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The Effect of Information Sharing on the Assessment of Supply Chain Performance in Uncertain Conditions

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Abstract— **The role of information sharing in achieving competitiveness has been recently a topic of considerable interest among researchers at various levels, including company, business, and supply chain management. Information technology has a significant effect on improving supply chain performance either directly or indirectly. In this paper, the impact of information sharing on competitive strategies and supply chain proceedes of the petroleum products distribution company is investigated in some provinces (Chaharmahal and Bakhtiari, Kohgiluyeh and BoyerAhmad, Tehran, Isfahan) in the conditions of uncertainty using z-number, Dubois and Prade methods. Here, the amount of confidence in human knowledge such as logistic, business, strategic, tactical etc., is included in the calculations. Fuzzy Theory in use to consider the existing epistindc uncertainty in the expert opinion the about the information sharing and supply chain performance indicators. According to the results of this research it can be concluded that the information unity has a direct and significant communication with competitive supply chain strategies, and supply chain competitive strategies in turn, have a direct and significant relationship with supply chain performance.**

Keywords: information sharing, supply chain performance, z-number, uncertainty

I. INTRODUCTION

In today's business environment, rivalry between the company and competitors has become a rival between the company's supply chain and competitors' supply chain, and the supply chain strategy necessitates finding a way to win the rivals [1]. "Supply chain management" refers to a set of attitudes aimed at

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ensuring the coherence of producers, suppliers, stocks and warehouses in order to produce and distribute the product at the right time, in the right place to the appropriate extent, and finally being capable to offer the level of service requested at the lowest cost [2]. The SCM process can be defined as an effective management of three complementary physical, informational and financial flows between the central corporation and its business partners [3,4]. Creating the correct mechanism based on online information plays an important role in cooperation between the working business partners [5].

This mechanism is designed for solving two different kinds of problems, which in the first one, the information sharing, and in the other, the common activities are of interest [6,7]. Accordingly, the information is often non-uniform and disparate between the upstream and the downstream supply chain partners [8]. Therefore, supply chain partners may be forced to predict market demand based on the incomplete information. Partners will need to accumulate a lot of goods to respond quickly to the market changes. As a result, production costs will increase and profit margins of the partners will decrease (the bullwhip effect). Hence, many studies emphasize the vital role of information sharing in efficient supply chain performance [9,10]. Uncertainty in supply chain management is one of the most important problems caused by the lack of accurate and complete information for decision making. Therefore, the probability of the adoption and acceptance of the information technology in organizations that are facing with more uncertainty is greater [11]. Due to the incomplete and approximate nature of information in supply chain management, the use of verbal variables and fuzzy logic helps approach the actual nature. Thus, in this research, we pay special attention to the relationship between information sharing and supply chain proceedes through fuzzy logic. But here, the main problem is that the reliability of the provided information is not considered. In this regard, due to dealing with ambiguity, the level of information provided is a matter of great importance. Compared to traditional fuzzy numbers, Z- numbers have more reliability to portray human knowledge. Thereby, the main question of the research is as follows: Does information sharing increase the supply chain proceeds in conditions of existing uncertainty? To answer this question, fuzzy logic and z number are used.

In this research, at first, information sharing will be presented in section 2, and then, the dimensions of the supply chain performance assessment will be explained in detail in part 3. The fuzzy number Z and possibility theory are presented in sections 4 and 5, respectively. The proposed framework for a case of products of research and its validity are presented in section 6. Finally, concluding remarks are reported in section 7.

II. INFORMATION SHARING

Information subscription means distributing useful information for systems, people or organizational units. To enhance the results of information multiplexing, organizations should answer four main questions: First we ask what to share, then whom to share it with, then how to share, and finally when to share. The quality of answers will help avoid redundancy, reduce sharing costs and better responses [12]. There exists a myriad of information in a supply chain, such as, logistic, business, strategic, tactical and many more [13]. Shared information in the supply chain colloquial system includes information between direct partners as well as the entire supply chain network [14]. Min et al. [15] represent information multiplexing as the heart of supply chain collaboration.

