information and financial problems are the most common problems across car manufacturing organizations when tried to apply supply chain management [10]. A bibliometric study was conducted in 2015, the research evidenced that the analytical hierarchy process (AHP) is the most appropriate and widely used method in supplier selection, supply chain performance evaluation, barriers analysis, supply chain development, warehousing, supply chain networking since 1993 [11]. In this paper a depth literature review on supply chain of automotive ventures has been done thoroughly after that it is found that there are a number of barriers in the supply chain of automotive sector, those hindrances recorded in a synchronized way, after that a model from those obstructions was made under the supervision of supply chain experts and academic professionals. A methodology which is based upon analytical hierarchy process (AHP) is applied for discovering significant barriers of supply chain in automotive sector.

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**2 METHODOLOGY**

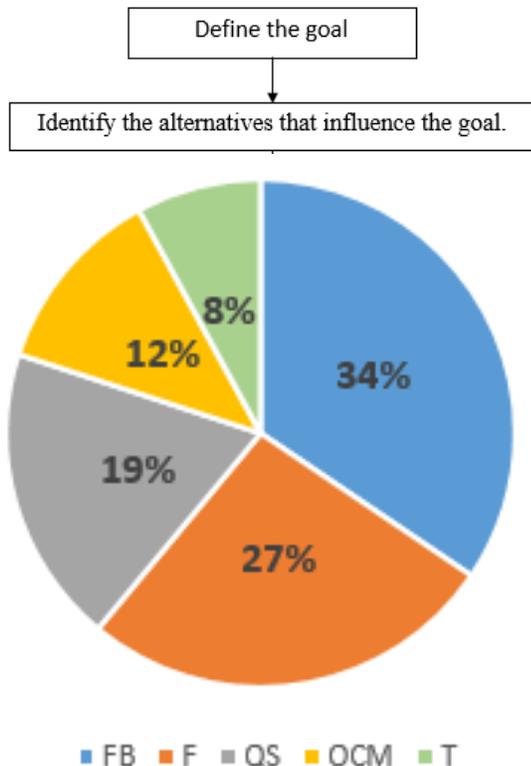
There are many Multi-Criteria Decision-Making (MCDM) methods used today, and AHP is one of them which was developed by Saaty in 1971 [12]. These decisional methods are designed to analyze individual's opinions about a pre-specified set of alternatives. The process of decision-making depends upon the knowledge and information of individuals. MCDM is a set of techniques that help decision-makers in numerous evaluations and leads to a better decision. The most important advantage of the AHP method is that it can quantify and compare alternatives and results in the ranking according to their weights by using pair-wise comparison. AHP method can be used in numerous decisions like selection among alternates, the ranking of alternatives, prioritization of alternates, etc. The basic principle of AHP includes a standard procedure, which is shown in Figure-1.

**3.1 Fundamental Scale for AHP**

Experts through questionnaire usually gain the pair-wise comparison by selecting a scale. The data is collected using the Saaty scale [12], and questionnaire is designed under the guidance of an academic experts.

**3.2 Analytical Hierarchy Process (AHP) Model**

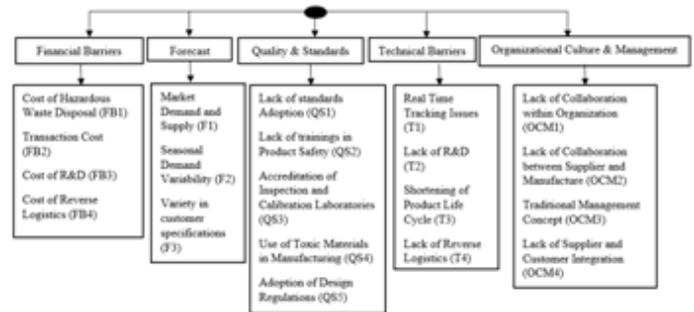
AHP uses the pair wise comparison of the criteria concerning other criteria and results in prioritized weights. In order to prioritize, we directly calculated the geometric mean of all individual opinions and eliminated those that are not consistent collectively. A structure of the sample model is shown in Figure-2.



