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ORIGINAL ARTICLE

Development of Iranian Pistachio Knowledge Management Model Based on Knowledge Management for Development (KM4D) Model

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A B S T R A C T

The purpose of this study is to develop a model for knowledge management of Iranian pistachios based on the Knowledge Management for Development (KM4D) model. The knowledge of farmers and new scientific knowledge are complementary in terms of strengths and weaknesses. By combining the two, one can achieve the success that would not be achievable by using them on an individual basis of two. The present study is an exploratory mixed study. A study was designed based on the combination of library studies, documentation, and exploratory mixed studies to form a cross-sectional study in terms of data analysis and processing method, and correlational research. The statistical population of the research is divided into two parts: the qualitative section which includes 7 people and the quantitative part which includes 149 farmers, experts, specialists and experts in pistachio agriculture, and horticulture. Simple random selections are selected. To analyze the data in the qualitative part, the grounded theory method based on the KM4D model has been used. The quantitative part based on descriptive statistical analysis using SPSS software version 23 to generate relevant graphs, mean, median, and frequency table. Implementing knowledge management in agricultural organizations has a significant role in improving pistachio agriculture and horticulture development. It will result in reducing costs, increasing quality, innovation, and continuous improvement. The current study has presented a new model in knowledge management of Iranian pistachios agriculture, which will benefit from the quantitative and qualitative development of this agricultural product. The main application of this study is to increase added value of farmer's products.

Introduction

Pistachios are a good source of protein, fiber, monounsaturated fatty acids, minerals, and vitamins, as well as carotenoids, phenolic acids, flavonoids, and anthocyanins (Roozban *et al.*, 2005). *Pistacia vera* (pistachio) is the only species in this genus that produces edible nuts large enough to be commercially acceptable (Mandalari, 2022).

The history of pistachio production and trade is very long in Iran. It is thought that pistachio plant was first grown by the Iranians. It can be said that the pistachio

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originated from the geographical location in Iran (Abrishami, 1979; Mandalari, 2022). The largest natural habitats of pistachio trees are in the cultural territory of Iran and the major pistachio orchards in the world have been established in this territory for centuries. The current quality and quantity of pistachio products in Iran have not been achieved all at once but as a result of efforts and initiatives of Iranian farmers and growers over the past centuries. Quality and quantity of pistachio product has been improved during the centuries by our ancestors in Iran and involved adapting the plant to the climate conditions, combining different varieties of the plant, and grafting them together until the best variety is produced (Hosseini et al., 2022). However, in today's world of business, success requires new models of knowledge management. In this way, in addition to maintaining and managing quality, a quantity of a product can also be expanded. For this reason, a system is required to increase the quantity as well as the quality of the product. The focus of this study is to define a knowledge management model based on KM4D for Iranian pistachios.

Importance and necessity

To study the importance and necessity of this research, we focused on the goals and missions of three institutions of the Iranian Pistachio Association, the Nut Exporters Union, and the Rafsanjan Pistachio Production Company. the Iranian pistachio industry many factors have been studied which includes: the goals and programs of each of the above institutions, important issues such as raising awareness in all matters related to the pistachio industry, establishing specialized committees, cooperation with centers and scientific and technical figures abroad, preparing periodicals, electronic, scientific and educational publications, collecting up-to-date statistics, and scientific information and transferring it to members and reviewing existing issues and problems and providing appropriate consulting solutions to improve the quality of planting, holding, harvesting and processing in terminals of recording, warehousing, transportation and export facilitation and its development. However, each of these institutions has acted individually and without paying attention to other factors, institutions, or other stakeholders' recommendations or activities. The institutions have taken scattered actions that have not led to the desired result for the country's pistachio industry and have not been able to solve the problems of the industry. In other words, a missing link called knowledge management is well felt by these institutions and their stakeholders. By designing the knowledge management model of Iranian pistachio, it is possible to increase the capacities towards an increase in quantitative and qualitative growth of its production. Increasing the quality of manufactured products, producing more products, gaining more added values in production and increasing market share are among the achievements that will be possible by implementing knowledge management in production.