III. SUPPLY CHAIN PERFORMANCE

The supply chain management function has been defined in various ways. In terms of Management Council of Supply Chain of Management Profession (2013), supply chain management involves the planning and management of all kinds of activities, including supply, ownership, conversion, management and procurement between and within companies, aimed at integrating business responsibilities and processes through a kind of coherence and the business model which is performed with a high performance. In addition, supply chain management includes flow of materials, products, information and money between the special companies and also between all businesses ranging from suppliers and manufacturers to supply chain customers to improve companies' long-term performance [16]. There are different methods for measuring the performance of supply chain management including integration, customer service delivery, cost effectiveness, level of inventory, level of service, total efficiency, suppliers' performance, timing, assets, flexibility, information and consistency of delivery, and delivery performance [17]. In this research, supply chain proceeds is considered to be its efficiency and overall effectiveness, and is measured through three dimensions of flexibility, integrity and accountability to supply chain customers [18,19].

A. Supply Chain Accountability (Responsiveness)

Responsiveness of the supply chain is defined as how the supply chain members respond by coordinating to the environmental changes. It considers the dynamic nature of the supply chain's capabilities, which allows the company to develop and renew specific company competencies and provide better response to the environmental changes [20].

Today's complex market needs to a permanent response, work, and the other efficient factors from all members of the supply chain [21] to be able to act and interact alternatively with the information gathered which is ultimately a controversy [22]. Therefore, supply chains accountability can be considered as a supply chain strategy.

B. Supply Chain Flexibility

Given the changes in the conditions of production and the market, companies are facing a lot of pressure. One way to deal with these pressures is to understand the supply chain and increase its flexibility to meet the different needs of its customers. But what is the meaning of flexibility?

Flexibility means variability in order to adapt and suit the environment and its changes in different situations [23]. The supply chain flexibility is the ability of the system to estimate the various rising expectations of customer in the least time, cost, functional losses, and organizational distortions [24]. The supply chain flexibility is based on two dimensions of weaknesses and capabilities [25]. We can define the weaknesses as follows: The main factors that make an organization susceptible to interruptions [26]. Supply chain capabilities can include features that enable a company to anticipate and overcome interruptions [25].

by several industry practitioners underscore the importance of having flexible supply chain processes to cater to changing market requirements, many fail to invest in establishing a flexible supply chain approach . There are two main reasons for this: flexibility is costly and it is difficult to see the prompt benefits of having such a capability. Further, it is crucial to choose the right kind and level of flexibility that fits the environment in which the firm is operating. For instance, our results indicate that firms that have high uncertainty are more vulnerable to risks in the supply chain; however, having the appropriate supply chain flexibility measures in location mitigates those risks [35].

C. Supply chain integration

Most of the concepts of supply chain integration clearly identify the two streams in the chain: flow of materials and information flow. Supply chain integration must include both these flows and cannot be limited to one of these flows. Coordination, cooperation and partnership are often used more or less in place to describe integrated efforts among partners to improve the efficiency of the supply chain [27]. The 'unified Integration term' refers to the implementation of unit control over a number of similar industrial or economic processes that previously played a role independently. Using this term in the supply chain, the supply chain integration can be defined as follows: The extent to which a producer strategically engages with partners in its supply chain and manages the inward and outsourced organizational processes. The goal is to achieve efficient and effective flows of products, services, information, money and decisions, which results in providing the highest value to the customer at a low cost and high speed [28].

IV. Z-NUMBER

A discrete Z-number is an ordered pair Z =(A ,B) where A is a discrete fuzzy number playing pattern of a fuzzy constraint on values of a random variable X: X is A. is a discrete fuzzy number with a membership function μ_B: $\{b_1,...,b_n\}[0,1]$, $\{b_1,...,b_n\}[0,1]$, playing a role of a fuzzy constraint on the probability measure of A: $P(A)=\sum_{i=1}\mu_A(X_i)P(X_i)$ (1) is B[29,30,31].

Due to the impreciseness that can be seen among linguistic variables, it is rational to use fuzzy sets to prepare objective Indices to classify the appropriate variables [32]. However, fuzzy sets are restricted by the degree of reliability of the linguistic variables which are used. Thus, the new notion of the Z-number will be exploited to efficiently tackle the aforementioned limitation.

