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Important Factors for Agile Supply Chain in Iranian Automobile Industries

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ABSTRACT: Automobile industry is one of the competitive industry in the world. The companies should be flexible to provide customers' demand. They need a good strategy to be flexible, agile is the best strategy for this problem. Supply chain is one of the important part of manufacturing, in the automobile industry they should have a good suppliers to answer any change in the product line. In Iran the suppliers of Automobile industries have a problem to be flexible and fast to answer the product line's change. In this study, the important factors for agile supply chain in Iranian Automobile industries introduced. This factors selected based on experts' opinion and analyzed by fuzzy Delphi method. The results indicated that Daily P.O.S feedback is the important factors for Iranian automobile industries.

KEYWORDS: Agile supply chain, Automobile industry, Fuzzy Delphi method

1- INTRODUCTION

The dynamic customer demands and increasing competition had forced manufacturing systems to exhibit transition. The agile system provides a variety of products in a short period with a cost-effective method (Vinodh, Sarangan, & Chandra Vinoth, 2014). Current revolutions in the industry need more flexibility, efficiency, and agility in order to use production equipment. In order to stay competitive, producers and manufacturers are obliged to enhance the flexibility and productivity of their systems. The production system should have a high level of agility and flexibility to change the products (Niakan, Baboli, Moyaux, & Botta-Genoulaz, 2016).

In recent years, there was a growing trend for firms to have innovation in their products and to offer various services to increase customers and to create opportunities to defeat other competitors. These variants of products and management strategies have a great potential to decrease the negative effects of product variety on supply chain efficiency, and output improvements in flexibility or agility (Um, Lyons, Lam, Cheng, & Dominguez-Pery, 2017).These days with the rapid rate of the economic globalization process firms are facing fierce competition. Many companies decided to improve the quality of products and reduce their price to attract customers attention (Wan, Xu, & Dong, 2017). It is going to be difficult and expensive for a firm to adapt to a competitive condition and solve all these problems if the external environment is affecting the organizations. Accordingly, many companies are sensitive about cooperation and investing in supply chain (SC) networks and logistics processes that are more flexible. Hence, cooperative behaviour and activities in supply chain management (SCM) had obtained notable importance as an essential pre-condition of staying in competitive and raising performance (Samdantsoodol, Cang, Yu, Eardley, & Buyantsogt, 2017).

A car includes more than a thousand parts and each part needs different technologies to be produced. Collecting and assembly of these parts in the best time with the best quality and price is a great job and it requires a long-term strategy to be obtained. In recent years, the automobile industries' framework had changed to Assembly Company where they bought raw materials from the suppliers and then they assembled and sent the car to their customers (Chen, Ellis Scott, & Suresh, 2016). The automotive industry is indubitably one of the largest and most influential industries in the world (Mathivathanan, Haq, & Kannan, 2017). It involves a wide variety of companies taking part in design, development, manufacturing, selling, and marketing of automobiles and their spare parts. The industry is a major contributor to the world's economy and is one of the most important economic sectors by revenue, such that its turnover is equivalent to the sixth largest economy in the world. Besides the economic impact, the industry is a huge contributor to the well-being of people and society, through affecting the quality of a human's life remarkably (Masoumi, Kazemi, & Abdul-Rashid, 2019).

The agile supply chain can help the organizations in achieving competitive objectives and providing customer's needs in highly competitive markets of the current turmoil. The prioritization indicators and identifying the factors that are more important in supply

chain agility in the automotive industry, as organizations recognize its weaknesses and know what aspects need to be improved more (Eshlaghy, 2011). Automobile firms had played an important role on the social group's path towards the property. This needs operational implementation so much on the far side of the mission statement. It is necessary to search out sensible approaches for property development within the businesses themselves, with regards to their supply chains (Koplin, Seuring, & Mesterharm, 2007).