Definitions

Knowledge management: Knowledge management or management of scientific findings means a systematic approach to categorizing, and publishing information and scientific findings. In such a way that they are available to other researchers when it is required so that they can perform their research more efficiently and effectively.

Knowledge management for development (KM4D): The knowledge management model for development designed and developed by the Knowledge Management Association of Austria, the Netherlands, and Switzerland with a focus on (Hariri, 2006):

- Knowledge and social capital management.
- Knowledge management and community economics.

- Knowledge management and industrial development.

- Knowledge management and policy-making empowerment.

- Knowledge management and competitiveness of economic sectors.

It is offered to prevent duplication, ensure success, ensure non-recurrence of failures, learn from previous experiences in service delivery, policymaking, product development, monitoring, partnering with other organizations, and protect and usage of tangible and intangible assets. Moreover, it can be contributed to the development of services, and products, and increase of productivity of human capital and other l resources (i.e. finance and energy) (Kiamanesh, 2011).

Materials and Methods

Study structure

The present study is a combination of different studies. In such a form that from a categorical research point of view, it is an exploratory mixed study, from a purpose and nature point of view, it is an applied study, from a type and method of data collection point of view, it is a combination of literature reviews and documentation, from the duration point of view, it is an exploratory mixed studies and from data analysis and processing, it is one of the correlational and causal study.

In the qualitative study part, the statistical population included members of the Iranian Pistachio Association, members of the board of directors of Rafsanjan Pistachio Cooperative and large growers, members of the cooperative and members of the board and members of the dried fruit exporters union.

In the quantitative study section, according to the organizational territory and spatial scope of the research, the statistical population included all members of the Iranian Pistachio Association, members of the board of directors of Rafsanjan Pistachio Cooperative and large growers, members of the board and members of the union of dried fruit exporters and pistachio producers, in other cities of Iran.

In the qualitative study section, purpose and experience-based sampling method were used. The sample size was not known in advance. The sampling was carried out until saturation in data was achieved. We chose the sample based on their expertise in the field and we conducted interviews with them. After 7 interviews, we felt that the study has reached the stage of information saturation. Information saturation is achieved when no new information was achieved in the last conducted interview. In the qualitative study section, semi-structured interviews based on the components of the KM4D model were used. This allowed us to learn about the experience level of farmers in their own language and to obtain the desired solutions to develop a model for managing the knowledge of agriculture and horticulture of Iranian pistachios.

Questions

Five questions were designed and sent to the participants as below:

1- Could you please explain what you think of developing a model for managing the knowledge of agricultural and horticultural knowledge of Iranian pistachios? Or in your opinion, what a model for managing the knowledge of agriculture and horticulture of Iranian pistachio should include?

2- In your opinion, what are the results and consequences of developing a model for managing the agricultural knowledge and horticulture in Iranian pistachios for farmers, research centers, traders, and the region's economy?

3- As an expert in agriculture and horticulture of Iranian pistachios, would you be able to explain what are the concerns, issues, and problems that growers and farmers face? In your opinion, what factors will

facilitate, accelerate, or conversely affect establishing a knowledge management system?

4- Considering that you have a continuous and active presence in the field of pistachio agriculture and horticulture in Iran, who is/are the influential person/people in the production of pistachios in the country? What role do these institutions play in the quantity and quality of pistachio production in the country?

5- In your opinion, how important is knowledge management for the country's pistachio industry, especially local knowledge? What is the role of individuals and institutions in the management of agricultural knowledge and pistachio horticulture in the country? What are the appropriate tools to disseminate and promote them?

In the quantitative study section, it was not possible to collect data through the study of an entire statistical population due to specific limitations such as lack of access to the entire statistical population, time consumption, geographical dispersion, and lack of cooperation. Therefore, it was decided to select a part of the statistical population as a sample to collect information. Furthermore, a probabilistic sampling method, "simple random sampling" technique was used.

