MAINTENANCE AND REPAIRS SYSTEM OF AUTOMOTIVE INDUSTRY FOR SUSTAINABLE INTERNATIONALIZATION

Sahar Ahmadian[1*], Tariq Tawfeeq Yousif Alabdullah[2], Iraj Motaghian[3]

[1,3] Department of Management, Buinzahra Branch, Islamic Azad University, Buinzahra, Iran

[2] Department of Management Information System, College of Administration and Economics, University of Basrah, & Economic Studies Department - Basrah & Arab Gulf Studies Center, Iraq

E-mail: [1)] dr.ahmadian1@gmail.com, [2)] tariqtariq1984@gmail.com

Abstract

The current article investigates the maintenance and repair system within Iran's automotive industry in the context of internationalization and proposes a prioritization model. This study employs the Gogus & Boucher and Chang extent analysis methods to calculate suitability percentages and significant weights, based on a sample of 17 experts from Bahaman Car Manufacturing Co. The proposed model comprises three levels: 1) factors influencing system internationalization; 2) indicators related to cost, speed, capability, and mission compatibility; and 3) sub-criteria for each indicator. The adoption capability holds the highest weight (0.639), followed by implementation speed (0.612), alignment with the organization's mission (0.454), and implementation cost (0.454). Notably, the primary contributors to cost are confidence and supplier competence, while employee competency and responsiveness play crucial roles in speed. The study highlights flexibility as a key competency, with mission compatibility predominantly influenced by IT infrastructure and self-control MR. This research contributes fresh insights to the understanding of effective global growth strategies by shedding light on enhancing the readiness of the maintenance and repair system for internationalization within Iran's automotive industry.

Keywords: Fuzzy Analytic Hierarchy, Internationalization, Maintenance & Repairs System

1. INTRODUCTION

Nowadays, the automotive industry, particularly in developed countries, has transformed into a national industry. In alignment with the automobile trade and its regulation, job security and workforce are major and contentious topics on the global stage. Each country's domestic strategy regarding automobile production significantly impacts the quality and operational procedures of its automotive industry at the international level. In essence, the competitive strength of global automotive manufacturing plants directly correlates with their performance in domestic markets. Consequently, regional competition among countries within a region has begun, with the victor in regional competition having the potential to succeed in the international market competition. Notably, some countries like Japan rapidly penetrated non-regional markets, such as Europe and North America, influencing adjustments in automobile manufacturing industries in those regions.

The globalization of automotive industries has stemmed from these shifts and modifications, evolving into an economic concept in the nineties. Economic activities

transcending national borders and expanding into worldwide markets are fundamental aspects of global economic globalization, evident in the automotive manufacturing sector. Expansion of products, international presence of companies and manufacturing facilities, cross-border exchange of parts, raw materials, and equipment, and the broadening of distribution and sales systems from regional to global levels all showcase globalization in automotive manufacturing. These steps and processes are orchestrated under a global and integrated management strategy. Globalizing the automotive industry not only draws commercial manufacturers into competitive markets but also paves the way for automotive plants to merge and exert more influential international presence (Agiri et al., 2015).

Referred to as the "locomotive of the industry," the automotive sector propels various industries such as plastics, steel, leather, rubber, and glass. Moreover, vehicle manufacturing triggers a chain reaction in part production, persisting long after the final product's creation. The high employment rate and significant value added by vehicle manufacturing have bestowed a pivotal role on this industry in the global economy. However, alongside the demand for state-of-the-art technology, automotive manufacturers rely heavily on substantial fixed and working capital, necessitating collaboration among financial, economic, and commercial entities for funding (Agiri et al., 2015).

Another challenge is the intensifying competition among vehicle manufacturers striving to capture larger market shares, resulting in diminished profit margins and stronger ties to global markets. Vehicle manufacturers are thus behemoth industries with modern technology, value-added components, and substantial global employment. Numerous mergers in the east and west, driven by the aspiration to reach multimillion-level production, have transformed these companies into colossal giants, rendering competition exceedingly challenging. These mergers are often aimed at entering competitor markets, harnessing manufacturing facilities, and leveraging technological chains in a fragmented market, which necessitates mass production for entry (Besley, T, 2013).

Conversely, maintenance and repairs constitute pivotal concepts in globally-minded organizations, particularly among senior directors and staff. Iranzadeh and Taghipour (2017) introduced an agile maintenance and repairs model with a focus on training in the maritime transportation sector, employing fuzzy Delphi and PROMETHEE methods for military shipbuilding. This research presents an agile maintenance and repairs model in maritime transportation, specifically military shipbuilding. The study's population consisted of maintenance and repair professionals in the strategic sea force of the army. Through the fuzzy Delphi method and PROMETHEE method, influential factors on maintenance and repairs were identified and ranked. The study highlighted that reparability, organizational learnability, and automatic maintenance and repairs are key factors in maritime transportation industries.

