Int. J. Nonlinear Anal. Appl. 11 (2020) No. 2, 115-125
ISSN: 2008-6822 (electronic)
http://dx.doi.org/10.22075/ijnaa.2020.4390

Present a Management Information System Deployment Model for Improving Food Security in Agricultural Sector of Khuzestan Province

Dariush Zalaghi[a], Farhad Lashgarara*[,b], Maryam Omidi[c]

[a] *Department of Agricultural Extension, Science and Research Branch, Islamic Azad University, Tehran, Iran.*
[b] *Department of Agricultural Extension, Science and Research Branch, Islamic Azad University, Tehran, Iran.*
[c] *Department of Agricultural Extension, Science and Research Branch, Islamic Azad University, Tehran, Iran.*

(Communicated by Madjid Eshaghi Gordji)

Abstract

Considering food security has always been one of the major goals of rural and agricultural development programs in Iran. Therefore, the present paper investigates the feasibility of introducing a management information system deployment model to improve food security in the agricultural sector of Khuzestan province. The research method was survey and field design. The research population was wheat farmers in Khuzestan province as 8500. The sample size was 400 using Cochran's formula. The sampling method was clustering method. Data analysis was performed using structural equations modeling and AMOS software. The results showed that the establishment of management information system had a significant effect on improving food security in the agricultural sector of Khuzestan province. Economic, technical and hardware requirements had the highest impact on MIS deployment to improve food security, respectively.

Keywords: Food security, Management information system, Agriculture, Khuzestan Province.
2010 MSC: 90B06,90B50,68U35,

*Corresponding Author: Farhad Lashgarara
Email address: f.lashgarara@srbiau.ac.ir, maryomidi@gmail.com, Zalaghidaruosh@gmail.com (Dariush Zalaghi[a], Farhad Lashgarara*[,b], Maryam Omidi[c])

Received: April 2019 *Revised:* January 2020

1. INTRODUCTION

Food security depends on economic, social, political, and cultural variables. Also climate change factors (water, light, ambient temperature and its extreme changes, wind and its distribution and environment), producers' income level, structures, institutions, human resources and age composition, educational level, consumption pattern (consumption changes, population growth method, per capita income growth rate, distribution network, nutrition patterns and market demand all affect agricultural products.

Although the challenges and crises mentioned above are serious obstacles to development, on the other hand, global developments have provided some opportunities. Opportunities created by the scientific and technological developments over the last half century as tools and materials technologies can be summarized in three areas: materials, gene and information. The first section deals with mechanical, chemical technologies (machinery, pesticides, toxic, and various nutrients and fertilizers). In the second group, biotechnology can be the source of serious changes in production efficiency and biological efficiency. The third group includes human capability in information engineering and management known as information and communication technology (ICT). Here, explaining and describing the role of communication technology as an opportunity to encounter new challenges and long-standing problems in agriculture is of great importance. One of the most important tools and existing opportunities is communication technology that can play a crucial role in filling the increasing gap in information, knowledge and development. These technologies have created enormous capacities for developing countries to achieve sustainable development [1].

These challenges and many other obstacles have made the adoption of alternative solutions to increase the efficiency, productivity and optimization of large scale agricultural production processes and fulfillment of agricultural and rural development unavoidable. Today, with the transition from a linear and behavioral approach to development, the systemic considers the agricultural production system as a whole and given the growth of inputs and facilities and based on the relevant global changes, technology growth includes a comprehensive concept in the form of quantitative and qualitative development of knowledge and information as the main goals of development activities. Indeed, the value of information in all economic activities, including the agricultural sector, is considered as an efficient means of achieving the unfulfilled goals of the industrial age. In this sense, in the modern perspective, the process of agricultural development is defined as a system called the agricultural knowledge and information system.

Management information system as one of the systems that can help us to improve food security is a system whose components include production centers, process, transfer and use of agricultural information and knowledge to enhance the content of knowledge and, ultimately, agricultural development and these components interact with each other to increase the knowledge content and finally agriculture development. These three components are in fact essential elements and are involved in this system based on the level of development of the agricultural sector, subsystems, mechanisms, and many other elements in the system [2]. By investigating the condition of this system in different countries, it can be concluded that agricultural development has a significant and causal relationship with the development of this system.

