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The Impact of Internal and External Driving Forces and Strategic Decisions on Supply Chain Risk Management (Case Study: Automotive Industry)

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Abstract

The primary purpose of this research was to understand the importance of supply chain strategies in the field of supply chain risk management, emphasizing the effectiveness and efficiency of agile and lean strategies to create resilience and robustness in the supply chain. Data was collected from 392 supply chain experts working in Iran's automotive industry to test hypotheses through structural equation modeling. The findings of this study show that Market Orientation (MO) (as an external force) has more signicant impact on the development of Agile Strategy (AS) than Lean Strategy (LS). In contrast, the Quality Management (QM) system (as an internal force) is highly correlated with the development of lean supply chain strategies. Moreover, agile and lean strategies also have a signicant impact on a resilient and Robust Supply Chain (RB). The proposed model helps organizations understand and create an ideal supply chain by implementing the right combination of both agile and lean supply chain strategies, which in turn helps to create a resilient and RB. Therefore, the findings of this study help policymakers to improve supply chain strategies by incorporating new management practices. This is original research that has various valuable insights for academic researchers and also supply chain strategy professionals as it reveals empirical evidence of the past vital concepts.

Keywords: Quality management, Market orientation, Risk management, Agile strategy, Lean strategy, Leagile strategy, Supply chain resilience, Supply chain robustness.

1 | Introduction

A supply chain includes all the steps and parts that directly or indirectly affect the supply of customer demand [1]. Therefore, the supply chain includes not only the manufacturer and suppliers but also warehouses, retailers, transportation and customers [2]. Focusing on improving supply chain performance is one of the critical elements required to meet customer needs and gain a sustainable competitive advantage, and therefore is of great interest to managers and researchers [3]. Businesses are highly dependent on their supply chain for their success and sustainability. Every business consists of one or more parts of the entire supply chain. Therefore, paying attention to the supply chain of any business is one of the essential priorities of senior managers. Trying to effectively manage this chain is the key to victory [4].

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Due to the scarcity of resources and the need to conserve resources for the next generation, significant growth in research and development has been done to create a sustainable market-focused production system to reduce supply chain waste and improve product recovery. On the other hand, create a stable, rapid reaction production system to produce a various of products required by customers [5]. Despite the increasing attention of managers, the impact and frequency of disruption in the supply chain is very high. Whenever there is a disruption in any network node, it causes a bottleneck in the supply chain and stops the entire supply chain network. Disruption can take many forms, including delays in order, quality problems in production, breakdowns of machinery, as well as natural disasters and catastrophic events, and its effects can vary from the operational level to the strategic level. According to Sodhi et al. [6] risk in the supply chain network harms supply chain performance in terms of efficiency and responsiveness. So, supply chain managers tend to be equipped with strategies for dealing with and managing risk. Ivanov et al. [7] confirm that resilience and robustness are two essential capabilities to manage supply chain risk effectively. This point of view is confirmed by Wieland and Wallenburg [8], who believe that in response to any disruption, the supply chain should be resilient and robust. Robustness is the operational capability that enables the supply chain to endure rather than adapt to disruptions. Resilience, on the other hand, is an active and responsive operational ability to deal with major and minor disruptions [8].

Effective risk management has always been one of the characteristics of successful firms to maintain competition in the long run. Because of the risky business environment, it can be tough for even senior supply chain planners to predict the outcome of their plans, decisions, and strategies. So, according to Deloitte's theory, strategic risks are one of the important reasons that can negatively affect supply chain risk management capabilities. Strategic risks influence or are shaped by strategic business decisions. Limited studies have focused on selecting and applying appropriate supply chain strategies to reduce risk. In addition, supply chain risk management and supply chain strategies are highly interrelated. Carvalho et al. [9] believe that the supply chain suffers costly disruptions. Therefore, senior managers must develop skills to reduce its adverse effects. It can be inferred that with proper implementation of supply chain strategies, its vulnerabilities will eventually be reduced [9].

Agile and lean supply chains are two strategies that any organization can choose to control its operations. Both strategies are often interrelated. Many scholars have argued that implementing a Lean Strategy (LS), due to its focus on minimum inventory and intensive planning, alone is not appropriate for the supply chain. Even agile implementation may not be cost-effective for firms. Thus, Naylor et al. [10] was the first researcher to introduce the concept of integrating both strategies into one supply chain, namely the leagile supply chain strategy. By using the leagile strategy, one can reap the benefits of both strategies [10]. Ambe states that the implementation of both agile and lean strategies enables companies to reduce costs, improve quality and respond to customer demand, while maintaining sustainability of the company's supply chain. Supply chain risk can be controlled by combining two agile and lean strategies [9]. The results of Rahimi and Alemtabriz [4] research in the Iranian military industry showed that Agile and lean strategies are intertwined, and their simultaneous implementation leads to improved supply chain performance [4]. There is limited empirical research in supply chain risk management and supply chain strategies such as lean and agile. Given the importance of two Agile and lean paradigms in improving the economical and rapid response of the supply chain to customer needs, implementing these paradigms is essential for the supply chain of products. Managers do not know which of these paradigms is a priority. Without this knowledge, not only will they fail to apply these paradigms properly, but they will also waste significant financial resources. The current research is designed to present a model of the leagile hybrid paradigm to answer these questions and resolve the ambiguity of managers in applying the leagile hybrid paradigm in the supply chain. On the other hand, from the contingency theory, theorists have argued that the efficiency, effectiveness or appropriateness of risk reduction strategies depends on the internal and external environment of the organization. Therefore, to solve a problem, there is no specific strategy consistently responsive in all situations.

Therefore, this research pursues several goals. The first step is determining how agile and LS decisions affect risk management ability. The second step is to try to discover and explain the driving factors that

help to formulate the appropriate combination of such strategies. Finally, the purpose of this research is to propose a framework that can help companies to create a robust and resilient supply chain with the help of these strategies. This study is not only contributing by bridging the gap by examining the impact of agile and lean strategies on supply chain resilience and robustness, but also focuses on how to improve supply chain risk management by balancing agile and lean strategies.

This study provides academic assistance and various strategic implications for managers and researchers. This paper is structured into five sections. Section 2 reviews theoretical foundations and the previous literature. In Section 3, the research method is explained. Section 4 presents the research findings using statistical analysis and finally, in Section 5, the conclusions and consequences of this research are discussed.