**Figure-1: Research flow diagram**

Figure-2: Analytical Hierarchy Process (AHP) sample model

A brief model of AHP that is used in this study is shown in Figure-3.



**Figure-3: Barriers analysis in effectiveness of automotive supply chain**

**4 RESULTS**

This research is conducted in automotive industries of Pakistan, targeting supply chain professionals to obtain results from the designed methodology. For this purpose, professionals and experts of supply chain have been contacted and survey was conducted in different automotive industries in Pakistan. The conceptual framework of this research focused on the literature review of barriers in the automotive supply chain of developed and developing countries. The results of the barrier analysis are shown in Table-1. The results of this study shows the comparison among Financial Barriers (FB), Forecast (F), Quality and Standards (QS), Technical Barriers (TB), Organizational Culture and Management (OCM).

**Table-1: a comparison of the barrier analysis in automotive industry**

ESC	FB	F	QS	T	OCM
FB	0.3439	0.5379	0.2254	0.3536	0.2628
F	0.1351	0.2113	0.3904	0.3378	0.2528
QS	0.2892	0.1025	0.1895	0.1657	0.2029
T	0.0634	0.0407	0.0746	0.0652	0.1528
OCM	0.1681	0.1073	0.1200	0.0775	0.1285

Similarly, the weightage of all the criteria and sub-criteria and then overall weighting of sub-criteria's with respect to main-criteria's is shown in Figure-4. The results of the effectiveness of barrier analysis shows Financial Barriers (FB) shows 34, Forecast (F) shows 27%, Quality and Standards (QS) shows 19%, Technical Barriers (TB) shows 8%, and Organizational Culture and Management (OCM) 12% effectiveness of automotive industry supply chain.



**Figure-4:** Barrier analysis in effectiveness of automotive supply chain

Further, the results shown in table-2, shows the results of criteria and sub-criteria, the local weight and global weights are also shown in this table. The results of this study shows that Financial barriers are most important factors, and Forecast is also important therefore Technical Barriers are least important factors in the implementation of the effectiveness of the automotive supply chain.

More specifically in the sub criteria of financial barrier (cost hazardous waste disposal, FB1) and in the sub criteria of forecast (market demand and supply, F1) are the most weighting barriers, for a broader aspect of the supply chain, financial barrier and forecast are the higher weighting barriers on the effectiveness of the automotive supply chain.

**Table-2:** weightage of main criteria and sub-criteria

Main-Criteria	Local Weights	Sub-Criteria	Local Weights	Global Weights
Financial Barrier	0.345	FB1	0.434	0.15
		FB2	0.270	0.09
		FB3	0.209	0.07
		FB4	0.087	0.03
Forecast	0.266	F1	0.521	0.14
		F3	0.244	0.06
		F2	0.235	0.06
Quality and Standards	0.190	QS1	0.264	0.05
		QS3	0.229	0.04
		QS4	0.206	0.04
		QS5	0.157	0.03
		QS2	0.144	0.03
Organizational Culture and Management	0.120	OCM3	0.282	0.03
		OCM4	0.262	0.03
		OCM2	0.231	0.03
		OCM1	0.226	0.03
Technical Barriers	0.079	T1	0.575	0.05
		T2	0.193	0.02
		T3	0.145	0.01
		T4	0.087	0.01
Total	1.0	1.0	1.0	1.0

#### 4 CONCLUSION

This study reveals important factors which may have impact supply chain in automotive industry. In this study it is identify barriers in the effectiveness of the automotive supply chain and the degree of influence, especially from the perspective of Original Equipment Manufacturer (OEM) in the automotive industries. To accomplish this, we have analyzed the literature on barriers from different developing and developed countries based upon the past studies AHP model was developed and further study was performed. This study will prioritize those barriers according to their weights and quantify the most influential barriers in the automotive sector.

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