This means that a link to an electronic questionnaire was sent to 300 members of the Iranian Pistachio Association, the board of directors of Rafsanjan Pistachio Cooperative, and growers, the cooperative, and the board of Nut Exporters Union. They were asked to answer the questionnaire questions.

Results

Results from the questionnaires

Below a list of role players who participated in this field is provided. They were chosen from Rafsanjan Pistachio Producers Cooperative, Iran Pistachio Association and Nuts Exporters Association.

A list of different figures is provided in the supplementary material. The supplementary Fig.1 (SF1) describes the demographic characteristics of a sample population. Supplementary Fig.2 (SF2) describes the Age and geographical distribution of the sample in Iran. Each sample population was analyzed based on education level, work experience, and institutional membership. Supplementary Fig.3 (SF3) describes Factors threatening Iranian pistachio production in the world from an exportation point of view, supplementary Fig.4 (SF4) describes factors threatening Iranian pistachio production from a production point of view, supplementary Fig.5 (SF5) describes factors threatening Iranian pistachio production from processing point of view and supplementary Fig.6 (SF6) describes factors threatening Iranian pistachio production from a policy-making point of view.

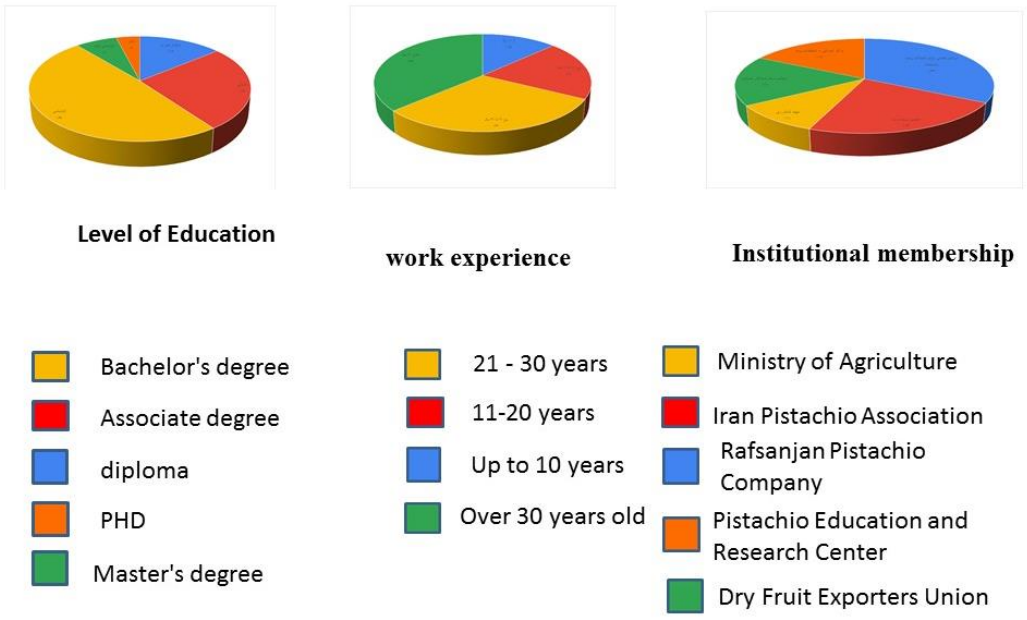

Fig. 1. Demographic characteristics of the sample population. Each sample population was analyzed based on education level, work experience, and institutional membership. Figure legend for each of the pie charts is provided beneath of the chart itself.