Maleki, in a paper "Investigate the Condition and a Comparative Study of Rural ICT in Iran (Case study of villages in Khuzestan province) has concluded that by introducing information and communication technology into rural areas, traditional and inefficient methods in agriculture and animal husbandry have been replaced with effective and modern methods.

In addition, the results of Anabestani and Vaziri's research in the analysis of the socio-economic and physical effects of ICT in rural development indicate that ICT expansion has had positive effects on

various socio-economic and physical aspects of the studied villages.
Barghandan have studied the role of information and communication infrastructure in rural development. The results of this study show that information and communication technology plays an important role in the economic, social and cultural development of the villagers. Lack of suitable telecommunication grounds in villages has made serious problems for ICT development in these areas. Also, in order to achieve cheap information and communication technologies in rural areas, considering the geographical, cultural, social and economic conditions of the villages, some technologies should be used to minimize costs and to provide the optimum information transfer.
Lashgarara and Borzuyi [3] in a research" The role of information and communication technology in improving the quality of life in rural areas" showed that paying attention to information and this technology plays an important role. Thus, the information variables are effective on improving the quality of life through helping the agricultural products marketing, expanding tourism industry, eliminating intermediaries, creating economic opportunities, generating income for villagers, increasing productivity, the necessary and applied training of agriculture and health training of the villagers.
Lashgarara [3], in a study "Identify the appropriate ICT tools to improve the food security of rural households from the point of view of agricultural promotion experts" showed that according to experts, the food security situation of rural households is unsuitable, but information and communication technologies are can play a major role in improving food security. The results of the study showed that radio, television, tape recorder, workshops and science trip are more cost-effective than other tools. In addition, television, workshops, science trip, exhibitions, festivals and print materials are more in line with household requirements.
Malek Saeedi [4] in a study "investigating the role of information and communication technologies in achieving sustainable agricultural and rural development" found that proper use of information and communication technologies enables farmers to optimally use new agricultural technologies, achieve sustainable development of agriculture and improve living standards for villagers.
Zhai [5] examines food security in China based on structure, system and resources. Using the system theory method, he found that the realization of food security in China should be based on its specific national conditions and effectively combine resource allocation, structural optimization and system relief.
Costa [6] investigate the relationship between agricultural productivity and food insecurity in Brazil. They found that there are significant relationships between the level of education of the household head, the presence of persons under 18 in the family, the profit of farmers and food security.
Bakhshizadeh [7] believe that information and communication technology is one of the facilitators of rural development and has great potential to help poor villagers, improve quality and food security, increase communication and information flow to support living strategies.
Bashir [8] in their study "The Determinants of Rural Household Food Security in the Punjab" found that their national food security level is equal to international food security but at the household level, 13% of households have not suitable food security. Monthly income, household livestock asset and household size have a positive impact on rural food security.
Falco and Chavas [8] investigated the effect of genetic variation on crop production and production risk on food security in Ethiopian regions. Using a torque-based approach and a random production function, they conclude that product diversity reduces production risk and improves nutrition status in the region. considers the effects of the development of ICTs in rural areas based on reducing dissatisfaction, improve social welfare and food security indices, and enhance knowledge and skills of villagers.
According to the statistics of agriculture year 2014-2015 of Ministry of Agriculture-Jahad, Khuzestan province with the total area under cultivation (rainfed and irrigated) 718 thousand hectares, ranked

first in cultivation area (7.18%) and irrigated area (12.53%). According to the same statistics, Khuzestan gained the first rank among other provinces with the production of 13.7 million tons (17.78%) of the agricultural products. The statistics also indicate that in the cereal group with the area under cultivation of 6000 hectares has reached the third rank and by producing 1.94 million ton has achieve the first rank of the country.

The purpose of the present study is to evaluate the feasibility of information system deployment to improve food security in the agricultural sector of Khuzestan province and creating such a system requires dedicating much time and costs and use a great deal of human resources and equipment. Therefore, it is necessary to carry out feasibility studies prior to the implementation of the operational plan and decide about the implementation or non-implementation of operating plan based on the feasibility results. In feasibility studies, it is attempt to identify and analyze the various technical, operational, economic and financial, social and cultural options, human resources, hardware and software, scheduling, legal, management and security in plan implementation to select the best choice in meeting the requirements.

