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Location the Convertion and compietion industries of agriculture in Khorasan Razavi province with Multiple Attribute Decision Making approach

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ABSTRACT

The importance of processing industries in agricultural sectors for generating benefit, reducing crop losses, creating job opportunities, providing food security and producing healthy food is obvious, and it was considered as a main key for agriculture development. However, locating the agricultural processing industries with costs in inventory management, safety storage, transportation, and distribution is an important issue. The objective of this study is to prioritize the cities located in Khorasan-Razavi Province in terms of the possibility of establishing the agricultural processing industries. Therefore, the criteria "availability of raw materials in the agricultural sector" is used as a criterion to assess the cities within Khorasan-Razavi Province. The Entropy Technique is used to calculate the weights of criteria and Vikor technique is used to rank the cities. Results obtained by Entropy technique indicates that criterion "production of vegetables" is an importance factor in establishment of processing industries in selected cities. In the next step, using the weights and data for the performance of cities in selected criteria also using the Vikor technique, we rank cities in terms of the possibility of establishing the agricultural processing industries. The results obtained in this step indicate that Mashhad, Neishabur and Torbatejam have a better condition to establish the industry.

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INTRODUCTION

Due to increasing growth of agricultural wastes in the farms, it is essential to pay more attention to processing industries in agricultural sector so that in developed countries, agricultural wastes are considered as the main sources for chemicals such as alcohol, acetone, pectin, paper and pulp, the types of essences used in food and health production, a variety of organic and amino acids such as lysine, alanine, citric, lactic, livestock and poultry food, various proteins for human, livestock and poultry consumption, and food supplements. In agriculture and related industries, along with major products, side products are produced in a wide range. In addition, there is a wide application for these products. So many developed countries and some developing countries consider a significant value for these substances. On the other hand, according to statistics, nearly half of agricultural products are lost during various stages even without being used. Due to slow progress of agricultural processing industries in our country compared with developed countries, it is not possible to fully and appropriately utilize all components of a product. According to the latest report by FAO on agriculture production, Iran had the 9th place in the world in food production 2007 with producing 13,874,000 tons fruit and 15,760,000 tons vegetable crops (Mahmoudi, 2009). In Article 18 of the Fourth Five-Year Development Plan of the country, the emphasis is on supporting the further development of processing industries so that the percentage of processed agricultural products to be increased by at least twice the current value and the wastes to be reduced by 50%. Processing industries in agricultural sector are industries directly or indirectly connected to agriculture. It refers to those industries in which an agricultural product is changed to another form for better consumption, more convenient supply and higher economic value. Moreover, the nature of the new product so that the nature of the new product is same as the substance, but the final product is a new substance (Kishore, 2004). According to another definition, processing industries are those relied on agricultural products and livestock or agricultural products are used as raw material in the process. The other definition specifies that

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agricultural processing industries refer to the units involved in processing of vegetable or animal substances. Processing means the alteration and conservation through physical and chemical changes, storage, packaging and distribution (Klimberg & Ratick S, 2007). The main priority proposed for the economic restructuring of rural communities through making new strategies for rural development is composition of agricultural and non-agricultural activities, particularly processing industries in agricultural sector (Taherkhani, 2007). Processing industries in agricultural sector play a significant role in preventing waste products in agriculture, creating added value in agriculture, increasing the rural incomes, enhancing the agricultural productivity, and increasing the share of industrial employment in rural areas; it also serves as a part of rural development process (Klimberg & Ratick S, 2007). Experiences Asian countries, especially China, India and South Korea gained over the past three decades indicate that processing industries in agriculture sector play an important role in rural development of these countries (Rahimi, 2004). The importance of agricultural processing industries is further understood when we consider the fact that after heavy industry, food industry has the second rank in the world in terms of size and expansion. Strategic food industry includes cereals, sugar, dairy products and oil. Moreover, since the added value of this industry equal to that of petrochemical industry, by exporting these products instead of part of oil products, we can move toward economic prosperity (Maqsudi, 2009). Determining the location of factory is an important issue in construction of plants, which unfortunately is not enough considered in Iran. For mother industries, this issue is significant in various aspects and is more sensitive. *Locating* is an important factor in the planning for regional development. Reasonable and balanced distribution of economic activities and regional development objectives cause economic growth, and a better distribution reduces regional disparities and inequalities in urban and rural areas and lead to social justice in the region (Agahi & Abdi, 2009). Finding a location to establish processing industries as an economically productive sector is an important and essential issues for adjusting the income disparity between urban and rural areas, which is believed by experts as the most effective approach leading to immigration reduction. A literature review is provided at the following:

