



## Evaluation of Organizations Agility Using ANP FUZZY and Fuzzy VIKOR Method Case Study: Amol Dairy Companies

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### Article

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### Abstract

Recently, most organizations forced to quit the competition, because they cannot compete with the environment, and they are not responsible to customers. Most of them forced to find a new strategy to reserve. In Iran, many companies are working in Dairy products, most of them want to be more successful in this field but they cannot participate in the competition. Therefore, they need strategies to fix this problem, Agility organization is one of the strategies to help companies stay in the competition. Companies should be agile to stay in the competition, and they can use agile correctors and abilities. In this research agile model designed by reliable research results and experts' recommendations whit using the Fuzzy ANP which they were working on the respective companies. After finding proper factors, this research sort these companies from an agility point of view whit using the Fuzzy TOPSIS Method. The results of this study show the best factors that can help Dairy companies' to be agile. In addition, these companies ranked based on agility.

## 1. Introduction

Agility, in the embrace of change, is aggressive and developmental. Agility seeks success in profit, market share and gaining customers in competitive markets that many companies are afraid to enter because they are turbulent centers. Ultimate agility is not assumed and there are no defects that the company or individual has reached the ultimate agility and completed it. Agility is constantly changing the performance of personnel and organization, the value of products and services, and constant changes in the opportunities of recruitment. The customer pays attention and requires constant readiness to face fundamental and superficial changes, and agile companies are always ready to learn anything new that will increase the profitability of taking advantage of new opportunities [1].

An agile organization and processes to meet customer needs with advanced technology to provide high quality products and services in a relatively short time together. Agility organization's ability to

provide high quality goods and services increases, so it is important to increase the competitiveness of the organization [2].

This study shows good agility for companies like Amul Dairy, Haraz, Gela and Kallh is. Since the company's products in the field of dairy products and various products for our customers interesting and because of market competition between companies in these types of products, so the company should measure the factors and the agility to identify. So in this study tried to identify the factors and criteria and provide a way to measure the agility of the organization and the agility of the company compared to each other.

## **2. Definition of Agility**

Agility is defined as the ability to thrive in environments that are constantly changing and unpredictable. In this regard, organizations should not be afraid of and avoid changes in their work environment, but should see change as an opportunity to gain a competitive advantage in the market environment. Since 1991, the term agility has been used for the first time. Agility means the ability to respond quickly and successfully to clean changes in the environment [3].

## **3. Organization's Agility**

It is an organization that has the ability to respond to unforeseen and unexpected changes in appropriate ways and at the right time, as well as to take advantage of change and gain the benefits of change as opportunities. An agile organization must be able to recognize environmental changes and view them as factors in growth and prosperity [4].

Every organization needs planned changes, which is a regular step towards restructuring the organization in a way that can adapt to the changing conditions of its external environment and achieve new goals. So this is difficult and sometimes costly, but such changes are important because they help the organization adapt to changes that occur in the organization and the environment that will threaten its survival. Because the dynamism and continuity of the movement of organizations depends on these changes and the necessary flexibility in each of the operations based on the goals of the organization. Another important point is that change and its method is very important, which means that if a method is successful in time and place and can not be successful in another nation and country. Therefore, all models of change should be used with in-depth study of the organization and society, so that the full potential of the country and society, and especially the efficient and specialized forces in management can be used optimally, and this is effective in terms of effort and cooperation, even if Cases of failure. It is also important to note that if change is accompanied by proper management, it can be used positively for the organization, but if the manager does not have the ability

to deal properly with change, change will become a crisis that can even lead to organizational failure. Top executives also need to change their perspective when faced with complex situations and changes. Just as Edison had changed his mindset more than anything else when he invented electricity. For this reason, he never spent his time improving the performance of the candle, because he knew he had to devise a new plan. Organizational change is a continuous process of experimentation and adaptation that adapts the organization's capabilities to the needs of today's dynamic and uncertain environment. Information gathering, communication and organizational learning are key elements of this process. Because learning acts as a catalyst.

On the other hand, one of the principles of agility is training and learning organization. In addition, the main driving force of agility is change. As can be seen and according to the above, there is a correlation between change with agility and organizational learning as well as learning with organizational agility. Although these concepts have been related to commercial and manufacturing organizations in the past, they can also be used in the service sector. And will gradually expand in this area. Therefore, regardless of the type of change, this article introduces auxiliary tools to make useful changes, use opportunities, adapt to change, and so on. Tools that can help the health system to cope with environmental changes and make changes to improve the situation, better access to health system goals and meet customer needs are organizational agility and learning are two important factors that Enable the manager to deal with change more accurately, quickly and effectively [3].

## **2- Literature review**

From the late 1980s to the mid-1990s, following extensive economic and political developments, many measures were taken in the field of new global business systems. The United States took the helm of the movement when it saw a significant downturn in global business, especially in manufacturing. In 1991, a group of industry experts observed that the rate of change in the business environment was faster than the ability of traditional manufacturing organizations to adapt.