Parsaei & Nili (2017) prioritized maintenance and repair strategies using a combined approach of DEMATEL, network, and COPRAS analyses in the vehicle parts manufacturing industry, focusing on Milad Qom Co. Strategies were collected from research literature and prioritized using a combination of DEMATEL techniques, network analysis, and COPRAS. The study involved a team of experts, and the

questionnaire served as the data collection tool. Results indicated the predictive strategy's suitability for the automotive parts industry.

Salmasnia and Ebrahimi (2016), in research, reviewed the selection of strategy of optimal maintenance and repairs for each component of electromotor from National Iranian Oil Refining & Distribution Co. (NIORDC). In this respect, an approach based on the ideal planning and analytic hierarchy process has been used. In this study, the strategies of maintenance and repairs based on the reliability and based on SAE JA 1011 and SAE JA 1012 are considered as reviewed options. On the other hand, since the cost of maintenance and repairs forms a considerable part of production expenses, and the failure risk of equipment is one of the important factors highly effective on the safety of personnel, two factors of cost and risk of equipment failure are used as the indicators for the assessment of maintenance and repairs strategies. The results indicate that the conditions-based and planned replacement strategies are suitable for most equipment.

Aghaei et al. (2015) were involved in the identification and ranking of key indicators effective in the agile maintenance and repairs using fuzzy Delphi attitude and fuzzy DEMATEL in the Iranian Automotive Industry. This study tries to review the literature related to agile maintenance and repairs, identify the agile key and effective MR indicators in the Iranian Automotive Industry using the fuzzy Delphi method, and determine the ranking of the effect of indicators using the fuzzy DEMATEL technique. The results of the study indicate the key indicators effective on the agile MR are: quick decision making, coordination, and cooperation, capabilities of IT infrastructures, active sharing of information with partners, quantity and quality of service, enjoyment of suitable technology, proper planning of activities, planning for supply of demand, self-control MR, the commitment of senior directors, participatory management style, virtual organization. Quick decision-making is the most effective and active sharing of information with partners is the most affected indicator.

Pourjavad & Shivoizad (2014) presented a model for the selection of maintenance and repairs strategy using the fuzzy analytic network, in which in a case study, three indicators and five strategies were used. The criterion for their selection is not clear. While Rabani et al. (2013) in a study, relying on fuzzy ideal planning, have reviewed the selection of the optimal strategy for maintenance and repairs of key equipment in the paper manufacturing industries. On this basis, for some water and oil pumps and paper paste in the paper manufacturing company, as a series of the most important manufacturing equipment of the company, optimal MR policy-making was performed. The results indicated predictive and preventive maintenance and repair strategy are preferred to the corrective strategy in the utilization of the resources and reduction of failures. Thus, these strategies provide useful information for the maintenance directors to restrict the negative aspects of a failure.

Fouladgar et al. (2013), presented a model for the selection of an ideal strategy for maintenance and repairs using the FAHP method. In this research, four indicators were used for ranking the five strategies. In this model, the ranking has been done only based on the FAHP method. Janani and Ziaeifar (2013) studied the solutions to the globalization of the Iranian economy, and the results indicated nowadays globalization occurs in the different fields of culture, politics, economy, and science, and what would be the approach of each country facing it, should be studied.

Ranjbar et al. (2012) reviewed the prioritization of strategies for maintenance and repairs with the help of functions of reliability and fuzzy decision making with a case study in the cement industry in a study. This study presented a suitable method for

decision making through a combination of fuzzy theory with FAHP, and using the FAHP process and considering the criteria of the possibility of occurrence and severity of impact, the best strategy of maintenance and repairs was selected. Mirmohammadi (2012) in his study reviewed globalization, its dimensions, and approaches. According to the results of this study, we could say globalization could be both a threat and a good opportunity, identification of threats and opportunities of globalization.

Jafari et al. (2011), presented a method for the selection of an ideal strategy of maintenance and repairs using fuzzy Delphi. In this study, the tangible and intangible objects were considered together, but the strategies used in this study are not complete. Bararpour and Iraqi (2006) modeled and reviewed in a study the situation of competition in Iran Khodro Co., compared to its local competitors, using SD methodology. Then, with the application of two scenario strategic options to the model, they simulated the situation of competitiveness of the Iranian Automotive Industry sector in a real competitive environment and with the attendance of other foreign competitors. The results of this study indicate that if infrastructure corrections are not applied in the national automotive industry, a decrease in tariff after full membership, will both reduce the government's income, and due to the increase in imports, production and employment will decrease in the automotive industry. However, if the subsidiary industries and part manufacturing are considered for the automotive industry, the said consequence could be intensified.

Golestan & Khodadad Hosseini (2006) designed the strategic model for entrance to the global market in the Iranian Automotive Industry in a study. This article aims the presentation of a conceptual model for the determination of the strategic model of the entrance of firms active in the developing countries into the global market. This model includes four levels of analysis (firm, local industry, developmental policies of advantage of national competition, the structure of the local industry, specifications and features of the national competitive environment, and relations of corporations with international players in the industry on the strategic capability of the corporation for the globalization and entrance to the global market in a unique framework, and indicates how the strategic capability of a corporation is a function of the core competency of corporation and synergy of the structure of the local industry, the synergy of national competition environment, and synergy of participatory advantage achieved through international relationships of the corporation with the global players in the industry.