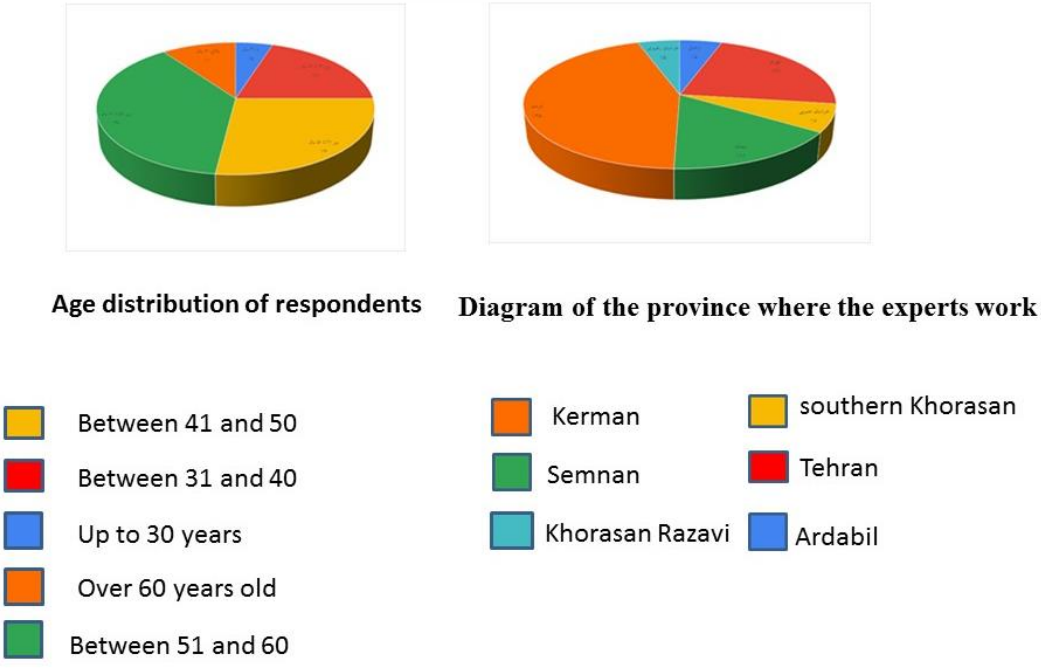

Fig. 2 . Age and geographical distribution of the sample in Iran. Each sample population was analysed based on education level, work experience, and institutional membership. Figure legend for each of the pie charts is provided beneath the chart itself.

- Members of Rafsanjan Pistachio Producers Cooperative Company consisting of pistachio s, farmers, and pistachio processors (SF1, SF2, and SF3).

- Members of the Iranian Pistachio Association consisting of growers, exporters, processors, domestic traders, and service providers (SF1, SF2, and SF3).

- Members of the union of dried fruit exporters consisting of traders and exporters of pistachios.

- Other contributors include suppliers, warehouses, researchers, officials, and policymakers in the public sector such as 1- the Ministry of Agriculture, 2- the Ministry of Industry, Mines and Trade, 3- National Union of Agricultural Cooperatives of Iran, 4- pistachio production companies, 5- pistachio research center, and 6- Pistachio Health Research Center.

Fig. 3. Factors threatening Iranian pistachio production in the world from an exportation point of view. Several factors including ignorance of pistachio industry policy makers, failure to benefit from specialized instructions, ignoring the loss of credibility of pistachio, and lack of strategy are amongst the factors.