Being the 12th largest maker within the world and therefore the largest within the Middle-East (Momeni, Monavarian, Shaabani, & Ghasemi, 2011& Ghasemi, 2011), Asian countries encompass a crucial role during this giant trade. In the 1960s, the Iranian automotive trade was first established by supporting international vehicle manufacturers. Trade is now dramatically rising and ranks first among Iran's main industries, such as the oil industry. In Iran, the auto industry is considered as one of the main and strategic industries; it is a major part where skilled and unskilled labour currently works in this area by the implementation of supply chain. It is strongly important to consider supply chain agility in the auto industry in order to meet the needs of customers in a timely and appropriate manner. It also pleases and empowers the supply chain.

In 2013, production of automobiles in Iran had dropped. The international relations of Iranian Government had resulted in sanctions on various sectors of Iran and automobile sector of Iran was one of those sectors. Because of the sanctions, import of various automobile parts from French car producers to Iranian market had declined (Aziz, Rana, Khan, & Qureshi, 2017).

In 2014, Ottolenghi highlighted that because of the supplier-related problems around 30 percent of the automobile manufacturers had gone bankrupt. The reduction in the production of automobiles had resulted in the shortage of automobiles in the country. Consequently, South Korean companies stopped taking any further orders from Iran for the procurement of Korean parts. This had resulted in an estimated increase of around 40 percent in the cost of production. Likewise, PSA Peugeot Citroen, French Automobile Company, observed the largest ever annual loss, due to the western sanctions they were not allowed to sell automobile parts to Iran. In response to non-cooperation of foreign sellers, Iran also had closed the production line of six foreign brands that were produced by Nissan, Hyundai, and Kia. Hyundai refused to sell parts to Iran. Likewise, Kia refused to provide air bag system. Nissan decided to abandon further relations with the Iranian company (Ottolenghi, 2014). Boudette (2014) highlighted that as a result of international sanctions on Iran, lots of automobile suppliers operated in Iran had left Iran. These included Fiat, General Motors, PSA Peugeot Citroen, Hyundai, and Toyota. These suppliers were from Italy, Germany, France, South Korea and Japan respectively (Boudette, 2014).

The Iranian car manufacturers had re-established their cooperation with European companies, such as Peugeot, Citroen, and Renault. As a result, the automotive industry has grown by nearly 151%. Additionally, a couple of years back, the Islamic Republic presented certificates to foreign car manufacturers that were willing to open sales branches in Iran. Around 40 foreign automotive manufacturers had already obtained the certificates, and the number was projected to grow over the forecast period.

Iran is one of the developed countries in the Middle East and has many automobile companies. This industry is important in Iran and it plays a key role in the country. However, the automobile industry in Iran has many problems especially in the supply chain and delivery system. This study proposed and improved the agility in the supply chain. The purpose of selecting this industry that is needs to improvement the supply chain based on agility. Furthermore, the manufacturing system needs to be agile to answer to the demands of the market. Supply chain agility can answer these demands with the best reaction. Therefore, to achieve these goals, automobile industries in Iran need to have agile supply chain.

2- LITERATURE REVIEW

An increasing trend had occurred in recent years for businesses to increase their product and offering a wide range of services to increase consumer choice and generate possibilities for competitive performance (Um et al. 2017). Most of the existing literatures show an advantageous relationship between increasing product variety and performance, suggesting that providing a high level of product variety has a positive impact on perceived brand quality and repeat business (Taheri et al. 2019), customer satisfaction (Eisingerich et al. 2016), firm performance (Sangari and Razmi 2015), and market share (Romaniuk et al. 2018). However, Wan et al. (2012) warned that, there can be too much of a good thing as sales performance would decline beyond the optimal level of product variety.

Both flexibility and agility area unit perceived as necessary for achieving variety-related ambitions (Um et al. 2018). Additionally, they had a tendency to acknowledge that supply chains area unit composed of each internal production activities, and external activities related to collaboration and coordination of channel partners. There are unit for several technologies, initiatives, and ideas that makers will use to assist deliver the requisite levels of supply chain flexibility and agility to support their desired levels of product selection (Thoben et al. 2017). These embody product configuration toolkits, cooperative networks (Lyons et al. 2013), proximate offer between a production facility and the target market (Thoben et al. 2017), scale-efficient production facilities, component sharing (Azab et al. 2013), postponement (Qrunfleh and Tarafdar 2013), product modularity (Aoki and Staeblein 2018), process modularity (Vickery et al. 2016), cellular manufacturing (Vickery et al. 2016) and multi-skilling of the workforce (Cuevas et al. 2016).