Kirubakaran and Ilangkumaran (2015) studied the selection of the optimal strategy of maintenance and repairs, where they presented a model using a combination of methods of FAHP for the selection of the best strategy of maintenance and repairs. In this research, four strategies and four main indicators, and several sub-indicators were used for the selection of the optimal strategy for maintenance and repairs, and the model is described using a case study in the paper industry. In this research, the selected strategies are not comprehensive.

Ghazi Nezami (2013), in an article based on the approach of sustainability, discussed the selection of the maintenance strategy in a manufacturing unit. In the first step, the main factors in each of the bases of sustainability are defined using the concept of factor analysis, and in the second step, the fuzzy Vikor technique was used for the selection of the most appropriate strategy of maintenance.

Arunraj and Maiti (2010) presented a model for the selection of the best strategy for maintenance and repairs using the FAHP and ideal planning methods. The cost and failure risk were used as two main indicators for ranking the strategies in this research. In this research, separate results are introduced for cost and risk, and no reply has been presented considering the two indicators.

Bertolini and Bevilacqua (2006) conducted a study in this field, in which ideal planning and AHP were combined for the selection of the best strategy for maintenance and repairs. In this study conducted on the centrifuge pumps, the used indicators used for the prioritization are only based on risk and do not include other aspects.

Bevilacqua and Braglia (2000) used AHP for the selection of the optimal strategies for maintenance and repairs. In this study, five strategies of maintenance and repairs were selected based on several prioritization indicators and for different groups of equipment. In this study, the strategies were selected based on the different groups of equipment instead of considering each equipment, and thereby the study does not enjoy a high precision.

The current organization operates within an intensely competitive environment, leaving no room for errors by its members. Even the slightest mistake can result in significant damage to the organization. Given the high costs associated with utilizing equipment and capital assets, proper maintenance of such resources becomes crucial. Considering the profound impact of globalization on economies, this study aims to identify and prioritize challenges related to the internationalization of the automotive industry.

In pursuit of this goal, the opinions of professionals and experts in fields like Industrial Engineering, economy, management, and relevant organizational units were gathered. Through the Delphi method, challenges were identified in the economic, environmental, and social aspects. The professionals' opinions were scored using a Likert scale, and the indicators were ranked based on these scores. The primary objective of the study is to assess the Maintenance & Repairs System of Iran's Automotive Industry in the context of internationalization and propose a viable model to address the identified challenges. The findings of this research hold value for vehicle manufacturers, aiding them in recognizing the importance of internationalization.

The global automobile industry, particularly in industrialized nations, has undergone substantial transformations, leading to both opportunities and complexities on a global scale. The quality and competitiveness of a nation's automotive industry are significantly influenced by factors such as domestic vehicle production strategies, job security, and personnel management. Success at the regional level often translates into success in the global market. Some countries, like Japan, have swiftly entered the global market, prompting changes in the manufacturing landscape. The process of globalization in the automotive manufacturing industry involves expanding product offerings, establishing global business presence, facilitating the exchange of parts and materials across borders, all managed by a comprehensive strategy.

As globalization's impact on economies continues to grow, understanding the challenges of internationalization within the automotive sector becomes increasingly important. This study intends to identify and prioritize the economic, environmental, and social challenges of internationalization within this business. The study selects key indicators, rates them, and ranks them in order of significance using the Delphi technique with input from professionals and specialists in domains including Industrial Engineering, economy, and management. The major goal of this study is to assess the Iranian

automotive industry's maintenance and repairs system in the context of internationalization and to suggest a workable strategy for resolving the identified issues.

2. LITERATURE REVIEW
2.1. Maintenance and Repairs System

A maintenance and repairs system encompasses a set of instructions, methods, processes, software, and hardware utilized to ensure the preservation, protection, and restoration of machinery and organizational equipment to an acceptable and standardized condition (Ajorlou, 1997). Another perspective defines maintenance and repairs (MR) as a combination of managerial and engineering activities aimed at preserving an object and restoring it to an acceptable state (Logistics Studies & Researches Center, 2011).

Maintenance entails a series of planned activities designed to prevent the sudden failure of machinery, equipment, and installations (Shahnaghi & Jafarian, 2008). On the other hand, repairs involve actions taken on a system or appliance that has experienced failure in order to reinstate it to operational status (Barouj & Riahi, 2004). In a broader sense, repairs encompass the activities conducted on a malfunctioning system or appliance to restore it to an operational state (Kazemi & Kasaei, 2001).