Soleimani (1996) in a study entitled "Studying the feasibility of establishing poultry slaughterhouse in the Lorestan Province" investigated requirements, capabilities, limitations and in general feasibility of the establishing poultry slaughterhouse in the province. In this study, he worked on identifying the product, studying the supply and demand and raw materials, determining the minimum capacity and finally he offered a proper place for this purpose. Dehbashi (2006) in his thesis entitled "Studying the feasibility of establishing processing industries in Kohkiluye-va-Boyerahmad Province", in addition to specifying natural, economic and social characteristics of the Province, tried to identify the potentials in the region, enhance the culture of people participation, strengthen the infrastructure, and to attract investment for processing industry. He believed that the processing industry in the province reduced the unemployment, reduced the immigration and lead to dynamic economy. Zandian (1999) in his thesis entitled "Feasibility of establishing industries in Bijar City", in addition to specifying the agricultural and industrial potentials in the city, used a questionnaire to collect data needed for investigating the capacity of this industry. He also studied the impacts of establishment of the industry on the use of agricultural and livestock production. He believed that processing industries plays an important role in reducing the immigration, increasing the employment, incomes, economic efficiency, and changing the production method. Amini (2002) studied on determining the location and the capacity of milk factory in Kermanshah Province by integrating the mathematical model of ideal planning (GP) and AHP technique. He divided the 11 city in the province to 6 sections in terms of milk production and consumption, considered the location and capacity of existing dairy plants, and recommended 7 plants to be constructed in Kermanshah and Kangavar. Rezaei (2007) studied the feasibility of dairy processing industries in Ilam. In this study, the research method is a combination of descriptive, analytical and documentary methods. The population is the whole province, and encompasses all the cities. The numerical taxonomy method is used to rank the cities, and the data are collected using documents, questionnaires and were interviews. Finally, the priority of each city is determined separately in the area of establishing processing industries, packing livestock products and for products including meat, wool and hair, leather and hide, white meat, and honey and beeswax. Taherkhani (2007) used TOPSIS technique to determine the priority of locations considered for processing industries in agriculture sector in rural area in Ilam Province. The results showed that Dehloran City has the shortest distance to the ideal solution and the farthest distance to less efficient place for locating the agricultural processing industries in the region in terms of availability of raw material. The results obtained by this model are quite consistent with the realities of the provinces and are confirmed by experts within the provinces. Nouri & Nilipour T. (2007) used Delphi technique to prioritize the development of processing industries in agricultural sector in Falavarjan, Isfahan. Finally, they offered 12 processing industries in agriculture sector for Falavarjan in 4 groups in order of priority. The priority is as follows: potato and products (mashed potato, powder, slices, snack, potato fries and granules, potato flakes, the French Fries and...), vegetables and products (canned vegetables, dried vegetables, frozen packed vegetables, puree, pulp and slices vegetables), fruit protection (as juice like cherry juice, as compote like cherry and pear, as canned fruits, as jams like cherry and pear jam, as fruit jelly, as juice using concentrated and dried fruit, as dried fruit). Sabahi and Mehri (2008), in addition to studying the location of milk collection centers in Khorasan Province, analyzed factors such as the number and