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While the external environment influenced organizations, it was becoming more difficult and expensive for one company to handle all these issues and to adapt in a competitive context. Therefore, many companies were paying more attention to collaboration and investing in more flexible logistics processes and supply chain (SC) networks supported by information communications and technology (ICT). Hence, collaborative behavior and activities in SC management (SCM) had gained considerable importance as an essential pre-condition of staying competitive and enhancing performance (Samdantsoodol et al. 2017).

Previous studies had used varied mixtures of performance indicators to outline agility performance. For instance, Paulraj and Chen (2007b) used flexibility, time, delivery, and responsiveness because the four vital factors of agility performance within the context of supplying management. Similarly, others had associated cycle time, delivery speed and dependability, customization, new entry, and suppleness with agility performance (Um 2017). The varied dimensions of agility performance was incorporated into three common areas in producing organizations, delivery performance in terms of delivery speed and dependability, flexibility performance in terms of volume and blend flexibility, and style performance in terms of recent entry and merchandise customization (Eckstein et al. 2015). Thus, supported by previous literature, agility performance during this analysis refers to a mix of metrics measurement structure responsiveness to promote needs in areas of style, delivery, and suppleness (Sangari and Razmi 2015). These performance dimensions play a vital role however a company changes its operational state below unsure and dynamical demands (Jajja et al. 2018).

Delic and Eyers researched on the effect of additive manufacturing adoption on supply chain flexibility and performance in automotive industry in 2020, the purpose of the paper was to provide a conceptual framework for analyzing the relationships among Additive Manufacturing adoption, flexibility, and performance in the supply chain context. The research provided insights as to how Supply Chain flexibility mediates the effect of Additive Manufacturing adoption on supply chain performance in the context of European automotive industry. Research findings indicate that Additive manufacturing adoption positively affects supply chain flexibility and that, in turn, supply chain flexibility positively affects supply chain performance. They suggested that companies should focus on flexibilities in the supply chain to improve its performance (Delic and Eyers, 2020).

In order to dispel the lean-agile ambiguity, and given that both high levels of flexibility and quality were required within the automotive industry Qamar et al 2019 published a paper in 2019. The paper's aimed to identify the relationship between flexibility and quality; and explore the quality and flexibility differences between lean and agile production. The obtained results showed that by incorporating an argument built on the strategy literature on Business Models and Dynamic Capabilities, we asserted that lean and agile firms had evolved to underpin different kinds of competitive advantage within the same industry, but these advantages were placed at different tiers in the automotive supply chain (Qamar et al. 2019).

To allocate orders to suppliers in an agile and flexible manner suitable to the automobile industry, Hendalianpour et al in 2019 worked on a paper. In this paper, parts supplied by a single source were eliminated from the set of parts. This paper addressed some new aspects of the subject and achieved robust results by considering five objective functions. The five functions were as follows; minimization of production line disruptions due to the performance of suppliers, minimization of the complaints of production line about supplied parts, minimization of defective parts received from suppliers (PPM), maximization of on-time delivery services, and minimization of overall costs of supplied parts (Hendalianpour et al. 2019).

Costa et al in 2017 suggested a concept model for agile assembly machine for sets applied in the automotive industry, small assembly operations comprising a large variety of models and short cycle time were usually carried out manually, due to their flexibility and agility. Critical factors such as quality, commitment with the delivery time, and increase of labour costs become attractive factors to start developing flexible and agile equipment that allows simple set-up, short cycle time, and traceability (Costa et al. 2017).

Radfar et al evaluated the effect of agility on Iranian automobile supply chain performance in 2012. In this research, the theoretical foundations of agile supply chain and supply chain functions were examined and using the opinions of experts and standard software manufacturing software, it was measured on the proposed model. The results showed that there was a relationship between agility in supply chain and performance of supply chain in Iranian automobile industry (Radfar et al. 2012).