These organizations were unable to take advantage of the opportunities that were offered to them, and this inability to adapt to changing conditions could lead to their bankruptcy and failure in the long run. Thus, for the first time, a new paradigm was published by the Yakuka Institute in a report entitled *The Enterprise Strategy of the 21st Century: The Perspective of Industrial Experts*. Immediately, the term agile manufacturing became commonly used with the publication of this report.

To supplement the above, in 1991, the US Navy-sponsored Layhae University, together with the Yakoka Institute, conducted studies on 13 major manufacturing organizations, including General Motors, General Electric, and I.A M, Texas Instrument and... did. The purpose of this study was to answer the question of what will be the characteristics of successful organizations in the years of the 21st century. Since then, more than 100 other

organizations have been studied, and in 1991 the study was dubbed the Study of Manufacturing Companies in the 21st Century, and later in 1995, the results of a study in Steven Goldman, Nigel, and Press: Agile competitors and virtual organizations were released

### Research method

In order to choose the best factors in assessing and evaluating research papers agility and the introduction of various factors, including management responsibility, agility, production management, IT agility, agility and agile workforce strategy. Technology, customers, partnerships with companies, external factors such as weather, economy, shareholders, government, competitors [15] Process, information, technology, production management and production strategy, staff, organization, resources and environmental management [16] and etc. were introduced. By studying these factors in selected companies, the leading causes of agility in the company and using fuzzy ANP were selected. These criteria and sub-criteria scoring after experts found comparing weights in the matrix. In addition, the VIKOR fuzzy ranking method is used for prioritization. In this study of 11 valid on previous research organization agility and agility factors were extracted. After presenting the survey through questionnaires, 17 of the 35 experts were selected for final review. Which are classified into 5 criteria. Table 1 shows these factors.

Table 1 A review of previous research on the agility of the organizations and its' evaluation

Factor	Sub-Factor	References
Market and customer agility	Matching customer feedback with products	[16-20]
Market and customer agility	Flexible business	[18]
Market and customer agility	Customer satisfaction rate of new product	[7]
Market and customer agility	Fast production and introducing the new product on time	[7]
Market and customer agility	Respond quickly to competitors	[7]
Technology agility	Diversity of equipment, technology and operational agility workstations	[15, 20, 21]
Technology agility	Level of company's information excellence	[19, 21]
Technology agility	Integration of technology and information	[17, 18, 21]
Technology agility	Network and information utilization rate for employees	[14]
Technology agility	Utilizing the new communication media	[21]
Production agility	Modular design	[22]
Production agility	Flexible production capacity	[23]
Production agility	Relationship based on trust with suppliers	[2, 16]
Production agility	Decreasing non- added value costs	[17, 19]
Production agility	Focus of cost system identifying the activities added value	[15]
Production agility	To invest on the latest techniques models design method	[16]
Production agility	Fixed manufacturing costs based on customer product pricing	[21]
Production agility	Short production development cycle	[23]
Production agility	Material transfer speed	[19, 21, 24]
Production agility	Creativity in products	[20]
Production agility	Product quality throughout the product longevity	[16, 20]
Production agility	Resource optimization	[21]

Production agility	Cope with the change	[25]
Production agility	Regarding quality standards in production of new products	[7]
Management agility	Hierarchy organizational chart beds	[2, 16]
Management agility	Delegating management	[17, 19]
Management agility	Management's interest in full automation	[22]
Management agility	Management's Interest to deliver new models	[15]
Management agility	Promoting a culture of transformation and modernization	[16]
Workforce agility	New and existing employees' enthusiasm toward Learning and training	[21]
Workforce agility	Team work	[23]
Workforce agility	Institutionalizing staff design proposals	[19, 21, 24]
Workforce agility	Multi-skilled and flexible Staff	[20]
Workforce agility	Collaboration interface	[16, 20]

After localization by experts, the following criteria had an average score above 7 to 10, selected according to Delphi Saati method following sub-criteria were evaluated [24-26]. Table 2 shows these averages.

Table 2 Average sub-criteria selected by experts

Criteria	Variables	Total average
<b>Workforce agility</b>	New and existing employees' enthusiasm toward Learning and training	<b>7.058</b>
<b>Workforce agility</b>	Team work	<b>7.025</b>
<b>Workforce agility</b>	Multi-skilled and flexible Staff	<b>7.05</b>
<b>Management agility</b>	Management's interest in full automation	<b>7.025</b>
<b>Management agility</b>	Management's Interest to deliver new models	<b>7.225</b>
<b>Management agility</b>	Promoting a culture of transformation and modernization	<b>7.041</b>
<b>Market and customer</b>	Matching customer feedback on products	<b>7.066</b>
<b>Market and customer</b>	Flexible Business	<b>7.116</b>
<b>Market and customer</b>	Customer satisfaction rate of new product	<b>7.258</b>
<b>Market and customer</b>	Rapid response to competitors	<b>7</b>
<b>Production agility</b>	Flexible production capacity	<b>7.433</b>
<b>Production agility</b>	Relationship based on trust with suppliers	<b>7.308</b>
<b>Production agility</b>	Innovation in products	<b>7.55</b>
<b>Production agility</b>	Compliance with quality standards to new products	<b>7.041</b>
<b>Production agility</b>	A variety of operational and workstation machines	<b>7.15</b>
<b>Technology agility</b>	Integration of technology and information	<b>7/025</b>
<b>Technology agility</b>	Diversity of equipment, technology and operational agility workstations	<b>7/025</b>
<b>Technology agility</b>	Level of company's information system excellence	<b>7/15</b>