In the suggested calculation, the first component of the Z-number is related to the fuzzy description of linguistic variables, and the second component is associated with the degree of reliability of the first one. The next example shows the idea of using a Z-number more understandable. Figure 1 depicts membership functions of fuzzy numbers related to linguistic variables indicating actual progress.

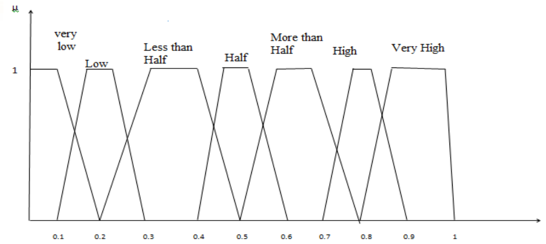


Fig1. Membership Function of Fuzzy numbers associated with linguistic variables indicating actual progress

Table 1. The fuzzy number assigned to each linguistic variables in figure1

Linguistic variables	Attributed Fuzzy number
Lowest	(0, 0, 0.1, 0.2)
Low	(0.1, 0.15, 0.25, 0.3)
Less than Half	(0.2 , 0.3 , 0.4, 0.5)
Half	(0.4,0.45,0.55 ,0.6)
More than Half	(0.5, 0.6, 0.7, 0.8)
High	(0.7, 0.75, 0.87,0.9)
Highest	(0.8 , 0.9 , 1,1)

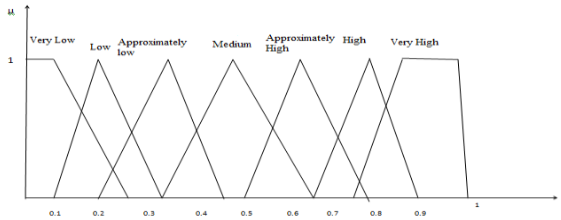


Fig 2. Membership Function of Fuzzy numbers correlated with linguistic variables indicating degree of reliability

Table 2. The fuzzy number assigned to each linguistic variables in figure 2

Linguistic variables	Attributed Fuzzy number
Lowest	(0, 0, 0.1, 0.24)
Low	(0.1, 0.22, 0.35)
Less than Half	(0.21 , 0.33 , 0.48)
Half	(0.35 , 0.5 , 0.62)
More than Half	(0.52 , 0.61, 0.8)
High	(0.64 , 0.79 , 0.9)
Highest	(0.78 , 0.89 , 1, 1)

V. CONVERSION OF A Z-NUMBER INTO A NORMAL FUZZY NUMBER

Based on a mathematical viewpoint, transformation of a Z-number into a standard computable form is critically important. Thereby, a method of conversion of a Z-number into a classical fuzzy number is presented in this section. However, since the concept of Z-numbers is fairly novel, research addressing Z-number is rare. Among them, [33] presented a new method of transforming a Z-number into a fuzzy number based on the fuzzy expectation of the fuzzy sets. Their model is utilized in this paper due to its simplicity and being straightforward to employ. Let us assume a Z-number as Z=($\tilde{A}$, $\tilde{B}$) where the left and the right parts describe the restriction and reliability, respectively. Let $\tilde{A} = \{< x, m_{\tilde{A}}(x) > x\hat{I}[0,1]\}$ and $\tilde{B} = \{< x, \mu_{\tilde{A}}(x) > x \in [0,1]\}$ where $\mu_{\tilde{A}}$ and $\mu_{\tilde{B}}$ are trapezoid membership functions. The procedure to apply method is given as follows:

1. Transform the second part (reliability) into a crisp value [33].

$$\alpha = \frac{\int x\mu_{\tilde{B}}(x)dx}{\int \mu_{\tilde{B}}(x)dx} \qquad (2)$$

where ∫ indicates an algebraic integration.

2. Add the weight of the second part (α) to the first part. The weighted Z-number is illustrated as
$\tilde{Z}^{\alpha} = \{< x, \mu_{\tilde{A}^{\alpha}}(x) > \big| \mu_{\tilde{A}^{\alpha}}(x) = \alpha\mu_{\tilde{A}^{\alpha}}(x)\}$
figure 4 demonstrates the novel Z~α.

