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DISTRIBUTION SECTOR PERFORMANCE MEASURE FRAMEWORK UTILIZING INTEGRATED BSC, FAHP AND FTOPSIS

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Abstract: *Intensifying competition and an increasing emphasis on supply chain performance are the main reasons for managers to be interested in evaluating their supply chain performance. Factors that affect the performance of a company supply chain are varied and depend on the supply chain sectors. This paper investigates the factors that affect the performance of a distribution sector in an Iranian supply chain. A questionnaire is designed based on the reviewed literature and interviewing with experts. The initial questionnaire includes questions about fifteen main factors and fifty-five sub-factors. Factors are related to four factors in the Balanced Scorecard (BSC) model. The initial questionnaire is analyses utilizing an exploratory and confirmatory factor analysis. As a result, a final questionnaire which consists of six main factors and twenty-two sub-factors is created. These factors are ranked using Fuzzy Analytical Hierarchy Process (FAHP) and Fuzzy Technique for Order of Preference by Similarity to Ideal Solution (Fuzzy TOPSIS). Utilizing these two techniques, and based on the experts preferences, the factors are ranked. Furthermore, Utilizing the BSC model, it is observed that this distribution sector has better performance in: internal processes, customer processes, finance processes, and finally, growth and learning processes.*

1. INTRODUCTION

Given the inherent complexity of the typical supply chain, selecting appropriate performance measures for supply chain analysis is particularly critical, since the system of interest is generally large and complex. One of the most difficult areas of performance measure selection is the development of performance measurement systems. This involves the methods by which an organization creates its measurement system. In this stage, important questions must be addressed including:What to measure? How are multiple individual measures integrated into a measurement system?How often to measure? How and when are measures re-evaluated? Therefore, it is necessary to stablish mechanism to deploy the supply chain strategy into operations as well as monitoring the performance measures of different sectors of supply chain, which can be measured, and therefore, managed

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through performance measurement factors. It is needed for those enterprises to define and use a structured performance measurement framework that allows managing performance under various performance dimensions.

In order to develop a framework for supply chain performance measurement many studies have been conducted in the literature. Previous work in supply chain performance measurement has generally focused on developing new performance measures for specific applications, such as Kuo and Smits (Kuo and Smits, 2003) for high-tech manufacturing company, and Gunasekaran, *et al.* (Gunasekaran, Patel, and Tirtiroglu, 2001) for service industries; benchmarking, such as: Camp and Camp Robert (Camp and Camp Robert, 1989); and categorizing existing performance measures, such as Neely, *et al.* (Neely, Gregory, and Platts, 1995).

Beamon (Beamon, 1999) established a foundation toward the development of a universal framework for the selection of performance measures for supply chain systems considered manufacturing supply chains and proposed three types of performance measures (Table 1) includes resource (generally cost), output (generally customer responsiveness) and flexibility measures. He developed a quantitative approach for flexibility measurement by considering four different types of flexibility.

Table 1
Performance measure types introduced by (Beamon, 1999)

Type	*resource measures*	*Output measures*	*Flexibility measures*
Goal	High level of efficiency	High level of customer service	Ability to respond to a changing environment
Composition	inventory levels, personnel requirements, equipment utilization, energy usage, and cost	customer responsiveness, quality, and the quantity of final product produced	Volume flexibility, delivery flexibility, Mix flexibility, new product flexibility
Examples	Total cost, distribution cost, manufacturing cost, inventory costs, return on investment	Sales, Profit, Fill rate, On-time deliveries, backorder/ stock-out, customer response time, manufacturing lead time, shipping errors, customer complaints.	Ability to respond to and accommodate difficulties such as poor delivery performance, poor supplier performance, poor machine performance.

Kleijnen and Smits(Kleijnen and Smits, 2003)presented five metrics that a large multinational company used to evaluate the SCM (Table 2) and described the effects of economic theories on multiple performance metrics using balance scorecard which consider four different dimensions of performance metrics includes 1- customer, 2- internal processes, 3- innovation and 4-finance.

Table 2
Performance metrics introduced by (Kleijnen and Smits, 2003)

Metrics	*Definitions*
Fill rate	The percentage of orders delivered 'on time'; that is, no later than the delivery day requested by the customer.
Confirmed fill rate	The percentage of orders delivered 'as negotiated'.
Response delay	The difference between the requested delivery day and the negotiated day.
Stock	Total work in process (WIP) which can be expressed as a percentage of total sales over the preceding m months
Delay	Actual delivery day minus confirmed delivery day.

