

Overseas cultivation: the complimentary approach for developing food security

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Abstract

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The aim of this study is to analysis the requirements for realization overseas cultivation to develop food security in Iran. The statistical population of the study is included 176 people who are theoretically selected from researchers, experts and activists from research centers, government organizations and private sectors. These people are active in the field of overseas cultivation. A questionnaire was developed to collect the necessary information. The dependent variable of this research was the improvement of food security, which has been measured in four aspects of food availability, food accessibility, food utilization and stability of the three mentioned dimensions of food security. The independent variables were the requirements for the realization of overseas cultivation in four groups including: policy-making; economic; cultural and social; agronomical and specialized ones. SPSS20 and AMOS22 software are used to analyze data. The result of inferential statistics, which is done using confirmatory factor analysis and Bayesian approach in Amos software, shows that all independent variables have a positive effect on the dependent variables. The study shows that “agronomical and specialized” requirement has the highest influence on the realization of overseas cultivation in this country. The “availability of technical information about the agriculture water resources in the target country” plays an important role in measuring the „agronomical and specialized” requirements element. In addition, the results show that among the four aspects of food availability, access to food, utilization and stability of the three mentioned aspects of food security, stability plays the most important role in the development of food security in Iran.

Keywords: food security; overseas cultivation; Iran

Introduction

The increasing pressure on natural resources of the planet and its fresh water supplies can be considered as one of the consequences of increasing demand for food in the world. This increasing demand for food and providing food security needs further production of foodstuff. In order to obtain food security in today’s world, countries resort to different

policies and strategies in areas of farmer-based agro-ecology, biotechnology, renewable energy, nuclear agriculture, information technology, nanotechnology and investment in the farmlands of the other countries. For these reasons, Iran also has concentrated on investment in farmlands in other countries as a part of complimentary long-term approach for meeting its food security requirements, referred to as “overseas cultivation”.

It is predicted that until 2050 the 7-billion world population reaches 9 billion. The most of this population will be located in low-income countries which at present face challenges for providing their basic needs such as water and energy. In the future decades, the growth of population and income increases the demand for food in a way that till 2050 about 80 percent of people will need more meat, 52 percent will need more grains and 40 percent will need more root vegetables and beans. The increase of food prices has undesirable consequences for poor and vulnerable people. Through researches, it can be predicted that until 2050 the price of some products such as corn seeds, rice and wheat will increase 104, 79 and 88 percent, in respect. Furthermore, the researches show that till 2050, in developing countries the number of people who suffer from hunger will increase and from 881 million reaches one billion (Rosegrant et al., 2013).

In these days, in order to achieve food security, many countries have developed different policies and strategies such as agro-ecological farming system, bio-technology, using renewable energy resources, nuclear agriculture, information technology, communication technology and nanotechnology. The increasing pressure on the global ground and fresh water is the result of the increasing demand for food which is the consequence of the increase of world population. Furthermore, changes in eating habits, the need for producing more biofuels due to the fluctuations of oil price and changes in policies of bioethanol production in the European Union and the United States causes the increase of use of natural resources (Rulli et al., 2013). Thus, as a part of the long-term strategy of providing food and energy security, many countries invested in agricultural land of other countries. This strategy which is known as “agriculture outside its national borders” has been welcome by many developed and developing countries. Considering the limitation of internal resources (mostly water and land), these countries rent or buy the farms of other countries and use them for growing food (ibid).

In 1996, on International Conference on Global Food Security, it was said that food security goals are achieved when all people at all times have physical and economic access to enough, healthy and nutritious food. Furthermore, food security means that people use foods that help them to have an active and healthy life (FAO, 2008). The concept of food security has gradually developed. In its extensive concept, food security is studied in three levels. In the first level, concepts such as production, consumption and quality are studied. In the second level, basic services, technologies, properties and rights are studied. In the third level, sustainable food is introduced (Shaw, 2008). The changes in food

security concepts are included in the changes of the unit of analyzing this concept which extends from that is understood by families and the concept that is meant by the world and nations who believe in the relation between food security and the environment (Maletta, 2014).