3. Convert the weighted Z-number into a normal fuzzy number by multiplying $\sqrt{\alpha}$ by $\tilde{A}^{\alpha}$.

$$\tilde{Z}' = \sqrt{\alpha} \times \tilde{A}^{\alpha} = (\sqrt{\alpha} \times a_1, \sqrt{\alpha} \times a_2, \sqrt{\alpha} \times a_3) \qquad (3)$$

Eventually, the initial Z-number is transformed to a normal fuzzy number (the reader can refer to [33] for more details and proof of the above theorem).

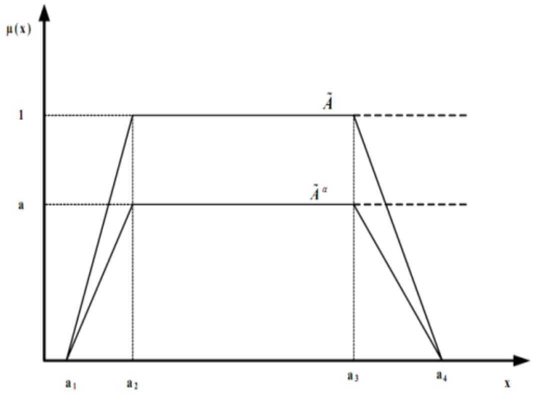


Fig 3. weighted Z-number

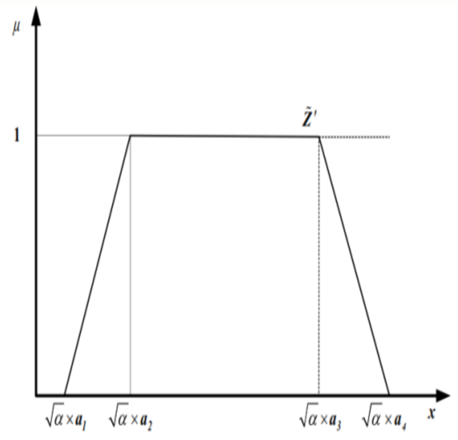


Fig 4. The normal fuzzy number converted from the Z-number

In this section, a numerical example is used to show the procedure of our approach. Assume an expert gives his opinion as follows:

$\tilde{A}$ =(0.7,0.8,0.9,1,1)

And his reliability is

$\tilde{R}$ =(0.8,0.9,1;1)

The proficienc's knowledge can be expressed to z-number as

$\tilde{Z}$ =($\tilde{A}$, $\tilde{R}$)=[(0.7,0.8,0.9,1;1),(0.8,0.9,1;1)]. At first, we should convert expert's reliability into fragile number

$$\alpha = \frac{\int x\mu_{\tilde{B}}(x)dx}{\int \mu_{\tilde{B}}(x)dx} = 0.9$$

Second, we append the weight of reliability to the constraint:

$\tilde{Z}_{\alpha}$=(0.7,0.8,0.9;0.9)

Third, convert the weighted z-number to regular fuzzy number according to the suggested approach.

$\tilde{Z}$= $(\sqrt{0.9}*0.7, \sqrt{0.9}*0.8, \sqrt{0.9}*0.9, \sqrt{0.9}*0.1;1) =$

(0.6641,0.7589,0.8538,0.9487;1)

VI. THEORY OF POSSIBILITY

This Theory of Possibility is established by Askarzadeh. The theory states that in uncertain environments, all possible events must be considered, and depending on the probability of these events, the possibility of contradictory events should be indicated. A fuzzy set consisting of the real line X with a convex and continuous fuzzy normal membership function is A- fuzzy number [34]. The basis of analysis in Dubois and Prade method is Theory of Possibility.

VII. THE THEORETICAL FAMEWORK OF RESEARCH

In sum, the literature review has identified various controversies in accepting the relationship between the information, the competitive strategy of the chain and the supply chain performance. Therefore, a study was designed to resolve this confusion through fuzzy logic with the help of the Z-number.

In order to guide the analysis, six research hypotheses were developed based on the identified findings as follows:

1. Sharing the information of supply chain will impact the supply chain response.
2. Sharing the information of supply chain will affect the supply chain flexibility.
3. Sharing the information of supply chain will affect the supply chain integrity.
4. Supply chain accountability affects supply chain performance.
5. Supply chain flexibility affects supply chain proceeds.
6. Supply chain integrity affects supply chain performance.