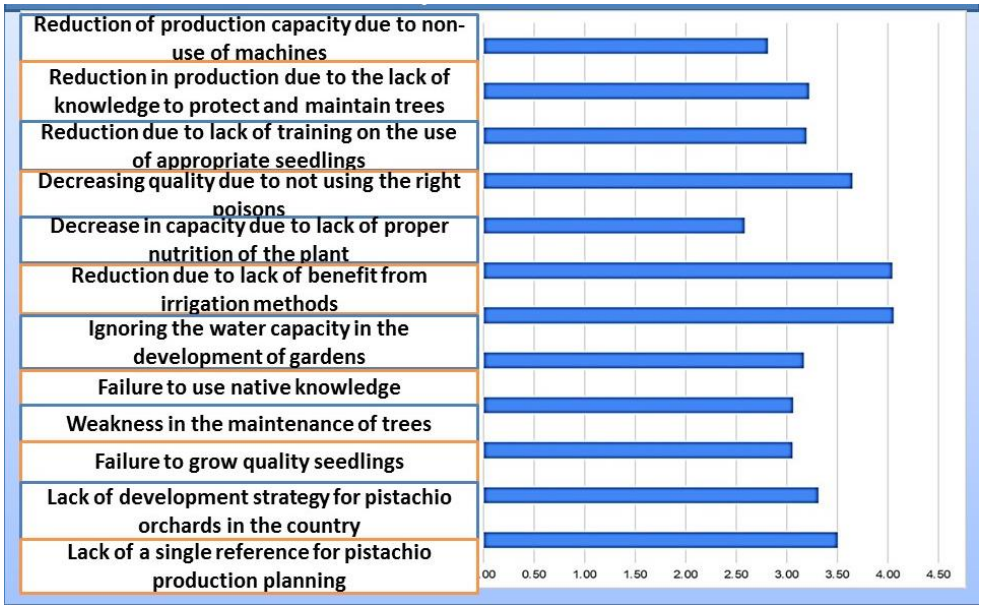

Fig.4. Factors threatening Iranian pistachio production from a production point of view. Several factors were identified and are listed on the left of the graph.

Based on the findings of this study, the studied institutions that have a direct relationship and impact on the Iranian pistachio industry are listed as follows:

Rafsanjan Pistachio Producers Cooperative Company is the most important company with about 70,000 members. It plays an important role in the

production, processing, and supply of pistachio products. It has an important role in the expansion of pistachio production and its processing capabilities in Iran. Various production, and processing groups are supported by them.

Iranian Pistachio Association was our second choice. They have the mission of reviewing existing issues, and problems, and providing appropriate consulting solutions for the quality of planting, holding, harvesting and processing in terminals of recording, warehousing, transportation and export facilitation and development and the establishment of specialized committees such as agriculture and horticulture, water, soil, processing, industry, statistics, informatics, advertising, marketing, education, research, publishing, information and finally public and international relations.

Nut Exporters Union carries a mission to increase the quality of dried fruit exports per international standards, statistics collection, scientific information, and technology transfer to the union members to improve professional knowledge and establish a research base approach. In addition, they have roles in finding and developing ways to export nuts and overcoming challenges in this respect.

Agricultural Research and Education Organization with numerous missions are related to this research to guide. They plan and implement activities and develop research and educational standards for the organization. It creates study opportunities and educational fields in the framework of research and educational cooperation with universities, domestic and foreign research and educational institutions, and centers. In addition to the above, it has a significant role in management information, publication of statistics, information, and educational findings.

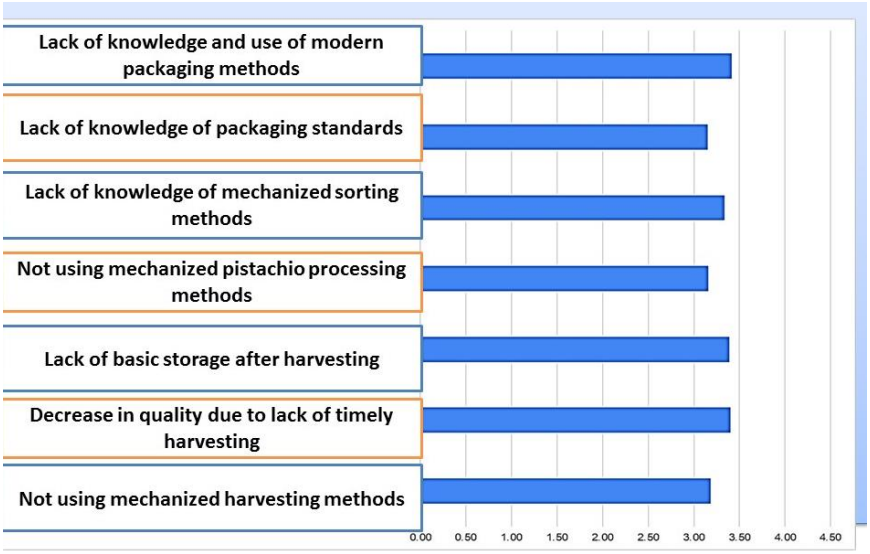

Fig. 5. Factors threatening Iranian pistachio production from a processing point of view. Several factors were identified and are listed on the left of the graph.