2.2. Types of Maintenance and Repairs

Within the realm of MR, industrial experts and professionals have defined various methods, predominantly categorized into three main domains (Barouj & Riahi, 2003).
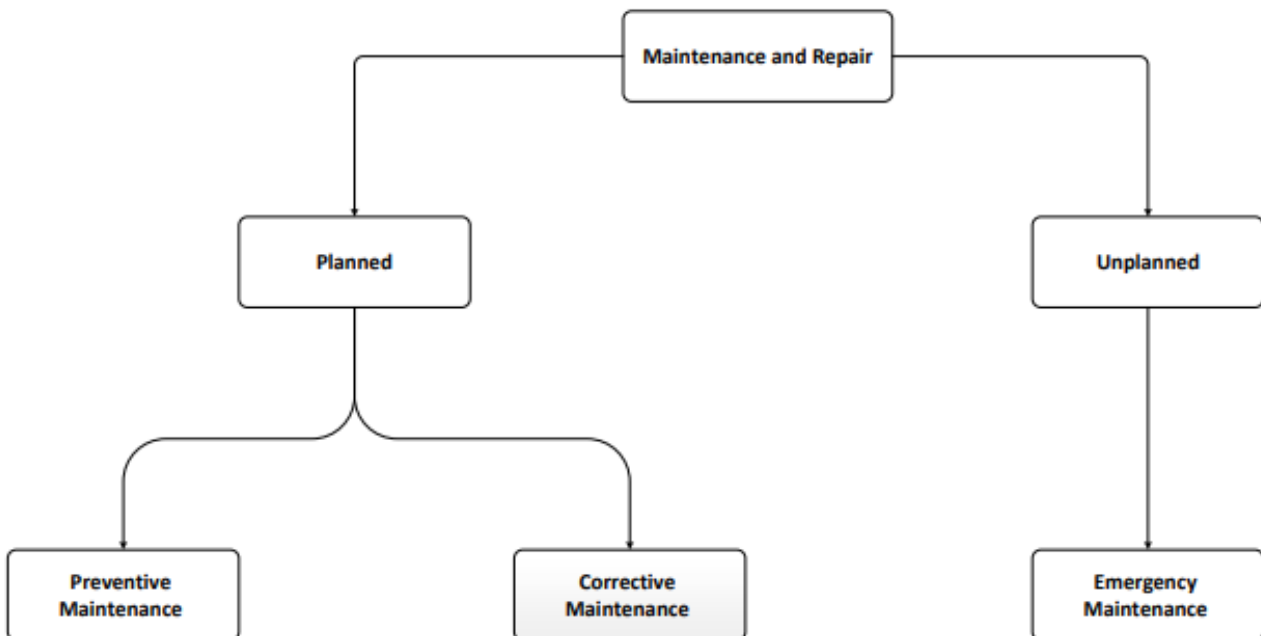

Figure 1. Types of Maintenance & Repairs

2.2.1. Emergency Maintenance (EM)

Emergency Maintenance involves immediate actions taken when equipment suddenly stops working or fails without prior notice. This type of maintenance is not pre-planned and requires immediate service to restore functionality. When faced with such failures, the primary focus is on quickly identifying the location of the failure and isolating it from other components. A well-organized repairs department can promptly take action once the cause and location of the failure are determined, facilitating the repair, correction, and reconstruction of the malfunctioning part.

2.2.2. Preventive Maintenance (PM)

Preventive Maintenance aims to prevent equipment defects from occurring. By implementing preventive maintenance, the system can be controlled and planned effectively. The objectives of the preventive maintenance and repairs system include:

a. Correcting minor issues on machinery to prevent larger failures.
b. Preserving performance levels of machinery to avert minor problems that could lead to failure.
c. Minimizing maintenance and repair expenses.
d. Preventing excessive wear and tear of equipment and installations.

The comprehensive definition of the preventive maintenance and repairs system, which is often the most economical type of MR, can be described as follows:

Preventive maintenance involves a planned and scheduled systematic approach to performing necessary maintenance actions according to a predefined schedule. The goal is to maintain optimal equipment conditions. It is designed to minimize waste caused by equipment failure and non-operation, guarantee the equipment's lifespan, and outline the operations to be executed in a preventive maintenance program. This method involves preparing schedules for such operations, analyzing recorded cases, and enhancing the content and frequency of preventive maintenance programs.

2.2.3. Corrective Maintenance

Corrective Maintenance addresses technical issues to maintain equipment at a standard level. These activities involve repairing or improving the equipment's condition. This type of MR allows for resource allocation planning and fault elimination. Proper planning can help prevent the accumulation of tools, repairable equipment, and spare parts, allowing for efficient actions with minimal manpower. While more preventive activities lead to better repairs, excessive focus on this aspect can result in additional expenses (Barouj & Riahi, 2003).

2.3. Repairs and Maintenance Strategies

The term "Maintenance and repairs" refers to a series of activities that extend machinery lifespan, reduce spare parts consumption, energy usage, and costs, while enhancing machinery's practical efficiency. Repairs and maintenance strategies encompass an organization's approach to implementing activities in this domain to increase efficiency, tailored to the organization's characteristics and equipment (Ben Mabrouk et al., 2016). This study explores four of the most common repairs and maintenance strategies:

a. Predictive Strategy

This strategy predicts machinery failures and involves performing operations periodically, regardless of equipment conditions. Statistical analyses are employed to anticipate when preventive activities should be applied to the equipment (Ebrahimi, 2011).

b. Preventive Strategy

This approach is based on reliability and involves scheduled maintenance of equipment at specific intervals. The goal is to reduce sudden failures through replacements and re-inspections of components with a high failure rate (Zaim et al., 2012).

c. Conditions-Based Strategy

This strategy aims to determine the optimal time for repairs and maintenance activities. Continuous monitoring of working conditions helps identify deviations from normal operating conditions. If necessary, equipment is evaluated and, if needed, halted to prevent further failure (Ben Mabrouk et al., 2016).

d. Corrective Strategy

The corrective strategy operates machinery until it fails. Once a machine fails, corrective maintenance actions (including preventive repairs to prevent further failures) are performed on the machinery. These actions are unplanned (Cheng and Tsao, 2010).

