Prioritizing the Development of Agricultural Conversion and Complementary Industries in Ahar County

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Authors' contributions

This work was carried out in collaboration between all authors. Author RA designed the study, performed the analysis, collected the data and wrote the first draft of the article. Author MI helped with the analysis, wrote the first draft of the article. Authors MSF and MK helped with data collection and writing the article. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Agricultural industrialization is an important breakthrough to the development of county economy and to the promotion of urbanization. The main aim of the current research is to prioritize the development of conversion and complementary industries in agricultural sector as well as exploring the barriers of creating these industries.
Methodology: We used Delphi method to collect and analyze the expert comments for prioritizing the development of agricultural conversion and complementary industries in Ahar county, Iran. The

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agricultural experts were selected among experts of Jihad Agriculture Organization and Ahar Municipality as well as academic stuff of Tabriz and Ahar in the field of agriculture. Totally, 20 persons have been selected to fill the questionnaires. We have provided two different kind of questionnaires; the aims of conversion and complementary industries were listed in the first questionnaire to determine their importance values. The second questionnaire has been arranged based on obtained results from the first questionnaire which was consisted of a list of creatable conversion and complementary industries. Selected persons prioritized these alternatives based on Delphi method.

Results: The results showed that increase in income of local farmers and value added and productivity of agricultural products are the most and the least important aims, respectively. Also, first and last priorities for suggested industries were providing of dairy production and roasting of beans such as lentil and grains such as wheat, respectively.

Conclusion: Based on the results, it is expected that the authorities and those in charge to encourage and attract investors to invest in the construction of more processing and conversion industries for agricultural, horticulture and livestock products.

1. INTRODUCTION

A common definition of agroprocessing industry refers to the subset of manufacturing that processes raw materials and intermediate products derived from the agricultural sector [1]. Thus, agroprocessing industry means transforming products originating from agriculture, forestry and fisheries. Indeed, it includes a very large part of agricultural production undergoes some degree of transformation between harvesting and final use. The industries that use agricultural, fishery and forest products as raw materials comprise a very varied group. They range from simple preservation (such as sun drying) and operations closely related to harvesting the production, by modern, capital-intensive methods, of such articles as textiles, pulp and paper [1].

Agriculture and industry have traditionally been viewed as two separate sectors both in terms of their characteristics and their role in economic growth. Agriculture has been considered the hallmark of the first stage of development, while the degree of industrialization has been taken to be the most relevant indicator of a country's progress along the development path. Moreover, the proper strategy for growth has often been conceived as one of a more or less gradual shift from agriculture to industry, with the onus on agriculture to finance the shift in the first stage.

Development of complementary industries and agriculture can be a good way to prevent injuries and to increase the value-added agricultural products [2]. Given that in developing countries, especially in Iran, almost one-fourth of agricultural products are wasted only due to lack of storage facilities and conserving industries. Agroprocessing industries, as a part of rural development process, can play a great role in preventing the waste of agricultural products, producing added value products, increasing rural families' income, improving productivity, and increasing the share of industrial employment in rural areas [3].

The potential for agro-industrial development in the developing countries is largely linked to the relative abundance of agricultural raw materials and low-cost labour in most of them. The most suitable industries in such conditions are indeed those that make relatively intensive use of these abundant raw materials and unskilled labour and relatively less intensive use of presumably scarce capital and skilled labour [1].

Many of the industries using agricultural raw materials have in fact those characteristics that make them particularly suitable for the circumstances of many developing countries. Where the raw material represents a large proportion of total costs, its ready availability at a reasonable cost can often offset such disadvantages as a lack of infrastructure or skilled labour. Furthermore, for many agro-industries, a small plant may be economically efficient, which is another important factor in developing countries where the domestic market is limited by low purchasing power and sometimes by the small size of the market itself.

Nearly fifteen billion dollars of Iran annual national income is spent on imports industrial goods. There is also nearly 30% of farmer

population in rural that spent two-thirds of a year on raising product. Existence of nearly 15% unemployment in the economy and also the lack of capital for setting up large industrial units, could be grounds for a national disaster [4].

Rural industrialization perspective holds that the spread of non-agricultural activities and diversification of the rural economy can not only be an important factor in promoting the value added agriculture but also increase welfare and provide goods and essential services in rural areas will also be followed [5], and plays an important role in rural development and agriculture [6].