Gunasekaran, *et al.* (Gunasekaran, Patel, and Tirtiroglu, 2001) developed a framework for measuring the 1- strategic, 2- tactical and 3- operational level performance in a supply chain. They presented a list of key performance metrics with the emphasis on performance measures dealing with suppliers, delivery performance, customer-service, and inventory and logistics costs in a SCM. Gunasekaran, *et al.* (Gunasekaran, Patel, and McGaughey, 2004) developed a framework for SCM performance measurement and metrics by using the results of an empirical study of selected British companies. They classified metrics and measures based on the following supply chain activities: 1) Plan,2) Source, 3) Make/assemble, and 4) Delivery/customer. As their empirical study, they identified some metric for each activities/processes and then classified them as "Highly important", "Moderately Important" and "Less important" metrics. Finally a framework for performance measurement in a supply chain introduced. Agarwal, *et al.* (Agarwal, Shankar, and Tiwari, 2006) presented a framework which encapsulates the market sensitiveness, process integration, information driver and flexibility measures of supply chain performance. They explored the relationship among 1- lead-time, 2- cost, 3- quality, and 4- service level and the leanness and agility of a case supply chain in fast moving consumer goods business. Then, they analyzed the effect of market winning criteria and market qualifying criteria on the three types of supply chains: lean, agile and leagile, which is the combination of the lean and agile types. They used ANP method to analyze the relative impact of different enablers on three SC paradigms.Hofman(Hofman, 2004)mentioned the challenges of right measurement and demonstrated a three-tiered hierarchy that enables managers to easily categorize different SCM metrics. Under this approach, managers quickly assess overall supply chain health at the top tier, diagnose problems at the mid-tier, and identify corrective actions at the ground level. Kuo and Smits (Kuo and Smits, 2003) provided insight in factors that improve the performance of a supply chain and developed the 'extended strategic alignment model based on the literature on next generation supply chains and the role of IT and business architectures. They used their model to analysis the Unitech worldwide SC for high-tech handheld scanning devices. Cho, *et al.* (Cho *et al.*, 2012) conducted a comprehensive literature review on performance measurement issues of service supply chains and established a framework for measuring the performance of service supply chain management. They introduced metrics based on the 1- strategic, 2- tactical and 3- operational level performance in a service supply chain. They used fuzzy analytic hierarchy process for prioritizing the metrics and applied their model in Hotel supply chain as a case study.Verdecho, *et al.* (Verdecho, Alfaro-Saiz, and Rodriguez–Rodriguez, 2014) applied BSC in performance measurement system and evaluated five perspectives, factors: 1) Financial, 2) Customer, 3) Organizational process, 4) Growth and Learning, 5) organizational cooperation process. Four major factors are in accordance with BSC, but the fifth factor which is the organizational collaboration is what the author added to BSC.

The purpose of this paper is to present a multi-criteria performance measurement framework for monitoring a distribution sector of a supply chain, considering the deployment of BSC approaches. With these tools, management of the different enterprises of the supply chain, distribution sector specifically in this paper, will obtain an overall prioritization of their performance factors so that decision makers can focus on those factors more relevant for their objectives.Based on experts' judgment, different factors and sub-factors are provided and ranked using integrated FAHP and FTOPSIS. The performance of the case company is also evaluated utilizing developed framework.

2. PROPOSED INTEGRATED METHODOLOGY

2.1. An overview of research methodology

This research is an applied research which used descriptive methods including Covariance matrix for correlations analysis which deals with studying of Pearson correlations. Among researches by which correlation matrix or covariance both are analyzed are the factor analysis and structural equation modeling. An exploratory and confirmatory factor analysis is also conducted in this research. First, through several interviews with experts as well as an extensive literature review, the factors affecting the performance of the distribution sector of supply chain are listed. These factories are formed a questionnaire withfifteen factors and fifty-five sub-factors. SPSS software, specifically Cronbach's alpha method, is utilized to verify and validate the questionnaire. Since management decisions are associated with uncertainty, analyses are performed on a fuzzy environment (Vafadarnikjoo, Mobin, Salmon and Javadian, 2015; Vafadarnikjoo, Mobin, Allahi, and Rastegari, 2015). Therefore, questionnaire is arranged from a five-level Likert scale. The initial questionnaire is based on fifteen factors and fifty-five sub-factors.These factors include: 1. Flexibility, 2. Customer, 3. Planning, 4. Cost, 5.