2 | Theoretical Background and Hypotheses

In this section, a theoretical and empirical review of the literature is presented. It has six sections. Section 2.1 provides an in-depth review of the most essential resource-based perspective theory. Supply chain risk management is explained in detail in Section 2.2, which includes two critical, strategies, namely resilience and robustness. Section 2.3, it provides theoretical foundations related to supply chain strategies, ie lean, Agile Strategy (AS), and a combination of both supply chain strategies. Section 2.4 discusses the internal and external forces needed to guide agile and lean strategies. In section 2.5, a summary of the background of the research is presented, and Section 2.6 explains the research hypotheses.

2.1 | Resource-Based View

The Resource-Based View (RBV) is a new approach to the theoretical issues of strategic management, which considers the organization's core resources, capabilities, and competencies as the basis for formulating strategies. In this view, the effectiveness of resources in driving the organization towards success is not the same. In the framework of the value chain, resources are transformed into capabilities, then into core competencies, and finally into competitive advantages. Therefore, in the process of strategic planning, the fundamental issue is to identify strategic capabilities, as well as to operationalize and measure them [11].

RBV focuses on the internal strengths and weaknesses of the organization, not on the opportunities and threats that arise from outside the organization. Firms need to focus on improving business performance by developing a resource-focused strategy and becoming a force for competitive advantage [12]. There is a belief that resources belonging to the organization are the main element of organizational competitiveness [13]. The primary function of the strategy is to create a competitive advantage, and the strategy should turn the organization's resources into a competitive advantage. This transformation occurs through the chain of resources, ability, core competency and competitive advantage. This issue is shown in *Fig. 1* [14].

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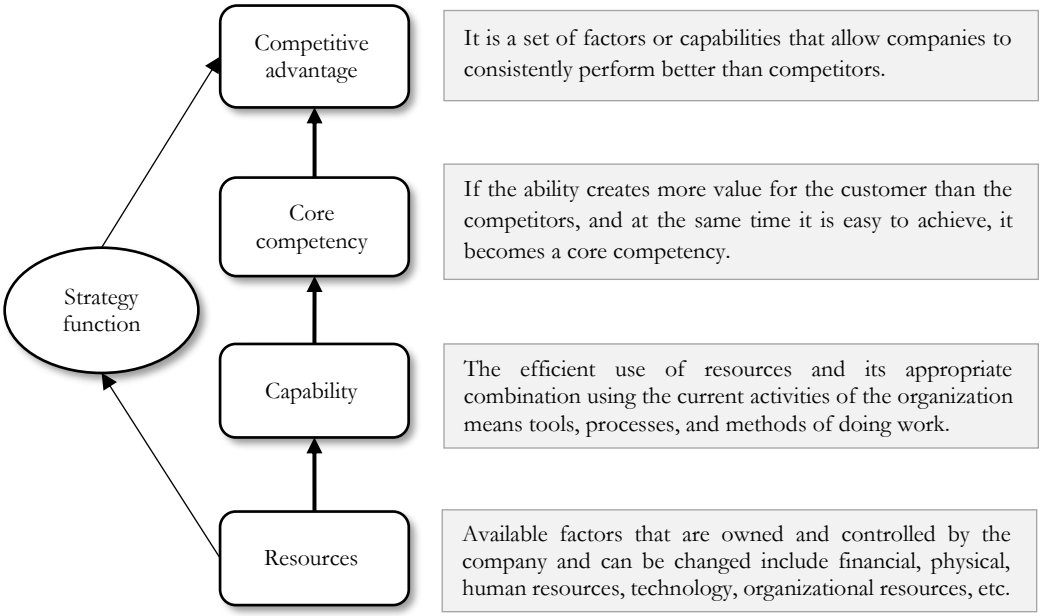

Fig. 1. RBV and the function of strategy.

RBV is a theoretical approach that emerged as a response to the disruption in the business environment caused by globalization, economic and political crises, and technological innovations. Based on RBV theory, organizations can achieve a competitive advantage by having valuable, unimaginable and irreplaceable resources. Resources can be classified into the following categories: human capital resources, physical capital resources, and organizational capital resources. The coordination of all these resources can improve the performance, competitiveness and sustainability of firms. Firms must build a set of strategic resources and capabilities to achieve sustainable competitive advantage by seizing opportunities and reducing risk. In this regard, resources must be aligned to shape capabilities following strategic organizational requirements in order to create or protect value [15]. According to the RBV theory, risk management capabilities consist of two parts: supply chain resilience and robustness. Since supply chain disruptions can have severe and long-term economic effects, resilience and robustness may be developed at the strategic level to deal effectively with supply chain disruptions. Developing supply chain resilience and robustness has tangible consequences for risk management. Thus, RBV theory is the basis of the primary theoretical model to discuss supply chain resilience and robustness [9].

2.2 | Supply Chain Risk Management

Supply chain risk management is a crucial management challenge that affects the organization's performance. All economic disruptions, natural and unnatural, and unforeseen threats affect the performance and profitability of supply networks. In other words, supply chain disruptions are unplanned events that may occur in the supply chain and affect the normal production flow. By increasing the risk of the supply chain, events that lead to disruptions in the flow of materials can cause large-scale disruptions. These disruptions may spread throughout the supply chain, and if supply chain activities cannot manage well the unforeseen disruptions, they will face potential negative consequences, and this will increase the business continuity risk and cause financial losses. Therefore, one of the challenges of today's business is to manage and reduce risk so that the supply chain is not damaged. Due to being in the sensitive region of the Middle East, the threat of natural disasters such as floods and earthquakes, and unique political and economic conditions, our country is highly exposed to all kinds of risks and, naturally, disruptions in all kinds of supply chains. Supply chain Quality Management (QM) measures, as one of the critical components of supply chain management and the development of QM programs, include not only traditional measures within the organization, but also include external measures across the organizational boundaries, which creates the integration of the company with its suppliers and customers [16].

To reduce vulnerabilities and ensure continuity throughout the supply chain, supply chain risk management can be used. It broadens the traditional risk management perspective by linking upstream and downstream supply chain risk. In summary, supply chain risk management identifies, evaluates, and controls uncertainty and potential risk in the supply chain, and reduces disturbances in both reactive and proactive ways. As mentioned earlier, the two main strategies of supply chain risk management, namely robustness which is proactive and resilience which is reactive nature in supply chain risk management, are important capabilities for effective supply chain risk management [8].