### Structural model of research

Data collection is important in any research because all of the results data leads to information and more complete information the results would be more correct and error-free.

Therefore, the information gathered about the criteria, sub-criteria are all collected from credible sources.

Also the research model is the result of experts' opinions. To collect the data from the selected companies 3 separate questionnaire was prepared and filled by the participating specialists of the companies to have high credibility. The first questionnaire investigates and selects the studied sub-criteria. The experts were asked to give the score of one to ten (from lowest to highest Importance) to sub-criteria and 17 sub-criteria from 35 sub-criteria were finally assessed. In the second questionnaire Paired comparisons were made between sub-criteria and criteria, since the research was to compare fuzzy criteria, Nine hour fuzzy spectrum was used. were used that are preferably the same, interstitial, less preferred, in between, very little, Intermediate, very high priority, and very little in between. In the third questionnaire after certain criteria and sub-criteria optimization

Companies were evaluated on their environment with a list of seven degrees to evaluate the options. Spectrum seven with language Variables such as very weak, weak, weak to moderate, moderate, relatively good, good, very good which were used for the evaluation of criteria and sub-criteria within the company.

### Research analysis methods

The questionnaires were distributed and their collection were as linguistic variables, they must be converted into fuzzy numbers. Given in the table 3 and table 4.

Table 3. Phase spectrum nine degree Saati methode scale

verbal equivalent	Reversed Fuzzy equivalent	Fuzzy equivalent
Same preferences	(1,1,1)	(1,1,1)
Intermediary	(1/3,1/2,1)	(1,2,3)
A little preferred	(1/4,1/3,1/2)	(2,3,4)
Intermediary	(1/5,1/4,1/3)	(3,4,5)
Preferred a lot	(1/6,1/5,1/4)	(4,5,6)
Intermediary	(1/7,1/6,1/5)	(5,6,7)
Preferred a lot	(1/8,1/7,1/6)	(6,7,8)
Intermediary	(1/9,1/8,1/7)	(7,8,9)
Completely Preferred	(1/9,1/9,1/9)	(9,9,9)

Table 4 average triangular fuzzy numbers GPA range of 7 degree to evaluate options

Linguistic variable	Fuzzy equivalent
Very weak	(0,0,1)
Weak	(0,1,3)
Weak to moderate	(1,3,5)
Moderate	(3,5,7)
Almost good	(5,7,9)
Good	(7,9,10)
Very good	(9,10,10)

### 3-1- Summary of experts' opinion

Phase average method is used for summing up the experts opinions.

Equation 1:

$$R_j = (R_j^l, R_j^m, R_j^r) = \left(\frac{1}{p}\right) \otimes (R_{j1} \oplus R_{j2} \oplus R_{j3} \oplus \dots \oplus R_{jp})$$

(j=1,2,...,n)

Equation 2:

$$W_j = (w_j^l, w_j^m, w_j^r) = \left(\frac{1}{p}\right) \otimes (W_{j1} \oplus W_{j2} \oplus W_{j3} \oplus \dots \oplus W_{jp})$$

(j=1,2,...,n)

For certain building Fuzzy numbers district center methods is used. And its' assessment for triangular fuzzy number M= (a, b, c) is as follows:

Equation3:

$$CA = \frac{(c - a) + (b - a)}{3} + a$$

M is the district center of the triangular number

### 3-2- Network compatibility level analysis

Vinod et al. 2011 [27] introduced a method for calculating the fuzzy pairwise comparison matrices level and compatibility. In this way, from each pairwise comparison matrices  $A_{n,n}$  two separate matrices  $A^m$  and  $A^g$  are made, and it is necessary to verify compatibility.  $A^m$  is achieved from median values of each expert preferences of the (median values of triangular fuzzy numbers).  $[A_m = a_{ijm}]$  the second matric is ( $A^g$ ) which is made from the geometric mean of the upper and lower limit of triangular fuzzy numbers.

