A Feasibility Study on the Development of Hazelnut Processing Industries in Guilan Province, North of Iran

Hossein Shahdab Langarudi, Saeed Firouzi[*]

Department of Agronomy, Rasht Branch, Islamic Azad University, Rasht, Iran

A R T I C L E I N F O

A B S T R A C T

The development of hazelnut processing industries is one of the major challenges of hazelnut production in Guilan province, Iran. Hence, the factors influencing the development of these industries in this province were explored by the Delphi technique in three rounds. After consultation with academic teachers and researchers of relevant research institutes, 31 experts were selected as the research panel members from Agriculture Jihad Organization and the affiliates of Hazelnut Research Institute in Guilan province. The results demonstrated that "specifically supporting large-scale and pioneer orchard owners to establish hazelnut processing industries", "establishing wholesale purchase centers of hazelnut in the context of agricultural production cooperatives", and "training agriculture processing industry experts of the province by dispatching them to countries pioneering in hazelnut processing industries" were the most prominent driving factors of the development of hazelnut processing industries in Guilan province as agreed upon by 98.81%, 96.68%, and 93.74% of the panel members, respectively. in addition, "inappropriate crop insurance coverage of hazelnut production" with an agreement rate of 95.55%, "the lack of a regional macro-plan for the development of agriculture processing industries in the province" with an agreement rate of 94.74%, "fluctuations in hazelnut market price and neglect in official monitoring of price balance in the market by the government", and "the lack of agricultural production cooperatives in the region and the weak cooperative culture " with agreement rates of 92.32% were found to be the main inhibiting factors of the establishment and development of hazelnut processing in the region.

Introduction

Hazelnut (*Corylus avellana* L.) is regarded as an important and highly consumed processed crop in the world, which not only consumed as a nut but also has plenty of applications in different food products (Anonymous, 2011). Nuts contain high level of nutritional value including antioxidants, minerals and fatty acids (Pakrah *et al.*, 2021; Sarikhani *et al.*, 2021; Sharifkhah *et al.*, 2020; Chatrabnous *et al.*, 2018). Among nuts, hazelnut is rich in vitamin B6 and contains 17-59% protein and 55-65% beneficial oil. Hazelnut oil

contains 83% oleic acid and is a major source of this food ingredient (Üstün and Turhan, 1996). Iran is the eighth largest hazelnut producer in the world after Turkey, Italy, the Republic of Azerbaijan, the USA, Chile, China, and Georgia (FAOSTAT, 2019). In Iran, permanent hazels are mostly grown in the Eshkevarat region in the north and the elevations of Qazvin, Ardabil, and Azerbaijan.

Based on the 2015 statistics of the Horticultural Research Department of Iran, the amount of cultivated

area of hazels in Iran is over 17,000 ha. Among the hazelnut-producing provinces, Guilan is the leading both in history and production rate where more than 85% of the whole hazel cultivated area is located in this province, in particular in the Rudsar county and the Eshkevarat region. Indeed, 7200 ha of the Guilan gardens are cultivated by hazels, which produce 6650 t of hazelnuts, accounting for 70% of the total hazelnut production of Iran (Anonymous, 2015). The livelihood of many households in the province depends upon hazel cultivation, directly or indirectly, but due to the poor hazelnut processing industries in this region, they can not make decent money. As a result, to increase the hazel farmers' income and employment in the hazelnut-producing regions, it is necessary to study the hazelnut processing industries in this province.

The agricultural processing industry can improve the productivity and profitability of the agricultural sector by reducing crop wastage and enhancing value-added crops. It can also contribute to rural development by means of enhancing the share of industrial employment in rural areas (Nouri and Nilipour Tabatabaei, 2007). There are many reports on the development of the processing industry in rural areas. In an attempt to answer this question "why the agricultural processing industry was less developed in the Marvdasht region, Ahmadian *et al*. (2013) indicated that barriers to financial issues and facility, mechanization, weakness in production factors, and legal, administrative, and market barriers were the major causes of the less-development of the processing industry in the studied region. The impact of these factors was more severe on the tomato paste than pickling and salinization industry. According to a study in Odisha State, India, Kishore (2004) enumerated access to raw material, demand market issues, investment environment, demand estimation, and financial and credit facilities as the major factors influencing the establishment and development of non-agricultural industries. Regarding the agricultural

processing industry, Edirisinghe (2001) enumerated some factors, including implementing food industry research, allocating facilities and accessible technologies, encouraging support services to develop healthy trade, and above all, having access to local marketing information as the approaches recommended by a commission of several APO countries for the development of the agricultural processing industry.