Robustness can be defined in terms of supply chain risk management as "the ability of the supply chain to withstand and manage its performance in the face of internal and external turbulences" [17]. This definition focuses on the ability to continue operations while resisting the effects of supply chain turbulences by providing alternative resources or, if an emergency plan is needed, for its rapid implementation. Robustness is considered a proactive strategy to cope with environmental changes, disruptions, or turbulences. Tang [15] defines a "robust strategy" as a strategy that will enable an organization to efficiently manage regular fluctuations under normal circumstances regardless of the occurrence of significant disruptions and helps an organization to sustain its operations during the disruption [15].

Resilience first appeared in materials science to describe the physical ability to return to its original state after any deformation. It is now emerging as a theory. The term supply chain resilience refers to the ability of the supply chain to restore its regular operation after realizing the effects of risks, threats and vulnerabilities [18]. Resilience by allowing businesses to develop goods with features and performance that Satisfies the needs of their customers, improves customer satisfaction [12]. One of the required features of any supply chain to continue operating and remain competitive, not only to resolve disruptions in the short term, but also to create the ability to adapt to changes and improve the organization in the long term. Management strategists argue that supply chain resilience is the ultimate competitive advantage in the present age. However, the literature has mainly focused on supply chain characteristics to determine the level of risk or resilience to external (such as floods, terrorist attacks, earthquakes, etc.) and internal (such as failure of actors in the supply chain) disturbances. Sheffi and Rice [19] define supply chain resilience as a state in which any firm can quickly recover and return to its ideal state after the disruption. In addition, Ponomarov and Holcomb [20] described resilience more effectively, stating that resilient firms can respond to disruptions at the desired level with management, control and improve operations in the supply chain networks through contingency and adaptability. Resilience is important because of the problems associated with risk management, as it enables the firm to be prepared to deal with risks posed by internal processes, suppliers and customers [9]. The main distinction between robustness and resilience is that resilience refers to the power of the supply chain to deal with disruptions and maintain operational processes as planned. In contrast, resilience describes the ability to recover to the initial state after the effects of disruptions have been internalized [18].

2.3 | Supply Chain Strategies

Lean supply chain strategy is a cost-based approach that proactively improves supply chain performance by reducing or eliminating all non added value activities at all stages of the product life cycle, from product design to final delivery to the customer [19]. The implementation of a LS is based on the fact that supplier organization is selected on the basis of quality and cost, in addition to the full use of capacity; Scale savings and technology optimization are considered to ensure the most efficient and accurate data transfer; The link between information must be developed Implementing this strategy will reduce costs, increase inventory turnover and prevent wastage in processes. Such benefits increase the desire of firms to implement LS in their supply chain [9]. In the 21st century, the production level of the company depends on customer demand for customer satisfaction. Manufacturing companies are constantly not only improving their services, processes and products, but also thinking of introducing new products to the market to expand their relationship with customers. An industry that needs high volume and high quality production with lower production cost and high efficiency compared to them,

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lean production is the best offer. This has led to complex production planning as well as control system that has made mass production of goods difficult especially in the automotive industry and the manufacturing sector that is struggling with competitive markets. Many automotive and manufacturing industries have switched to lean production because lean production meets consumer demand by reducing waste. The primary goal of lean industrial production is to provide products with the lowest cost (reduction of waste) and the shortest time, in order to satisfy consumers. Various researchers focus on their research paper benefits of lean implementation such as cycle time, inventory, waste, failure, Overall Equipment Effectiveness (OEE) set up time etc. [21].

In an era when industries are changing the business environment, every organization faces challenges, so to improve the supply chain, an AS must be used [21]. The agile approach is based on the fact that in the current turbulent environment, organizations must offer new, high-quality products to the market in the shortest time in order to retain current customers and attract new customers [21]. Agile supply chain strategy can be considered as benefiting from resilience and adaptability in order to respond dynamically, quickly and continuously to the changing needs of customers and the competitive environment. By implementing this strategy, the firm effectively adapts to the market, responds more quickly to customer demand, and cooperates more effectively with suppliers. Customer responsiveness is critical at all levels of the supply chain, because it is a competitive market need that organizations must understand customer demand and anticipate market changes. Dubey and Gunaskaran [1] have stated that customer responsiveness is an influential factor in globalization and can be achieved by adopting an AS [9].

Applying a lean supply chain in an organization leads to improvements in the form of cost reduction, high inventory turnover, defect prevention and shorter delivery time. These benefits have forced organizations to upgrade their supply chain based on lean principles. Although the lean supply chain has reduced production costs, this supply chain model has failed to be flexible to customer demand. This has caused managers to have the desire to use and develop the agile supply chain model to be considered as an alternative to the lean supply chain. Nevertheless, the concept of lean remains a prerequisite for an agile supply chain. The need for organizations to respond quickly and strongly to fluctuations in demand, in the form of volume and variety, has motivated them to move from lean strategies to agile strategies [23]. Findings indicate that there are a set of criteria specific to LS, such as process-focused criteria, cost, productivity, inventory, and delivery-based criteria, and specific criteria for agility, such as flexibility, responsiveness, information sharing and collaboration. Also, agile and lean strategies have commonalities in terms of quality, time and customer satisfaction. Lean practices are objective and focus on the organization's internal processes, while agile practices target the external environment [24]. A comparison of the main features of two agile and lean strategies is presented in *Table 1* [23].

Table 1. Key characteristics of agile and lean strategies.

Characteristic	Lean Supply Chain	Agile Supply Chain
Product type	Widely used products	Innovative products
Variety of products	Few	A lot
Product life cycle	Long	Short
Market demand	Predictable	Variable-unstable
Attractiveness for customers	Lower price	Faster access
Total marginal profit	Down	Top
The main cost in the system	Physical costs	Buying and selling costs
Penalty for shortage of goods in the system	Long-term contracts	Immediate and variable
Chain purchase policy	Buying goods	Allocation of capacity
System information capability	Optimal	Mandatory
System prediction mechanism	Algorithmic	Consultative

In recent years, another business philosophy called Leagile, a combination of agile and lean thinking, has emerged as one of the choices for the supply chain of organizations, so that both the benefits of being lean (eliminating types of waste) and flexibility it has agility. This approach is generally related to products that are assembled according to the customer's order. Because its demand forecast has very low volatility and relatively high accuracy [23]. Leagile supply chain strategy is a combination of agile and lean strategies, named by Naylor et al. [25]. Companies today tend to be flexible and responsive in a cost-effective manner.

Overall, this hybrid strategy provides the advantages of both agile and lean philosophies for the organization. Leagile supply chain strategy provides cost-effective resource control, flexibility and operational adaptability upstream and downstream of the supply chain in an unpredictable market environment [9]. The results of research by Srinivas et al. [26] show that inadequate human resource management, insufficient technology and innovation, and financial constraints are among the barriers to leagile strategy [26]. Yadav and Kumar [27] confirmed the positive effect of using leagile strategy in improving the operational, economic and even environmental efficiency of the supply chain [27].