Food security analysis determines that whether there was a change from food insecurity to food security or vice versa. It also determines that whether such changes are possible or not. The factors which could result in food insecurity are lack of access to food, inappropriate use of food and the periods of instability. In another word, food insecurity is a situation in which people cannot have access to sufficient amount of healthy and nutritious food. In this case, they could not naturally grow or have an active and healthy life (FAO, 2015). Producing enough healthy food to satisfy the needs of the world population, while considering ecological sustainability, is changing to the growing challenges of the coming decades (Dehyouri and Hosseini, 2009). Factors such as increasing food production through the increase of the cultivated land surface, increasing the yield of each unit of cultivated surface, better support the work forces, better equip the agriculture sector, do researches, holding training classes and agricultural education for farmers, cultivating high yield seeds, directing the cultivation model towards the market need, localizing and integrating cultivation and irrigation methods, marketing and importing agricultural products can implement food security (Pourkakhak, 2003). Food security and its relation to sustainable agriculture are rapidly becoming the important concern of developing countries (Bakshi, 2006). Using boundary model by which the under cultivation surface increases and new lands are discovered as well as using model of securing natural resources which has the characteristics of European agriculture during 18 and 19 century and combines agriculture and husbandry and using some methods to fertilize soil and improve the quality of soil and through considering other production factors, agricultural sector can be developed. The above-mentioned approaches can improve agricultural sector and increase the supply of domestic products. This way, supplying food products will have a stable trend (Mobini Dehkordi, 2008). Global food production changes and the trend of the social insecurity as well as explosion of population cause the decrease of land surface per capita. In order to increase domestic food production and develop production yield, new technologies should be used (Ebadi, 2004).

A large-scale land acquisition is the acquisition of any tract of land larger than 200 hectares and or twice the median land-holding, according to the national context. International Land Coalition (ILC) considers a 200-hectares land as a large piece of land. A 200-hectares land is ten times a small

farm. According to FAO's report, this scale is larger than the median land-holding in the world except for South Africa, Argentina and Uruguay (Geary, 2012).

Countries which acquire the most land are located in the Middle East, Southern East of Asia, Europe and North America (Rulli and D'Odorico, 2014). Overseas farming is a type of direct foreign investment in agricultural sector (often with different goals) in which one side is the host country and the other is the guest country. It is worth noting that in modern global geopolitical interactions, overseas farming is not limited to crops and garden products but it is included in poultry farming, meat, fishing even dairy industry (Khaledi et al., 2014). In "overseas cultivation" some strategic agricultural products such as grains and oil seeds may be considered as target products (Khaledi et al., 2014). The supporters of overseas farming believe that more investment in agricultural sector provides a significant opportunity for developing it (Bringezu et al., 2014). They also point to the increase of direct investment volume in agricultural sector, the increase of the number of farms, the development of the infrastructure in order to develop rural industry, decreasing poverty and improving food security, creating more job opportunities in rural areas, providing the beds for transferring the technology of planting and harvesting agricultural products, being familiar with modern farming techniques, taking advantage of innovations in agricultural production, increasing currency income of the host country and stabilizing world prices of agricultural products (Von Braun and Meinzen-Dick, 2009). The lands that have been less considered in the past short period of time, at present hundred thousand hectares of them are sought by international investors. Land indicates one's identity and provides his living and food security (Cotula et al., 2009). Food product importers had to discover new tools and replace the old ones with them in order to ensure food security. Among these tools, there are land acquisition and investment in countries which have a large amount of agricultural land (Songwe and Deininger, 2009). A combination of international rules, correct governmental policies, the mediation of civil society, media and local communities in order to minimize the challenges and taking advantage of the profits of land assignment is necessary (Von Braun and Meinzen-Dick, 2009). Friis and Reenberg (2010) studied the process of assigning lands to the foreign investors in Africa and introduced it as an effective factor that can benefit fertile agricultural lands and make agricultural, policy development, cultural, population, economic, technological and climatic changes. In his article on "Assigning agricultural land to foreign investors and evaluating its effect on water resources of desert countries", Philip Woodhouse (2011) says that choosing the site of the project and the type agricultural product