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capacity of milk collection centers, the distribution, type of ownership, type of collected milk, milk transportation distance and time. Then, according to the regulations and standards set by the Department of Animal and Food Administration, the capital costs and the running costs of milk collection centers were estimated and the minimum economic capacity of a milk collection centers was determined; therefore, non-economic constructed centers were determined and analyzed. Mahdavi et al. (2010) investigated the feasibility of development of rural industries in Ajabshir. To collect data, this study used both library and field methods, and to test the assumptions, it used SWOT model and Atlas graph. The results showed that base on the priority and four factors affecting the feasibility of development of rural industries, communications networks with a weight of 24, agriculture with a weight of 16, mining industry with a weight of 6, and the energy with a weight of 2 had first to fourth place. UN Industrial Development Organization while emphasizing on establishment of processing industries in rural areas, stated that rural industrialization and poverty reduction can be complementary; by establishment of industries in rural areas, employment and income are improved through the promotion of small- scale investments based on using local resources and processing these resources (Rezaei, 2007). David Rogers (1978) studied the effects of industries establishment in Iowa towns and rural areas and showed that industrialization of rural areas can bring great benefit for society, so that the integration of families also the per capita income are increased, and income distribution is more balanced. Shin (1985) analyzed the rural development policies in Taiwan and specified the followings as effects of establishing the industry in rural areas in Taiwan: specialization, urban-rural balance, local incomes increase and non-agricultural employment increase. Klimberg & Ratick S. (2007) attempted to create and apply a method to model locating problems. For this, they used data envelopment analysis (DEA) and performance criteria to compare the performance of different locations and to find the optimized place. In this study, considering the performance criteria and DEA and models used for locating the industry, they introduced a robust method for multi-objective locating problems created. Cho et al (2008) proposed a new fuzzy multi-criteria decision making model for finding the optimum location of production facilities. The model considers of qualitative and quantitative criteria to rank sites in group decision making. This approach considers the significance coefficient for each member in the group. Generally, the goal of developing processing industries is making a balance, using the available resources, meeting the villagers' needs inside the village, increasing the welfare of the rural society, and utilizing the inactive human resources which have had to immigrate to find job opportunities because of the inequities caused by dysfunctional economies. Expanding the processing industries can lead to properly utilization of rural areas potential, better leisure time, utilization of rural production, a scientific view toward production and economic utilization of products, higher incomes, diversification of the rural economy, less distance between city and countryside, rural domestic development, less implicit and explicit unemployment and immigration, access to land, raw materials, human resources, initial non-expensive infrastructure, and finally cheaper products. Therefore, developing rural industries, especially processing industries, after investigating the feasibility of establishment is essential to realize the decentralization purpose and to utilize the opportunities and the relative advantages of regions for balanced and comprehensive regional development. Agricultural sector in Khorasan-Razavi Province is a great and main crop producer and with capacities including more than 1,087,466 hectares of cultivated area for agricultural and horticultural products, and more than 11,739,746 livestock units with more than 7,592,413.9 tons of agricultural, horticultural and livestock products plays decisive role in national and state economy, in ensuring the main needs of the community, food security, supplying raw materials needed by industry, and job creation. About 31.1% of employment belongs to this sector which has provided the greatest job opportunity after service sector, and more than half of the rural population is working in agriculture sector and it is their source of income. Furthermore, the cities located in the Province are suitable locations to establish the processing industries in agriculture sector. By establishing the processing industries, the further development of agricultural sector is possible. Considering the importance of this issue, this paper seeks to answer the following question: Which city in the Khorasan-Razavi Province has the higher priority for establishment of processing industries in agriculture sector?

MATERIALS AND METHODS

Studied Area and Used Data:

With an area of 116,349 square kilometers, Khorasan-Razavi Province is geographically located in latitudes between 33 degrees and 37 minutes to 30 degrees and 41 minutes and longitude 56 degrees and 19 minutes to 61 degrees and 18 minutes. It is the fourth largest province with 833 kilometers of border shared by Turkmenistan and Afghanistan. Internally, this province has also border shared by North-and South-Khorasan, Semnan and Yazd. Mashhad is the capital of Khorasan-Razavi and this province has 26 cities, 67 districts, 71 towns, and 160 villages. According to census population in 2006, the province has over 5,515,980 residents including 3,753,512 urban populations (68%), 1,762,468 rural populations (32%) and 2,434,306 (44.13 %) residents in Mashhad, the provincial capital (State Statistical Yearbook, 2009).