2.4 | External and Internal Forces

A review of the past literature shows two influential driving forces of strategic management. A Market Orientation (MO) is an external factor that allows any firm to cope with changing market conditions by offering a high quality product. On the other hand, the QM system focuses on continuous improvement of the supply chain, which provides superiority in internal and controllable operations. So, it can be said that with MO, external opportunities and threats are fully understood and then for planning and proper implementation of strategies, through QM system, the use of available resources is closely monitored, which will bring the desired result [28].

MO has attracted the attention of researchers for more than two decades. Marketing in a company is said to promote the concept of the market. The philosophical background of marketism is the concept of marketing. Cultural MO is an organization that, with maximum efficiency and effectiveness, provides the necessary behaviors to create superior value for customers and, as a result, continuous superior performance for business [29]. Market-oriented companies must analyze the strengths and weaknesses of competitors and, on the other hand, use the knowledge to develop and implement strategies to create sustainable advantage and superior performance [30]. MO enables firms to understand the needs and expectations of their current and future customers. This market intelligence is then shared across all departments of firms to improve operations. According to Day [31], MO connects the organization to the external environment by focusing on the changing needs of the customer, the movement of competitors, environmental uncertainty and shareholder expectations. In addition, Ahire et al. [32] also acknowledged that organizations need to be market-oriented in response to unpredictable market conditions that allow them to gather market information so that they can adapt to it. Tseng and Liao [33] also stated that market-oriented organizations by collecting, disseminating and responding to market information with the help of inter-departmental coordination, enable the organization to perform well with diverse customer demand and unbridled competition in the market [9]. According to the opinion of Kohli and Jaworski [34], successful MO has three main requirements, which are: customer focus, coordinated marketing, and inter-department coordination in the firm. The firm must understand customer needs, so that firm is able to apply orientation, either reactive or proactive orientation. Reactive orientation usually makes firms focus on understanding and satisfying the current needs of the consumer [30]. The above discussion leads to that MO act as sensor which drives organizations to shape their strategies accordingly.

QM system as an essential strategic management tool has been considered in recent decades to create strategies in practice. Quality practices and their applications are involved at all levels of organizations to optimize resources. QM system is a concept related to the management procurement of resources until the delivery of the product to the final destination and even after-sales service. In addition, QM system is always looking for continuous improvement to achieve sustainability, competitiveness and efficiency. Talib et al. [35] showed that Implementing and improving the quality culture in the organization can increase organizational performance through engaging employees, improving relationships with suppliers and employees and customer orientation. Top managers who seek quality and are actively involved in QM, in fact, strengthen and change the strategies, vision and value of QM in the organization. Thus, QM system must be done extensively through management from top to bottom levels and all operational processes of the organization. The results of Wang et al. [36] research showed that quality improvement throughout supply chain processes leads to cost reduction, improved

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resource utilization, and improved process efficiency. In an organization, excellence can be achieved through the proper implementation of a QM system [37].

2.5 | Research Background

In the following, a summary of previous research is presented in *Table 2*.

Table 2. Summary of previous research.

Author(s)	Research Title	Result
Mohr-Jackson [38]	Conceptualizing total quality orientation	The author synthesizes existing knowledge on the topic and provides a foundation for future research by outlining the scope of the total quality orientation construct and providing an operational definition.
Lai [39]	MO in quality-oriented organizations and its impact on their performance	The findings of this research show that MO is positively and strongly related to the application of QM and business performance.
Min et al. [40]	A MO in supply chain management	MO is the basis for supply chain management and supports the implementation of QM.
Dehghan KhalilAbad and Aref [41]	Investigating the impact of supply chain QM practices and capabilities on operational and innovation performance (a case study of food industry companies in Mashhad)	Today, the competition from the company level has been moved to the competition between their supply chains, and an agile and lean supply chain is considered as a very important and decisive competitive advantage in the field of competition. The results show that the capabilities and actions of supply chain QM have an impact on innovation and operational performance.
Karim and Zaman [42]	A methodology for effective implementation of lean strategies and its performance evaluation in manufacturing organizations	Market oriented organizations execute the LS well because both are used to meet customer expectations.
Ghanbari et al. [43]	The impact of strategic cost management on the relationship between supply chain practices, top management support and financial performance improvement	Strategic cost management has a positive and significant effect on the relationship between different measures of non-financial performance of the supply chain and different measures of financial performance improvement.
Zelbst et al. [44]	Relationships among MO, JIT, TQM, and agility	Market oriented directly and positively impacts AS. Updating external information and maintaining constant communication with customers, competitors and shareholders allows the manufacturing company to quickly respond to changes in the volatile market.
Wang and Wei [28]	The importance of MO, learning orientation, and quality orientation capabilities in TQM: an example from taiwanese software industry	The importance of QM is not only limited to providing high quality products or customer satisfaction, but also plays an essential role in reducing supply chain costs in an efficient way by continuously improving process performance.
Nicholas [45]	Hoshin kanri and critical success factors in QM and lean production	QM and lean production is a solution for focusing the organization, aligning goals and plans at all levels, integrating goals and strategies.

Table 2. Continued.