Moreover, Eghbali *et al*. (2018) stated that economic, production, structural, environmental, and infrastructure factors are the major obstacles to the development of the processing industry in the agricultural sector of Fereidn County, Isfahan province, Iran. In a study on the driving and inhibiting factors of the processing industry in North Khorasan province, Iran, Kalantari *et al*. (2010) found that bank facility granting was the most prominent barrier to the establishment of the processing industry in the province. Bozorgmehr *et al*. (2013), applying the SWOT method revealed that the key problem in the context of developing fruit processing industries in North Khorasan province was the lack of working capital, which resulted in preventing the owners of fruit industries from accurately planning for the purchase of raw materials and entailing problems for their production process. Through a qualitative analysis of fruit processing industry challenges in Kermanshah province, Iran, Moradi *et al*. (2015) implicated poor governmental supports, extensive paperwork in the licensing process, problems in labor supply, poor informing process, and the lack of strategic planning as the main impediments hindering the development of fruit processing industry in the study site.

Despite the key role of the processing industry in rural development and agriculture sustainability conservation, Guilan province is suffering from the lack of hazelnut processing industries, accordingly, all hazelnut production of the province is mostly purchased from farmers in the raw form at a cheap price and is

husked and processed outside the province. Even, the hazelnut processing industries, outside the province, merely convert the product into nuts whereas processed hazelnut has many applications in the chocolate, candy, and oil industries. The lack of this industry, especially in Guilan province as the leading hazelnut producer, restricts the income of hazelnut farmers severely, thereby jeopardizes the sustainability of its production. It is, therefore, of crucial significance to explore the factors driving or hindering the development of hazelnut processing industries in Guilan province. Accordingly, the present research used the Delphi technique to shed light on the driving and inhibiting factors of the development of hazelnut processing in the province. The results can end in regional planning.

Materials and Methods

The research was conducted in Guilan province located in the north of Iran (Fig. 1). The province has an area of 14042 km^2 stretching between the latitudes 36°43' and 38°27' N and the longitudes 48°53' and 50°34' E.

In this research we apply the Delphi technique in three rounds. Delphi is a specialized group opinion poll for future prediction, in which the opinions and judgments of individuals are collected and summarized in a certain domain (Fathi Vajargahi, 2013). The technique is mainly employed when there are constraints on the use of mathematical rules and formulas (Ahmadi Ahangarkalaei, 1997).

The Delphi technique is implemented through the following eight steps: (i) formulating a research question; (ii) selecting research panel members, (iii) administering the first-round questionnaire, (iv) collecting and analyzing first-round responses, (v) preparing feedback of the first round and developing and administering the second-round questionnaire, (vi) repeating steps 4, 5, and 6 for developing the third-round questionnaire, (vii) analyzing the responses, and (viii) reporting the results to the panel members (Ravonne, 2014; Stewart and Shamdasami, 1980). Fig. 2 shows the standard framework of a 3-round Delphi study in brief.

Fig. 1. Map of the study site: Guilan Province, north of Iran

The panel should be composed of at least 7-15 individuals. Accordingly, the academic teachers in Guilan province and the researchers of the Technical and Engineering Department of Hazelnut Research

Institute were consulted to identify and select 31 hazelnut experts including, experts of Agriculture-Jihad Organization in Guilan province and the affiliated agriculture agencies (including the Agriculture

Management Service of the counties of Rudsar, Langarud, Amlash, Lahijan, and Siahkal), as well as the experts of the Technical and Engineering Department as the Delphi panel members. Then, the selected members were requested to participate in the research after briefing on the goals and procedures, and they agreed. Finally, the Delphi technique was conducted through the following three rounds:

Round 1

In round 1, the following two open-ended questions were asked and the research panel was requested to answer them one by one.

(a) What are the driving factors of the development of hazelnut processing industries in Guilan province?

(b) What are the inhibiting factors of the development of hazelnut processing industries in Guilan province?
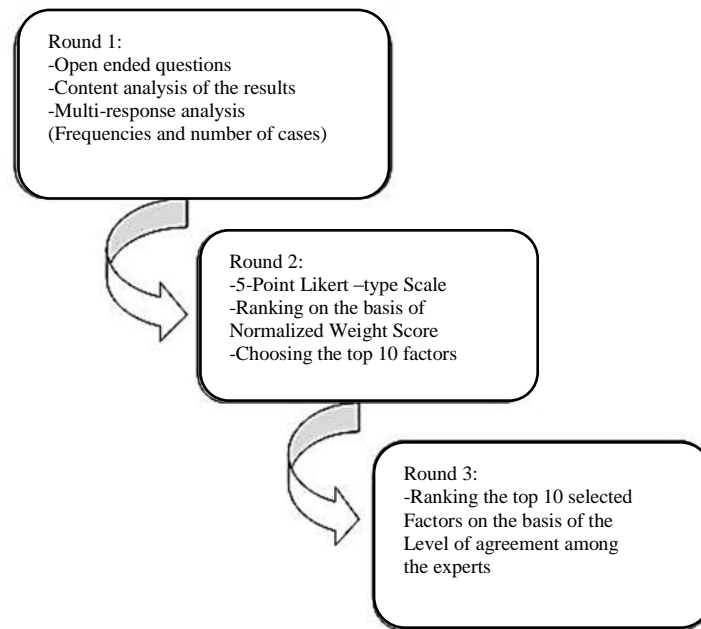

Fig. 2. The 3-round Delphi study framework (Firouzi and Azarian, 2019)

The questionnaires were sent to the panel members and their results were received by a deadline. Consequently, after summarizing the obtained results, 14 driving and 14 inhibiting factors were identified. At this step, based on the frequency of votes by the research panels, a hierarchy is developed in which the importance of factors was arranged from the most to least. The percentage of responses was calculated by dividing the number of votes to each item or the number of opinions by the total frequency of the items, and the percentage of the items was examined by dividing the

frequency of each item by the total number of panel members (31 individuals).