Ahar county is a high capable city for agricultural industrial development. Because it has over one hundred thousand hectares of fertile and cultivable lands as well as tremendous resources of soil and water. In this county, 143,000 tons horticultural products, 148,000 tons agricultural product are being produced. Also, there are 850,000 livestock units which produce 46 tons dairy products. Despite all of these facts, there is no agricultural conversion and complementary industry in this area. Therefore, in this research we aimed for prioritizing the development of agricultural conversion and complementary industries using Delphi method.

2. MATERIALS AND METHODS

2.1 Study Area

Ahar county has 3073.93 km^2 which consists 6.76 percent of the whole province. Based on the area, it is the number fifth amongst the counties of the province. It is adjacent with Calaibar county from the north, Ardabil province from the east, Haris county from the south, and Varzaghan county from the west. According to preliminary results of General Population and Housing Census in 2006, there are 149119 people in this county which 91075 people are settled in the city and 58,044 people are in rural areas.

The main crops of the county consist of wheat, barley, forage, grain, vegetable and canola. Forage is the product with the highest amount followed by wheat and barley. In the horticulture sector, the highest value of production belongs to apples and peaches followed by other fruit trees including apricot, cherry, and almond. In the livestock sector, according to estimates by experts in 2010, the number of animals was

848,415 livestock units which 324,800 units were sheep and goats and 523,615 unites were native and hybrid and pure cattle and buffalo. According to relevant organizations, in 2010 over 5199 tons of red meat where produced while only 1788 tons were consumed in the county; so there was a surplus which exported to other cities of the province. In this year, the produces and consumed milk was 46545 and 17584, respectively. Also, 321 tons of honey were produced and 60 tons consumed in the county. Both surplus of milk and honey were exported without processing to the rest of the counties in the province.

2.2 Methodology

This study is an applied research based on the aim of the research project. According to the nature of the project and the reviewed literatures, using the opinions of experts in this field is essential to achieve the correct result. Regarding this fact, Delphi model was selected because it can respond the research questions by collecting and analyzing the opinions of experts.

2.3 Delphi Method

Delphi method entails a group of experts who anonymously reply to questionnaires and subsequently receive feedback in the form of a statistical representation of the "group response," after which the process repeats itself. The goal is to reduce the range of responses and arrive at something closer to expert consensus. The Delphi Method has been widely adopted and is still in use today [7].

Delphi is a professional survey to predict a future in which we can derive different results. This method is simple while produces more confident result in which collects and summarizes the opinions and judgments of the experts in a specific field of science [7]. From the perspective of the Delphi method, human's judgments are legitimate and useful inputs for predictive analyzes [8]. Sometimes, solo thinking and judgments of experts can be unilateral. Although, judgment of expert groups can also be influenced by the desires of the leader of the group, and participants might be reluctant for the revision on previous ideas. To overcome such shortcomings, the Delphi method with theoretical and methodological guidelines was developed at RAND during the fifties and sixties [9,10]. This method is designed based on a process of a communication group to achieve a convergence

of opinions on a particular topic in the real world [11].

We used the following steps outline to undertake the Delphi study [12]:

1. Designing the questionnaire
2. Inviting participants to take part
3. Sending out the first round of questionnaire
4. Analyzing the responses from round 1 questionnaire
5. Preparing the second round questionnaire
6. Sending out second round questionnaire
7. Analyzing the results of the second round questionnaire for agreement and degree of consensus
8. Reporting the findings

3. RESULTS AND DISCUSSION

Regarding crop, horticulture and livestock production, this county has a fertile ground for industries and related materials. Except for two cold storages with the capacity of 4,000 and 6,000 tons, there are no additional conversion and complementary industries in the county. In this study, to prepare the necessary data for later analysis, important agricultural products, surplus, wastes, fresh consumption, and the consumed products in the region has been studied. Table 1 shows the results of these studies.

In the first step, first questionnaire was prepared by the question designer and the analyst. This questionnaire were filled out by Delphi's team and the responses were collected and analyzed. This stage is the first round of the Delphi method. The designing and analyst team designed the second questionnaire based on the derived results. This team consisted of

four person including the researcher, the supervisor and advisor of the thesis and an expert in food industry from Agricultural Jahad organization.

Then we gathered Delphi groups. These groups were composed of a set of twenty people including the experts and professionals in the field of agricultural conversion and complementary industries in the study area. Table 2 shows the grouping of Delphi team based on the job type and educational qualification.

In the first round of Delphi, the aim was to achieve the most important goals and standards of the agricultural conversion and complementary industries in Ahar county. Designing the questionnaire, as well as quantifying and analyzing the goals will help us to determine the weighting of objectives and to reach a detailed prioritizing.