Author(s)	Research Title	Result
Krehbiel and Miller [46]	Should agile be part of your QM?	AS is not so comprehensive and complete that it can be considered as an independent QM. However, it can be an important part of a QM approach.
Imam Vardi Malik et al. [23]	Leagile supply chain evaluation model for apparel	The assessment of Leagile of the supply chain helps organizations to identify and prioritize the indicators and criteria of the leagile of the supply chain, choose the appropriate supply chain approach from among the proposed approaches, and the specified indicators and criteria of leagile according to Prioritize them among the components and elements of the organization's supply chain.
Junaid et al. [47]	A neutrosophic ahp and topsis framework for supply chain risk assessment in automotive industry of Pakistan	The three criteria of agility, resilience and robustness are considered as the main coping strategies for risk management.
Christopher and Rutherford [48]	Creating supply chain resilience through agile six sigma	A supply chain robustness results from a LS. While supply chain resilience is related to AS.
Blackhurst et al. [49]	An empirically derived framework derived framework of global supply resiliency	An agile supply chain has resilience and due to this ability it can adapt itself to changes in the environment and recover quickly after a disruption, which has a positive effect on the performance of the chain.
Derakhshi Khajeh and Jabarzadeh [16]	Developing a causal model of factors influencing supply chain resilience	Based on field studies, the main effective components for increasing resilience and reducing recovery time have been identified, among which the importance of risk management in resilience through reengineering, agility, integration and flexibility of the supply chain. It is strengthened by investing in the development of growth and learning of the organization.
Amir taheri et al. [50]	The impact of supply chain strategies on supply chain integration and competitive performance (case study: Kerman tire industry)	The results of this research show that a lean supply chain is suitable for companies with higher priorities for quality, cost and delivery strategies. On the other hand, an agile supply chain is suitable for companies that compete in a flexible strategy
Wieland and Marcus Wallenburg [51]	Dealing with supply chain risks: linking risk management practices and strategies to performance	Having a Robust Supply Chain (RB) in the organization can help to achieve a resilient supply chain.
Ahmed and Huma [9]	Impact of agile and lean strategies on supply chain risk management	MO as an external force has a greater influence on the application of AS compared to LS, on the other hand, QM as an internal force has a greater influence on the development of lean supply chain strategies. In addition, lean strategies have a significant impact on a RB and agile strategies have a significant impact on a resilient supply chain. A RB can also help achieve a resilient supply chain.
Safavi Mirmahalleh et al. [52]	A model for risk management in the supply chain of Iran's gas industry	The results showed that external risks, production and transmission risks, organizational risks are important in risk management in the country's gas industry supply chain. Also, production, maintenance, transferand transmission and external risks are the highest risk in the first priority of control by the country's gas industry management.

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Table 2. Continued.

Author(s)	Research Title	Result
Goli and Kianfar [53]	Designing a mask closed loop supply chain network by mathematical modeling and fuzzy multi-objective optimization approach	The goals of maximizing the final profit and minimizing the environmental impact are in conflict with each other because reducing the environmental impact leads to an increase in the total cost and reduces the profit of the organization. Also, the increase in demand for various types of masks increases the profit of the chain linearly, but its effect on the environmental effects of the chain has a completely non-linear behavior.
Mohammadi et al. [54]	The effect of production and strategic resilient and supply chain agility on performance (case study: Iran Khodro company)	Strategic resilient has a positive effect on company performance. The agility of the supply chain has an impact on the company's performance. Supply chain agility mediates the effect of strategic resilient on company performance.
Mohammad and Kazemipoor [55]	An integrated multi-objective mathematical model to select suppliers in green supply chains.	An integrated approach for supplier selection in the supply chain and order policy from each of them was investigated in this study. In order to achieve the goals of the research both multicriteria techniques, to select the suppliers (a strategic decision), and optimization methods, determine the optimal order level from each supplier and optimal routing (an operational decision) have been applied.
Rabbani et al. [56]	Presenting a new approach toward locating optimal decoupling point in supply chains	Locating supply chain decoupling point as a strategic decision was addressed in this paper. To do so, an AHP-DEA method was developed and the results were analyzed in a company from food industries in order to validate the proposed structure.
Chansamut [57]	Information system model for educational management in supply chain for thai higher education institutions	The research result shows that information system model for educational management in supply chain for Thai higher education institutions is consisted of 7 key elements which are 1 main element, 2 raw materials, 3 suppliers, 4 manufacturers, 5 service provider, 6 finished product 7 customers. The results from experts' agreement information system model for educational management in supply chain for Thai higher education institutions was a high level. It showed that information system model for educational management in supply chain for Thai higher education institutions could be used to develop information system.

According to the mentioned studies, this research examines the impact of agile and lean strategies on the robust and resilience of the supply chain. Also, the role of internal and external factors affecting these strategies in the automotive industry is examined. This study tries to bridge the gap in previous research by examining the impact of agile and lean strategies on the supply chain, on the other hand, by balancing agile and lean strategies, it also focuses on how to improve supply chain risk management.

2.6 | Hypotheses Development

According to the research background and theoretical foundations and to examine the relationship between driving forces, strategic decisions and supply chain risk management in the form of a comprehensive test, the following hypotheses have been formulated.

Hypothesis 1: There is a positive and significant relationship between MO and QM.

Hypothesis 2: There is a positive and significant relationship between MO and LS.

Hypothesis 3: There is a positive and significant relationship between MO and AS.

Hypothesis 4: There is a positive and significant relationship between QM and LS.

Hypothesis 5: There is a positive and significant relationship between QM and AS.

Hypothesis 6: There is a positive and significant relationship between LS and supply chain robustness.

Hypothesis 7: There is no significant relationship between AS and supply chain robustness.

Hypothesis 8: There is no significant relationship between LS and supply chain resilience.

Hypothesis 9: There is a positive and significant relationship between AS and supply chain resilience.

Hypothesis 10: There is a positive and significant relationship between RB and resilience supply chain (LR).

Based on the hypotheses presented above, the conceptual model of this study is shown in *Fig. 2*.