Round 2

Within the second-round questionnaire, all items were asked on a five-point Likert scale (ranged from very weakly agreed to weakly, relatively, strongly, and very strongly agree). As such, all opinions were provided to all panel members and they were requested to express the degree of their agreement with each item. After collecting the questionnaires, we applied the SPSS software package to rank the results based on their

degree of importance and normalized weight score. Hence, weights were assigned to the levels of the five-point Likert scale (1 = very weakly agreed, 2 = weakly agreed, 3 = relatively agreed, 4 = strongly agreed, and 5 = very strongly agreed). The degree of the importance of the individual items was determined by dividing the total opinions of the experts (considering the equivalent coefficients of the responses) by the number of items. The normalized weight score for each item was also estimated by dividing the degree of the importance of the item by the total importance degree of all items. Then, Kendall's W test confirmed the necessity of proceeding to round 3 (Heico, 2012).

Round 3

Based on the results obtained from the second round, the seven highest ranks of the inhibiting and driving factors were asked from the Delphi panel within the third-round questionnaire. Since the items were fewer, it was possible to compare the alternatives and more precisely give a relative opinion as to the percent of agreement with each item. The final opinions were arranged from the most to least important. Based on the final consensus, all factors with a consensus of >90% were selected and introduced as the most important factors. At the end of each round of the research, the results were presented and discussed in tables containing the driving and inhibiting factors downwardly.

Results

Since the research goal was to identify the inhibitors and drivers of the development of hazelnut processing industries in Guilan province, Iran, the research findings as to the driving and inhibiting factors are represented separately.

The drivers of the development of hazelnut processing industries

The Delphi technique was employed in three rounds. Therefore, the findings of these rounds as to the driving factors are separately presented as follows.

Results of the first round of the drivers

According to Table 1, it is demonstrated that "improving the quantity and quality of the crop through supportive agronomic plans" with an agreement rate of 90.32% among the panel members was ranked the most important driving factor of the development of hazelnut processing industries in Guilan province, in the first round of the Delphi study. The second rank was assigned to "establishing wholesale purchase centers of hazelnut in the context of agricultural production cooperatives" with an agreement rate of 61.29% and then the third rank was assigned to "introducing beneficial nutritional characteristics of hazelnuts through public media" with an agreement rate of 38.71%.

Results of the second round of the drivers

Table 2 represents the results of the second round of the Delphi research. In this round, the opinions of all experts were presented in the form of five-choice items to all participants, and the results were ranked by the degree of importance and normalized weight score. Table 2 shows the agreement of the hazelnut experts with different items in Guilan province. The shift in ranking in the second round is an intrinsic feature of the Delphi technique since experts change their opinions based on the opinions of the other experts in the first round. According to the results achieved from the second round, "training the regional agriculture processing industry experts by dispatching them to pioneer countries in hazelnut industries" and "specifically supporting large-scale and pioneer orchard

owners to establish hazelnut processing industries" were both selected as the leading driving factor of the development of hazelnut processing industries in Guilan province with a normalized weight score of 7.72. In the first round, these two factors were ranked eleventh and ninth with frequencies of 2 and 3, respectively. Besides, "supporting related applied projects and researches along with developing and activating hazelnut research

centers in the region ", which was ranked seventh in the first round with a frequency of 6, was ranked second in the second round with a score of 7.59. The third rank was assigned to "establishing wholesale purchase centers of hazelnut in the context of agricultural production cooperatives" with a normalized weight score of 7.53.

Table 1. The results of the first round of the Delphi research: the drivers of the development of hazelnut processing industries in Guilan province, north of Iran.