The designed questionnaire consisted of 16 goals. Each expert compared and evaluated the goals. The results are summarized in the Table 3.

However, this is certain that due to various constraints, all the goals cannot be achieved simultaneously. That is why it is necessary to prioritize the goals so the limited resources can be allocated to the more prior one. In the first round of Delphi, goals (8 goals) with equal or higher weight than the average (0.625) has been selected. These selected goals are shown in Table 3. According to the expert opinions, goals such as increasing the income of local farmers, enhancing the investment of private sectors in local development and creating new jobs and

Table 1. Five years average of surplus production of Ahar County

Group	Horticultural products				Livestock products			Beans products	
Name of surplus product	Apple	Peach	Apricot	Cherry	Red meat	Milk	Honey	Lentil	Haricot bean
Production (ton)	114300	6174	2658	2265	5158	42870	282	3926	5604
Waste (ton)	32004	1645	744	226	206	2144	2.8	392	560
Fresh consumption (ton)	4175	820	820	820	1938	14911	89.5	1491	1491
Surplus production	78121	3709	1094	1219	3014	25815	189.7	2043	3553
Amount of processing (ton)	10000	0	0	0	0	0	0	0	0
Process able products	68121	3709	1094	1219	3014	25815	189.7	2043	3553

Reference: Ahar's Agricultural Jahad organization and personal calculation of the authors

increasing employment rate are the high priorities for development of agricultural conversion and complementary industries in Ahar county.

For preparing the second questionnaire we used two types of information: 1) suggested industries based on the results of analyzing the first questionnaire (Table 1) which included 21 case for agricultural conversion and complementary industries, and 2) derived goals based on the results of analyzing the first questionnaire which include 8 different goals. Based on the derived information, the second questionnaire was designed and was filled out by Delphi groups.

As the second round, the weight of each suggested agricultural conversion and complementary industry was calculated. Results are summarized in Table 4.

In the last stage, using a histogram (distribution of the weights and the break points) derived from the expert opinions, agricultural conversion and complementary industries in Ahar city were prioritized. This prioritization was the final achievement of the research which proposed 21 options for conversion and complementary industries. These proposed options were categorized into four groups based on their priority (Table 4).

Table 2. The members of the groups of Delphi

Group	Workplace	Education	Number (person)
Executive stuffs in this area in Ahar county	Agricultural Jahad Organization of Ahar county	Bachelor or master of science with an average experience of 18 years in the field of conversion and complementary industries, horticulture, agronomy, animal husbandry, and public administration.	12
Executive and institutional organizations	Department of Industry and Mining and Agricultural Jahad Organization of East Azerbaijan province	Bachelor or master of science with an average experience of 17 years in the field of food industries	4
Academic stuffs of university	University of Payam Noor, Islamic Azad, and of Faculty of Agriculture of Ahar city	PhD or master of science with an average experience of 6 years in the field of Geography, agricultural development, economic sciences and the food industry	4

Table 3. Goal of developing agricultural conversion and complementary industries in Ahar County in the order of their priority

Priority	Goal	Weight
1st	Increasing the income of local farmers	0.773
2nd	Enhancing the investment of Private sectors in local development	0.718
3rd	Creating new jobs and increasing employment rate	0.718
4th	Preventing irregular migration from rural to urban areas	0.686
5th	Diversification of agricultural and livestock products	0.653
6th	Better use of the capabilities of human resources	0.651
7th	Provide the of consumer and industrial needs of the society	0.638
8th	Develop the role of agriculture in the region	0.634
9th	Development of foreign trade (export)	0.613
10th	Linking agriculture, industry, and services	0.592
11th	Development of regional trade (with other counties and provinces)	0.588
12th	Improve the quality and standard of agricultural products	0.578
13th	Increasing storage time agricultural and food production	0.566
14th	Reduce waste and decay of agricultural products	0.551
15th	Better use of resources and capabilities of the natural environment and agriculture	0.546
16th	Increase the added value and efficiency in the agricultural sector	0.493

Table 4. Final result of prioritizing suggested agricultural conversion and complementary industry for Ahar County