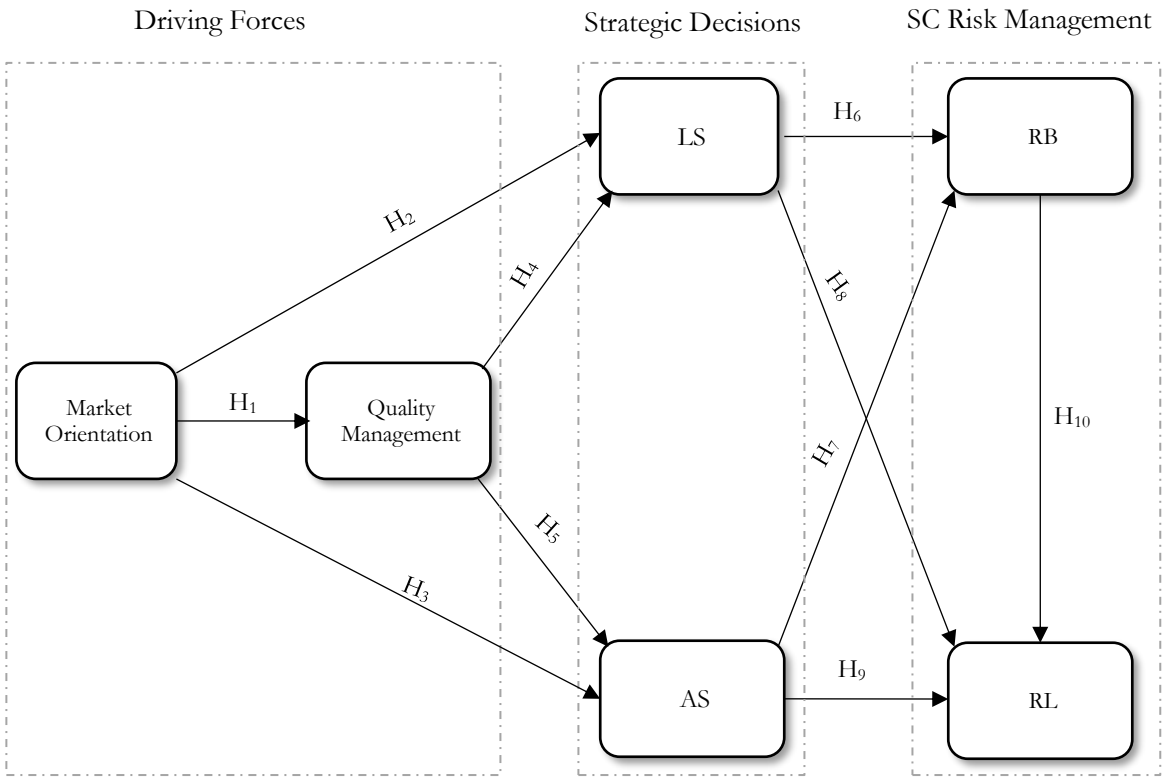

Fig. 2. Conceptual model of research.

3 | Research Methodology

The present research is applied in terms of orientation, case study in terms of strategy, descriptive and survey in terms of purpose, and tries to generalize the results to the statistical population by using data collected from samples. The statistical population of this study includes managers and experts in the supply chain of automobile firms [58]. Due to the size of the firms under study, the size of the population is unknown and based on the Cochran's formula (at a 95% confidence level) the minimum sample size will be 384 people. The structured questionnaire was distributed through face-to-face and electronic referrals. For electronic cases, follow-up messages were often sent to remind key respondents as well. A total, 392 valid responses were received. This questionnaire has 22 questions with 5-point Likert scale, which are evaluated from 1 to 5 (where 1 = strongly disagree and 5 = strongly agree). The variables have been adapted from [9]. In this study, Structural Equation Modelling (SEM) technique and Confirmatory Factor Analysis were used, and SPSS and AMOS software were used to model structural equations. The flow process of this applied research is shown in *Fig. 3*.

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Fig. 3. Flow chart of research process.

4 | Research Findings

4.1 | Descriptive and Demographic Statistics of the Research

The demographic characteristics of this study are presented in *Table 3*.

Table 3. Sample demographics summary.

Demographics	Classification	Frequency	%
	Man	316	80.6
	Female	76	19.4
	Less than 30 years	34	8.8
	31 to 40 years	68	17.3
	41 to 50 years	162	41.3
	More than 50 years	128	32.6
	Diploma and lower	38	9.7
	Associate and bachelor	248	63.2
	Masters	82	21
	Doctoral	24	6.1
	Less than 5 years	53	13.5
	5 to 10 years	167	42.6
	11 to 20 years	97	24.7
	More than 21 years	75	19.2
Total		392	100

According to the table, about 81% of the participants are men. People aged 41 to 50 years (with 41.3%) were among the most participants, and people aged less than 30 years (with 8.8%) were among the lowest participants. People with an associate's degree and a bachelor's degree (with 63%) are the most respondents. This means that most participants have at least a university degree. The work experience of most respondents, with a frequency of 167 people, is between 5 and 10 years. Information about descriptive statistics of variables is shown in *Table 4*.

Table 4. Describes the research variables.

Construct	Average	Min	Max	Sd
MO	3.27	1.33	5.00	0.78
QM	3.41	1.67	5.00	0.64
LS	3.33	1.33	5.00	0.66
AS	3.48	1.33	5.00	0.63
RB	3.24	1.25	4.50	0.64
RL	3.23	1.50	4.75	0.69

As can be seen, the highest average of respondents for the AS component was 3.48, and the lowest average of respondents was related to the RL component of 3.23. Also, the highest standard deviation is related to the MO variable (0.78), and the lowest standard deviation is related to the AS variable (0.63).

4.2 | Validity and Reliability of Research Tools

Before testing the hypotheses, the validity and reliability of the research variables should be checked using the confirmatory factor analysis test. For convergent validity test using confirmatory factor analysis, the factor loads of each variable must be greater than 0.4 and significant. On the other hand, Average Variance Extracted (AVE) should be greater than 0.4. The results showed that the factor load of all items is more than 0.5, which for the sake of brevity, the tables were not presented. The results of AVE are presented in *Table 5*, so the convergent validity of the questionnaire is confirmed.

Table 5. AVE results for convergent validity.

Construct	MO	QM	AS	LS	RB	RL
AVE	0.762	0.510	0.661	0.546	0.605	0.683

To examine the discriminant validity of the variables, the Fornell-Larcker matrices were used and the results of which are presented in *Table 6*. The primary diameter of this matrix is the square root of the AVE values, and only the first-order hidden variables are entered in the matrix. According to the Fornell-Larker matrix, the value of AVE denominators is greater than the correlation value between them, which indicates good discriminant validity, and good fit for the measurement model.

Table 6. Fornell-Larker matr ix results for discriminant validity.

Construct	MO	QM	AS	LS	RB	RL
MO	**0.873**					
QM	0.518	**0.714**				
AS	0.409	0.619	**0.813**			
LS	0.425	0.687	0.524	**0.739**		
RB	0.512	0.336	0.445	0.632	**0.778**	
RL	0.476	0.510	0.648	0.421	0.360	**0.826**

Reliability determines the accuracy of the measurement. This means that if the research is repeated under the same conditions, the score or value of the questionnaire will not change much. To evaluate the reliability of the questionnaire, Cronbach's alpha test and compositional reliability were used, and their results are presented in *Table 7*. Since all coefficients are greater than 0.7, it shows the internal consistency of the results and the reliability of the questionnaire.

Table 7. Results of the questionnaire reliability.

Construct	Number of Questions	Cronbach's Alpha Coefficients	Compositional Reliability
MO	4	0.874	0.845
QM	3	0.795	0.709
AS	4	0.863	0.874
LS	3	0.801	0.843
RB	3	0.813	0.867
RL	5	0.903	0.729

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4.3 | Test the Normality of Data Distribution

Kolmogorov-Smirnov (KS) test was used to evaluate the normality of the distribution of research variables. According to *Table 8,* the hypothesis of normality of data distribution is accepted at the level of 5% error probability (hypothesis H_0 based on the normality of data distribution). In other words, the distribution of research data is normal.