Coordination, 6. Delivery, 7. Organization, 8. Quality, 9. Rivals, 10. Purchase Order, 11. Learning and Growth, 12. IT, 13. Time, 14.Logistics, and 15.Innovation. The factors are designed in conformity with four main factors of the balanced scorecard (BSC) (Brewer and Speh, 2001; Danaei and Hosseini, 2013) including: 1. finance approach (cost), 2. Customer approach (time, quality, flexibility, customer and delivery) 3. Learning and growth perspective (innovation, growth and learning, and IT), and 4. Internal processes approach (competitors, coordination, purchase order, planning, logistics and organization).The fifteen factors are divided to above mentioned agents:

Since the questionnaire is integrated for the first time in the area of supply chain distribution sector, it needed to be subjected to an exploratory and confirmatory factor analysis. After aforementioned analysis, the questionnaire is formed sixmain factors and twenty-two sub-factors. Therefore, the obtained factors are studied by exploratory factor analysis and the conceptual model of supply chain performance evaluation iscreated.Finally, the frameworkisverified using confirmatory factor analysis. Finally, Fuzzy AHP (Kabir and Sumi, 2014; Kabir and Sumi 2014; Skeete and Mobin, 2015; Mobin, Roshani, Saeedpoor and Mozaffari, 2015; Allahi, Mobin, Vafadarnikjoo and Salmon, 2015; Saeedpoor, Vafadarnikjoo, Mobin and Rastegari, 2015)and Fuzzy TOPSIS (Mobin, Roshani, Saeedpoor and Mozaffari, 2015; Saeedpoor, Vafadarnikjoo, Mobin and Rastegari, 2015) tools are applied to weight and rank the factors, respectively. The description of FAHP and FTOPSIS are presented as follows:

2.1. Fuzzy Analytical Hierarchy Process (FAHP)

Researchers have applied various methods in the realm of fuzzy AHP such as geometric mean, fuzzy modification of the logarithmic least squares, extent analysis, two-stage logarithmic programming (Kabir, Ahsan and Hasin, 2012; Kabir and Akhtar Hasin 2012). In this study, the revised version of the extent analysis method of Chang (Chang 1996) using triangular fuzzy numbers in fuzzy AHP is utilized (Kabir & Sumi, 2014; Kabir and Sumi 2014). The steps of fuzzy AHP method are as follows (Kabir and Sumi, 2014; Kabir and Sumi 2014):

Step 1: Establishing the pair-wise comparisons matrix: Pair-wise comparisons of all criteria should be done by acquiring opinions of the experts or decision makers. The geometric mean is also applied to obtain the aggregated opinions of all decision-makers.

Step 2: Calculating consistency ratio (CR): After aggregating opinions of decision-makers: It is necessary to calculate the CR which must be lower than 0.1. In order to compute the consistency ratio, the aggregated opinions which are in triangular fuzzy numbers should be converted into crisp numbers. Here, the graded mean integration method is shown in Equation (1) has been applied, where

$P(\tilde{C}) = C$ is the crisp value of a triangular fuzzy number. *l*, *m* and *u* are the smallest, middle and greatest possible values of a triangular fuzzy number respectively.

$$P(\tilde{C}) = C = \frac{l + 4m + u}{6} \quad (1)$$

Step 3: Calculation of $\tilde{S}_i$ values for criteria: These values can be calculated utilizing Equation (2) (Wang, Luo, and Hua 2008), where $\tilde{S}_i$ represents the fuzzy synthetic extent with respect to the criterion *i*. l_{ij}, m_{ij} and u_{ij} are the smallest, middle and greatest possible values of the $(i, j)^{th}$ triangular fuzzy element of the comparison matrix respectively.