Equation 4:

$$w^m = [w_i^m] \quad \text{where} \quad w_i^m = \frac{1}{n} \sum_{i=1}^n \frac{a_{ijm}}{\sum_{i=1}^m a_{ijm}}$$

Equation 5:

$$w^g = [w_i^g] \quad \text{where} \quad w_i^g = \frac{1}{n} \sum_{i=1}^n \frac{\sqrt{a_{ij_u} \cdot a_{iji}}}{\sum_{i=1}^m \sqrt{a_{ij_u} \cdot a_{iji}}}$$

N is matrix dimension. ( $\lambda_{max}$ ) the biggest special value is calculated for each of the matrix from the following relationship:

Equation 6:

$$\lambda_{max}^m = \frac{1}{n} \sum_{i=1}^n \sum_{j=1}^n a_{ijm} (w_j^m / w_i^m)$$

Equation 7:

$$\lambda_{max}^g = \frac{1}{n} \sum_{i=1}^n \sum_{i=1}^n \sqrt{a_{ij_u} \cdot a_{iji}} (w_j^g / w_i^g)$$

According to the Saati method, the index of compatibility (CI) which shows the deviation from full compatibility, is calculated as follows:

Equation 8:

$$CI^m = \frac{(\lambda_{max}^m - n)}{(n - 1)}$$

Equation 9:

$$CI^g = \frac{(\lambda_{max}^g - n)}{(n - 1)}$$

Equation 10:

$$CR = \frac{CI}{RI}$$

To calculate the compatibility rate  $CR=CI / RI$  random parameters of  $R^m$  and  $R^g$ . If both ( $CR^m$  and  $CR^g$  compatibility rate) each paired comparison matrix is bigger than 0.1. It should be requested from the expert to reconsider his/her preferences.

Sub-criteria are the results of library studies in the selection process, and the excel software was used for the selection of sub-criteria and scoring by experts and the fuzzy processes, making certain and making Super matrices of network analysis process and VIKOR ranking. In addition, for the final weighting of super matrix in the network analysis process MATLAB software was used.

#### 4- Results



## Export of criteria by experts

The output of the first questionnaire is as a table of average scores given by experts to sub-criteria which ranges from 1 to 10 (1 less important, 10 most important). Table 5 is the average for selected scores and the selected sub-criteria had the average above 7. Table 5 shows these final selection.

Table 5 : the final selection of the criteria by the experts

Criteria	Sub-criteria	Total average
Workforce agility	New and existing employees' enthusiasm toward Learning and training	7.058
Workforce agility	Team work	7.025
Workforce agility	Multi-skilled and flexible Staff	7.05
Management	Management's interest in full automation	7.025
Management agility	Management's Interest to deliver new models	7.225
Management agility	Promoting a culture of transformation and modernization	7.041
Market and customer	Matching customer feedback on products	7.066
Market and customer	Flexible Business	7.116
Market and customer	Customer satisfaction rate of new product	7.258
Market and customer	Respond quickly to competitors	7.00
Production	Flexible production capacity	7.433
Production	Relationship based on trust with suppliers	7.308
Production	Innovation in products	7.55
Production	Regarding quality standards in production of new products	7.041
Technology	Diversity of equipment, technology and operational agility workstations	7.15
Technology	Level of company's information system excellence	7.025
Technology	Integration of technology and information	7.025

The results of this questionnaire is that we have 5 criteria and 17 sub-criteria and to rank these sub-criteria we use network analysis method.

## Output of fuzzy analytical data network

After collecting the questionnaires for paired comparisons become with fuzzy and making fuzzy numbers to real numbers and weighting of the sub-criteria that was done in Excel, it is worth mentioning that the compatibility rate of all the pairwise comparison matrices have been less than 0.1. Key outputs expected in this section were initial matrix, which is normal and limited and are the following tables 6 and 7.