determines that under any conditions, water has always been one of the necessities of these kind of projects (Geary, 2012). Large-scale land acquisition transactions can threaten the life of poor people and change the land use in a way that the investors like (Anseeuw et al., 2012). Attacks for conquering agricultural lands and land transactions considerably affected the price of land and water. Just in 2007, in Brazil, Poland and in the west of Middle America, the price of agricultural lands increased 16, 31 and 15 percent in respect (Von Braun and Meinzen-Dick, 2009). Schoneveld (2011) said that biofuels motivated northern countries especially European industrial countries to invest on land acquisition. He also said that the South Asian countries and the Middle East countries which have limited amount of agricultural lands, invested on land acquisition to produce more food. Through the world, land acquisition takes place in accompany with taking advantage of a large amount of fresh water. This fact had not been considered before (Rulli et al., 2013). In recent years, private investors, pension funds and big companies have been interested in cooperating with national food security policies and in order to increase their property, they invested in agricultural sectors. In order to ensure their investment and to prevent the transaction risks such as the denial of having access to agricultural products or water resources and in order to prevent its negative effects on local people's living, food insecurity and the environmental damages, they invested on land acquisition (Heumesser and Schmid, 2012).

Through the world, the agricultural land acquisition is one of the subjects of sustainability which studies issues such as food security, land management, agricultural development and having access to the resources. A large number of active players in the agricultural development sector, policy-makers, investors and agricultural researchers cooperate with the goals of sustainability to make people understand the nature of this phenomenon (Messerli et al., 2014). Hunt (2015) points to the role of governments and global issues and the importance of the way of making contracts on land acquisition and its effect on securing the benefits of local communities of the host country. She also emphasizes on the necessity of appropriate policies which pave the way for achieving these goals. Furthermore, she evaluates the pros and cons of land acquisition from the international communities' point of view. Breu et al. (2016) evaluated 475 investments on large agricultural lands and concluded that the main goal of land acquisition is to ensure the guest country's right of having access to water resources as their country faces the shortage of water resources.

Below, the differences between "land grabbing" and land acquisition for "overseas cultivation" are summarized. Land grabbing usually is accompanied by:

- Denial of human rights;
- Infringe the principles of Free Prior and Informed Consent (FPIC) which is related to what affect the societies while all are informed about these principles and stopping or rejecting them is possible;
- Grabbing land is not established on a comprehensive evaluation and its social, economic and environmental effects are neglected;
- Explicit contracts which avoid the recognition of specific promises on occupation and sharing the profits;
- Neglecting cooperative and democratic planning, dependent and independent supervision and legal cooperation (Geary, 2012).

According to Statistical Center of Iran (2013), in Iran, like many other less developed countries, 27.1 percent of the expenses of urban families in 2012 belonged to food and snacks while at that time, rural families spent 42.3 percent. It is predicted that if the present economic and production situation continues, like 2015, the number of people who suffer from malnutrition once more exceeds 5 percent and it is possible to reach 6 percent (Mir, 2016). According to FAO's report (2015), during the last two decades, at least 3 million and at most 4.2 million Iranian people had suffered malnutrition. Different countries have different strategies to achieve food security. These strategies are agrolological farmer-based technology, technologies based on common researches, biotechnology, geographical information system (GIS), global positioning system (GPS), food irradiation and information and communication technology (Lashgarara, 2008). Furthermore, nanotechnology which improves and deepens the precision of the future developments and reinforces precise agriculture in food supply chain is another strategy that is used in order to achieve food security (Barrera, 2011). Despite the existing challenges and deficiencies, in order to achieve food security and to develop agriculture in Iran, designing methods of production which are in accordance with climatic zoning, land use, the topography maps of the country and the regional capabilities of the land can help reduce the production costs and increase the position of food security in the related industries. Thus, through producing and marketing high-quality agricultural products, we can better compete in the regional and international markets (Mobini Dehkordi, 2008). Besides developing domestic products and increasing the import, there is a third strategy to achieve food security which is called "overseas cultivation". This concept has been used since the beginning of the 21st century. It can be used in Iran as a complementary solution to achieve food security. The shortage of water resources and the less agricultural lands are among the reasons of paying attention to overseas cultivation in Iran. Furthermore, in order to prevent

the damages to agricultural lands and due to the insecurity of entering the international markets as well as responding the domestic demands for food and to support the vulnerable countries in international competitions, overseas cultivation can be used as a successful strategy (Khaledi et al., 2014).

Researches showed that Iran with 165 million hectares surface area has 18.32 million hectares agricultural lands. Among all of these lands, 10.3 million hectares have high quality to be cultivated and the rest need more investments in order to be improved. Iran is located on a desert belt and 89.7 percent of it is dry. Its average annual rainfall is 250 millimeters (29 percent of the world rain) while its average annual evaporation is 2000 millimeters (8 times more than the world average). Iran's rainfall is 413 billion cubic meters and its renewable water resources are 130 billion cubic meters. With this trend, until 2020 Iran will need 198 billion cubic meters potable water and its agriculture sector will require 170.7 billion cubic meter water while its renewable water resources are 130 billion cubic meters (Zahedi and Najafi, 2012).