Agricultural Information and Information Technology Center is another important organization that has the mission of supporting information, research, training, and educational activities of researchers, education, and extension organization, conducting applied research to improve the quality of services. It also has a role in creating, developing, and expanding skills, knowledge, and development of software platforms and hardware.

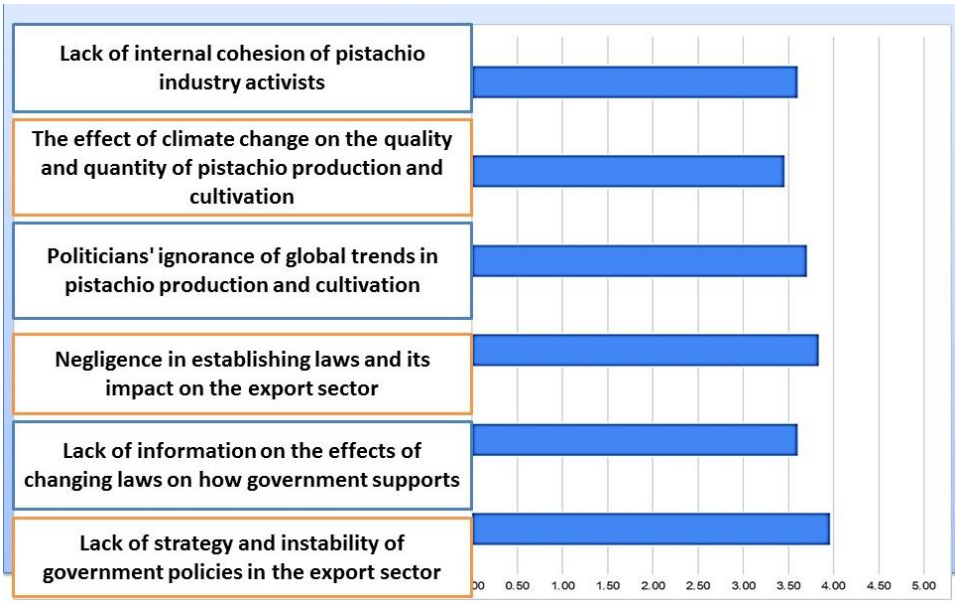

Fig. 6. Factors threatening Iranian pistachio production from a policy-making point of view. Several factors were identified and are listed on the left of the graph.

Agricultural Education and Extension Institute have objectives such as the development and empowerment of knowledge and skills of human capital in the agricultural sector. It facilitates the process of transfer of knowledge and new technologies to audiences and learners, development and promotion of job skills, development of agricultural activities for women and youth, and general development of knowledge management and information system in the agricultural sector.

Pistachio Research Institute (a subset of the Horticultural Research Institute) has a mission of providing appropriate solutions to increase yield and improve the quality of pistachios produced. The process will be conducted by considering the adaptation of different cultivars to climatic conditions. It uses effective measures and methods to maintain and support pistachio production with an emphasis on environmental issues in the direction of sustainable development in the agricultural sector.

The agricultural meteorology office has a mission of identifying local features related to agricultural products. These features include climate, water resources, soil, and physical conditions. In addition, the meteorology office provides a suitable structure for land use, such as determining the fertility characteristics of the land, and developing the area with irrigated or rainfed cultivation.

Factors threatening Iranian pistachio production

According to this study, the factors threatening the position of Iranian pistachios in international markets were divided into four areas of export, production (SF3), processing (SF4), and policymaking (SF5) which are discussed below:

Exportation field

In this section threatening factors related to the exportation field are discussed. A diagram is provided in the supplementary material (SF3) analyzing the exportation field. The factors are provided below:

-Unstable supply of global markets due to reduced pistachio production capacity and instability in exports and supply.