$$\tilde{S}_i = \left(\frac{\sum_{j=1}^{n} l_{ij}}{\sum_{j=1}^{n} l_{ij} + \sum_{k=1,k\neq i}^{n} \sum_{j=1}^{n} u_{kj}}, \frac{\sum_{j=1}^{n} m_{ij}}{\sum_{k=1}^{n} \sum_{j=1}^{n} m_{kj}}, \frac{\sum_{j=1}^{n} u_{ij}}{\sum_{j=1}^{n} u_{ij} + \sum_{k=1,k\neq i}^{n} \sum_{j=1}^{n} l_{kj}} \right), i = 1,2, \dots, n \quad (2)$$

Step 4: Determining final importance weights (W_i): Final importance weights of criteria can be achieved by the applying total integral value with the index of optimism according to Equations (3) and (4) in which represents the degree of optimism or pessimism of decision makers and its value is between zero and one. The nearer α is to 1, the more optimistic the decision-makers. In Equation (3), $I_T^\alpha(\tilde{S}_i)$ shows the total integral value of $\tilde{S}_i$ with the index of optimism/pessimism (α). In Equation (4), W_i represents the final importance weight of the criterion *i*.

$$I_T^\alpha(\tilde{S}_i) = \frac{1}{2}\alpha(m_i + u_i) + \frac{1}{2}(1-\alpha)(l_i + m_i) = \frac{1}{2}[\alpha u_i + m_i + (1-\alpha) l_i] \quad (3)$$

$$W_i = \frac{I_T^\alpha(\tilde{S}_i)}{\sum_{i=1}^{n} I_T^\alpha(\tilde{S}_i)}, \qquad i = 1, 2, \dots, n \quad (4)$$

2.2. Fuzzy TOPSIS

Chen (Chen 2000)extended the TOPSIS method under the fuzzy environment. Based on the concept of fuzzy TOPSIS method introduced by Chen (Chen 2000), a Closeness Coefficient (CC) is defined so as to rank all alternatives through calculation of distances to both Fuzzy Positive-Ideal Solution (FPIS) and Fuzzy Negative-Ideal Solution (FNIS). In this research, the steps of Fuzzy TOPSIS are adopted from Mobin, *et al.* (Mobin, Roshani, Saeedpoor and Mozaffari, 2015) and Saeedpoor *et al.*, (Saeedpoor, Vafadarnikjoo, Mobin and Rastegari, 2015)), and presented as follows:

Step 1: Assume that a decision team consists of *K* decision-makers then the aggregated rating of alternatives $(\tilde{x}_{ij})$ can be calculated by Equation (5) in which

$\tilde{x}_{ij}^{K}$ denotes the rating of the K^{th} decision-maker and can be described by a triangular fuzzy number (a_{ij}, b_{ij}, c_{ij}). The number of decision makers is presented by K. The aggregated importance weight of j^{th} criterion based on opinions of K decision makers can also be achieved by Equation (6), where $\tilde{w}_j$ represents the fuzzy aggregated importance weight of the j^{th} criterion based on opinions of K decision makers, and $\tilde{w}_j^K$ is the fuzzy importance weight of the jth criterion based on the opinion of K^{th} decision-maker. Concisely a fuzzy decision matrix ($\tilde{D}$) can be constructed as Equation (7), where A_i represents the i^{th} alternative (i = 1, ..., m), and C_j represents the j^{th} criterion (j = 1, ..., n).

$$\tilde{x}_{ij} = \frac{1}{K}\left[\tilde{x}_{ij}^1(+)\tilde{x}_{ij}^2(+) \dots (+)\tilde{x}_{ij}^K\right]z \qquad i = 1,2,\dots,m \quad j = 1,2,\dots,n \tag{5}$$

$$\widetilde{w}_j = \frac{1}{K}\left[\widetilde{w}_j^1(+)\widetilde{w}_j^2(+) \dots (+)\widetilde{w}_j^K\right]j = 1,2,\dots,n \tag{6}$$

$$\widetilde{D} = \begin{matrix} & C_1 & C_2 & \cdots & C_n \\ A_1 & \tilde{x}_{11} & \tilde{x}_{12} & \cdots & \tilde{x}_{1n} \\ A_2 & \tilde{x}_{21} & \tilde{x}_{22} & \cdots & \tilde{x}_{2n} \\ \vdots & \vdots & \vdots & \cdots & \vdots \\ A_m & \tilde{x}_{m1} & \tilde{x}_{m2} & \cdots & \tilde{x}_{mn} \end{matrix} \tag{7}$$