2. CONCEPTUAL MODEL

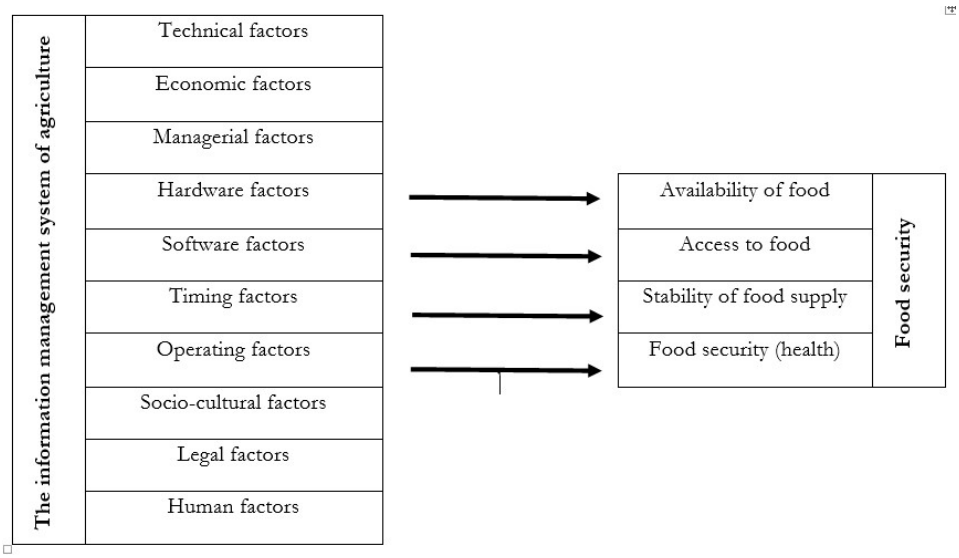

Figure 1: Conceptual model of feasibility study of agricultural information management system for improving food security in agricultural sector of Khuzestan Province

2.1. RESEARCH METHODOLOGY

The research method was survey and field design. This research is applied in terms of type. In terms of the process of implementation process is combined, the logic of the research is comparative, longitudinal, prospective and quasi-experimental in terms of method and is also communicative causal. Due to the relative advantages in Khuzestan province for the large-scale production and plantation of wheat, including production inputs (equipment, machinery, suitable seed, adaptable land, etc.), storage capacity (availability of large numbers of silos), as well as guaranteed purchasing of wheat by the government, the research population of this study is all wheat farmers in Khuzestan province as 8500. Sample size was 400. The sampling is clustering method. In this study, both library and field methods were used. The data were collected in theoretical basics and research backgrounds using literature review and library method. The dependent variable is food security (e.g. quality and

security indices of food including food availability, security and food stability). Independent variables include hardware, software, human resources, technical requirements, economic requirements, legal, socio-cultural, managerial, operational, and timing requirements. Questionnaires and interviews were used to collect data related to the requirements of establishing an information management system in the agricultural sector of Khuzestan province by referring to the agriculture service centers. A researcher-made questionnaire was designed based on the main research questions scored by a five-point Likert scale. To assess the face and content validity of the questionnaire, the views of experts in the field of agriculture and information technology management were used. Cronbach's alpha coefficient was used to assess its reliability. Data analysis was performed using structural equations modeling and AMOS software.

2.2. Hypothesis Testing Measures

Significance level. In hypothesis testing, the level of significance is the probability that we reject the null hypothesis (in favor of the alternative) when it is actually true and is also called the Type I error rate.

$$\alpha = \text{ Significance Level } = \text{P(Type I error)} = \text{P (Reject } H_0 | H_0 \text{ is true)} \tag{2.1}$$

Because α is a probability, it ranges between 0 and 1. The most commonly used value in the medical literature for α is 0.05, or 5%. Thus, if an investigator selects α=0.05, then they are allowing a 5% probability of incorrectly rejecting the null hypothesis in favor of the alternative when the null is in fact true. Depending on the circumstances, one might choose to use a level of significance of 1% or 10%. For example, if an investigator wanted to reject the null only if there were even stronger evidence than that ensured with α=0.05, they could choose a =0.01as their level of significance. The typical values for α are 0.01, 0.05 and 0.10, with α=0.05 the most commonly used value.