These assumptions form the conceptual framework of the research, as shown in Figure 5.

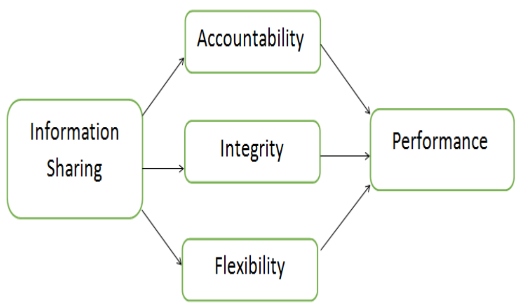


Fig 5. Conceptual Model of the research

The statistical population of this research consists of the managers and experts related to the supply chain of industries. The statistical population can be defined differently according to the purpose of the study and the type of observation unit. In this research, 95 managers and experts related to the supply chain of industries were selected as a statistical sample using stratified random sampling method.

VIII. CASE STUDY AND DATA ANALYSIS

The National Iranian oil products Distribution Company (NIOPDC) was established in 1928 and it has been supplying and distributing the country's oil products for nearly 90 years. Having been staffed by 6243 permanent personnel and about 10000 Informal personnel and using facilities, including 37 regions, 232 districts, 3742 oil products supply stations, 2312 CNG supply stations, 50 aircraft refueling centers, 13000 oil tankers and oil tanks for oil products and liquid gas transportation, 8 ships and marine floating oil storage tanks and storage facilities for four major products with a capacity of 12.7 billion liters, this company is responsible for managing supply and monitoring daily distribution of more than 240 million liters of different oil products all over the world. In the current research, national oil products distribution companies of different regions (Chaharmahal and Bakhtiari, Kohgiluyeh and BoyerAhmad, Tehran, Isfahan), including 40 sections respectively as the following DMUs were investigated:

Distribution of studied oil products: (Chaharmahal and Bakhtiari: DMU1 - Tehran headquarters: DMU2- Kohgiluyeh and Boyerahmad Headquarters: DMU3- Isfahan Headquarters: DMU4- Lordejan: DMU5- Borujen: DMU6- Shahrekord: DMU7- Yasuj: DMU8- Gachsaran: DMU9 - Dehdasht: DMU10- Isfahan: DMU11- Kashan: DMU12- Fereydoun City: DMU13- Khomeinishahr: DMU14- Najaf Abad: DMU15- Shahinshahr: DMU16- Shahreza: DMU17- Khorasgan: DMU18- Fouladshahr: DMU19- Mobarakeh: DMU20- Baharestan : DMU21- Zarinshahr: DMU22- Tiran: DMU23- Golpayegan: DMU24- Falavarjan: DMU25- Aran and Bidgol: DMU26- Tehran: DMU27- Nasimshahr: DMU28- Golestan: DMU29- Ghods: DMU30- Melard: DMU31- Varamin: DMU32 - Shahriar: DMU33 - pakdasht: DMU34 - Ray: DMU35 - Robat Karim: DMU36 - Pardis: DMU37 - Andisheh: DMU38 - Gharchak: DMU39 - Islamshahr: DMU40)

At first, according to table 3 indices, a questionnaire was designed and distributed amongst 290 cases of managers and experts (quality control section –planning section -warehouse section – inspection section-management section-CNG section) of these companies. These 290 persons are the managers who not only have information knowledge but also are familiar with the company's strategy and only these persons can respond the questionnaire professionally.

In this paper, a method of converting Z-numbers to classical fuzzy numbers is proposed according to the Fuzzy Expectation, and then, using z-fuzzy number, Dubois and Prade methods are used in this study. For the Z-analysis, according to the double-jump method (Dubois and Prade), this number is against zero value (compared to zero). To investigate each of the research hypotheses, the indices of research components such as information sharing, supply chain responsiveness, integration, flexibility and performance have been determined.