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As mentioned previously, the objective of this study is to prioritize the cities located in Khorasan-Razavi in terms of the capacity for establishing processing industries in agriculture sector. To locate and establish the processing industries in agriculture sector in selected regions, it is necessary to, in addition to determining the most important factors affecting the establishment of industries also the weight of factors, use a proper prioritization techniques for establishing the industry. Therefore, Khorasan-Razavi Province with all its 26 cities was selected and Shannon entropy method was used in order to calculate the weight of factors and Vikor multi-criteria decision making method was used for prioritizing the areas.

Mardukhi (1993) considered agricultural potential, soil fertility, water conditions, human resources, market, and appropriate technology in the area as the most important requirements for processing industries. Farahmandian (2000), in his study on determining the suitable sites for the establishment of industries, considered the capacities and potentials of the site as the most important factor in the development of processing industries. Sharifian (2001), in his study showed that how increasing facilities of agricultural processing industries lead to improves in the industry and growth and development of agriculture sector in rural areas. He considered availability of cheap and simple facilities as the most important factor affecting the development of processing industries in rural areas. Taherkhani (2007) knows only the factor "availability of raw materials" as the major factor affecting the location of processing industries in agriculture sector. Kalantari et al. (2010) investigated the factors driving and inhibiting the development of processing industries in North-Khorasan Province. The results indicate that the contribution of driving is more effective that inhibiting factors; thus, by enhancing the driving factors and overcoming inhibiting factors, we can help in further development of agricultural processing industries in the province. Kishore (2004) in his study on Orissa state of India came to the conclusion that an improvement in infrastructures may enhance the advantages of a location and cause the industries to be located in the areas with better performance in terms of infrastructures. He has also studied factors such as available raw materials, market, investment conditions, finance and credit facilities, and estimated demand, and considered them as factors affecting the development of industry. According to these studies, there are several factors which are essential for the development of processing industries. But the most important factor is the potential of the region for supplying raw materials for such industries which are the main requirement for developing processing industries (Dehbashi, 2006). To prioritize the selected areas, this study also considers the criterion *availability of raw materials* as one of the most important factors affecting the establishment of industries in the cities located in Khorasan-Razavi. The indices and the total agricultural production of each of these indices are shown in Table 1 for each city. It should be noted that this data is about the performance of cities in 2009.

Table 1: Total agricultural production for each city.

Index City	livestoc k	horticulture	forage crops	vegetables	Saifi (Galizi)	Cereals	industrial crops	grains
Mashhad	516478	67212	99278	213972	65687	261	23092	129167
Kalat	22105	162255	4181	7564	288	89	252	16476
Binalood	57468	32663	986	2518	149	33	0	869
Nishabur	283293	82378	191500	96028	23704	807	53699	203592
Taht-Jolgeh	25469	2262	51754	11571	1002	133	18272	46900
TorbatHeidarieh	52119	12081	53701	38191	10322	243	114268	74010
Mah-Velayat	13909	31525	5980	1777	20740	29	7962	25820
Rashtkhar	29076	593	36300	17455	26111	21	77010	59025
Zaveh	20400	3193	25901	18096	6626	124	44849	35410
Torbatjam	54955	9182	77789	84750	212314	164	50557	141055
Saleh Abad	5852	321	5052	2682	20071	152	2479	11665
Taibad	36937	3285	88098	2477	183864	31	10738	87070
Chenaran	236135	115806	117351	136065	8212	120	28516	85490
Sarakhs	19915	450	43910	0	57100	0	22090	33210
Fariman	28413	19265	19687	78161	13488	124	8618	49856
Sabzevar	133100	16602	34073	16767	95614	151	92409	121561
Jovein	25926	1591	65795	9585	42016	85	145075	56610
Jaghtay	26949	5438	34300	882	40493	40	75153	48890
Kashmar	110633	29473	19774	19425	19235	261	1057	17065
Khalil Abad	20970	58478	14458	6182	5413	71	980	13960
Quchan	67300	52642	58986	44458	5833	161	11630	43290
Dargaz	23019	6704	21600	5239	1612	25	8926	38242
Bardaskan	30723	33296	57295	2774	7861	84	7897	38850
Gonabad	58971	7695	17529	3668	3194	33	3644	15475
Bajestan	11986	11925	10862	1033	8288	24	3095	12078
Khaf	31559	1442	27104	4248	44496	19	24223	33250