Items	Frequency	Responses %	Cases %
Improving the quantity and quality of the crop through supportive agronomic plans			
Establishing wholesale purchase centers of hazelnut in the context of agricultural production cooperatives			
Introducing the beneficial nutritional characteristics of hazelnuts through public media			
Reforming hazelnut import policies			
Specifically supporting investors of hazelnut processing industry			
Integrating orchards and establishing equipped storages for long-term storage of hazelnuts			
Supporting related applied projects and researches along with developing and activating hazelnut research centers in the region			
Participating in international markets and learning hazelnut exportation standards			
Specifically supporting large-scale and pioneer orchard owners to establish hazelnut processing industries			
Linking the industrial sector to the agricultural sector			
Training the regional agriculture processing industry experts by dispatching them to pioneer countries in hazelnut industries			
Placing hazelnut in the food market by supplying it to the supportive baskets of employees and workers			
Establishing an academic discipline in hazelnut production and processing in the region			
Developing roads connecting the farms to facilitate agricultural activities			
Total			

Results of the third round of the drivers

The results of the third round (Fig. 3) indicate that "specifically supporting large-scale and pioneer orchard owners to establish hazelnut processing industries", which was agreed upon by 98.81% of the panel experts, was ranked as the most important driving factor of the development of hazelnut processing industries in Guilan province, north of Iran, followed by "establishing

wholesale purchase centers of hazelnut in the context of agricultural production cooperatives", agreed upon by 96.68% of the experts, in the second rank. The third rank was assigned to "training agriculture processing industry experts of the province by dispatching them to countries pioneering in hazelnut processing " with an agreement rate of 93.74%.

Table 2. The results of the second round of the Delphi research: the driving factors of the development of hazelnut processing industries in Guilan province, north of Iran.

Items	Level of importance	Normalized weight score	Priority
Training the regional agriculture processing industry experts by dispatching them to pioneer countries in hazelnut industries	3.94	7.72	1
Specifically supporting large-scale and pioneer orchard owners to establish hazelnut processing industries	3.94	7.72	1
Supporting related applied projects and researches along with developing and activating hazelnut research centers in the region	3.87	7.59	2
Establishing wholesale purchase centers of hazelnut in the context of agricultural production cooperatives	3.84	7.53	3
Placing hazelnut in the food market by supplying it to the supportive baskets of employees and workers	3.77	7.40	4
Participating in international markets and learning hazelnut exportation standards	3.74	7.34	5
Reforming hazelnut import policies	3.70	7.27	6
Specifically supporting investors of hazelnut processing industry	3.65	7.15	7
Introducing the beneficial nutritional characteristics of hazelnuts through public media	3.61	7.08	8
Linking the industrial sector to the agricultural sector	3.61	7.08	8
Integrating orchards and establishing equipped storages for long-term storage of hazelnuts	3.48	6.83	9
Improving the quantity and quality of the crop through supportive agronomic plans	3.48	6.83	9
Establishing an academic discipline in hazelnut production and processing in the region	3.35	6.58	10
Developing roads connecting the farms to facilitate agricultural activities	3.00	5.88	11
Total	50.98	100	

The inhibitors of the development of hazelnut processing industries

Since the Delphi technique was applied in three rounds, the findings of these rounds as inhibiting factors of hazelnut processing industries are separately presented as follows.

The findings of the first round of the inhibitors

Based on the frequency of the responses to the open-ended question of the first round, 14 items were identified as the major inhibiting factors of the development of hazelnut processing industries in Guilan province, Iran (Table 3). Accordingly, "the fact that hazelnut production is uneconomical under the status quo, which discourages its production" was ranked the most important inhibiting factor by gaining 80.65% of the items. "Unfamiliarity of orchard owners with scientific hazelnut harvesting methods and post-harvest technologies", which appeared in 74.19% of the responses, was ranked the second. Finally, the third rank was assigned to "fluctuations of hazelnut market price and neglect in official monitoring of price balance in the market by the government" (64.52%).
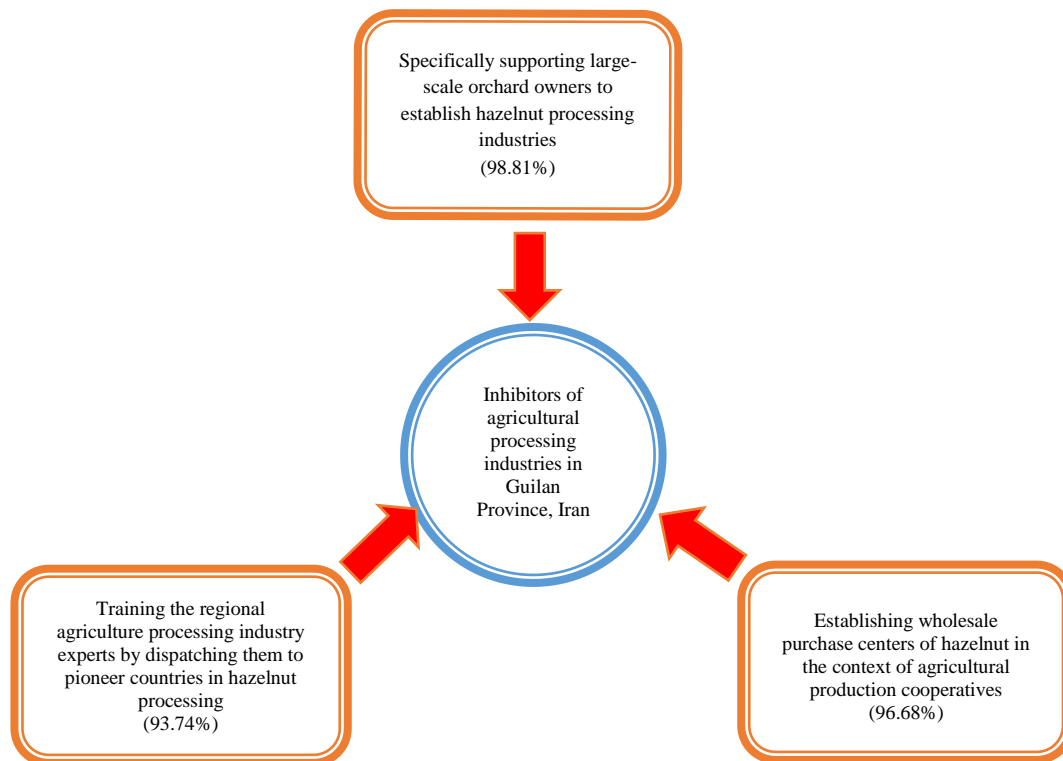
Fig. 3. The final results of identifying the drivers of the development of hazelnut processing industries in Guilan province, north of Iran.