Step 2: The linear scale transformation is applied to transform the various criteria scales into a comparable one. Hence, the normalized fuzzy decision matrix ($\tilde{R}$) can be obtained by Equations (8), (9) and (10). Considering that is the set of benefit criteria and is the set of cost criteria.

$$\tilde{R} = \left[\tilde{r}_{ij}\right]_{m\times n} \tag{8}$$

$$\tilde{r}_{ij} = \left(\frac{a_{ij}}{c_j^*}, \frac{b_{ij}}{c_j^*}, \frac{c_{ij}}{c_j^*}\right), \quad c_j^* = \max_i c_{ij} \qquad if \quad j \in B \tag{9}$$

$$\tilde{r}_{ij} = \left(\frac{a_j^-}{c_{ij}}, \frac{a_j^-}{b_{ij}}, \frac{a_j^-}{a_{ij}}\right), \quad a_j^- = \min_i a_{ij} \qquad if \quad j \in C \tag{10}$$

Step 3: Considering a weight of each criterion, the weighted normalized fuzzy decision matrix ($\tilde{V}$) can be obtained using Equation (11) in which $\tilde{v}_{ij} = \tilde{r}_{ij}(.)\widetilde{w}_j$

$$\tilde{V} = \left[\tilde{v}_{ij}\right]_{m\times n} \qquad i = 1,2,\dots,m \qquad j = 1,2,\dots,n \tag{11}$$

Step 4: Then, the FPIS or A^* and FNIS or A^- can be defined based on Equations (12) and (13) in which $\tilde{v}_j^* = (1,1,1)$ and $\tilde{v}_j^- = (0,0,0)$, $j = 1, 2, \dots, n$. The distance of each alternative from A^* and A^- can be calculated according to Equations (14) and (15) where $d(\tilde{x}, \tilde{z})$ denotes the distance measurement between two triangular fuzzy numbers $\tilde{x} = (l_x, m_x, u_x)$ and $\tilde{z} = (l_z, m_z, u_z)$ as shown in Equation (16).

$$A^* = (\tilde{v}_1^*, \tilde{v}_2^*, \dots, \tilde{v}_n^*) \tag{12}$$

$$A^- = (\tilde{v}_1^-, \tilde{v}_2^-, \dots, \tilde{v}_n^-) \tag{13}$$

$$d_i^* = \sum_{j=1}^{n} d(\tilde{v}_{ij}, \tilde{v}_j^*) \qquad i = 1,2, \dots, m \tag{14}$$

$$d_i^- = \sum_{j=1}^{n} d(\tilde{v}_{ij}, \tilde{v}_j^-) \qquad i = 1,2, \dots, m \tag{15}$$

$$d(\tilde{x}, \tilde{z}) = \sqrt{\frac{1}{3}[(l_x - l_z)^2 + (m_x - m_z)^2 + (u_x - u_z)^2]} \tag{16}$$

Step 5: Finally, the value of CC is defined utilizing Equation (17). The alternative that has the greatest value of CC stands at the highest rank.

$$CC_i = \frac{d_i^-}{d_i^* + d_i^-} \qquad i = 1,2, \dots, m \tag{17}$$

3. APPLICATION OF PROPOSED METHODOLOGY IN THE CASE STUDY

3.1 Factor Analysis

The initial questionnaire of the research is examined using Cronbach's alpha (Santos 1999). The Cronbach's alpha in this questionnaire obtained 0.976which indicates the validity and reliability of the questionnaire.