Shannon Entropy:

In most multi-criteria decision problems, especially multi-attribute decision problems, it is essential and an effective step to have and know the relative weights of the criteria. This study utilizes the Shannon entropy

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method as one of the most popular methods to calculate the weights of indices. Entropy is considered as an important concept in social science, physics and information theory is. When the data of a decision matrix is completely specified, it is possible to use the entropy method for evaluating the weights. The idea of this method is that the higher distribution of values of an index means that this index is more important than others (Momeni, 2006).

This method includes the following steps (Soleimani-damaneh & Zarepisheh, 2009):

1. Creating the data matrix:

After collecting data for cities in Khorasan-Razavi Province, a matrix is created whose rows and columns are the cities and the indices used in this study, respectively. This matrix is represented as follows where A_i represents the *i*th city; X_j is the *j*th index, and r_{ij} indicates the status of *i*th city in terms of *j*th index.

$$\begin{array}{c|cccc} & x_1 & x_2 & \cdots & x_n \\ A_1 & x_{11} & x_{12} & \cdots & x_{1n} \\ A_2 & x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ A_m & x_{m1} & x_{m2} & \cdots & x_{mn} \end{array}$$

2. Un-scaling the decision matrix using time norm:

After preparing the basic data matrix, considering that different indices may have different scales, it is necessary to make indices free of scale and eliminate the heterogeneity in indices. Un-scaling is applied based on the following equation:

$$P_{ij} = \frac{r_{ij}}{\sum_{i=1}^{m} r_{ij}} \quad ; \quad j = 1, \dots, n \; ; \; \forall_{ij}$$

3. Calculating the entropy for *j*th index (E_i) using the following equation:

$$E_j = -k \sum_{i=1}^{m} [P_{ij} \, ln \, p_{ij}] \quad ; \; \forall_j$$

So that: $K = \frac{i}{LNm}$ (m = the number cities within Khorasan-Razavi)

4. Calculating the degree of uncertainty or deviation (d_j) using data obtained for the *j*th index:

$$d_j = 1 - E_j \quad ; \quad \forall_j$$

5. Calculating the weights of indices using the following equation:

$$W_j = \frac{d_j}{\sum_{j=1}^{n} d_j} \quad ; \; \forall_j$$

Using the weights calculated for indices at this step, the index with higher weight is considered more important than the others and it has greater impact on establishment of processing industries in cities within Khoeasan-Razavi Province than the other indices.

VIKOR:

Multi-criteria decision models are models which have been highly interested during the past two decades. These techniques and models have found widespread application in complex decision problems when there are several diverse criteria. The ability of these techniques in significantly reducing the complexity of decision problems making, simultaneously using both qualitative and quantitative criteria; providing a structured framework for decision problems, and finally the simple application has made them as a tool for decision-makers in various field. These techniques formulate the decision problems in the form of a decision matrix as the following matrix, and analyze them.