The findings of the second round of the inhibitors

The results shown in Table 3 were employed to implement the second round of the research. Table 4 presents the agreement of the hazelnut experts in Guilan province, Iran, with the opinions of the research experts in the second round of the Delphi as to the inhibitors of the development of hazelnut processing industries in the province. The results gotten from the second round revealed that "fluctuations of hazelnut market price and neglect in official monitoring of price balance in the market by the government" with a normalized weight score of 7.75 was ranked as the top important factor inhibiting the development of hazelnut processing industry in this province. This factor has allocated the third place in the first round with an agreement rate of 64.52%. "The lack of hazelnut export perspective" and "the lack of a regional macro-plan for the development of agriculture processing", which were ranked tenth and sixth with agreement rates of 12.90 and 38.71% in the first round, respectively, were commonly ranked the second inhibiting factor of the development of hazelnut processing industries in Guilan province with a normalized weight score of 7.69. Furthermore, "inappropriate crop insurance coverage for hazelnut production" with a normalized weight of 7.56 was ranked third. It was ranked fifth in the first round with an agreement rate of 48.39% too.

Table 3. The results of the first round of the Delphi research: the inhibiting factors of the development of hazelnut processing industries in Guilan province, north of Iran.

Items	Frequency	Responses %	Cases %
The fact that hazelnut production is uneconomical under the status quo, which discourages its production			
The unfamiliarity of orchard owners with scientific hazelnut harvesting methods and post-harvest technologies			
Fluctuations of hazelnut market price and neglect in official monitoring of price balance in the market by the government			
Illiteracy and low-literacy of most hazelnut producers in Guilan province			
Inappropriate crop insurance coverage for hazelnut production			
The lack of a regional macro-plan for the development of agriculture processing industries			
The lack of agricultural production cooperatives in the region and the weak cooperative culture among the orchard owners			
The old age of most hazelnut producers			
Less importance of hazelnut production versus rice production in the plans of the organizations in charge of agriculture			
The lack of hazelnut export perspective			
Fewer skilled-worker in Guilan province			
Lack of assurance to harvesting adequate and high-quality crop in different years			
Complexity and high costs of hazelnut processing versus other orchard products			
High wastage of hazelnut crop in the region			
Total			

The findings of the third round of the inhibitors

The results obtained from the third round (Fig. 4) demonstrated that "inappropriate crop insurance coverage for hazelnut production", agreed upon by 95.55% of the experts, was ranked as the most important inhibitor.

The second rank was assigned to "the lack of a regional macro-plan for the development of agriculture processing industries" as an inhibitor of the development of hazelnut processing industries in Guilan Province with an agreement rate of 94.74%. "Fluctuations of hazelnut market price and neglect in official monitoring of price balance in the market by the government" and "the lack of agricultural production cooperatives in the region and the weak cooperative culture among the orchard owners" with agreement rates of 92.32% were commonly placed in the third rank among all inhibitor factors.

Table 4. The results of the second round of the Delphi research: the inhibiting factors of the development of hazelnut processing industries in Guilan province, north of Iran.