Reports show that to be the most optimistic, Iran possesses about 130 billion cubic meters of the world's renewable water (calculating the volume of return water), 126 billion cubic meters of which is accessible.

According to the report of Iran's Ministry of Energy, in 2011, about 86 billion cubic meter or Iran's water resources were used in the agriculture sector (Mir, 2016).

Among the important issues of Iran's agriculture are landownership and land use systems. The small size of production units and the dispersion of agricultural lands prevent from using advanced technologies, equipping the infrastructure, using advanced machinery, improving the efficiency of irrigation methods and developing the agriculture industry (Hoghoughi Esfahani, 2012). According to the report of Iran's Ministry of Agriculture Jihad (2016), in order to modify and remove the weak points of the food supply models for 2026 outlook, it is predicted that at that time to satisfy the need for food, the agriculture sector (with or without importing agricultural products) should supply a specific amount of basic products. Considering the trend of producing these products during last years, it is predicted that to improve food security in future years, some appropriate strategies should be implemented. Table 1 estimates the production volume of wheat, barley, white rice, corn seeds, sugar and oil.

As the figures in Table 1 show, in 2026 Iran will produce 16605 thousand tons of wheat so in this regard it will be self-sufficient. Until 2026 Iran will produce 4551 thousand tons of barley so in this regard it will be self-sufficient, as well. But until 2026 Iran has deficiency needs for products such as white rice, corn seeds, sugar and oil. Until 2026, Iran's deficiency need for white rice, corn seeds and oil is estimated 1224, 3674

Table 1. Prediction of the need for some agricultural products in Iran until 2026 (thousand tones)

Number	Type of product	Production volume in 2016	Required volume till 2026	Predicted production volume in 2026	Deficiency needs in 2026
1	Wheat	11800	15256	16605	–
2	Barley	2890	4484	4751	–
3	White rice	1917	3306	2082	1224
4	Corn seeds	2100	6974	3300	3673
5	Oil	154	1656	875	781

Source: Iran's Agriculture Jihad Ministry, 2015

and 781 thousand tons in respect. Overseas cultivation can be a complementary solution for the improvement of food security in Iran. The decision to take advantage of overseas cultivation is an issue and the other issue is the way of implementing this strategy in the country and providing the necessary domestic and foreign situations for a successful, fruitful and long-term entering to this type of cultivation (Khaledi et al., 2014). So it seems necessary that when designing mechanisms and regulations of overseas cultivation, more attention is paid to its requirements. Iran should also pay more attention to these requirements. Some of these requirements are as below:

- The necessity of comprehensive and overall rules for implementing necessary coordination between different executive organizations;
- Determining the role of government in overseas cultivation;
- Identifying the role of private sector in the implementation of overseas cultivation;
- Determining public supports and encouragements to attract investments'
- Coordination between executive units such as banks, costumes and funds;
- Predicting international supports for investors in the target countries;
- Providing information for the applicants on the political and economic situation of the target countries;
- Estimating the domestic needs and the needs for the products of overseas cultivation;

- Identifying the countries which have water resources and agricultural lands considering the geopolitical situations;
- Being aware of the rules of foreign investment in target countries;
- Necessary mechanisms of using the efficiencies of private sectors.

For more explanation, these requirements are classified as policy-making; economic; cultural and social; agronomical and specialized requirements.

The results of this research which was conducted on overseas cultivation are summarized in Figure 1, considering the theoretical framework of this research.

The aim of the research

The general goal of this study is the analysis of the requirements of overseas farming in order to develop food security in the Islamic Republic of Iran. To reach this goal, the following specialized requirements were analyzed:

- Policy-making requirements to fulfill the goals of overseas cultivation in Iran;
- Economic requirements to fulfill the goals of overseas cultivation in Iran;
- Social and cultural requirements to fulfill the goals of overseas cultivation in Iran;
- Agronomical and specialized requirements to fulfill the goals of overseas cultivation in Iran;
- The effect of fulfilling the goals of overseas cultivation on the improvement of food security in Iran.