3. RESEARCH METHODS

This study employs an applied research approach with specific objectives. The goal of applied research is to advance practical knowledge within a particular field. In other words, applied research aims to practically apply knowledge, and the data collection method used is survey research. Furthermore, in terms of data collection methodology, it falls under descriptive research, which enhances understanding of existing conditions and facilitates decision-making. The statistical population for this study comprises 88 professionals working in organizational departments related to the globalization of the automotive industry in the economic, environmental, and social dimensions within Bahman Automotive Manufacturing group. Through the use of decision-making methods and a focus on involving knowledgeable professionals, a purposive judgmental sampling method was employed to select a sample of 20 professionals who possess expertise in the economic, environmental, and social aspects. Subsequently, questionnaires were distributed to all professionals, and 17 completed questionnaires were returned.

Data collection in this study was accomplished using a questionnaire. The questionnaire included questions aimed at determining the weight of indicator significance and potential solutions. Professionals completed the questionnaire to express their level of agreement with the model components and criteria. Responses were provided using verbal variables such as "low," "very low," "moderate," "high," and "very high." Recognizing that individuals' unique characteristics can influence their interpretation of quality variables, a consistent scope for quality variables was defined to ensure uniform responses among professionals.

After gathering professionals' responses in the form of verbal items, these responses were converted into a fuzzy scale. The quality variables were defined as triangular fuzzy

figures, based on Table No. 1. This process aids in accommodating different interpretations of quality variables by individuals and contributes to the analysis of the collected data.

Based on the fuzzy Delphi method, first, the opinions of the decision-making group are collected, and the triangular fuzzy figure in view of the professionals is allocated based on the verbal term selected by them, as the desired criterion, because sometimes, utilization from the explicit figures in the decision making for such issues is very difficult and impractical. In this account, triangular fuzzy figures are used (Ahadi & Ghazanfarirad, 2011). Moreover, a fuzzy figure is a useful tool that could be used efficiently for system modeling in conditions of uncertainty and imprecise data.

Table 1. Triangular Fuzzy Figures of Verbal Variables

Definitive fuzzy number	Triangular fuzzy figure	Verbal variables
0.9375	(1 & 0.25 & 0)	Very high
0.75	(0.75 & 0.15 & 0.15)	High
0.50	(0.5 & 0.25 & 0.25)	Moderate
0.25	(0.25 ، 0.15 ، 0.15)	Low
0.0625	(0 & 0 & 0.25)	Very low

The analytic hierarchy process, presented by Thomas L. Saaty in the 1970s, is one of the most popular and practical techniques of multi-indicator decision making. This method is based on hidden pairwise comparisons. The FAHP refers to the fuzzification of the classic AHP method using the figures and fuzzy calculations (Azar & Faraji, 2010). To encounter the ambiguity existing in the opinion of humans, Professor Lotfizadeh, presented a theory of fuzzy sets in 1965 to model the uncertainty created due to the ambiguity and lack of precision in the events. In 1992, Chang presented a very simple method for the expansion of AHP to the fuzzy environment. This method, which was based on the mathematical average of opinions of professionals and the hourly normalized method, and was developed using fuzzy triangular figures, was received by the researchers (Zanjirchi, 2011). The steps of this method are as follows:

a. Step 1- Depicting the hierarchical tree. In this step, first, the hierarchical tree of decision is depicted using the target levels, criteria, and sub-criterial.
b. Step 2- Formation of pairwise comparison matrix. In this step, the agreed matrixes are formed according to the decision tree and using the opinion of the professionals, and then, the incompatibility rate is calculated, according to Gogus & Boucher (1998).
c. Step 3- This step is the step of calculation of the mathematical average of the opinion.
d. Step 4- In this step, the total elements of the line are calculated.
e. Step 5- This step is the normalization step of the weights of lines.
f. Step 6- In this step, the degree of possibility of being greater is determined.
g. Step 7- This step is the normalization step of the vector of weights.
h. Step 8- This step is the step combination of weights for obtaining the priorities (Zanjirchi, 2011).

Using hierarchical structure and following the steps of the fuzzy process referred to above, first, the opinion of the professionals (through the change of verbal phrases to the fuzzy triangular figures) is aggregated, and for assurance of the compatibility of matrixes, the incompatibility rate is calculated according to Gogus & Boucher (1998), and then, the weight of each of criteria at levels two and three of hierarchical structure is calculated.