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$$\begin{array}{c|cccc} & x_1 & x_2 & \cdots & x_n \\ A_1 & x_{11} & x_{12} & \cdots & x_{1n} \\ A_2 & x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ A_m & x_{m1} & x_{m2} & \cdots & x_{mn} \end{array}$$

In above matrix, A_i represents the *i*th option; X_j is the *j*th index, and x_{ij} indicates the value of *j*th index for *i*th option. MADM methods are different and each has particular characteristics and application requirements. One of the most important methods has been used in decision problems is VIKOR technique (Amiri et al, 2011; Chang & Hsu, 2009; Tong et al, 2007)

VIKOR technique includes the following steps:

1. Un-scaling decision matrix using the following equation:

$$f_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} {x_{ij}}^2}}$$

2. Specifying the positive ideal solution (A^+) and negative ideal solution (A^-) using the following equations:

$$A^+ = \{(max f_{ij} \mid j \in J) \; or \; (min f_{ij} \mid j \in \acute{J}) | i = 1, 2, \dots, m\}$$
$$= \{f_1^+, f_2^+, \dots, f_j^+, \dots, f_n^+\}$$
$$A^- = \{(min f_{ij} \mid j \in J) \; or \; (max f_{ij} \mid j \in \acute{J}) | i = 1, 2, \dots, m\}$$
$$= \{f_1^-, f_2^-, \dots, f_j^-, \dots, f_n^-\}$$

3. Calculating the desired value (S_i) and the undesired value (R_i) for each option using the following equations:

$$S_i = \sum_{j=1}^{n} w_j \left(f_j^+ - f_{ij}\right) \Big/ \left(f_j^+ - f_j^-\right)$$

$$R_i = Max_j \left[W_j \left(f_j^+ - f_{ij}\right) / \left(f_j^+ - f_j^-\right)\right]$$

Where S_i and R_i are desired value and the undesired value for each option, respectively; and W_j is the weight of each option. The weight of criteria is calculated usually through various weighting methods, including entropy and AHP. This study, as previously mentioned, uses the entropy method to calculate the weights of indices.

4. Calculating VIKOR index using the following equation:

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

Where Q_i is the value of VIKOR index for *i*th option, $S^+ = MinS_i$, $S^- = MaxS_i$, $R^+ = MinR_i$, $R^- = MaxR_i$, and *v* which is the maximum group desirable weight is usually considered 0.5.

5. Ranking the options: in technique VIKOR, the option with the minimum weight is the best one.

Results:

In order to rank the cities in the province in terms of the advisability for establishing the processing industries in agriculture sectors, Vikor Multi-Criteria Decision technique is used. For this, it is necessary to calculate the criteria weights as an input for Vikor technique before using this technique. Since the data of decision matrix is based on the total production of the agricultural sector, this study is based on real data and the views of people involved in decision-making are not considered. Accordingly, the Shannon entropy technique is used to calculate various index weights. Shannon entropy is an important concept which has a significant role in information theory. The basic idea of using this method to calculate the weights of criteria in multi-criteria decision problems was first introduced by Zeleny. Nowadays, this technique is used to evaluate uncertainties, and also in various scientific fields such as social science, chemistry, operations research, etc. When data in a

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decision matrix is completely specified, it is possible to use entropy method to measure weights. The idea of the method is that the higher distribution of the values of an index means that this index is more significant than the others. The results obtained by this approach are provided in Table 2.

Table 2: Weight of parameters used in this study.

livestock	horticulture	forage crops	vegetables	Saifi (Galizi)	Cereals	industrial crops	grains	
0/797	0/784	0/886	0/725	0/767	0/846	0/808	0/902	E_j
0/203	0/216	0/114	0/275	0/233	0/154	0/192	0/098	d_j
0/137	0/145	0/077	0/185	0/157	0/104	0/129	0/066	W_j

As Table 2 indicates, the significance of production indices for grains, industrial crops, cereals, vegetables, forage crops, horticulture, and livestock production are considered in prioritizing the selected areas as 0.066, 0.129, 0.104, 0.157, 0.185, 0.077, 0.145, and 0.137, respectively. These weights indicate that cities with better performance in creating indices with higher values in Shannon's entropy technique (for example, the production of vegetables index) have a higher place in final ranking by Vikor technique. After calculating the indices weights, the weights are considered in decision matrix, and using the Vikor technique, the cities in the province are ranked in terms of the capacity for establishment of processing industries in agriculture sector. The results are summarized in Table 3.