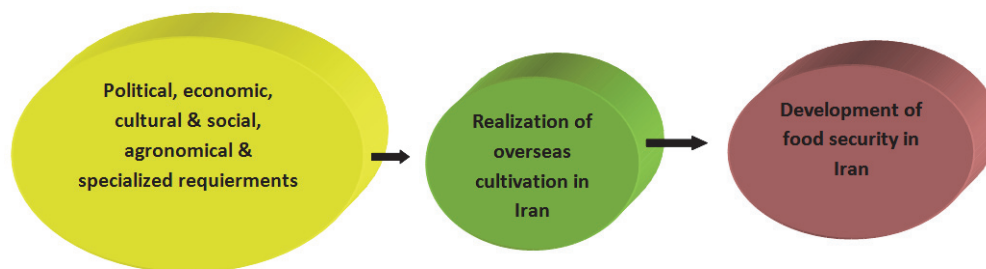


Fig. 1. Theoretical framework of the research

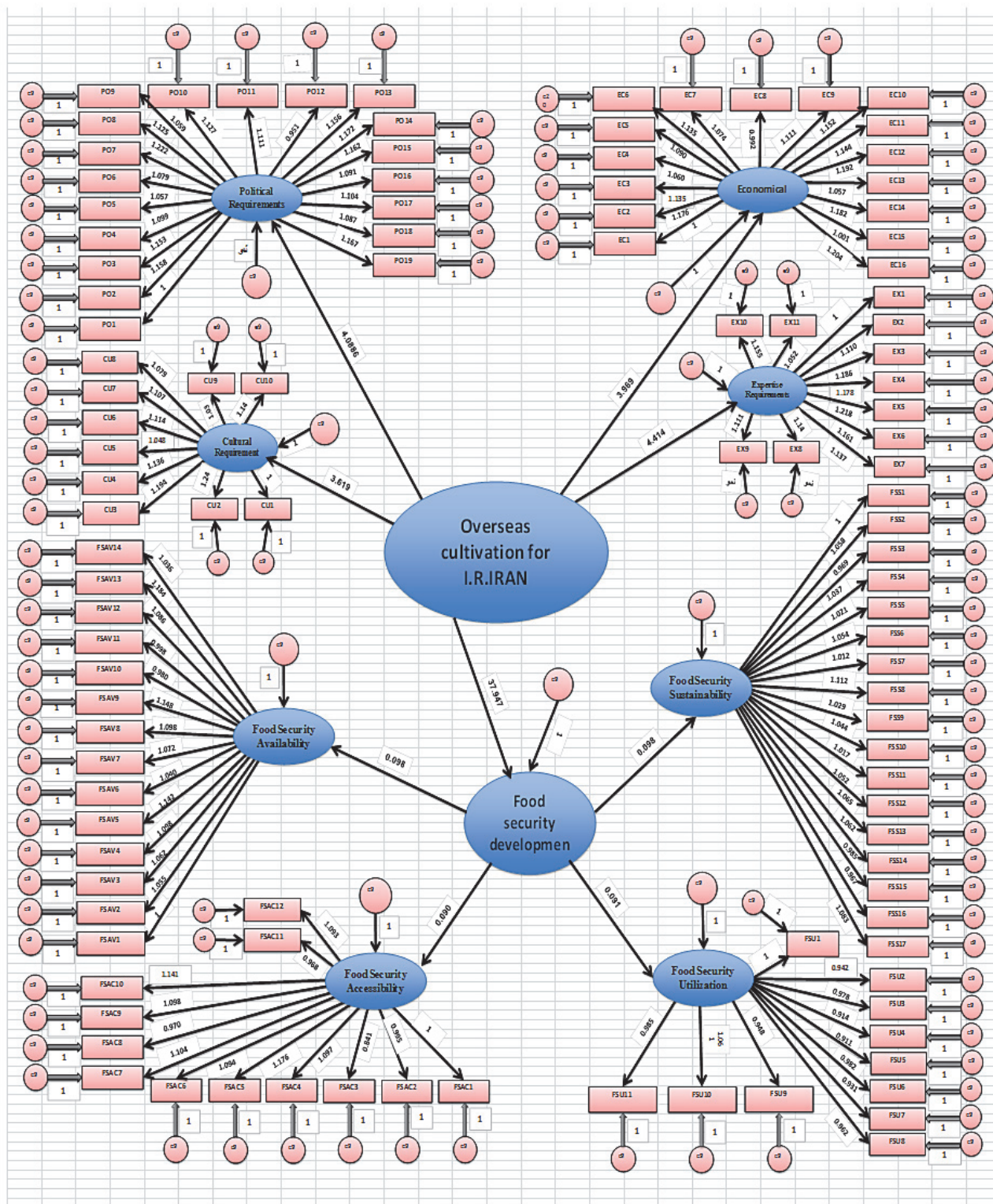


Fig. 2. Model of processed data

Methodology of the research

This is a practical study which was conducted quantitatively and qualitatively. Furthermore, this study has a deductive approach. It is a long-term and futuristic study. It was not conducted experimentally but it is a survey research. The static community of this research contained 176 (N=176) of researchers and experts of research centers, public sectors and economic activists of private sectors who were selected purposefully. The tools of this study were library resources. For field studies, this research used questionnaires. The dependent variable was the improvement of food security which was studied based on four dimensions: food availability, food accessibility, using food and food sustainability. And the independent variable was the overseas cultivation which has policy-making; economic; cultural and social; agronomical and specialized requirements. This questionnaire was validated by experts and its reliability was measured using Cronbach's Alpha in a group of 30 respondents ($\alpha=0.821-0.964$). To analyze the data collected through filling in the questionnaire, SPSS20 and AMOS22 Statistics software was used.

Findings

The findings in the descriptive statistics sector indicate that the mean age of the respondents was 46 and more than 50 percent of them had a master degree (54%) who had studied agricultural sciences. Most of the respondents were specialized experts (more than 69%) who were working in public organizations. Furthermore, the respondents had more than 21 years job experience.

Analyzing the data (deductive statistics)

In order to test the hypotheses of the research and to introduce a model for evaluating the way through which the requirements of overseas cultivation affect the food security development in Iran as was indicated in Figure 2 (the processed data model), confirmatory factor analysis was used. Considering the complexity of the model and the insignificant share of each passive parameter from sampling volume ($m = n/NPAR = 176/111 = 1.586 \ll 4$) Bayesian approach of AMOS software was selected as the best alternative (Najafabadi and Najafabadi, 2013).