-Lack of information of policymakers of the pistachio industry about the emerging trends in the world pistachio market.

-Lack of information or disregard for the needs of customers in the world pistachio market

Production field

Many factors influence the production field. Most importantly, the below items can be named. In addition to the below items, a diagram is provided in the supplementary material (SF4) describing factors that influence the production field.

-Neglecting water capacities and water resources to create and develop pistachio orchards is the main factor in this category.

-Reduction of pistachio production capacity due to a lack of knowledge and skills to use and replace modern irrigation methods is the second factor in this area.

Processing field

These factors are summarized in supplementary Fig.5 (SF5). A brief list of 3 of them is provided below:

-The decreased quality of pistachio product due to lack of information and use of modern and mechanized methods of pistachio packaging.

-The decreased quality of pistachio product due to lack of fast and timely harvest of pistachios.

-The decreased quality of pistachio product due to lack of proper and principled storage of pistachios after harvest.

In the field of policy making

Policymaking sector is the most important of all and it has the greatest impact on threatening the position of Iranian pistachios in the international markets. (Supplementary material – SF6).

-Lack of strategy and instability of governmental policies in the export sector.

-Lack of policy makers' control over the consequences and effects of changes in the law which may (or may not) support the export sector.

Design of a KM4D model

In response to the main question of this study, the following features were considered to design a KM4D model (Asrar-ul-Haq, 2016):

-Lack of strategy and instability of governmental policies in the export sector

-The Decreased quality of pistachio product due to lack of proper and principled storage of pistachios after harvest.

-The goal of establishing pistachio agricultural and horticultural knowledge management is to produce pistachios with the highest quality and the highest quantity for the sustainable supply of products to the global market.

-Examining the mission and duties of the responsible institutions involved in pistachio exports indicates that there is a great challenge in the implementation of knowledge management and that is nothing but the island (isolated) operation of each institution and lack of integrated communication.

-The process of pistachio production and export needs to be reviewed so that according to customer needs and market expectations, pistachio production and supply should be managed. Therefore, being aware of this issue, designing a comprehensive model for pistachio agriculture and horticulture knowledge management should include other players and stakeholders who are active in the country's pistachio industry so that the flow of information and knowledge dissemination is coherent and integrated between all of the pillars which will lead to minimizing the threats identified in the research.

-Implementing pistachio agricultural and horticultural knowledge management will face several main challenges. These challenges include:

-Increased number of stakeholders which includes governmental institutions, private institutions, educational/research institutes, and cooperatives. The listed organizations and institutions have different levels

of facilities. Unsurprisingly, conflicts of interest are observed among them.

-Increase in a number of audiences and their diversity from different sectors and groups. The audience comes with a wide range of skills, literacy, and expertise. This makes it challenging to communicate with.

-The need to pay serious attention to the local knowledge of pistachio producers and processors.

-Updating and revising the knowledge tree in the field of pistachio agriculture and horticulture, with the addition of new topics and content.

-Paying attention to effective tools for disseminating knowledge for each of the different groups of audiences (virtual or face-to-face or correspondence training).

-The need for accreditation of local (indigenous) knowledge. Accurate accreditation to the local knowledge holders must be given.

-The need to design a model using new technologies in the establishment of knowledge management.

With these considerations, the model of pistachio horticultural and agricultural knowledge management based on KM4D model can be drawn as follows.

Fig. 7. The horticultural and agricultural knowledge management model of pistachio based on the KM4D model. Based on the model, based on management and agricultural sciences, responsibility for each of the organizations is defined. The importance of this model is to avoid parallel work and to increase added value for farmers' products.

Discussion

To develop a model of knowledge management of Iranian pistachio agriculture, interviews were analyzed, and based on them the following results were obtained.