4. RESULTS AND DISCUSSION

Given the qualitative nature of creative concepts, brainstorming, and the subjects discussed in the "research methodology" chapter, the utilization of the fuzzy Delphi method—capable of evaluating expert opinions on a more flexible scale—proves beneficial. The fuzzy Delphi method serves quality analysis, especially when expert decisions form the basis. In a similar vein, Lou et al. (2012) employed the fuzzy Delphi method to analyze questionnaires for the selection of appropriate indicators concerning students. In light of the analytical findings from the third chapter, the fuzzy Delphi hierarchical method was chosen for determining parameter weights, their ranking, and eventually presenting the final model. Similarly, Hsu et al. (2010) incorporated a similar method in their research, employing a fuzzy hierarchical analytic method to assess the value of each indicator within a list of production technologies.

By employing a hierarchical structure and following the aforementioned fuzzy process steps, the initial step aggregates expert opinions (converting verbal expressions to fuzzy triangular figures as per Table No. 1). To ensure matrix compatibility, the incompatibility rate is calculated in accordance with Gogus & Boucher (1998). Subsequently, the weights of criteria at levels two and three within the hierarchical structure are calculated.
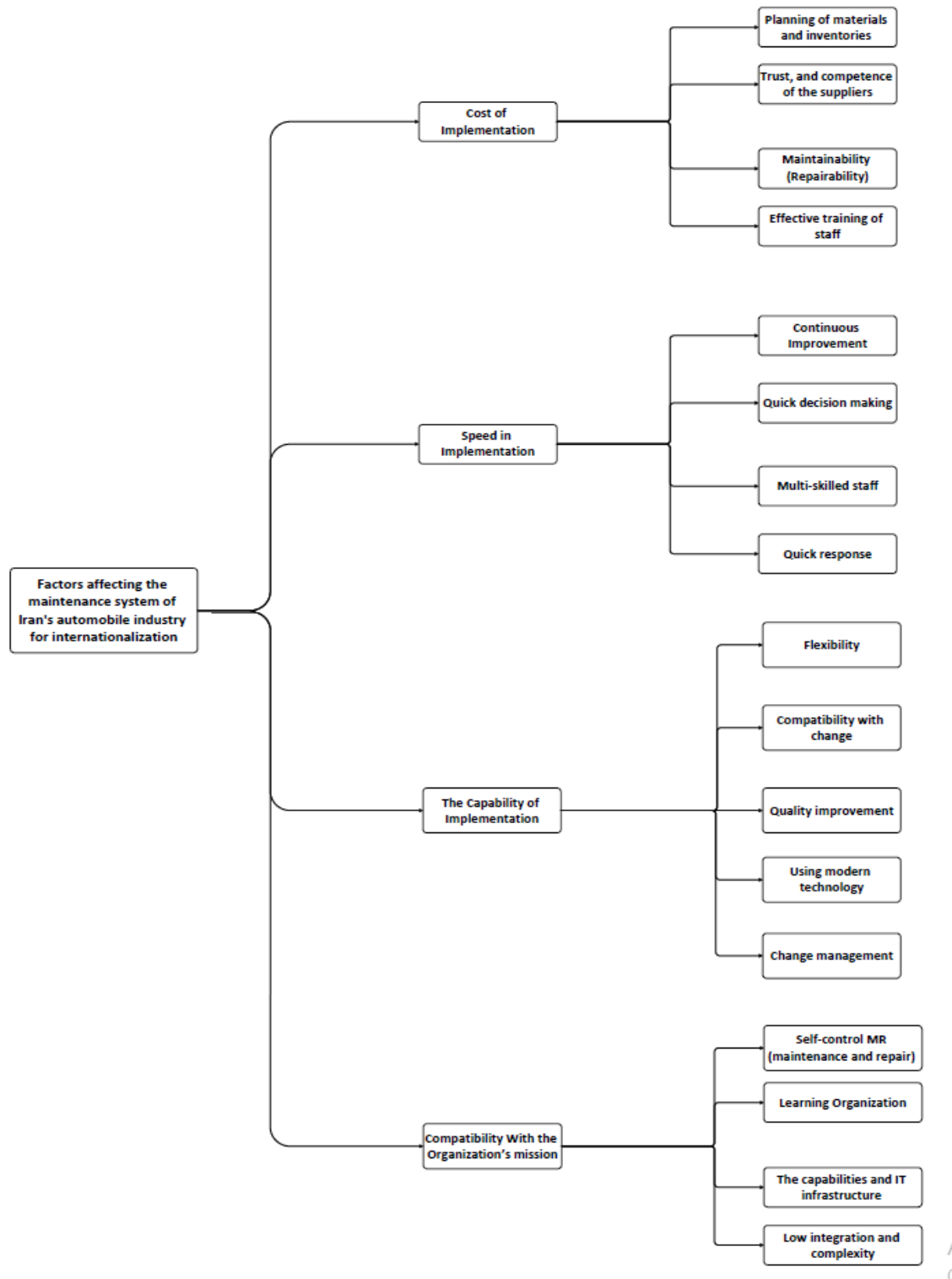
Figure 2. Hierarchy Tree of Factors Effective on Maintenance and Repairs System in Iranian Automotive Industry