Table 2. Prioritizing requirements which affect overseas cultivation in Iran

Importance of requirements	Type of requirement (structure)	Bayesian coefficient	Standardized path coefficient	Coefficient of total effect on overseas cultivation	Structure code in the model
1	Agronomical and specialized	4.114	0.972	0.972	EX
2	Policy-making	4.088	0.971	0.971	PO
3	Economic	3.969	0.970	0.970	EC
4	Cultural and social	3.619	0.965	0.965	CU

By using validated Bayesian confidence interval with a probability of 95 percent it will be possible to decide about the significance of each path is the level of 5 percent. According to the results obtained from the coefficients of the path, it is concluded that:

- All the independent variables have positive effects on dependent variables;
- All paths are accepted in a significant level of 5 percent as in validated confidence intervals the zero value was not found (Najafabadi and Najafabadi, 2013).

Prioritizing the effective quadruple requirements on the fulfillment of oversea cultivation goals in Iran

As it is indicated in Table 2, among policy-making; economic; social and cultural; agronomical and specialized requirements, which have positive and significant effects on the fulfillment of overseas farming in Iran, based on the coefficient which was calculated using Bayesian method, and considering the standardized path coefficient, "agronomical and specialized" requirements have the most important effect on it. Then policy-making; economic; cultural and social requirements have important effects on overseas cultivation in Iran in respect.

Prioritizing "agronomical and specialized" requirements

Considering the coefficients which are shown in Table 3, among eleven "agronomical and specialized" requirement "the existing specialized information on water resources for agricultural activities in the target country", "the existing specialized information on climatic conditions for agricultural activities in the target country" and "the existing specialized information on the potentials of agricultural lands in the target country" have the largest total effect on overseas cultivation in respect.