Standard deviation. The standard deviation is a statistic that measures the dispersion of a dataset relative to its mean and is calculated as the square root of the variance. It is calculated as the square root of variance by determining the variation between each data point relative to the mean.The Formula for Standard Deviation is as follows:

$$\text{Standard Deviation } = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}} \tag{2.2}$$

where:
x_i = Value of the i^{th} point in the data set
$\bar{x}$ = The mean value of the data set
n = The number of data points in the data set
The application of the normal distribution comes from assessing data points in terms of the standard deviation. We can determine how anomalous a data point is based on how many standard deviations it is from the mean. The normal distribution has the following helpful properties:

1. 68% of data is within ± 1 standard deviations from the mean.
2. 95% of data is within ± 2 standard deviations from the mean.
3. 99.7% of data is within ± 3 standard deviations from the mean.

Critical Value. In statistical hypothesis testing, the critical values of a statistical test are the boundaries of the acceptance region of the test. The acceptance region is the set of values of the test statistic for which the null hypothesis is not rejected. Depending on the shape of the acceptance region, there can be one or more than one critical value.

Standard error of the estimate. It is a measure of the accuracy of predictions. Recall that the regression line is the line that minimizes the sum of squared deviations of prediction (also called the sum of squares error). The standard error of the estimate is closely related to this quantity and is defined below:

$$\sigma_{est} = \sqrt{\frac{\sum (Y - Y')^2}{N}} \tag{2.3}$$

where σ_{est} is the standard error of the estimate, Y is an actual score, Y' is a predicted score, and N is the number of pairs of scores. The numerator is the sum of squared differences between the actual scores and the predicted scores.

2.3. RESEARCH FINDINGS

Main hypothesis: Establishment of management information system is effective in improving food security of agricultural sector of Khuzestan province.

The main hypothesis of the research "the effect of the establishment of management information system in improving food security in the agricultural sector" is verified by the results of path analysis $\beta = 300.30$ and p <0.05, which shows the effect significance. As a result, the establishment of a management information system has a significant impact on improving food security in the agricultural sector of Khuzestan province and as its t-value is 3.219 and this value is outside the range of -1.96 and 1.96, the null hypothesis is rejected and H1 is supported. Thus, this hypothesis is supported with the probability of 99%.

Table 1: Results of the main research hypotheses

Hypotheses	Standard estimation	Standard deviation	Critical ratio	Significance level	Support or reject hypothesis
Establish information <-- management system improve food security	0.257	0.080	3.219	0.001	Support hypothesis

3. DISCUSSION AND CONCLUSION

In this study, the main research hypothesis "the effectiveness of the establishment of management information system on improving food security was supported with the probability 99%.

Economic requirements had the highest impact on food security, and then technical, hardware, operational, software, socio-cultural, timing, legal, human resources and managerial requirements, respectively, were at the next priorities of the impact on food security. Therefore, managerial requirements had the least impact on food security, but at the same time all the requirements of the sub-hypotheses of research were verified.

The results obtained in the present study also confirm the impact of economic factors as the most effective factor in other related studies. Seyyed Hamzeh and Damari [10], in a study, considered the economic factor of households as the first priority of food security in the society, which is consistent with the results of this study. Also, Shakouri [11] stated that the factor of wealth and household income is the main factor and the first priority of food security of the society. Therefore, in many studies economic requirements are among the first priorities of food security in societies.

The second factor in terms of impact on food security is technical factors and requirements in this study. the type and the amount of applicability in management information system as well as