Table 8. Results of data distribution normality test.

Construct	KS	Sig.	Result
AS	0.562	0.905	Normal
LS	0.647	0.796	Normal
MO	0.699	0.713	Normal
QM	0.984	0.715	Normal
RB	0.506	0.963	Normal
RL	0.974	0.299	Normal

4.4 | Predictive Relevance of the Model

In PLS, model fit is usually measured through R^2 and Q^2 (Stone-Geisser Criterion). The coefficients R^2 are related to the endogenous (dependent) variables of the model and show the effect of the exogenous variable on the endogenous variable. R^2 less than 0.30 is considered as low, between 0.30 and 0.60 is considered as moderate, and greater than 0.60 is considered as strong structural model fit. In this research, the amount of R^2 values as shown in *Table 9* indicate a moderate to strong model fit.

As mentioned above, Q^2 is another tool for measuring the capability of predictive relevance. This measure was produced in Smart PLS and is required to be equal to or greater than 0. A Q^2 value larger than zero for a particular endogenous latent variable indicates the PLS path model has predictive relevance for this construct. The test results are presented in *Table 9*.

Table 9. Structural model fit analysis.

Construct	R^2	Q^2
AS	0.46	0.293
LS	0.38	0.364
QM	0.48	0.158
RB	0.52	0.284
RL	0.67	0.421

4.5 | Hypotheses Testing

In this study, ten hypotheses were tested using the SEM technique. All hypotheses (except the seventh and eighth hypotheses) are statistically significant and verifiable. *Fig. 4* shows the path coefficients of the research hypotheses.

Details of the hypothesis test results are presented in *Table 10*. Regarding the hypotheses, the results indicate that MO has a positive and significant impact on QM ($\beta = 0.415$, $p < 0.001$). Therefore, the first hypothesis of the research is strongly supported. In this regard, MO has a positive and significant impact on LS ($\beta = 0.212$, $p < 0.001$) and AS ($\beta = 0.458$, $p < 0.001$). Therefore, the second and third hypotheses are also supported.

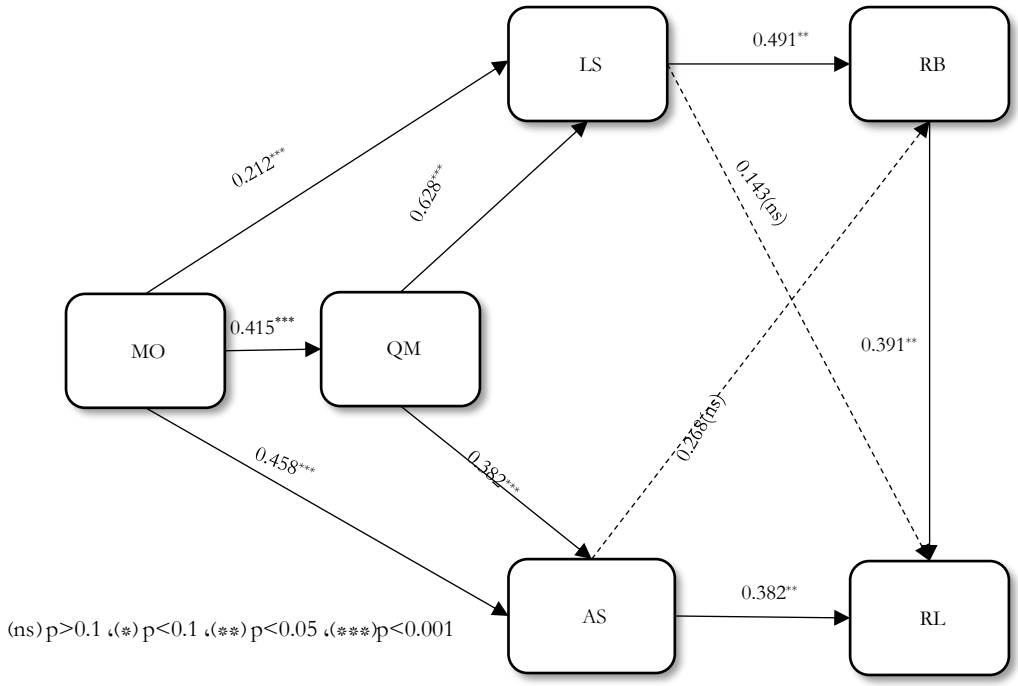

Fig. 4. Hypotheses testing.

QM has a positive and significant impact on two lean strategies ($\beta = 0.628$, $p < 0.001$) and AS ($\beta = 0.382$, $p < 0.001$). This result indicates that by increasing the level of QM, agile and lean strategies are applied in the supply chain better. Therefore, the fourth and fifth hypotheses of this research are also supported.

LS has a positive and significant impact on creating a RB ($\beta = 0.491$, $p < 0.01$), but LS does not have a significant effect on RL flexibility chain ($\beta = 0.143$, $p > 0.1$). According to the theoretical foundations of research, this relationship should be insignificant. Therefore, the sixth and eighth hypotheses are supported. The AS has a positive and significant impact on RL ($\beta = 0.382$, $p < 0.01$), but the LS does not have a significant impact on RB ($\beta = 0.268$, $p > 0.1$). According to the theoretical foundations of research, this relationship should be insignificant. Therefore, the seventh and ninth hypotheses are supported. Finally, creating a RB has a positive and significant impact on RL ($\beta = 0.391$, $p < 0.01$). Therefore, the tenth hypothesis is also supported.

Table 10. Hypotheses testing results.

Hypotheses	Relationships	B-Coefficient	T Statistics	P Values	Decision
H_1	MO→QM	0.415	11.581	0.0001	Supported
H_2	MO→LS	0.212	3.729	0.002	Supported
H_3	MO→AS	0.458	7.433	0.001	Supported
H_4	QM→LS	0.628	4.182	0.009	Supported
H_5	QM→AS	0.382	3.482	0.004	Supported
H_6	LS→RB	0.491	3.460	0.01	Supported
H_7	AS→RB	0.268	1.617	0.114	Supported
H_8	LS→RL	0.143	1.427	0.261	Supported
H_9	AS→RL	0.382	9.915	0.034	Supported
H_{10}	RB→RL	0.391	3.657	0.028	Supported

4.6 | Results of Research Model Fitting

After testing the research hypotheses, it must be ensured that the SEM has a proper fit. There is a wide range of fitness criteria and indicators that can be used to measure the overall pattern. *Table 11* shows the results of several indicators. As can be seen, all the fitting characteristics are within the proper range. Therefore, the desirability of the SEM in fitting the collected data is confirmed.