Godarzi and Rahimi in 2017 investigated five functions; the goal of minimizing production line downtime due to supplier performance, minimizing production line complaints from suppliers parts, minimizing defective parts suppliers (PPM), maximizing on-time delivery, and total cost of parts supply to achieve the advantage of agility in Iranian automobile industry. The minimizing production line downtime due to supplier performance and minimizing production line complaints from supplier parts were very important for automobile industry to delivery on time (Godarzi and Rahimi 2017).

Sohrabi and Harati conducted a study in 2015 to identify and rank the indicators affecting supply chain agility in Saipa Automotive Group. The results identified 11 indicators that influenced supply chain agility in Saipa were revealed, as well as ranking factors to develop the skills of staff, use of IT, new product introduction, flexibility, cost reduction, responsiveness and sensitivity market, process integration, customer satisfaction, delivery speed, tailored planning, and product quality (Sohrabi and Harati 2015).

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Aghaei pour et al with the aim of developing an agile supply chain model to solve the problem of defective cars on the floor of Iran Khodro Company, they conducted a research in 2019. By studying the literature on the subject, 11 key factors for success in the agile supply chain were identified and provided to Iran Khodro supply chain experts in the form of a questionnaire. Based on the results of the questionnaire and using the ISM technique, Iran Khodro agile supply chain model was designed. The results showed that the insight this model provided to managers can help them in strategic planning to improve the supply chain agility and supply the parts and equipment needed for defective vehicles on the floor of Iran Khodro Company (Aghaei pour et al. 2019).

Ziarani and Jafarzade Afshari published a paper in 2014, in this paper, an approach was used that by linking competitive advantages, supply chain agility indicators and supply chain agility enablers, the most appropriate enablers that were effective to increase supply chain agility were identified so that the company in question can use these enablers to improve your competitive position. This approach was based on the methodology of expanding quality performance, especially quality house. Some of the most important results of this research were as follows; Competitive Advantages, Quality and Flexibility, Product Diversity, Supply Chain Agility Characteristics: Manpower Flexibility, Flexibility in Operating Instructions and Usage From IT software systems, speed of action in decision making, supply chain agility equipment: first, implementation of empowerment programs and manpower training, second, building trust-based relationships with suppliers and end consumers, and third, development of information technology and business (logistics) Electronic in the supply chain (Ziarani and Jafarzade Afshari 2014).

Motadel et al published a paper in 2014. In this paper, supply chain agility indicators in the automotive industry of Tehran and priority of them had been identified. Also the model of supply chain agility in SAZEGOSTAR SAIPA Co. was obtained with regression. To determine the supply chain agility five classes were considered and the sensitivity analysis model was used for supply chain agility reliability (Motadel et al. 2014).

In 2018, Rostami et al. conducted a study to examine the role of supplier innovation and information sharing on supply chain agility in Iran's automotive industry. In order to meet the needs and desires of the customer in a timely manner and to create the ability in the supply chain to compete with competitors in domestic and foreign markets, addressing the issue of supply chain agility was of great importance. In this study, the effect of supplier information sharing and innovation on supply chain agility (Iran Khodro supply chain) was investigated and a questionnaire was used to collect information and enter information using Spss and Smart Pls software. The results showed that both hypotheses were confirmed and the significant and positive effect of information sharing and supplier innovation on supply chain agility was proven (Rostami et al. 2014).

Ismailian and Ramezani in 2016 researched on a paper to provide a model for agility in automobile supply chain, the results showed that competency and information technology criteria and relationship indicators based on trust and product quality played an important role as the basis that market criteria and customer satisfaction index were recognized as the top of supply chain agility. This model helped supply chain managers in strategic planning to improve supply chain agility and knew which metrics and indicators to invest and strengthen to achieve supply chain agility (Ismailian and Ramezani 2016).