Table 2. Aggregate Matrix Fit Level

Compatibility rate	Title of assembled matrices	Levels of hierarchy structure
0.632	Aggregated matrix of pairwise comparisons of implementation cost factor sub-criteria	The third level
0.0711	Aggregated matrix of paired comparisons of speed factor sub-criteria in implementation	
0.0516	Aggregated matrix of pairwise comparisons of the sub-criteria of the feasibility factor	
0.0394	The assembled matrix of paired comparisons of the sub-criteria of the coordination factor with the mission of the organization	
0.0218	The assembled matrix of pairwise comparisons of sub-criteria of the pathological factor of the maintenance and repairs system	Second level

To calculate the final weight of each of the sub-criteria, indicating their significance based on the opinion of the experts, it is necessary to multiply the weights of the third level by its related benchmark weight in the second level. Table No. 3 displays the weight of second-level criteria (compared to the target level), and weight of sub-criteria at the third level, and the final weight of each of the sub-criteria.

Table 3. Relative & Final Weights of Criteria and Sub-Criteria

indicator Title	Weight of indicators	parameter	Local Weight	Final weight
Cost of Implementation	0.454	planning of materials and inventories	0.681	0.309
		Trust, and competence of the suppliers	0.695	0.315
		Maintainability (Repairability)	0.660	0.299
		Effective training of staff	0.628	0.285
Speed in Implementation	0.612	Continuous Improvement	0.649	0.397
		Quick decision making	0.573	0.350
		Multi-skilled staff	0.682	0.417
		Quick response	0.625	0.382
The Capability of Implementation	0.639	Flexibility	0.780	0.498
		Compatibility with change	0.728	0.465
		Quality improvement	0.522	0.333
		Using modern technology	0.484	0.309
		Change management	0.503	0.321
Compatibility With the Organization's mission	0.575	Self-control MR (maintenance and repair)	0.644	0.370
		Learning Organization	0.580	0.333
		The capabilities and IT infrastructure	0.687	0.395
		Low integration and complexity	0.546	0.314

Considering the final weights of criteria and sub-criteria in table No. 3, we could prioritize the factors effective for maintenance and repairs of the Iranian Automotive Industry for internationalization. Figures No. 1 and 2 display the bar diagram of the final weights of criteria and sub-criterial.
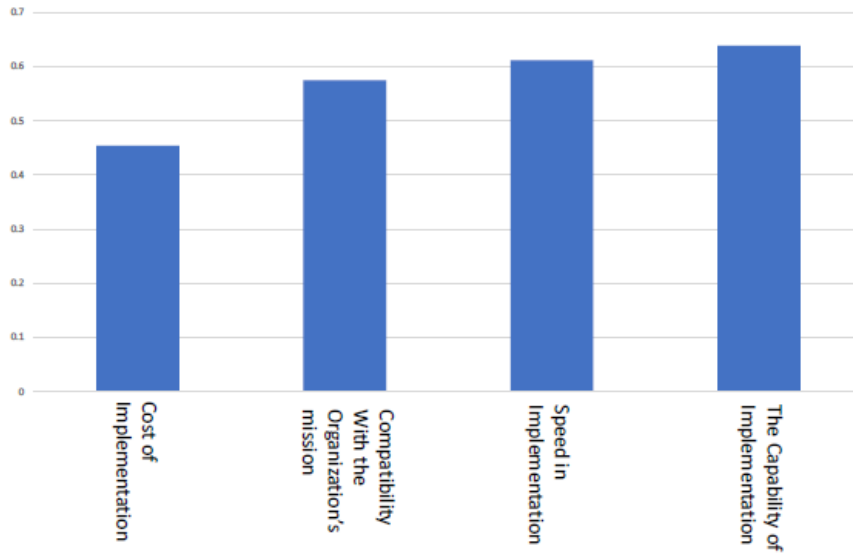