Then, the exploratory factor analysis (Thompson 2004) is conducted. In conducting the exploratory factor analysis, it must be ensured that existing data can be used to analyze. By using KMO test, the adequacy of sampling is ensured. This index ranges from zero to one. If the index value is close to the one then the data are appropriate for factor analysis; otherwise, factor analysis is not suitable for the data. In this case study, the index is obtained as it is greater than 7.0. Then, existing correlation in the data is appropriate for factor analysis.In order to check if there is a correlation between the data or not, the population Bartlett's test is used. Since statistic of KMO equals 8.08 and is more than 7, the sample is sufficient to conduct exploratory factor analysis. Also, since the significance level(sig) of Bartlett's statistic is zero(sig = 0/000) and is less than 0.05, the structure of the data are appropriate for exploratory factor analysis. Due to the fact that significance level (sig) is less than 0.05 so null hypothesis is rejected and the alternative hypothesis means there is good correlation between the data structure is confirmed. The second result of exploratory factor analysis is called a common chart. Numbers in the second column EXTRACTION are determination coefficients and show the amount of variance explanation (Questions). If this number for a variable (questions) is smaller than 0.5, that variable (Question) should be removed and perform exploratory factor analysis again, because this amount being small means that the variable (Q) is not associated with any of the factors.In the present analysis in this paper, all the questions are bigger than 0.5. The third output of the exploratory factor analysisis to determine variance. The number of factors is identified and the amount of variance explaining for each of them is characterized. In this research, there are six factors which have Eigen vectors that are larger. Therefore, they remain in the chart. The cumulative variance is obtained 90.599 which shows that 90.599% of factors affecting the performance of distributed supply chain. Total variance of the model is used as a measure of total credit. The cumulative variance explaining should be by greater than 60. The forth outputof exploratory factor analysis, which is the most important output,is called Rotated factor matrix. This matrix determines that what variable (Question) is related to each factor. Divergent validity is one of the goals of exploratory factor analysis. Divergent validity exists when every question with the factor in which it is located contain more than 0.5 and with the other factors is less than0.5.

After the exploratory factor analysis, factors are classified as follows:Factor 1:Store cost, which includes the following questions: In-store inventory turnover costs (F11), Rate of return on investment in store(F12), Profitability of goods sold in store (F13), and Ware housing costs in store (F14).Factor 2: The track of determining client needs to timely delivery, which includes the following questions: Determining customer requirements (F21), Distribution Management at the store (F22), Delivery systems to meet specific customer's need (F23), Reliability of delivery (on-time and without error) (F24). Factor 3: Management based on objective in partnership with clients and competitors, which includes the following questions: Planning for employee's involvement in projects (F31), Transportation management inside and outside the store (F32), Partnership and cooperation withcompetitors (F33), Retaining customers (F34), and Number of over-due orders (F35). Factor 4: Growth and learning, which includes the following questions: Management commitment to the tasks and duties of the store (F41), Creative designing of planning new models at store (F42), and Job satisfaction (F43). Factor 5: Inventory and capacity management which includes the following questions: In-store inventory costs (F51), Capacity planning at the store (F52), and Purchase management at the store (F53). Factor 6:Appropriate information system and services, which includes the following questions:True information (F61), Level of service compared to competitors (F62), and Level of customer service (F63).

In this research, the confirmatory factor analysis (Brown 2015) is conducted twice. For the first-time, the relationship between observed variables (22 factors in the Questionnaire) and the dimensions of each exploratory factor analysis (store costs, the track of determining client needs to timely delivery, Management based on Objectives in partnership with clients and competitors, Learning and growth, Inventory and capacity management and appropriate information system and services) are examined. In the case of standardized estimate, the coefficients are homogenized and there is a possibility to compare them with each other. When the amounts of latent and manifest relevant variables are considered,provided by equal correlation coefficients or load factors, then load factors obtain values between zero and one.If a load factor is less than 0.3, the correlation is considered as a weak one and is ignored. The load factor between 0.3 and 0.6 is acceptable and more than 0.6 it is highly desirable.According to result their amounts for dormant and manifest variables are more 0.3 and their percentages are acceptable.In the constructed model in this research, to assess the generalize ability of the obtained parameters as well as determine the significance of relationships between variables, the significance coefficient test is used. If the value of significance coefficient is outside the range of (-1.96, 1.96) then it can be said that the relationship between the variables is significant. Based on the result obtained for this paper, all measures are in acceptable percentage and outside the range of (-1.96 and 1.96).

The second confirmatory factor analysis can be defined as attribution of hidden variables to a larger structure. In the first confirmatory factor analysis, the relationship between observed variables (questions) are determined by the dimensions of the latent variables. But, in the second confirmatory factor analysis,the relationship between the dimensions of the variables affecting the performance of the organization's performance is examined. In other words, in the second confirmatory factor analysis, we investigate the relationship between six factors derived from exploratory factor analysis with the performance of the store. The relationship between latent variables (size detected) and variables being measured are all greater than 0.3.Also, the case of being significant are shown and the measures of Latent variables and variable of organization's performance is outside of the range of (-1.96, 1.96). Furthermore, the model fit index in two models, such as GFI,AGFI,TLT,NFI,CFI,RFI,IFI are upper than 0.9 and chi-squares are proper. Normed Chi-squares are about 3 and RMSEA are less than 0.1.