Table 6. Super initial matrix

	Goal	work force	Market and customer	Technology	Management	Production	A1	A2	A3	B1	B2	B3	B4	C1	C2	C3	D1	D2	D3	E1	E2	E3	E4
Goal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
work force	0.466	0	0.578	0.234	0.141	0.048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Market and customer	0.148	0.494	0	0.288	0.172	0.046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Technology	0.053	0.594	0.231	0	0.128	0.046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Management	0.249	0.562	0.258	0.136	0	0.045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Production	0.084	0.549	0.254	0.136	0.061	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A1	0	0.252	0	0	0	0	0	0.897	0.103	0.07	0.14	0.206	0.584	0.13	0.732	0.138	0.12	0.272	0.608	0.139	0.148	0.327	0.386
A2	0	0.101	0	0	0	0	0.8	0	0.2	0.561	0.174	0.193	0.072	0.093	0.423	0.484	0.658	0.262	0.08	0.092	0.571	0.159	0.177
A3	0	0.646	0	0	0	0	0.8	0.2	0	0.549	0.093	0.084	0.273	0.089	0.658	0.253	0.111	0.444	0.444	0.219	0.594	0.094	0.094
B1	0	0	0.057	0	0	0	0.084	0.268	0.647	0	0.472	0.084	0.444	0.267	0.108	0.624	0.6	0.2	0.2	0.06	0.542	0.108	0.29
B2	0	0	0.627	0	0	0	0.084	0.268	0.647	0.072	0	0.673	0.255	0.444	0.111	0.444	0.714	0.143	0.143	0.257	0.589	0.062	0.092
B3	0	0	0.247	0	0	0	0	0	0	0.209	0.708	0	0.083	0.56	0.128	0.312	0.544	0.346	0.11	0.261	0.583	0.051	0.105
B4	0	0	0.07	0	0	0	0.084	0.268	0.647	0.723	0.09	0.187	0	0.588	0.298	0.115	0.458	0.323	0.22	0.113	0.513	0.052	0.321
C1	0	0	0	0.652	0	0	0.084	0.268	0.647	0.368	0.157	0.157	0.234	0	0.125	0.875	0.225	0.638	0.137	0.048	0.587	0.17	0.195
C2	0	0	0	0.081	0	0	0.647	0.084	0.268	0	0	0	0	0.2	0	0.8	0.09	0.354	0.556	0.337	0.303	0.123	0.237
C3	0	0	0	0.267	0	0	0	0	0	0.606	0.216	0.121	0.056	0.889	0.111	0	0.671	0.094	0.234	0.098	0.116	0.306	0.481
D1	0	0	0	0	0.267	0	0.673	0.243	0.084	0.368	0.241	0.157	0.234	0.084	0.25	0.666	0	0.833	0.167	0.312	1.143	0.099	0.085
D2	0	0	0	0	0.664	0	0.209	0.708	0.083	0.033	0.303	0.325	0.338	0.638	0.081	0.281	0.875	0	0.125	0.227	0.605	0.049	0.12
D3	0	0	0	0	0.069	0	0.238	0.088	0.673	0.506	0.255	0.165	0.074	0.573	0.32	0.107	0.875	0.125	0	0.601	0.223	0.054	0.122
E1	0	0	0	0	0	0.188	0.095	0.254	0.651	0.043	0.597	0.259	0.101	0.619	0.096	0.284	0.706	0.216	0.078	0	0.243	0.118	0.639
E2	0	0	0	0	0	0.522	0.06	0.705	0.236	0.106	0.24	0.045	0.608	0.587	0.081	0.332	0.72	0.212	0.067	0.612	0	0.102	0.286
E3	0	0	0	0	0	0.079	0.12	0.269	0.611	0.258	0.134	0.044	0.564	0.242	0.101	0.657	0.295	0.093	0.612	0.108	0.247	0	0.645
E4	0	0	0	0	0	0.211	0.705	0.236	0.06	0.452	0.265	0.065	0.219	0.168	0.751	0.081	0.658	0.072	0.27	0.089	0.253	0.658	0
SUM	1	2.199234	1.320726	0.7936	0.5012	0.18516	4.516	4.221	4.263	4.925	4.169	2.765	4.141	6.171	4.375	6.454	8.321	4.627	4.051	3.572	7.26	2.533	4.274

After entering the data, then the normalizing operation of the super matrix will be done, which displayed in Table 7.