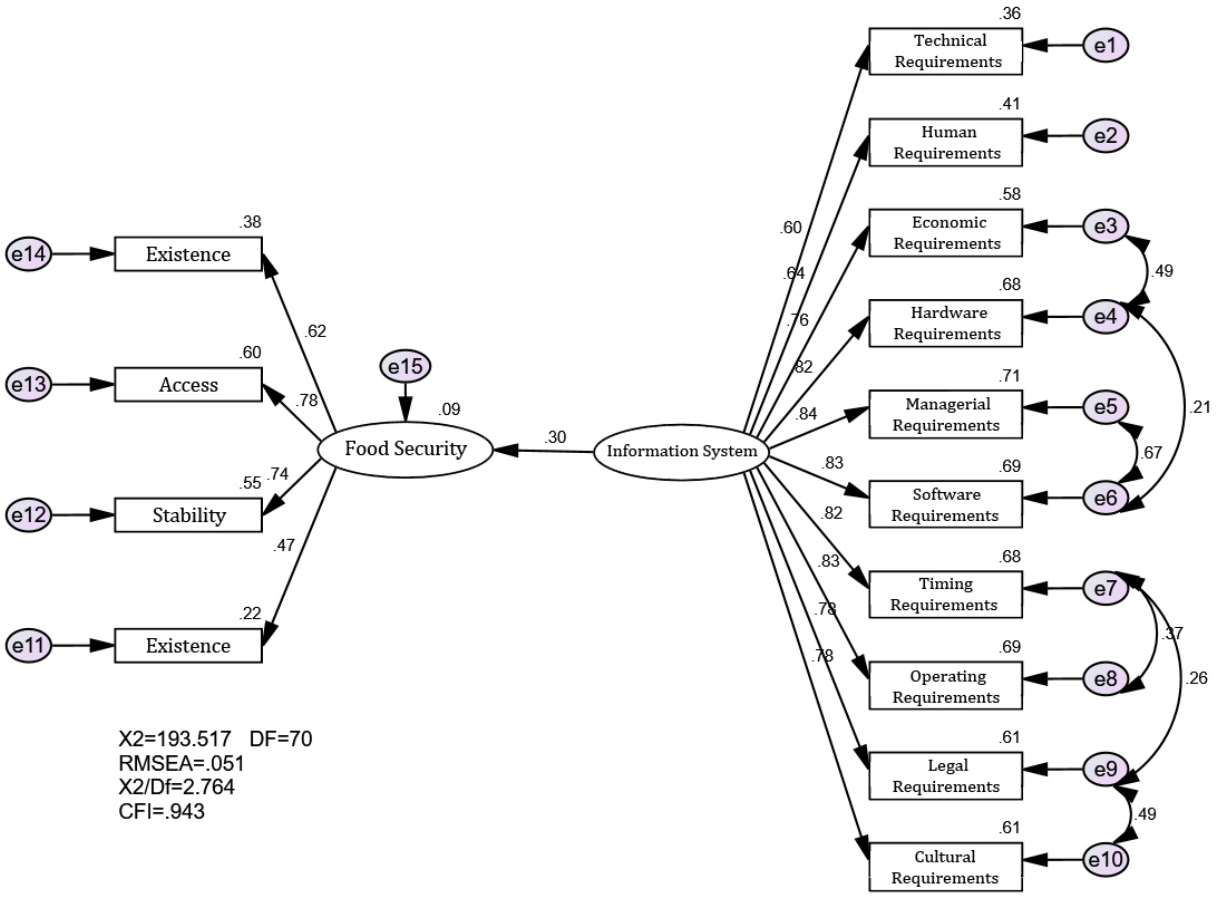

Figure 2: Structural research model to investigate research hypothesis at standard mode

covering all the required applications in a way that the user applies the system easily and with high productivity is one of the effective factors on increasing food security.

According to the results of the present study, the third effective factor on food security is hardware factors and requirements that have been mentioned in previous studies. the hardware tools and capabilities to implement management information system among the most influential factors on its optimal performance.

Various researches have been done in the past on the fourth effective factor of this research as operational factors and requirements.

Regarding the cultural requirements in this study as considered as a significant effective factor on food security based on the results.

Another factor considered in the present study that was found to have a significant impact on food security after reviewing the results is the timing requirements.

The legal requirements are the eighth effective factors on food security based on the results of the present study.

The results of the present study verified the significant relationship between human resource requirements and food security as the ninth factor in terms of importance level.