Table 3: The results of the ranking capability of establishment of processing industries in cities in Khorasan-Razavi Province.

city	S_i	R_i	Q_i	Rank
Mashhad	4/081	0/841	0/061	1
Kalat	7/552	0/999	0/889	14
Binalood	8/597	1	0/992	26
Nishabur	3/477	0/889	0/153	2
Taht-Jolgeh	8/021	0/996	0/924	17
TorbatHeidarieh	6/643	0/952	0/654	6
Mah-Velayat	8/378	0/992	0/945	22
Rashtkhar	7/575	0/998	0/888	13
Zaveh	7/971	0/982	0/876	11
Torbatjam	5/412	0/945	0/515	3
Saleh Abad	8/570	1	0/989	25
Taibad	6/823	0/988	0/785	8
Chenaran	5/384	0/962	0/564	5
Sarakhs	8/073	1	0/941	20
Fariman	7/710	0/956	0/769	7
Sabzevar	6/241	0/922	0/521	4
Jovein	6/760	0/992	0/791	10
Jaghtay	7/612	0/996	0/884	12
Kashmar	7/792	0/993	0/892	16
Khalil Abad	8/242	0/993	0/937	19
Quchan	7/354	0/973	0/789	9
Dargaz	8/463	0/993	0/957	23
Bardaskan	7/960	0/987	0/890	15
Gonabad	8/549	0/986	0/942	21
Bajestan	8/682	0/995	0/985	24
Khaf	8/137	0/993	0/926	18

The first column of Table 3 is cities in Khorasan-Razavi, the second column is the desired values for each city, the third column is undesired values for each city, the fourth column is Vikor technique index, and the fifth column is the rank of each city based on Vikor technique. The city with the minimum Vikor weight is the best option considered by Vikor. According to the ranking results obtained by this technique, the priority of cities in Khorasan-Razavi Province for establishment of processing industries in agricultural sector is as the following: Mashhad, Nishabur, Torbatjam, Sabzevar, Chenaran, Torbat-Heidarieh, Fariman, Taibad, Quchan, Jovein, Zaveh, Jaghtay, Rashtkhar, Kalat, Bardaskan, Kashmar, Taht-Jolgeh, Khaf, Khalil Abad, Sarakhs, Gonabad, Mah-Velayat, Dargaz, Bajestan, Saleh Abad and Binalood.

Discussion and Conclusion:

The importance of processing industries in agricultural sectors is obvious for generating added value, reducing crop losses, creating job opportunities, providing food security and producing healthy food, and it is considered as a main key for agriculture development. The expansion of this industry stabilizes the income and increases the farmers' profit. When the productivity is increased and demand for raw products is reduce, it will also provide conditions that prevent the products to be lost and price to have a negative volatility. On the other

hand, finding a proper location for establishing processing industries in agriculture sector with costs related to inventory management, safety storage, transportation, and distribution is very important. According to this, this study attempted to prioritize the cities within Khorasan-Razavi Province to terms of sustainability for establishing processing industries in agriculture sector. Therefore, the index of production for products including livestock, horticulture, forage crops, vegetables, cereals, industrial products and grains was used as a criterion for evaluating the cities within Khorasan-Razavi Province. At first, the Shannon entropy technique was used to calculate the weights of indices. Results obtained by applying this technique indicate that the criterion *vegetable production* is very important for the establishment of processing industries in selected cities. In the next step, the weights and the data related to the performance of cities in the province in selected criterion are used to rank the cities in terms of capacity for establishment of processing industries in agriculture sector using Vikor technique. Results obtained through this step indicate that Mashhad, Nishabur and Torbatjam are more suitable for the establishment of these industries. Therefore, we suggest planners and officials in agriculture and industry sectors in Khorasan-Razavi to prioritize the cities in terms of their capacities while making a decision on the establishment of this industry and allocating the budget for it. It is also suggested that in future studies, the city's capacity to establish the industry to be measured using further criteria and this will provide very useful information for planners for policy making in order to remove imbalances. It is also recommended that other multi –criteria decision-making techniques including TOPSIS, electer, linear assignment, etc. to be sued to rank the cities, and the obtained results to be compared with results obtained in this study.

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