Table 3. Research Variables

Information Sharing • Our firm exchanges more information with our partners than our competitors with their partners. • Information flows more conveniently among our company and our partners than our competitors with their partners. • Our company profits more from sharing information related to our partners than our competitors with their partners. • Our partners provide all the information that somehow affects us.
Accountability • Compared to our rivals, our supply chain responds more rapidly and more efficiently to changing customers and suppliers. • We review it when we disclose our customers' dissatisfaction with our own products, and we will take corrective action. • We measure consistently the satisfaction level of our customers in the long term.
Integrity • Inside of organization • Outside of organization
Flexibility • We review our products periodically to ensure that they are in line with the wishes of our customers. • We are always thinking about designing and producing new products
Performance • In our company, the total cost of the supply chain waste in each year decreases much more than the competitors. • In our company, the time length of the cash cycle of the supply chain decreases much more than the cash flow of the competitors in each year . • In our company, the profit margin of the supply chain increases much more than the competitors' in each year. • In our company, market share is growing much more than the competitors' in each year.

To analyze the hypotheses of the research, fuzzy logic and Z-number are used. For this purpose, the first and second components of Z-number are Characterized using verbal variables using Table 1. The second component of z was determined using verbal variables using Table 3. The verbal variables were converted into fuzzy numbers, and using Kang et al's [33] method the fuzzy number z was converted into the classical fuzzy number (Table4)

Table 4. Z - Fuzzy number and related classical fuzzy number

Hypothesis	Z - fuzzy number	Classical fuzzy number
1	((0.4,0.45,0.55,0.6),(0.35,0.5,0.62))	(0.28,0.32,0.38,0.42)
2	((0.4,0.45,0.55,0.6),(0.1,0.22,0.35))	(0.28,0.32,0.38,0.42)
3	((0.5,0.6,0.7,0.8),(0.1,0.22,0.35))	(0.23,0.28,0.33,0.38)
4	((0.4,0.45,0.55,0.6),(0.1,0.22,0.35))	(0.19,0.21,0.25,0.28)
5	((0.8,0.9,1,1) , (0.52,0.61,0.8))	(0.64,0.72,0.8,0.8)
6	((0.8,0.9,1,1) , (0.52,0.61,0.8))	(0.64,0.72,0.8,0.8)

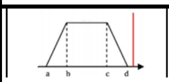
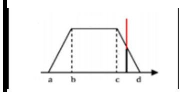
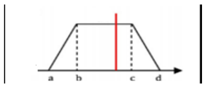
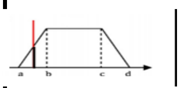
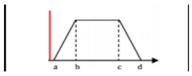
I. Z-NUMBER ANALYSIS

We mean the same indices as presented in Table 3, which have been effective in the performance of the supply chain of companies in accordance with the conceptual model of Fig. 2. All of these indices were extracted from the international references by consulting experts, and were qualitatively questioned. Then according to Table 2, the qualitative criterion was assumed to be fuzzy (uncertainty), and finally was analyzed with the fuzzy probability hypothesis.

As managers and experts responded to questionnaire indices qualitatively and the data provided by them were not accurate, a fuzzy set was used in order to consider uncertainty of information sharing and supply chain proceedes indices.

For the Z-analysis, according to the double-jump method, this number is against zero value (compared to zero). This method is based on the theory of possibility [32]. $\tilde{Z}$ was presented as a trapezoidal fuzzy number, therefore, five scenarios were developed in the analysis (Table 5). The results of the analysis are presented in the following table. The vertical line (red line) shows zero value. According to the table, $T(\tilde{Z} \le 0)$ and $T(\tilde{Z} \ge 0)$ are numerically between zero and one. In the analysis, the fuzzy property of $\tilde{Z}$ is retained.The red vertical line may be placed in 5 areas.

Table 5. $\tilde{Z}$ was presented as a trapezoidal fuzzy number

Scenario No.	The state of $\tilde{Z}$ against 0	Possibility Degree $\tilde{Z} \le 0$	Possibility Degree $\tilde{Z} \ge 0$	Decision	Available shapes
1	d<0	$T(\tilde{Z} \le 0) = 1$	$T(\tilde{Z} \ge 0) = 0$	**Very low effect**	
2	c<0<d	$T(\tilde{Z} \le 0) = 1$	$T(\tilde{Z} \ge 0) = \frac{d-0}{d-c}$	**Very low effect with possibility degree of** $\frac{d}{d-c}$	
3	b<0<c	$T(\tilde{Z} \le 0) = 1$	$T(\tilde{Z} \ge 0) = 1$	**No effect**	
4	a<0<b	$T(\tilde{Z} \le 0) = \frac{0-a}{b-a}$	$T(\tilde{Z} \ge 0) = 1$	**high effect with possibility degree of** $\frac{-a}{b-a}$	
5	a>0	$T(\tilde{Z} \le 0) = 0$	$T(\tilde{Z} \ge 0) = 1$	**high effect**	