The construct of lightsomeness was introduced by researchers of the Iacocca Institute of Lehigh University in 1991 (Bottani, 2009). It absolutely was initially introduced among the sector of producing and within the construct of versatile manufacturing systems (Sarker, Munson, Sarker, & Chakraborty, 2009). Since then, it had received increasing attention from each educational and business field. Within the field of management system, supply chain lightsomeness may be a comparatively new construct (Braunscheidel & Suresh, 2009). Researchers conceptualized supply chain lightsomeness as a broad and multi-dimensional construct. Within the most general sense, supply chain lightsomeness is outlined because the capability of supply chain functions to produce a strategic advantage by changing surprising market uncertainties and potential and actual disruptions into competitive opportunities through collection requisite assets, knowledge, and relationships with speed and surprise (Bottani, 2009); (Braunscheidel & Suresh, 2009; Christopher, 2000); (Khan K & Pillania, 2008; Sambamurthy, Bharadwaj, & Grover, 2003; Swafford, Ghosh, & Murthy, 2006). Christopher in 2000 created the model for agile supply chain model based on four main factors; Virtual, Market sentence, process integration and Networked based. This model was used in a study by Christopher (2000) as shown in Figure 1.

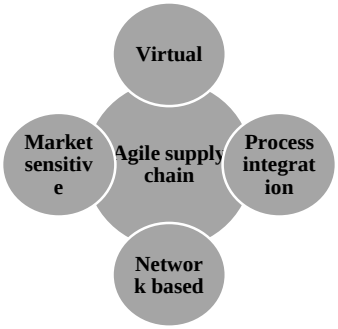

Figure 1 Agile supply chain model modified from Christopher (2000)

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Network based

A distinguishing feature of agile companies is their use of flexible arrangements with a wide supply base. This idea of the supply chain as a confederation of partners linked together as a network provides an important ingredient of agility (Parisi et al., 2015). Table 1 shows the Network based factors that were used for agile supply chain.

Table 1. Network base Factors

Factors	References
Leverage partners' capabilities	(Agarwal, Shankar, & Tiwari, 2007; Cheung, Chiang, Sambamurthy, & Setia, 2018; Wu, 2019)
Focus on core competencies	(Agarwal et al., 2007; Christopher, Harrison, & van Hoek, 2016; Cohen, 2016)
Act as network orchestrator (Leader)	(Agarwal et al., 2007; Cooper, Watson, & Worrall, 2016)

Market sensitivity

Being close to the customer has always been a goal of any market-oriented business. Closeness with customer help in getting customer data quickly and accurately that ultimately leads into quick production introductions (Giannakis & Louis, 2016). In this study, Daily P.O.S feedback, Capture emerging trends, listen to customer are used as a sub factors for Market sensitivity. Table 2 shows the used factors.

Table 2. Market sensitive Factors

Factors	References
Daily P.O.S feedback	(Agarwal et al., 2007; Deshmukh & Mohan, 2016; Tziner & Rabenu, 2018)
Capture emerging trends	(Agarwal et al., 2007; Sodhi & Tang, 2017)
listen to customer	(Agarwal et al., 2007; Gunasekaran et al., 2018; Iddris, Awuah, & Gebrekidans, 2016)

Virtual Integration

The agile supply chain is virtual in the sense that it is connected and integrated through shared information on real demand so that all the players in the chain, from the manufacturers to the customers, are all working to the same set of numbers. Suppliers need to be more closely connected through shared information (Samdantsoodol et al., 2017). Table 3 shows the factors for Virtual integration.

Table 3. Virtual Factors

Factors	References
Shared information on real demand	(Agarwal et al., 2007; Lou & Rezaeenour, 2016; Tarafdar & Qrunfleh, 2017)
Collaborative planning	(Agarwal et al., 2007; Brusset, 2016; Giannakis & Louis, 2016)
End-to-end visibility	(Agarwal et al., 2007; Sithole, Silva, & Kavelj, 2016; Soosay & Kannusamy, 2018)

Process Integration

The integration of supply chain processes is the extent to which the financial, information and physical flows are integrated in a focal firm with its supply chain partners. In order of fulfillment, such processes are linked to customer satisfaction in the supply chain or the on-demand side of the supply chain (Giannakis & Louis, 2016). The factors for Process integration are shown in Table 4.