Table 7 Super normalized matrix

	Goal	work force	Market and customer	Technology	Management	Production	A1	A2	A3	B1	B2	B3	B4	C1	C2	C3	D1	D2	D3	E1	E2	E3	E4
Goal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
work force	0.466	0	0.249	0.13	0.094	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Market and customer	0.148	0.154	0	0.161	0.114	0.039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Technology	0.053	0.186	0.1	0	0.085	0.039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Management	0.249	0.176	0.111	0.076	0	0.038	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Production	0.084	0.172	0.109	0.076	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A1	0	0.079	0	0	0	0	0	0.189	0.018	0.014	0.034	0.075	0.141	0.021	0.167	0.021	0.014	0.059	0.15	0.039	0.02	0.129	0.09
A2	0	0.032	0	0	0	0	0.171	0	0.036	0.114	0.043	0.07	0.017	0.015	0.097	0.075	0.079	0.057	0.02	0.026	0.079	0.063	0.041
A3	0	0.202	0	0	0	0	0.171	0.042	0	0.112	0.023	0.03	0.066	0.014	0.15	0.039	0.013	0.096	0.11	0.061	0.082	0.037	0.022
B1	0	0	0.024	0	0	0	0.018	0.056	0.116	0	0.116	0.03	0.107	0.043	0.025	0.097	0.072	0.043	0.049	0.017	0.075	0.043	0.068
B2	0	0	0.27	0	0	0	0.018	0.056	0.116	0.015	0	0.243	0.062	0.072	0.025	0.069	0.086	0.031	0.035	0.072	0.081	0.025	0.021
B3	0	0	0.106	0	0	0	0	0	0	0.042	0.173	0	0.02	0.091	0.029	0.048	0.065	0.075	0.027	0.073	0.08	0.02	0.025
B4	0	0	0.03	0	0	0	0.018	0.056	0.116	0.147	0.022	0.068	0	0.095	0.068	0.018	0.055	0.07	0.054	0.032	0.071	0.021	0.075
C1	0	0	0	0.364	0	0	0.018	0.056	0.116	0.075	0.038	0.057	0.057	0	0.029	0.136	0.027	0.138	0.034	0.013	0.081	0.067	0.046
C2	0	0	0	0.045	0	0	0.138	0.018	0.048	0	0	0	0	0.032	0	0.124	0.011	0.076	0.137	0.094	0.042	0.049	0.055
C3	0	0	0	0.149	0	0	0	0	0	0.123	0.053	0.044	0.014	0.144	0.025	0	0.081	0.02	0.058	0.027	0.016	0.121	0.112
D1	0	0	0	0	0.178	0	0.144	0.051	0.015	0.075	0.059	0.057	0.057	0.014	0.057	0.103	0	0.18	0.041	0.087	0.157	0.039	0.02
D2	0	0	0	0	0.442	0	0.045	0.149	0.015	0.007	0.074	0.118	0.082	0.103	0.019	0.044	0.105	0	0.031	0.063	0.083	0.019	0.028
D3	0	0	0	0	0.046	0	0.051	0.019	0.121	0.103	0.062	0.06	0.018	0.093	0.073	0.017	0.105	0.027	0	0.168	0.031	0.021	0.029
E1	0	0	0	0	0	0.159	0.02	0.053	0.117	0.009	0.146	0.094	0.024	0.1	0.022	0.044	0.085	0.047	0.019	0	0.033	0.047	0.149
E2	0	0	0	0	0	0.44	0.013	0.148	0.042	0.022	0.059	0.016	0.147	0.095	0.018	0.052	0.087	0.046	0.017	0.171	0	0.04	0.067
E3	0	0	0	0	0	0.067	0.026	0.056	0.11	0.052	0.033	0.016	0.136	0.039	0.023	0.102	0.035	0.02	0.151	0.03	0.034	0	0.151
E4	0	0	0	0	0	0.178	0.15	0.05	0.011	0.092	0.065	0.023	0.053	0.027	0.172	0.013	0.079	0.016	0.067	0.025	0.035	0.26	0
SUM	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

After normalizing the Super matrix, we should make limited super matrix which is done in MATLAB. So that the weights in 17 exponent were shown as the final weight of the sub-criteria in Table 8.

Table 8 sub-criteria obtained weight

Criteria	abbreviated name	Variables	weight of sub-criteria
Workforce	A1	Multi-skilled and flexible Staff	<b>0.068</b>
Workforce	A2	Team work	<b>0.0593</b>
Workforce	A3	New and existing employees' enthusiasm toward Learning and training	<b>0.0627</b>
Market and customer	B1	Flexible Business	<b>0.0578</b>
Market and customer	B2	Matching customer feedback on products	<b>0.0581</b>
Market and customer	B3	Customer satisfaction rate of new product	<b>0.0453</b>
Market and customer	B4	Respond quickly to competitors	<b>0.0579</b>
Technology	C1	Level of company's information excellence	<b>0.0572</b>

Technology	C2	Diversity of equipment, technology and operational agility workstations	0.0497
Technology	C3	Integration of technology and information	0.05
Management	D1	Promoting a culture of transformation and modernization	0.0676
Management	D2	Management's Interest to deliver new models	0.0575
Management	D3	Management's interest in full automation	0.0591
Production	E1	Regarding quality standards in production of new products	0.0601
Production	E2	Innovation in products	0.0619
Production	E3	Relationship based on trust with suppliers	0.0606
Production	E4	Flexible production capacity	0.0673

Based on the above table the most important sub-criteria can be identified. The results show that employees which are multi-skilled and flexible, promote the transformation culture and modernization and flexible production capacity, interest in new and existing employees for teaching and learning, innovation in products, the relationship with suppliers based on trust and regarding the quality standards to make new products, have the highest weight. They are the most important criteria.

W=

(0.067,0.0592,0.062,0.0577,0.058,0.0453,0.0578,0.0571,0.0496,0.05,0.0676,0.0575,0.0591,0.0601,0.0619, 0.0605, 0.0672)

Now for ranking the selected companies in terms of agility, we use the weight obtained from the sub-criteria with fuzzy VIKOR method.

### Outputs of fuzzy VIKOR method

In this method at first we give surveys to selected companies' experts and after examining the sub-criteria in their company, they announced the desirability of sub-criteria in their company. After collecting the questionnaires and the conversion of fuzzy numbers to certain numbers and doing the VIKOR methods' calculations, the agility level of the companies is rated compared to each other and it shows in table 9.