The fuzzy number Z = (a, b, c, d) shows the effect of components proportional to the hypotheses. Due to its trapezoidal fuzzy, 5 scenarios are presented (Table 5). **Hypothesis 1**: As you can see, scenario 4 occurs, which means that the supply chain information sharing highly affects the responsiveness of supply chain.

Hypothesis 2: The result obtained for Z is (a> 0). Thus, it can be concluded that the sharing of the supply chain information highly affects the supply chain flexibility.

Hypothesis 3: here, a> 0 is obtained, too. So information sharing has a huge affects on supply chain integration.

Hypothesis 4: From the Z-number obtained here, it can be concluded that, the supply chain responsiveness highly affects the supply chain performance.

Hypothesis 5 and 6: The resulting Z-number shows that the flexibility and integrity of supply chain highly affect the supply chain performance.

II. DISCUTIONS

Information sharing refers to the company's ability to transfer knowledge with supply chain partners in an effective and efficient way. The shared information in the colloquial system of supply chain embraces the information between direct partners as well as the whole supply chain network.

The effects of the components on each other are selected among 5 options (very low, low, no effect, high and very high, i.e., 5 scenarios shown in table 5, that the problem hypotheses are based upon their statistical analysis). In hypothesis 1, as you can see, scenario 4 happens. This means that supply chain information sharing will significantly affect supply chain responsiveness (as a <0 <b). In hypotheses 2 and 3, the result obtained for z is (a> 0) and scenario 5 happens. This means that sharing the supply chain information greatly affects the supply chain flexibility and supply chain integration. In hypothesis 4, as you can see, scenario 4 happens. This means that supply chain information sharing will significantly impacts supply chain performance (as a <0 <b). Finally, in hypotheses 5 and 6, the result obtained for z is (a> 0), thus scenario 4 happens, indicating supply chain information sharing will affect flexibility, and integrity of supply chain significantly impacts the supply chain performance.

IX. CONCLUSIONS

In this research, the relationship between information sharing and competitive strategies and supply chain performance of industry has been investigated using fuzzy logic.

As shown in table 4, data collected from the qualitative questionnaire distributed among 290 cases of managers and experts were converted into fuzzy numbers using convertation of a Z-number into a normal fuzzy number method, and then, using fuzzy theory method, they were analyzed and shown in table 5, and the problem hypotheses were investigated as 5 scenarios.

The results of the analysis are presented in Table 5. The vertical line (red line) shows zero value. According to the table, $T(\tilde{Z} \leq 0)$ and $T(\tilde{Z} \geq 0)$ are numerically between zero and one. In the analysis, the fuzzy property of $\tilde{Z}$ is retained.The red vertical line may be placed in 5 areas.

Communication information refers to the companies' ability to share knowledge with supply chain partners in an effective and efficient way. The purpose of competitive strategies is to share the supply chain information and the ability to coordinate with environmental changes (responsiveness) and the ability to continuously reduce costs (efficiency), which is measured with three factors of accountability, flexibility and integrity. The results of research show that the information sharing is related to all of the three supply chain strategies, but strongly dependent on the accountability and the integrity of the supply chain. Information sharing leads to a high level of information exchange between the partners, as well as high effectiveness of information, and thus, enhances the supply chain in harmony with environmental change. The linkage between supply chain and performance strategies has also been confirmed. This means that according to the results, each organization capability to coordinate internal and external activities depends on its success in effectively and efficiently using the information. In this regard, it is possible to use a comprehensive logistic system to integrate the production requirements and stock warehouse inventory and to arrange suppliers' information such that the required items can be delivered to the company as soon as possible (at the lowest possible time and cost) and be available to the production or assembly line. Under these circumstances, it is hoped that all the outputs including physical products, components, parts and even services will be available to the customers sooner than the predetermined time.

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