Table 4. Process integration Factors

Factors	References
Co-managed inventory	(Agarwal et al., 2007; Kilubi, 2016; Sabet, Yazdani, & De Leeuw, 2017)
Collaborative product design	(Agarwal et al., 2007; Moon, Lee, & Lai, 2017; Tarafdar & Qrunfleh, 2017)
Synchronous supply	(Agarwal et al., 2007; Eckstein, Goellner, Blome, & Henke, 2015; Jin, Wang, Zhang, & Zeng, 2019)

3- RESEARCH METHODOLOGY AND ANALYSES

This study administrated three questionnaires. The first questionnaire collected data to find the important factors for agile supply chain from respondents. This questionnaire designed based on Fuzzy Delphi method and 50 experts answered this questionnaire. The sample for this study was selected the public and private sectors in Iranian Automobile Company, were drawn from the automobile suppliers, manufactures and car dealership firms. The expert team included project managers, quality managers, sale managers, supplier managers, top manager of companies and managers of car dealership from more than 500 companies. In this study, Fuzzy Delphi were used choosing the factors. In this part, the methods that were used in this study were explained.

Fuzzy Theory

In 1965, Zadeh introduced Fuzzy Theory (Bathaei et al., 2019; Saaty, 2005; Zadeh, 1978). Fuzzy logic has been proven to be an effective in MCDM method. Fuzzy set theory is an extension of classical set theory that allows solving many problems related to dealing the imprecise and uncertain data. Fuzzy logic takes into account the insufficient information and the evolution of available knowledge (Balmat, Lafont, Maifret, & Pessel, 2011). It permits inaccurate input and it permits many rules to embrace issues with nice quality. For disadvantages, fuzzy systems are typically tough to develop. In several cases, they need varied simulations before having the ability to be employed in the important world. Fuzzy has been employed in engineering, economic, environmental, social, medical, and management. Several of those varieties of issues profit of the provision of inexact input (Velasquez & Hester, 2013).

Fuzzy number

Fuzzy numbers are units of area of a fuzzy set of real numbers, and that they represent the growth of the concept of confidence interval. consistent with the definition created by Dubois and Prade (1978) those numbers that may satisfy these three and four are known as fuzzy numbers, and therefore the following is that the clarification for the options and calculation of the triangular and tetragon fuzzy variety. In this study, the triangular fuzzy numbers were and Figure 2 presented the model of this numbers.

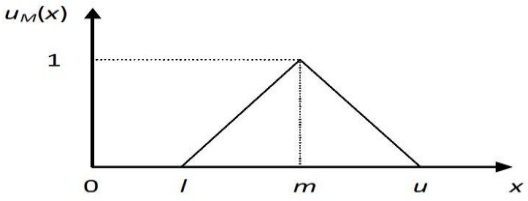

Figure 2 Triangular fuzzy numbers

According to the nature of Triangular Fuzzy Number (TFN), TFN and the extension principle put forward by Zadeh (1965), the algebraic calculation of the triangular fuzzy number.

The overall valuation of the fuzzy judgment

The overall valuation of the fuzzy judgment copes with the fact each that respondent perceives otherwise toward every criterion. The next valuation of the linguistic variable definitely varies among people. We integrate the overall fuzzy judgment by Eq. (1).

$$E_{ij} = (1/m)\odot(E_{ij}^{1}\oplus E_{ij}^{2},\cdots,\oplus E_{ij}m), \quad (1)$$

Defuzzification

The result of each alternative's fluffy synthetic decision is a fluffy number. It is therefore necessary for each alternative to use the non-fuzzy ranking method for fuzzy numbers during service quality comparison. In other words, defuzzification is a technique for converting the fuzzy number into crisp real numbers the defuzzification procedure is to locate the value of Best Non fuzzy Performance (BNP). This purpose is served by several methods available like Mean-of-Maximum, Center-of-Area, and α-cut Method (Zhao & Govind, 1991) are the most common approaches. This study utilizes the Center-of-Area method due to its simplicity and does not require an analyst's personal judgment. The defuzzification value of a fuzzy number can be obtained from Eq. (2).

$$BNP_{ij}=[(UE_{ij}-LE_{ij})+(ME_{ij}-LE_{ij})]/3+LE_{ij}\forall i,j. \quad (2)$$

Fuzzy approach is used on vague objects like airline service quality satisfaction. Because the evaluation results from the view of linguistic variables of the different evaluators, the difference and ambiguity will be there. Moreover, the traditional method of evaluation required evaluators to choose between very dissatisfied, not satisfied, fair, satisfied and very satisfied. This would force the evaluator to undertake an over-high or over-low assessment, thus affecting the accuracy of the assessment (Tsaur, Chang, & Yen, 2002).