The possibility of developing a sustainable production of pistachios and supply to global markets can be created with the benefit of knowledge management.

Increased interactions and coordination between the departments are achieved from the contextual model of

this research, which is influenced by knowledge management.

From a conceptual point of view, research data were analyzed. Briefly, the underlying model of this research is influenced by knowledge management that leads to actions and interactions. The consequences of these actions and interactions are agricultural development. One of the actions of this model is the tendency to grow and develop with the benefit of knowledge management. This motivates mobility and the desire to grow and progress. On the other hand, Iranian pistachio farmers will succeed in benefiting from the mentioned features to offer this profitable agricultural product in the world markets and cause economic success and bring prosperity to themselves and the nation.

Benefiting from a powerful organization or cooperative will enable farmers to meet the various needs of pistachio farmers and growers can lead to agricultural development. This requires the benefit of knowledge management by cooperative members who are farmers. By designing the knowledge management model of Iranian pistachio, it is possible to increase the capacities and achieve growth in the quality and quantity of its production. Increasing the quality of manufactured products, producing more products, gaining more added value in production, and increasing market share are among the achievements that will be possible by implementing knowledge management in production.

The vigilance of cooperative managers, presence in global markets, review of competitive advantages, opportunities, and threats and other effective factors are required to achieve this demand. Iranian pistachio farmers will succeed in taking advantage of the mentioned features to offer this profitable agricultural product in the world markets and cause economic success.

Knowledge management enables sustainable development in the country. This study shows the role and importance of knowledge management in the development of the country. Benefiting from the achievements in the humanities can lead to industrial or agricultural development.

Comparing the results of this study with other studies in the field of knowledge management models, it can be noted that in other studies, knowledge management models have a limited set of employees, and the issue is to establish knowledge management for the employees of a specific and focused organization. Whereas, in this research, the issue is the implementation of knowledge management in a diverse set of contributors who are members of various institutions and they have varying levels of literacy and multiple interests to accept different roles. It is worth mentioning, to the best of our knowledge, this study has been the first study in the field of its innovative and novel features which were used to design the research.

Suggestions

According to the knowledge management model presented in this study, the following considerations are suggested to the authorities in different fields:

The project offers below suggestions to the officials of the Ministry of Agriculture:

- Development of a strategic and long-term plan for expansion of pistachio products in all dimensions.

- Elimination of parallel work between the centers and other institutions; reviewing and integrating of the executive and operational processes in the field of infrastructure, research, organization and promotion.

- Targeting and compiling the annual action plan and notifying the agricultural ministry management of the provinces to improve the quantity and quality of production.

- Allocating budget by programs and goals and monitoring the implementation of programs.

- Development of protection law in the production, processing, and export sectors.

- Coordination between the ministries and the parliament and the central bank for special attention and alignment of activities and policymaking of other bodies.

Considering that the project studied knowledge management at different levels of the organization, below suggestions are made to the officials of the Agricultural Research, Education and Extension Organization, officials of the Agricultural Education and Extension Institute, and officials of the Agricultural Information and Information Technology Center:

- Establishment of a permanent secretariat for knowledge management with the invitation and presence of full-fledged representatives of all decision-making and effective institutions and units.

- Definition and implementation of project need assessment and leveling of the audience.

- Designing knowledge management processes in different sectors.

- Compilation of educational content based on video training.

- Designing a motivational system to encourage the use and participation in the role of knowledge management.

- Creating a specialized electronic database and library based on technology capabilities to share knowledge management in the organization.

Below are suggestions that can be made to the Pistachio Producers Cooperative and Pistachio Association:

- Designing and proposing a motivational model for cooperative members to provide facilities appropriate to role-playing and participation in the knowledge management system.

- Organizing groups to record the experiences and local knowledge of farmers and growers (consisting of students and experts).

Proposal to the officials and managers of the union of dried fruit exporters.

- Compiling a pistachio map of the world.

- Designing a mechanism to support future research projects in the future of the pistachio market and producers.

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