Items	Level of importance	Normalized weight score	Priority
Fluctuations of hazelnut market price and neglect in official monitoring of price balance in the market by the government	4.00	7.75	1
The lack of hazelnut export perspective	3.97	7.69	2
The lack of a regional macro-plan for the development of agriculture processing industries	3.97	7.69	2
Inappropriate crop insurance coverage for hazelnut production	3.90	7.56	3
Less importance of hazelnut production versus rice production in the plans of the organizations in charge of agriculture	3.87	7.50	4
The lack of agricultural production cooperatives in the region and the weak cooperative culture	3.81	7.38	5

among the orchard owners

|			
Fewer skilled-worker in Guilan province	3.77	7.31	6
Illiteracy and low-literacy of most hazelnut producers in Guilan province	3.74	7.25	7
The unfamiliarity of orchard owners with scientific hazelnut harvesting methods and post-harvest technologies	3.61	7.00	8
The old age of most hazelnut producers	3.61	7.00	8
Lack of assurance to harvesting adequate and high-quality crop in different years	3.48	6.75	9
The fact that hazelnut production is uneconomical under the status quo, which discourages its production	3.45	6.69	10
Complexity and high costs of hazelnut processing versus other orchard products	3.29	6.38	11
High wastage of hazelnut crop in the region	3.13	6.06	12
Total	51.60	100	
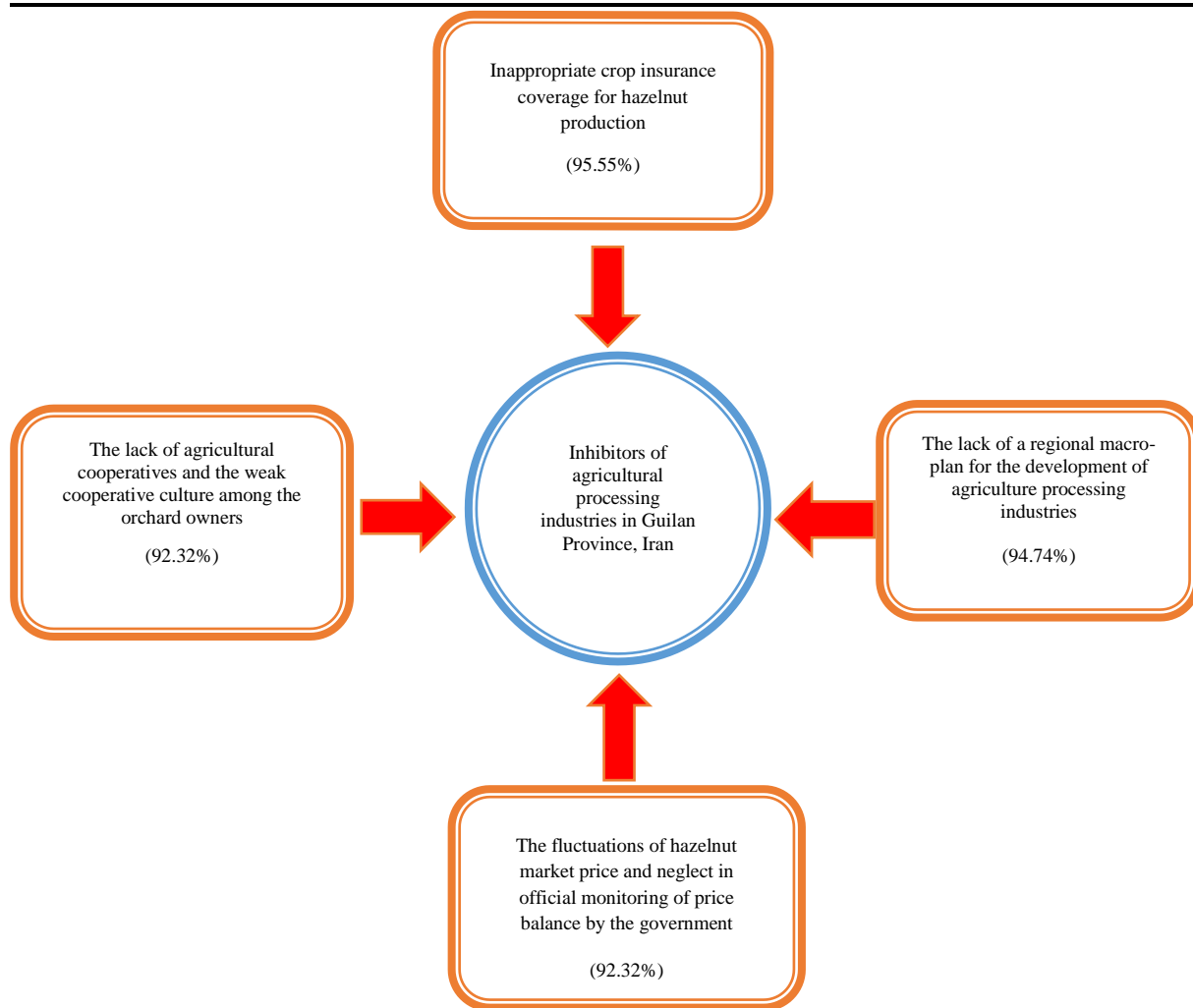
Fig. 4. The final results of identifying the inhibitors of the development of hazelnut processing industries in Guilan province, north of Iran.