The Delphi methodology may be an ancient prediction approach that does not need massive samples. It is often used to come up with knowledgeable agreement for complicated topics (Hartman, 1981). The Delphi methodology suffers from low convergence professional opinions and a lot of execution value. Murray et al. (Murray, Pipino, & van Gigch, 1985) integrate the Delphi methodology and fuzzy theory. Membership degree is applied to determine the membership perform of every participant. Ishikawa et al. introduced fuzzy theory into the Delphi methodology (Ishikawa et al., 1993). Max-min and fuzzy integration rule

are developed. Hsu and Yang applied a triangular fuzzy variety to include professional opinions and establish a Fuzzy Delphi Methodology (Hsu & Yang, 2000). There are two key points in FDM which are triangular fuzzy number and defuzzyfication process. Triangular fuzzy number consists of three values, namely m_1 (smallest value), m_2 (the most plausible) and m_3 (largest value). Triangular fuzzy number used to generate the scale of linguistics (same as the Likert scale) in which linguistic scale is used to translate linguistic variables to fuzzy number. The number of levels of the scale linguistic agreement must be in odd numbers (1, 3, 5, 7, 9) higher scale linguistics provided the data to be more accurate. In this study, we use five point linguistic scales such as in Table 5.

Table 5. The 5-Point Linguistic Scale

Linguistic Scale	Triangular fuzzy number
Very Important	(0.75, 1, 1)
Important	(0.5, 0.75, 1)
Moderately Important	(0.25, 0.5, 0.75)
Unimportant	(0, 0.25, 0.5)
Very Unimportant	(0, 0, 0.25)

The FDM process

When using the FDM method in a study, there is a sequence of steps to be followed:

Step 1: Share the questionnaire with experts to determine the importance of the evaluation criteria of the variables that measured by using linguistic variables.

Step 2: Convert all linguistic variables (triangular fuzzy number)

Step 3: For every factors, use the vertex method to calculate the average.

Step 4: Defuzzification the weights

Step 5: Factors weighing more than 7 are accepted. According to Cheng and Lin, the overall group consensus should be more than 70 percent (Cheng & Lin, 2002).

4- RESULTS OF THE STUDY

Each expert gave a score to the factors between ranges of 1 to 5 in crisp numbers and then the numbers were converted to fuzzy numbers. After converting to the crisp numbers to fuzzy numbers, the average of the fuzzy numbers was obtained, Weights were given based on fuzzy numbers so that they can be adapted to the crisp numbers. Table 6 shows the average of the weights based on fuzzy numbers and final crisp numbers. Based on FDM, factors that have weight more than 0.7 were accepted.

Table 6 Average of the weights and final scores

Code	Fuzzy numbers (L,M,U)	Final score
H1	(0.53, 0.77, 0.90)	0.73*
H2	(0.42, 0.67, 0.85)	0.64
H3	(0.51, 0.75, 0.90)	0.72*
I1	(0.48, 0.72, 0.88)	0.69
I2	(0.45, 0.69, 0.88)	0.67
I3	(0.39, 0.61, 0.80)	0.60
J1	(0.52, 0.76, 0.91)	0.73*
J2	(0.37, 0.61, 0.83)	0.60
J3	(0.50, 0.75, 0.91)	0.72*
K1	(0.52, 0.76, 0.93)	0.73*
K2	(0.39, 0.63, 0.82)	0.61
K3	(0.50, 0.74, 0.92)	0.72*

According to Table 6, the first column is the factor's code based on the questionnaire. The second column is the weights of factors that represent fuzzy numbers (L= lower, M= medium, U= upper) and the third column is the final factors weights showed in script numbers. Only 26 factors with (*) in Table 4.2 were accepted. These numbers are the average score of the experts' answers using Fuzzy method. Then these final scores are converted to linear numbers.