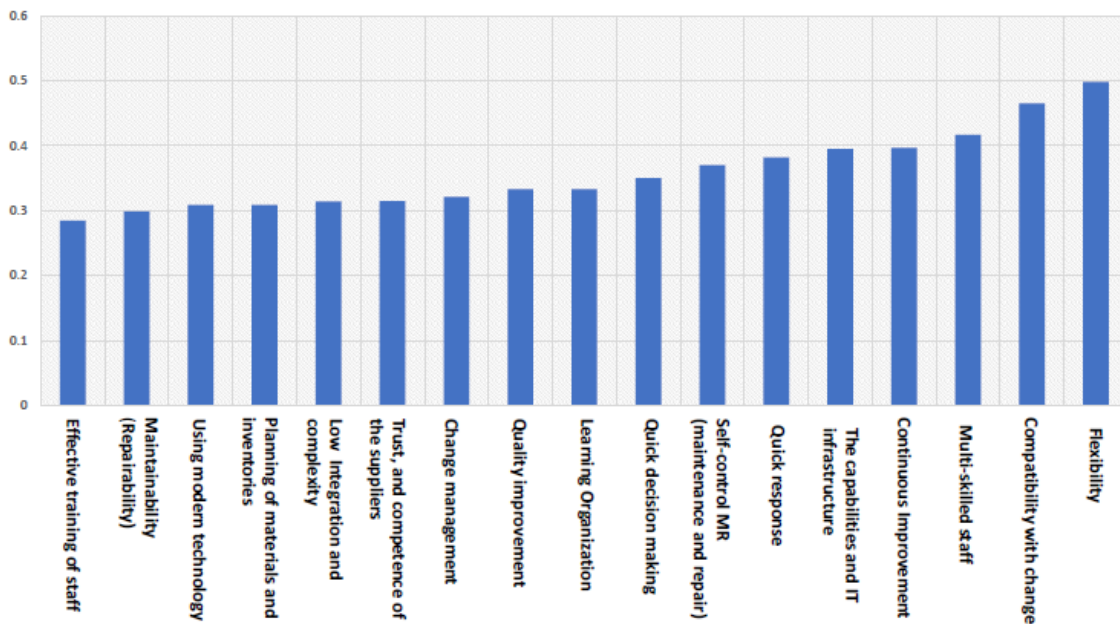**Figure 3. Criteria Final Weight Diagram**

Figure 4. Criteria Final Weight Sub-Diagram

Finally, through data collection and analysis, achievement of relative reliability, and consensus among professionals, as well as the ranking of each parameter based on their weight according to the opinion of the professionals, this research designs a model for the prioritization of factors effective on the maintenance and repairs of Iranian

Automotive Industry for the internationalization. This model consists of three levels: at the first level, there are the factors effective in the maintenance and repairs system of the Iranian Automotive Industry for internationalization. In the second level, there are four indicators of cost of implementation, the capability of implementation, and compatibility with the organization's mission, and at the third level, we could find the criteria of each of these indicators.

As it is observed in table 2, the criterion of the capability of implementation with the weight of 0.639 has the most significance, and then, speed in implementation and compatibility with the organization's mission respectively with weights of 0.612 and compatibility with the organization's mission are in the next priorities, and the indicator of the cost of implementation with the weight of 0.454 has the least significance. Moreover, the results indicate among the parameters of indicator of the cost of implementation, trust, and competence of the suppliers in the first rank, and materials and inventories planning and reparability are in the second and third ranks. Among the parameters of indicator of speed in implementation, the capable and multi-skilled staff, continuous improvement, and quick response are respectively in priority. Among the parameters of indicator of capability of implementation, flexibility has the highest priority, followed by the sub-criteria of compatibility with change, quality improvement, change management, and application of modern technology respectively. Among the parameters of indicator of compatibility with the organization's mission, the capabilities and IT infrastructure and automatic MR have the highest significance.

The investigation conducted by Iranzadeh and Taghipour (2017) confirmed earlier research by emphasizing the importance of elements like reparability, institutional learnability, and automated maintenance in the maritime transportation sector. Aghaei et al. (2015) stressed the value of indicators for agile maintenance, including swift making choices, IT infrastructure capacities, and cooperative information sharing. These results were consistent with the limitations of our investigation. It is clear that maintenance and repairs have a significant impact on a variety of factors, including operational effectiveness, risk mitigation, and product quality. Our study highlights the complexity of maintenance and repairs, refuting constrained interpretations and presumptions that frequently skew professionals' and experts' opinions. Although predictive maintenance is important, it does not cover all aspects of this industry. Instead, strategic decisions are made in both proactive and reactive ways as part of maintenance and repairs, emphasizing the crucial role that directors, supervisors, and experts play in directing these activities. Therefore, it is crucial to appreciate the artistry involved in maintenance and repair, where preventative measures complement reactive ones and the human element still has a key position.

5. CONCLUSION
The research aimed to identify and rank crucial elements for enhancing the internationalization of Iran's automotive industry through effective maintenance and repairs. Two key stages were employed: gathering indicators via questionnaires and library research, and then ranking them using the FAHP technique. The hierarchical

structure encompassed factors influencing internationalization-focused maintenance and repair, with execution capability ranked highest (0.639), followed by execution speed (0.612), and alignment with objectives. Implementation cost held less significance (0.454). Factors determining these indicators were analyzed, such as supplier trust for cost, rapid reaction for speed, and flexibility for execution capability. The study provided insights into operational improvements that prioritize flexibility, adaptability, and aligning with the company's objectives.

Considering the priority of the parameters of the indicator of capability of implementation, it is suggested the Iranian Automotive Industry use all dimensions for the performance assessment, pay attention to the sub-criteria of flexibility purposively, and think about measures for the prioritization of network flexibility, make the upgrade of indicators of cost of implementation, speed of implementation and compatibility with the organization's mission as a tool for the upgrade of indicator of capability of implementation in Iranian Automotive Industry. Taking into account the indicator parameters of the speed of implementation, it is suggested to consider the gap existing between the capable and multi-skilled staff in the Iranian Automotive Industry as an important factor in the speed of implementation, and identify the gaps existing in the organization through training need assessment, and contentious improvement, and take necessary actions.

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