Discussion

A review of related Delphi studies shows that the impact of assistance of pioneer farmers in the development of technological changes in agriculture has usually been focused on by the research panel experts (Firouzi *et al.*, 2017; Zehtab Naebi *et al.*, 2015; Samizadeh and Firouzi, 2017). This result can be related to higher financial benefits to large-scale farmers of introducing positive changes in agriculture, such as the creation of hazelnut processing industries in the studied region. Moreover, small gardeners are often forced to sell their crops to local brokers at lower prices due to their financial debts. While, the large gardeners supply their crops at the appropriate time to gain the highest profit. Therefore, the fact that the impact of pioneer farmers on developing hazelnut processing industries in the studied region was ranked first is reasonable.

The financial problems of small-sized hazelnut garden owners and forcing them to sell their products to the local brokers cheaply can lead to a shortage of raw hazelnut product and finally contribute to discouraging the establishment and development of hazelnut processing industries in the studied region. That's why "establishing wholesale hazelnut purchase centers in the context of agricultural production cooperatives" was selected as the second important driver for the development of the hazelnut processing industries in the present study. Considering the importance of crop marketing for agriculture development, it is necessary to identify suitable markets for the farmers to supply their crops. In this regard, the agricultural cooperatives can serve an important role in marketing of agricultural products, eliminating brokers, and ultimately improving farmers' production and income (Maroufi and Rasouli Azar, 2014).

Undoubtedly, the role of the skilled and efficient labor force in agricultural development is undeniable. Since various agricultural and horticultural crops such as tea, olives, and rice are cultivated in Guilan province,

this region has a good capacity in the skilled human resource sector for the agricultural industries. Therefore, in the current situation, training these people by sending them to leading hazelnut-producing and processing countries can play an important role in the development of these industries in the region. Consequently, it is quite reasonable that "training the regional agriculture processing industry experts by dispatching them to pioneer countries in hazelnut processing" was ranked in the highest place by the panel members.

The first driving factor identified for the development of hazelnut processing industries in the studied region calls for the transfer of hazelnut processing industries to the pioneer and large-scale gardeners, but this requires addressing their concerns about the impact of environmental factors on the crop yields because if they do not harvest sufficient crop, investors in the hazelnut processing sector will face serious financial losses. Therefore, establishing adequate and special crop insurance for hazelnut production is essential. Agriculture is naturally a risky activity and the farmers face a variety of natural, agronomic, and market-related risks. Given indeterminate annual profits, farmers worry about their ability to repay their debts (Hazel, 1992).

The lack of a regional macro-plan for the development of agriculture processing industries was also determined as the second barrier to developing hazelnut processing industries. The required macro-plan may be in form of supportive proceedings including, allocating provincial funds, organizing training programs to increase experts' technical knowledge, and helping to provide required infrastructures such as necessary licenses for establishing hazelnut processing units in the studied region.

The fluctuations of hazelnut market price and neglect in governmental monitoring as a deterrent of hazelnut processing industries are also consistent with

the results obtained from the Delphi study on the factors affecting the development of mechanization of rice cultivation in Guilan Province (Yousefzadeh and Firouzi, 2016).

Experts argued that agricultural cooperatives have considerable potential to boost agribusinesses. These cooperatives provide a good opportunity for farmers to cooperate in various fields, transfer experience, and teach scientific methods and approaches in agriculture and marketing. In Iran, agricultural cooperatives have also opened up great opportunities for cooperation, education, and economic prosperity in the agricultural sector, but a research suggests that the existing barriers to the active participation of farmers in agricultural cooperatives have resulted in the recession of the agricultural cooperatives (Ansari *et al.*, 2015).

Conclusions

The results show that some managerial, social, technical, and economic factors affect the development of hazelnut processing industries in Guilan Province, north of Iran. Based on the last round of the Delphi study, the governmental support of providing the required infrastructures to establish hazelnut processing industries by the large-scale hazelnut gardeners is of essential proceeding in the studied region. Moreover, the Agricultural Organization of Guilan Province must plan to establish suitable local cooperative wholesale hazelnut purchase centers to enhance the financial power of the regional hazelnut producer and to ensure providing sufficient inputs for hazelnut processing units. On the contrary, dispatching the regional agricultural processing industry experts to the pioneer countries such as Turkey to speed up the development of hazelnut processing industries should be considered in the supportive governmental proceedings. The Delphi study also demonstrates that a detailed crop insurance plan is required to compensate for some of the financial losses arising from crop failure caused by its production risks,

especially for large-scale hazelnut gardeners. All the identified barriers to the hazelnut processing industry development emphasized the need to promote cooperative cooperation.

Acknowledgements

Conflict of interests

The authors declare that they do not have any conflict of interest.

References

Ahmadi Ahangarkalaei S (1997) Designing a model for measuring and evaluating the level of productivity in the Iranian hand-woven carpet industry. Master's Thesis, Faculty of Industrial Engineering, Amir Kabir University of Technology, Tehran, Iran.

Anonymous (2011) Nuts & seeds in health and disease prevention / edited by Victor R. Preedy, Ronald Ross Watson, Vinood B. Patel. Available online: http://ezproxy. cput. ac. za/login ?url = http:// www.dawsonera.com/depp/reader/protected/external/ Abstract View/ S9780123756893 (assessed December 2014).