Prioritizing the effects of overseas cultivation on food security development in Iran

As Table 4 shows, considering the coefficients which were calculated using Bayesian method and the standardized coefficients in the processed model, among the four

Table 3. Prioritizing agronomical and specialized requirements

Priority	Agronomical and specialized requirements (items)	Bayesian coefficient	Standardized coefficient	Coefficient of total effect on overseas cultivation	Item code in the model
1	Existing specialized information on water resources for agricultural activities in the target country	1.218	0.977	0.949	EX5
2	Existing specialized information on climatic conditions for agricultural activities in the target country	1.186	0.975	0.948	EX3
3	Existing specialized information on the potentials of agricultural lands in the target country	1.178	0.975	0.947	EX4

Table 4. Prioritizing the dimensions of food security improvement which are affected by overseas cultivation

Priority effect	The dimensions of food security	Bayesian coefficient	Path standardized coefficient	Coefficient of the total effect on food security development in Iran	Structure code in the model
1	Food sustainability (stability)	0.098	0.966	0.966	FSS
2	Food availability	0.098	0.965	0.966	FSAV
3	Food utilization (consumption)	0.091	0.960	0.960	FSU
4	Food accessibility	0.090	0.960	0.960	FSAC

dimensions of food security which are included in food availability, food accessibility, food utilization and food sustainability (stability) in the three mentioned dimensions, “sustainability (stability)”, “food availability”, “food use” and “access to food” have the first to the fourth rank of developing food security in Iran.

Prioritizing the components of food sustainability (stability) in food security development

Table 5 shows the results of implementing the model of the coefficient of the total effect of the components of food sustainability (stability) on the structure of food security development in Iran. Bayesian path coefficients as well as standardized coefficients show that among seventeen components of food sustainability (stability) dimensions, “maintaining basic agricultural resources such as fresh water and soil”, “increasing the stability in providing the needed basic agricultural products” and “developing skills of producing basic agricultural products in large scales” in respect have the first to the third rank of the highest total effect on food security development in Iran.

Table 5. Prioritizing the components of food sustainability (stability) in food security development in Iran

Priority	Components of food sustainability (stability) (items)	Bayesian coefficient	Standardized coefficient	Coefficient of total effect on food security development in Iran	Component code in the model
1	Maintaining basic agricultural resources such as fresh water and soil	1.112	0.969	0.936	FSS8
2	Increasing the stability in providing the basic agricultural products needed in Iran	1	0.967	0.935	FSS1
3	Increasing the skills of producing basic agricultural products in large scales	1.083	0.967	0.935	FSS17

Conclusions

1.The most important findings of this research which were obtained using deductive statistics, confirmatory analysis of the structure and Bayesian AMOS software show that the factor of “fulfilling overseas cultivation for the Islamic Republic of Iran” has significant and positive effects on “food security development in Iran”. The structural equation of these effects is:

Food security development in IRAN=37.947*Overseas farming for IRAN +error

2.This study shows that among four analyzed requirements which affect the fulfillment of overseas cultivation in Iran, “agronomical and specialized requirements” have the highest effect on the fulfillment of overseas cultivation in Iran. Furthermore, among the items of agronomical and specialized requirements, “specialized agricultural information about water resources in the target country” has the most and the best role in measuring the effect of “agronomical and specialized requirements”. It is worth mentioning that the following studies also point to the importance of these requirements and the results of this study are in accordance

with the following research works: Odeny et al. (2010), Rulli et al. (2013), Friis and Reenberg (2010), Woodhouse (2012), GRAIN (2012, 2015), Barbut (2014), Davis et al. (2015), Breu et al. (2016) and Nasr Esfahani (2014).

3. Based on the coefficients of the path of the processed model, among the four dimensions (food availability, food utilization, food accessibility and food sustainability) which affect food security development in Iran, “food sustainability (stability)” in the three dimensioned of food security” has the highest effect. Furthermore, the component of “maintaining basic agricultural resources such as fresh water and soil” has the most important role in measuring “food sustainability (stability)” dimension. The following studies confirm the above-mentioned results: Atkin (2009), Hallam (2009), Friis and Reenberg (2010), Woodhouse (2012), Borrás et al. (2011), Deininger and Byerlee (2011), Khaledi et al. (2014), Nasr Esfahani (2014), FAO (2015), Breu et al. (2016).

Suggestions

To support those who want to be active in overseas farming through providing them with important agronomical and specialized information about the reliable resources of the target country through diplomatic channels;

To synergy the potentials of the active individuals who are interested in overseas cultivation and this way, to make an association whose goal is food security improvement;

Determining preferential tariffs in customs and give prior to the clearance of basic products of overseas farming.

Studying international mechanisms of purchasing the products of overseas cultivation and transfer the products into Iran.

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