In the first step normalizing of the experts' data should happen which is as follows its formula is as:

Equation 11:

$$n_{ij} = \frac{x_{ij}}{\sum_1^m x_{ij}}$$

Table 9 normalized specialists' opinion

	Kalleh	Gella	Haraz doosheh	Salleh	total
Multi-skilled and flexible Staff	0.329	0.111	0.231	0.329	1
Team work	0.314	0.151	0.22	0.314	1
New and existing employees' enthusiasm toward Learning and training	0.289	0.154	0.203	0.353	1
Flexible Business	0.303	0.185	0.278	0.233	1
Matching customer feedback on products	0.269	0.251	0.203	0.277	1
Customer satisfaction rate of new product	0.266	0.173	0.28	0.28	1

Respond quickly to competitors	0.327	0.192	0.231	0.25	1
Level of company's information excellence	0.303	0.284	0.117	0.297	1
Diversity of equipment, technology and operational agility workstations	0.262	0.244	0.214	0.28	1
Integration of technology and information	0.297	0.251	0.205	0.247	1
Promoting a culture of transformation and modernization	0.277	0.154	0.258	0.311	1
Management's Interest to deliver new models	0.263	0.16	0.277	0.3	1
Management's interest in full automation	0.286	0.157	0.272	0.286	1
Regarding quality standards in production of new products	0.267	0.27	0.241	0.223	1
Innovation in products	0.318	0.195	0.244	0.244	1
Relationship based on trust with suppliers	0.28	0.238	0.187	0.295	1
Flexible production capacity	0.291	0.232	0.201	0.277	1

For VIKOR method we should find the most desirable and undesirable number in each column, which is obtained from equation 12 and equation 13:

$$F + = \text{Max } f_{ij} \quad (\text{Equation 12})$$

$$F - = \text{Min } f_{ij} \quad (\text{Equation 13})$$

Since all sub-criteria will be increasing + Fj and -Fj of each column is as follows:

Table 10 Fj + and Fj - for each column

Table+ Fj &- Fj	Fj+	Fj-
Multi-skilled and flexible Staff	0.329	0.111
Team work	0.314	0.151
New and existing employees' enthusiasm toward Learning and training	0.353	0.154
Flexible Business	0.303	0.185
Matching customer feedback on products	0.277	0.203
Customer satisfaction rate of new product	0.28	0.173
Respond quickly to competitors	0.327	0.192
Level of company's information excellence	0.303	0.303
Diversity of equipment, technology and operational agility workstations	0.28	0.214
Integration of technology and information	0.297	0.205
Promoting a culture of transformation and modernization	0.311	0.154
Management's Interest to deliver new models	0.3	0.16
Management's interest in full automation	0.286	0.157
Management's Interest to deliver new models	0.27	0.223
Innovation in products	0.318	0.195
Relationship based on trust with suppliers	0.295	0.187
Flexible production capacity	0.291	0.201

In the next step we should calculate the Ri and Ri

Si= Regret function ; Ri= Group desirability function

Equation 14:

$$S_i = \sum_{j=1}^n W_j * \frac{f_j^* - f_{ij}}{f_j^* - f_j^-}$$

Equation 15:

$$R_i = \max \left[ W_j * \frac{f_j^* - f_{ij}}{f_j^* - f_j^-} \right]$$

Table 11 shows  $S_i$  and table 12 shows  $R_i$  of each company

Table 11  $S_i$

<b>Company</b>	<b><math>S_i</math></b>
Kalleh	<b>0.087</b>
Gella	<b>0.75</b>
Haraz dooshe	<b>0.621</b>
Salleh	<b>0.204</b>

Table 12  $R_i$

<b>Company</b>	<b><math>R_i</math></b>
Kalleh	<b>0.020</b>
Gella	<b>0.067</b>
Haraz dooshe	<b>0.067</b>
Salleh	<b>0.067</b>

The next step is to count  $Q$  for each company to select the top company:

Equation 16:

$$Q_i = v \left[ \frac{S_i - S^*}{S^- - S^*} \right] + (1 - v) \left[ \frac{R_i - R^*}{R^- - R^*} \right]$$

$$Q_i = v \left[ \frac{S_i - S^*}{S^- - S^*} \right] + (1 - v) \left[ \frac{R_i - R^*}{R^- - R^*} \right]$$

$$S^* = \text{Min}S_i; S^- = \text{Max}S_i$$

$$R^* = \text{Min}R_i; R^- = \text{Max}R_i$$

Table 13 shows  $R$  and  $S$  values.

Table 13 amounts  $S$  &  $R$

<b>S+</b>	<b>0.0878</b>
<b>S-</b>	<b>0.75</b>
<b>R+</b>	<b>0.020</b>
<b>R-</b>	<b>0.067</b>

And the  $Q$  of each company is as follows:

Table 14 shows Company  $Q$  values.