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Table 7 shows that only six factors for agile supply chain were identified as important based on the experts' answers. This table shows the rank and weights. Shared information on real demand, Daily P.O.S feedback and Co-managed inventory carry the same weights of 0.73 and synchronous supply, Listening to customer and End-to-end visibility obtained the same weights of 0.72.

Table 7. Agile supply chain accepted factors

Rank	Factor	Code	Weight
1	Shared information on real demand	K1	0.73
2	Daily P.O.S feedback	H1	0.73
3	Co-managed inventory	J1	0.73
4	Synchronous supply	J3	0.72
5	Listening to customer	H3	0.72
6	End-to-end visibility	K3	0.72

5- DISCUSSION AND CONCLUSION

In this study, 12 factors from four agile supply chain aspects were selected. Based on Table 4.6, experts scored the factors based on their importance in the automobile industry, Daily P.O.S feedback got the best score followed by Co-managed inventory, Shared information on real demand, Listening to customer, Synchronous supply and End-to-end visibility are the best between them. Table 4.3 show the agile supply chain accepted factors with the final rank and weights.

Feedback is one of the essential components of the objective environment that is rarely discussed in a manufacturing field experiment, but the feedback components are typically calculated and usable in manufacturing situations. Feedback has also been studied mainly in laboratory settings and has been shown to increase target setting levels and contribute to higher motivation levels (London and Smither, 2002) and other behaviors that enhance performance. Feedback will usually provide data on the nature, scope and direction of errors so that they can be corrected (Forza and Salvador, 2000). Given that it is the knowledge of a person's success in relation to a norm that determines the subsequent amount of effort expended and his overall level of performance, it is rational to assume that in order to optimize performance improvement, both a challenging goal and knowledge of progress towards the goal are required. Implementation methodologies and expected outcomes can be established for output by separately isolating these advantages. Researchers claim that goal setting and feedback increase productivity and thus strengthen the ability of a company to compete.

Nowadays, companies do not work on their own; they are now linked to several other partners (Alzoubi and Yanamandra, 2020). Sharing knowledge involves transmitting valuable data to programs, individuals or organizational units. Organizations can answer four key questions in order to maximize the outcomes of knowledge sharing: first, we ask what to share, then who to share it with, then how to share, and finally when to share. The quality of responses will help prevent duplication, minimize costs of sharing and boost responses (Cheng et al., 2020). It is also possible to refer to the word' Information Sharing 'as' Knowledge Sharing 'or' Information Integration '. In a supply chain, there is a multitude of data, such as logistics, company, strategic, tactical and many more. With recent developments in Information Technology (IT), the effect of information sharing on supply chains has become more important.

In addition, several studies have been performed to reflect on the effect of knowledge sharing on product quality. Further research, however, still have space to explain exactly how and what knowledge should be communicated and the beneficial effects on improving quality (Ganguly et al., 2019). The academic community as well as the business world have long been concerned about collaboration and alignment in supply chain management (SCM). Supply chain partners need to boost their competitive advantages by knowledge sharing to succeed in today's economy (Chi et al., 2020). With advancements in information technology, it is possible to model various network frameworks to bring the collaboration between supply chain partners even closer. This collaboration and cooperation lead to a supply chain that is more beneficial and efficient. Knowledge flows can improve, confusion can be minimized and higher quality goods with lower prices will be purchased by the ultimate customers in a shorter period of time (Migdadi et al., 2018). Purchases and revenues, inventory status, product growth, revenues and forecasting, market development, future strategy, production cost, technology know-how, and order monitoring are the types of information to be exchanged in the context represented by Pandey et al. (2016).

Sharing information refers to the company's ability to exchange expertise and information in productive and efficient ways with supply chain partners. In traditional supply chain networks, shared information incorporates information between direct partners as well as the entire supply chain network. Information sharing is necessary for effective and productive use by partners. Accountability and effectiveness are closely linked to the extent of knowledge exchange. As one of the cornerstones found, exchanging knowledge

is the vulnerability in the main chain's relationships. Supply chain members are able to share data frequently with each other as a single key to work together. Information communicated between members of the supply chain should be of an updated and reliable source and exchanged in an acceptable, timely, confidential and trustworthy manner.

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