Anonymous (2012) Trade promotion organization of Iran (TPO). 2012. Available from: http://www.fa.tpo.ir (assessed January 2015).

Ansari H, Jourablou M, Pourafkari N, Hashemianfar A (2015) Investigating the Social Factors that Influence Participation in Agricultural Cooperatives and Comparison with Industrial Cooperatives in Tehran Province. Iranian Journal of Co-operative and Agriculture, 4(13), 73-100.

Bozorgmehr A, Rabbani Nasab M, Yavari A, Heidari M (2013) Development strategies of horticultural processing industries in northern Khorasan Province Approach (SWOT) analysis of strategic factors, Agricultural Economics and Development. 27(2), 103-113.

Chatrabnous N, Yazdani N, Vahdati K (2018) Determination of nutritional value and oxidative stability of fresh walnut. Journal of Nuts. 9(1), 11-20.

Edirisinghe C (2001) Country Paper: Sri Lanka. "Report of the APO Multi-Country Study Mission on Rural-Based Food Processing Industry, Asian Productivity Organization, Tokyo, Japan", 126-131.Gainesville, G.A. 2014. The Delphi Technique in Educational Research. SAGE open, April-June 2014: 8p.

Eghbali J, Asadi A, Shabanali Fami H (2018) [Expansion of agro-processing industries in the county of Fereidan: challenges and perspectives (Persian)]. Journal of Rural Research, 9(3), 360-375, *http://dx.doi.org/ 10.22059/jrur.2018.237695.1138*

FAOSTAT (2019) FAO, www.fao.org. (Assessed on March 2, 2021).

Fathi Vajargah K (2013) Educational needs assessment: patterns and techniques, Avidj issue, 5th edition, 208 p. [In Persian].

Firouzi S, Allahyari MS, Hadizadeh F, Koundinya V (2017) Factors affecting the development of hazelnut harvesting mechanization in Guilan Province of Iran. Journal of Nuts, 8(1), 1-10.

Firouzi S, Azarian F (2019) Propellants of mechanical pruning and plucking of tea (a case of developing countries). Information Processing In Agriculture. 6, 454– 461.

Hazel PBR (1992) The appropriate role of agricultural insurance in developing countries. Journal of International Development. 4(6), 567-581.

Kalantari KH, Rahnama A, Movahed Mohammadi H (2010) Factors driving and inhibiting further development of processing industries and agriculture in the province of North Khorasan, Economics and Development, Year XVIII, No. 70 [In Persian].

Kishore C (2004) Rural Non-Farm Activities in Specific Regions of Orissa. Journal of Rural Development. 16(1), 457-464.

Maroufi E, Rasouli Azar S (2014) Investigating the role of marketing of agricultural products in the system of agricultural and rural economy of Iran. International and Online Conference on Green Economy. 1-7.

Moradi Kh, Agahi H, Zarafshani Q, Pap Zan A (2015) Qualitative analysis of the challenges of fruit processing industries in Kermanshah province NVivo Software, Rural Research. 6(3), 483-514.

Nouri SHA, Nilipour Tabatabaei Sh (2007) Prioritization of agro-based-industries in the Falavarjan township of Isfahan province using Delphi method. Geographical Research Quarterly. 39(61), 161-177.

Pakrah S, Rahemi M, Nabipour A, Zahedzadeh F, Kakavand F, Vahdati K (2021) Sensory and nutritional attributes of Persian walnut kernel influenced by maturity stage, drying method, and cultivar. Journal of Food Processing and Preservation, e15513.

Üstün NS, Turhan S (1996) Research on technological characteristics of hazelnuts grown in middle and east Black Sea coast. National Symposium on Hazelnuts Nuts and Fruits, Samsun, Turkey. pp. 169–170.

Samizadeh SM, Firouzi S (2017) The driving and inhibiting factors of mechanized tobacco production in iran using the delphi technique," International Journal of Agricultural

Management and Development (IJAMAD). 7(1), 109-119.

Sarikhani S, Vahdati K, Ligterink W (2021) Biochemical properties of superior Persian walnut genotypes originated from southwest of Iran. International Journal of Horticultural Science and Technology. 8(1), 13-24.

Sharifkhah M, Bakhshi D, Pourghayoumi M, Abdi S, Hokmabadi H (2020) Effect of pollination time on yield and antioxidant properties of some pistachio cultivars. International Journal of Horticultural Science and Technology. 7(1), 51-8.

Stewart D, Shamdasani P (1980) Focus groups: Theory & practice, Vol. 20: Applied social research methods series. Newbury Park, CA: Sage.

Zehtab Naebi R, Firouzi S, Ebrahimzadeh MR (2017) Promoters and deterrents of developing mechanization of peanut cultivation in north of Iran. International Journal of Agricultural Management and Development. 5(1), 1-8.