Priority	Rank	Suggested agricultural conversion and complementary industry for Ahar County	Weight
1st	1	Production of dairy products (milk, cheese, cream, butter, yogurt, and etc.)	0.773
	2	Fruit puree and concentrate and syrup, nectar, and juice production	0.718
2nd	3	Industrial livestock slaughterhouse and conversion of the wastes (bone powder, blood powder, and etc.)	0.718
	4	Creating cold stores	0.686
	5	Grading, packing and sorting fruits	0.653
	6	Producing organic fertilizer from animal and plant wastes	0.651
	7	Livestock and poultry concentrate	0.638
3rd	8	Canning fruits like apple, peach, apricot, and etc.	0.634
	9	Grading and packaging of medicinal herbs and extracts	0.613
	10	Canning beans such as lentils and haricot beans, and etc.	0.592
	11	Freezing and packaging red and white meat	0.588
	12	Packing honey and jam production	0.578
	13	Canning white and red meat	0.566
	14	Leather production	0.551
	15	Prepared meat products (sausages, hamburgers, sausages, and etc.)	0.546
	16	Fruit chips industries	0.493
	17	Fruit lavashak industries	0.773
4th	18	Apple vinegar factory	0.718
	19	Cake and biscuit factory	0.718
	20	Bowel cleaning, bowel sorting of small cattle	0.686
	21	Roasting beans such as lentils and grains such as wheat	0.653

As the final result, the first priorities were production of dairy products (milk, cheese, cream, butter, yogurt, and etc., and fruit puree and concentrate and syrup, nectar, and juice production. The second priorities were industrial livestock slaughterhouse and conversion of the wastes (bone powder, blood powder, and etc., creating cold stores, grading, packing and sorting fruits, producing organic fertilizer from animal and plant wastes, and livestock and poultry concentrate. The third priorities were canning fruits like apple, peach, apricot, and etc., grading and packaging of medicinal herbs and extracts, canning beans such as lentils and haricot beans, and etc., freezing and packaging red and white meat, packing honey and jam production, canning white and red meat, leather production, prepared meat products (sausages, hamburgers, sausages, and etc.), fruit chips industries, and fruit lavashak industries.

It should be noted that besides filling out the questionnaire, the experts also suggested some industries which weren't listed in our questionnaire including following cases:

Wood related industries, producing pulp and paper from straw, producing bio-fertilizers, industrial drying fruits, sumac packaging industries, wool related industries, producing milk powder, bean packing industries, pasta production, and fishery related industries.

Despite the fact that there has been many researched advocated to prioritizing goals, since this study is a case study, direct comparison of achieved results with the other published researcher can't be made. However, we have review some works which are most similar to the current research. Alimoradi et al. [4] have conducted a research to prioritize the creation of complementary and processing industries of the agricultural sector by using the delphi method in Dehloran city of Ilam province. Their results showed that in the type of crops mostly devoted to the wheat (the largest cultivated area irrigated to wheat crops city in Dehloran with 16,720 hectares and 15,902 hectares of wheat). Industries such as flour and bran, wheat storage silos and making pasta were in the first priorities also due to the spread of farming in the area. Due to excess production volume and product; cannery and packing plant fungus was followed but given the relatively small amount of fruit orchards and other products.

Ahmadian et al. [3] Identified and analyzed the effective factors in underdevelopment of

agricultural conversion and complementary industries in Marvdasht County. First, they identified preventive factors in industries, then they formulated a questionnaire with 16 items under 5 main obstacles, in a five-item Likert scale, and the managers completed the questionnaires. The study results showed that both tomato paste and pickle industries were both equally affected by the obstacles and barriers such as "financial problems", "mechanization", "legal and administrative impediments", "lack of production elements", and "market barriers".

4. CONCLUSION

Regarding the high potential and capacity in agricultural fields, the key to solve the problems of the agricultural sector of Ahar county is to develop agricultural conversion and complementary industries. Today, the most important problems in this county is the lack of agricultural conversion and complementary industries. This forces the farmers to sell their products cheaper and without any conversion and as a result, without any value added. Because of the underdevelopment of mechanization, the lack of packaging, processing and finishing near the centers of production and the lack of refrigeration to store the products, the rate of waste increases and large amount of production will be wasted.

Despite the fact that more than 148,000 agricultural products and 143,000 horticultural products is being produces annually in Ahar county, it's capabilities in the agricultural industries has been neglected. Underdevelopment and lack of mechanization and agricultural related industries causes large amounts of financial loss for the local farmers. Without any doubt, the development of agriculture and processing industry enhances the dynamic of economy, reduces rural migration to the cities, increases farmers' incomes, creates new jobs, reduces the amount of wastes, increases value added, and improves the quality of farmers life. So it is important to evaluate and to discover the capacities and abilities in the region and to plan the investment based on their priorities. Livelihood of farmers depends on their agricultural incomes, thus it is expected that the authorities and those in charge to encourage and attract investors to invest in the construction of more processing and conversion industries for agricultural, horticulture and livestock products.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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