3.2. Factor weighting and ranking

The final factors are weighting by Fuzzy Analytic Hierarchy Process(AHP). The resulted weights are presented in Table 3:

Table 3
Weights obtained by FAHP Method

Weights	*Factor*	*weights*	*Factor*
0/0454	F34	0.0456	F11
0.0451	F35	0.0455	F12
0.0455	F41	0.0547	F13
0.0455	F42	0.0456	F14
0.0452	F43	0.0452	F21
0.0458	F51	0.0458	F22
0.0455	F52	0.0454	F23
0.0453	F53	0.0458	F24
0.0450	F61	0.0455	F31
0.0453	F62	0.0451	F32
0.0456	F63	0.0455	F33

Then,Fuzzy TOPSIS method is utilized to rank the factors. In this research, Table 4 is used to convert linguistic variables into fuzzy numbers.

Table 4
Linguistic Scales for Fuzzy Importance Weights of Experts (Skeete and Mobin 2015)

Linguistic Variable	*Triangular Fuzzy Number*
Very Low (VL)	(0.0, 0.1, 0.3)
Low (L)	(0.1, 0.3, 0.5)
Medium (M)	(0.3, 0.5, 0.7)
High (H)	(0.5, 0.7, 0.9)
Very High (VH)	(0.7, 0.9, 1.0)

The result of performing FTOPSIS, which is the rank of factors, is presented as follows: 1-Store cost, 2-The track of determining client needs to timely delivery, 3-Management based on objectives in partnership with clients and competitors, 4-Growth and Learning, 5-Inventory and capacity management, 6-Appropriate information system and services

4. DISCUSSION AND CONCLUSION

In this research, the exploratory and confirmatory factor analyses are utilized to categories the six affecting factors in the distribution section of an Iranian supply chain. Factors are captured from litrature and interviewing with experts, and follow the four factors of balanced scorecard. Given the obtained results, and according to the weighs and ranks of factors, the store has the best performance in the internal processes approach and then has devoted attention to customer approach, financial approach, and finally growth and learning. Moreover, these fifteen factors of performance from managers' view passed to the experts ofcase company in Tehran, Iran in the form of another questionnaire. They rated these fifteen factors. The results show that from the store managers' view, the order of factors is: 1. Customer, 2. Quality, 3. Planning, 4. Time, 5. Cost, 6. Harmony, 7. Purchase and order, 8. IT, 9. Innovations, 10. Flexibility, 11. Delivery, 12. Organization, 13. Competitors, 14. Growth and learn, and 15. Logistics. The fifteen factors from managers' point of view are classified in four categories of the balanced scorecard. Managers have considered customer approach as the most important factor, then cost factor, internal processes approach, and finally growth and learning.

References

Agarwal, A., Shankar, R., & Tiwari, M. K. (2006), Modeling the metrics of lean, agile and leagile supply chain: An ANP-based approach. *European Journal of Operational Research*, *173*(1), 211-225.

Allahi, S., Mobin, M., Vafadarnikjoo, A., & Salmon, C. (2015), An Integrated AHP-GIS-MCLP Method to Locate Bank Branches. In *Proceedings of the 2015 Industrial and Systems Engineering Research Conference*.

Beamon, B. M. (1999), Measuring supply chain performance. *International Journal of Operations & Production Management*, *19*(3), 275-292.

Brewer, P. C., & Speh, T. W. (2001), Adapting the Balanced Scorecard to Supply Chain Management. *Supply Chain Management Review,* V. 5, No. 2 (Mar./Apr. 2001), P. 48-56: Ill.

Brown, T. A. (2015), *Confirmatory factor analysis for applied research*. Guilford Publications.

Camp, R. C. (1989), Benchmarking-The Search For Industry Best Practices That Lead To Superior Performance. *Quality progress*, *22*(4), 62-69.