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Table 11. Research model fitting results.

Fitness Criteria	CIMIN/Df	GFI	IFI	TLI	CFI	NFI	RMSEA
The main pattern	4.501	0.990	0.951	0.990	0.948	0.930	0.009
Acceptable level	1 to 5	More than 0.9	More than 0.9	More than 0.9	More than 0.9	More than 0.9	Less than 0.05

5 | Conclusion and Recommendations

In such a competitive era where the changing market environment and the changing needs of customers have intensified, supply chain managers are more emphasizing on implementing dynamic strategies to get a quick response at the lowest cost. The aim of this research is to propose a conceptual framework for analyzing the drivers of leagile strategy and also to provide empirical evidence of the effectiveness of agile and lean supply chain strategies in creating a resilient and RB, and on the other hand, the impact of risk management on supporting agile and lean strategies. Initially, our results showed that QM is significantly affected by MO. This finding is consistent with the results of previous research. This means that the more market oriented and produce quality work, the more value it creates for the customer. MO is also significantly associated with both agile and lean strategies. Also, the results show that MO meets with customers and understands their needs, which will lead to a better direction of the strategies needed by the organization. Upon further investigation, the findings suggest that MO has a more significant effect on AS than LS. Lee [59] also supports this point of view, who suggested that an AS understands the changing needs of customers, therefore can respond effectively to the market. In contrast, LS can be helpful in environments where market demand is stable. Thus, it can be concluded that the AS can respond in times of uncertainty and is more market oriented than the LS. However, to drive both agile and lean strategies, supply chain managers must focus on the market and be aware of their customers' needs, as well as manage product quality accordingly to respond quickly to volatile markets by reducing non-value-added activities.

Based on the results of this research, QM as an internal driving force is effective in both agile and lean strategies. The application of QM makes it possible to maintain production quality, thus meeting or exceeding customer expectations. Previous studies have confirmed this hypothesis by stating that QM is a suitable tool for implementing lean supply chain in the organization. Manufacturers can gain a competitive advantage in an increasingly volatile market by providing quality products, fast and reliable delivery, and flexibility. So it can be concluded that the existence of QM is essential for the better implementation of LS compared to AS. Anyway, the findings emphasize that before implementing both agile and lean strategies, companies should focus on QM, as it directly helps drive both supply chain strategies.

The results of this study also show that lean strategies have a significant positive effect on RB. Currently, many benefits of implementing a LS for supply chain managers have been identified, the most important of which is the elimination of non-value-added activities that improves productivity, and simplifies operations, and ultimately makes supply chain robust. On the contrary, the present study concluded that the implementation of AS in the organization would not significantly lead to a supply chain robust. However, the evidence from this study shows that LS leads to robustness compared to AS. Therefore, to create a robustness supply chain, managers need to put more emphasis on implementing a LS.

This study supports the hypothesis that both agile and lean strategies are essential in supply chain risk management. Agility (unlike the lean supply chain) has a strong positive impact on resilience. The results of this research also support this concept, because the LS operates on the just-in-time technique, which means no buffer stock and less inventory, making unpredictable events challenging to deal with. According to the theoretical foundations and findings of this study, networks must be able to respond quickly to uncertain events in order to achieve a resilient supply chain. Therefore, manufacturing firm's professionals must have the agility to create a resilient supply chain.

Also, the findings showed that a RB increases its resilience. The findings of this hypothesis are consistent with the results of previous research, as Wieland and Wallenburg [51] showed that AS and RB are two essential elements to creating a resilient supply chain. Therefore, it can be concluded that by implementing

agile and lean strategies, organizations create robustness which leads to a resilient supply chain, and this is the ideal supply chain which that proactively and reactively controls its risk from upstream and downstream supply chains.

5.1 | Managerial Implication

This research considers QM as an internal driving force and MO as an external driving force to implement both agile and lean strategies. In addition, if there is no connection between the internal operations of the organization and its external environment, the customers' needs may not be properly and fully included in the production. The findings of this study emphasize that integrating MO and QM is critical to creating a resilient and RB in an unstable and dynamic environment. Most importantly, the managers are advised to focus first on the external environment and the customer, then transfer the customer's voice to QM, as QM has a greater impact on both agile and lean strategies.

This study also suggests that policymakers emphasize QM as the priority to provide quality products that should be commensurate with the customer's needs. In addition, the main goal of manufacturers is to reduce production costs and closely monitor the production flow, which reduces the possibility of defects. Therefore, the company's focus on QM (as an internal environment driving) will be necessary to implement both agile and lean strategies.

The findings also suggest that automotive industry supply chain professionals should focus on implementing leagile strategy (the combination of agile and lean strategies) to create resilient and RBs, as this study shows that both agile and lean strategies work well when the voice of the customer is recognized, and information is shared within the organization with other departments. Both agile and lean strategies have advantages for the organization. The benefits of both strategies can be achieved by combining these two strategies. This proposed model helps supply chain professionals strengthen resilient supply chains by working to eliminate disruptions in the supply chain and improve responsiveness to customer, while improving robustness by cost-effectively implementing a LS. The main goal of implementing a LS is to reduce waste and make full use of resources. On the other hand, the main goal of the AS is to respond quickly and appropriately to unpredictable demands and dynamic environments. These results lead manufacturing organizations to how lean supply chains are critical to create robustness and how agile supply chains are critical, and the ability to create resilience which helps firms to determine the best direction for their ideal supply chain.

In the last few years, due to the intensification of international sanctions, automotive managers could not take an essential step in the field of raising the quality, and controlling the cost of products and creating diversity. Sanctions limited their access to quality raw materials and new technology, and the result was low-quality, expensive cars and unsatisfied consumers. Based on this, it is suggested that the domestic automobile manufacturing companies should not neglect the localization of production and the strengthening of the domestic supplier, as well as the activation of the research and development unit. A manufacturer with a LS should choose criteria to select a supplier, and a manufacturer with an AS should use criteria to support their agility.

5.2 | Future Research Recommendations

This study emphasizes the direct relationship between the factors affecting the supply chain, so in future studies it will be interesting to investigate some of the mediating effects. In addition, future studies can examine the effect of integration as a moderating factor. Also, examining the factors affecting QM and MO may improve the research model and create more perspectives. This study has been done in the automotive industry; due to the different environmental and operational conditions of industries, the implementation of this model in other industries is necessary.

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