Table14  $Q$  amount of company

<b>Kalleh</b>	<b>0</b>
Gella	<b>0.9839</b>
Haraz dooshe	<b>0.0895</b>
Salleh	<b>0.50</b>

The next step is to evaluate two final decision making conditions for VIKOR method which investigates the accuracy of the calculations:

The first condition: If the option A1 and A2 have the first and second position in M the following equation should exist:

Equation 17:

$$Q(A_2) - Q(A_1) \geq \frac{1}{m-1}$$

### **Investigating the first condition**

$$m-1 = 16; 1/16 = 0.0625; \quad 0.50 - 0 \geq 0.0625$$

The first condition is approved.

The second condition: A1 option should be recognized as the superior rank in S or R.

The second condition is not applicable if both options A1 and A2 are selected as the top choice.

Investigating the second condition: The Kalleh Company is selected as a top rank in S and R groups. This condition is approved too.

### **Discussion and conclusion**

In the present era flexibility in the business market is an important element of any organization in order to maintain and preserve. If an organization fail to preserve itself with the outside environment. It will lose the competition between companies and lose its' place in the market.

Agility in any organization is the most important issue and should be taken seriously. Many elements play an important role in each organization's agility, which we tried to evaluate in this study. This study investigates the factors affecting agility in organizations and investigates these factors in the dairy companies such as Kalleh, Douche, Haraz, Gela and review the agility of the 4 companies compared each other and ranked them based on their agility between the four companies. The model presented in this survey is gathered from several valid sources and this model was surveyed by the view of experts of the companies. So after selecting the sub-criteria Weighting is done by using fuzzy network analysis process carried out after pair-wise comparison questionnaires were distributed between experts. The procedures was performed in Excel and the final weight was obtained using MATLAB software. After weighting the data was transferred to Excel for ranking by VIKOR fuzzy method.

This ranking was done after distributing the questionnaire and the results are according to the table.

1-5 The results of the survey questions.

1-1-5 Which one of the indicators examined in more efficient in organizations' agility?

The results show that multi-skilled and flexible employees, promoting the transformation culture and modernization, flexible production capacity,

New and existing employees interest in teaching and learning, product innovation, relationship with suppliers based on trust and respect

Regarding quality standards to make a new product have the highest impact on the agility of organizations and companies from Experts' view.

1- Multi-skilled and flexible employees are the most important asset of the organization and the employees which are more capable and multi-skilled

Have the ability to help organizations in the hour of need, they may require an employee to work in another part and multi-skilled employee will help to solve the problem and the organization can meet their customers' needs and compete with their rivals.

2- Promoting culture of change and modernity, culture transformation and modernization are important factors in an organization for changing and adapting as quickly as possible with their outside environment. As organizations promote culture of change and renewal employees will know the meaning of premature change easier and cooperate better in order to create change in their organization.

3- Flexible production capacity: in the present era customers' needs don't have complete consistency with the development of technology and new up to date products, customers are attracted to new products, so companies need to make their capacity flexible In order to meet the needs of previous clients and keep them and also meet the needs of new customers and to compete with their counterparts in the field of business and does not fall behind. Falling behind and losing the business to a competitor actually makes the company continue working hardly, and they may be withdrawn from the competition completely.

4- Interests of existing and new employees in teaching and learning: motivation and satisfaction among employees of an organization enhance the growth and excellence of creativity in organizations and can provide solutions to respond to competitors and the market. Discussion about employee training is one of the most important responsibilities of the organization to make their employees ready toward the threads and the new opportunities in order to take the greatest advantage of their expertise and ability.

5- Product innovation: Nowadays, products will change and progress faster than we think. The longevity of the products has come down to such an extent that the organization have to



think about what the next product will be at the beginning of introducing a product. A product become more accepted, if it helps the customers more.

6- Relationship based on trust with the suppliers: It's one of the most important factors is the agility of the organization. Whatever the organization makes its' relationship better with suppliers and could meet their needs of more needed raw materials or changes in raw material and presentations of materials with the help of the suppliers. So it can better respond to the needs of the market and changes in the business arena. The Faster the adaption to change the more agile an organization will be.

7- Regarding the quality standards to produce a new product: the quality is always the choice of the customer and is the sign of superiority of one company over the other. Regarding the quality standards will enhance the quality of the products easier for customers to choose their products and with improvements in quality the customers will choose the products easier. Quality is always in sight and every organization is always improving the quality to have an advantage in competition with their peers.

#### **2-1-5- Saleh, Haraz, Gela, and Kalleh dairy companies are at what level of agility?**

As shown in table 14-4 Kalleh company was more agile than the other companies because of product innovation, enthusiasm of employees to learn which made this company the best.

In addition to the competition in the domestic market it also thinks about the exports of its products and exported its products outside the country borders. Which shows the ability of the company in all areas of production, management, and staff. In each of the criteria there are important sub-criteria for making the selected dairy companies agile. The important sub-criteria of agility are such as agility in the workforce, multi-skilled and flexible employees, in market dimension and customers, the implementation of customer feedback on products, in terms of the variety of machines in operation and workstation in technology dimension, in agility management, promoting the culture of innovation and transformation, and in the relationship based on trust with the suppliers in production dimension.

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