Chang, D. Y. (1996), Applications of the extent analysis method on fuzzy AHP. *European journal of operational research*, *95*(3), 649-655.

Chen, C. T. (2000), Extensions of the TOPSIS for group decision-making under fuzzy environment. *Fuzzy sets and systems*, *114*(1), 1-9.

Cho, D. W., Lee, Y. H., Ahn, S. H., & Hwang, M. K. (2012), A framework for measuring the performance of service supply chain management. *Computers & Industrial Engineering*, *62*(3), 801-818.

Danaei, A., & Hosseini, A. (2013), Performance measurement using balanced scorecard: A case study of pipe industry. *Management Science Letters*, *3*(5), 1433-1438.

Gunasekaran, A., Patel, C., & McGaughey, R. E. (2004), A framework for supply chain performance measurement. *International journal of production economics*, *87*(3), 333-347.

Gunasekaran, A., Patel, C., & Tirtiroglu, E. (2001), Performance measures and metrics in a supply chain environment. *International journal of operations & production Management*, *21*(1/2), 71-87.

Hofman, D. (2004), "The Hierarchy of Supply Chain Metrics." *SUPPLY CHAIN MANAGEMENT REVIEW*, 8(6), 28-37.

Kabir, G., & Sumi, R. S. (2014), Power substation location selection using fuzzy analytic hierarchy process and PROMETHEE: A case study from Bangladesh. *Energy*, *72*, 717-730.

Kabir, G., Ahsan, M., & Hasin, A. (2012), Framework for benchmarking online retailing performance using fuzzy AHP and TOPSIS method. *International Journal of Industrial Engineering Computations*, *3*(4), 561-576.

Kleijnen, J. P., & Smits, M. T. (2003), Performance metrics in supply chain management. *Journal of the Operational Research Society*, *54*(5), 507-514.

Kuo, D. C., & Smits, M. (2003, January), Performance of integrated supply chains-an international case study in high tech manufacturing. In *System Sciences, 2003. Proceedings of the 36th Annual Hawaii International Conference on* (pp. 10-pp). IEEE.

Mobin, M., Roshani, A., Saeedpoor, M., Mozaffari, M. (2015), Integrating FAHP with COPRAS-G method for supplier selection (case study: an Iranian manufacturing company). *Proceeding of 2015 American Society of Engineering Management (ASEM) conference.*

Neely, A., Gregory, M., & Platts, K. (2005), Performance measurement system design: a literature review and research agenda. *International journal of operations & production management*, *25*(12), 1228-1263.

Saeedpoor, M., Vafadarnikjoo, M., Mobin, M., Rastegari A. (2015), A SERVQUAL model approach integrated with fuzzy AHP and fuzzy TOPSIS methodologies to rank life insurance firms. *Proceeding of 2015 American Society of Engineering Management (ASEM) conference.*

Santos, J. R. A. (1999), Cronbach's alpha: A tool for assessing the reliability of scales. *Journal of extension*, *37*(2), 1-5.

Skeete, A., & Mobin, M. (2015), Aviation Technical Publication Content Management System Selection Using Integrated Fuzzy-Grey MCDM Method. In *Proceedings of the 2015 Industrial and Systems Engineering Research Conference* (pp. 1-10).

Thompson, B. (2004), *Exploratory and confirmatory factor analysis: Understanding concepts and applications*. American Psychological Association.

Vafadarnikjoo, A., Mobin, M., Salmon, C., & Javadian, N. (2015), An Integrated Gray-Fuzzy Cause and Effect Approach to Determine the Most Significant Categories of Project Risks.

Vafadarnikjoo, A., Mobin, M., Allahi, S., Rastegari, A. (2015), A hybrid approach of intuitionistic fuzzy set theory and DEMATEL method to prioritize selection criteria of bank branches locations. *Proceeding of 2015 American Society of Engineering Management (ASEM) conference.*

Verdecho, M. J., Alfaro-Saiz, J. J., & Rodriguez–Rodriguez, R. (2014), A performance measurement framework for monitoring supply chain sustainability. In *Annals of Industrial Engineering 2012* (pp. 331-338). Springer London.

Wang, Y. M., Luo, Y., & Hua, Z. (2008), On the extent analysis method for fuzzy AHP and its applications. *European Journal of Operational Research*, *186*(2), 735-747.