As the last necessity discussed in the present study, managerial requirements have also had a significant impact on food security, which according to Rezaeian's (2006) results, the support of the top managers of the organization as one of the factors with significant effect between the set of effective

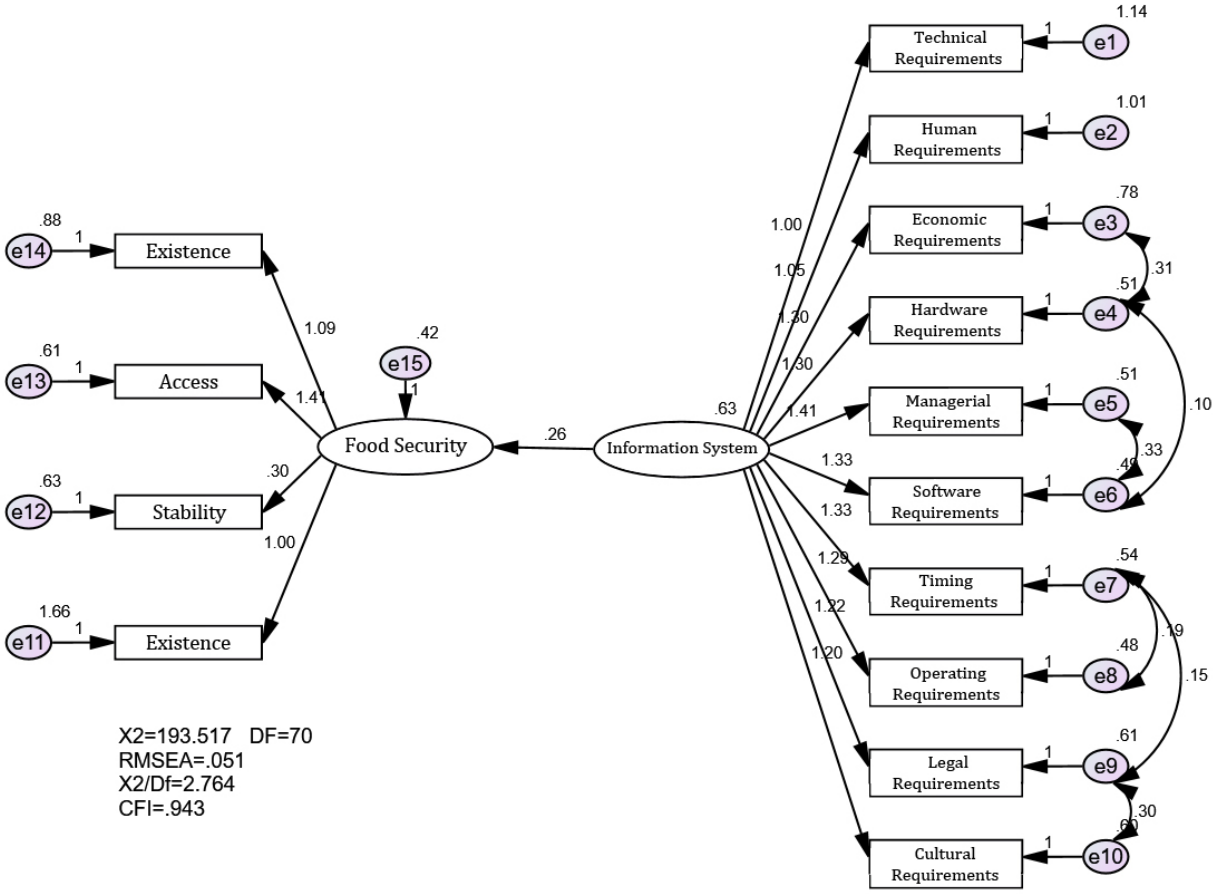

Figure 3: Structural research model of research hypothesis at non-standard mode

factors on the performance of the management information system.

4. RECOMMENDATIONS

Specifically, regarding the various factors considered in the present study, the following recommendations can improve the process of establishment and optimal performance of the Agricultural Management Information System (AMIS) and ultimately achieve its highest impact on increasing food security in Khuzestan province;

1- First recommendation 1: Economic requirements: The Government as the main authority of food security of the country along with the key institutions involved in the production of agriculture and the effective actors in food security , is required to choose an interactive and specific plan to provide economic resources to deploy such systems that in addiction to provide the main costs of implementation of the project, present the dynamics of this movement in the agricultural sector, and after launching the systems with the suitable function, provide the maintenance costs and update it from the supportive resources. In order to improve food security, it is suggested that private and public sector investment in information and communication technology be implemented to deploy management information system and provide the government support for investors in this sector.

2- Recommendation 2, Technical requirements: Government and authorities should perform purposeful expansion of communication infrastructure in agriculture and the distribution of production

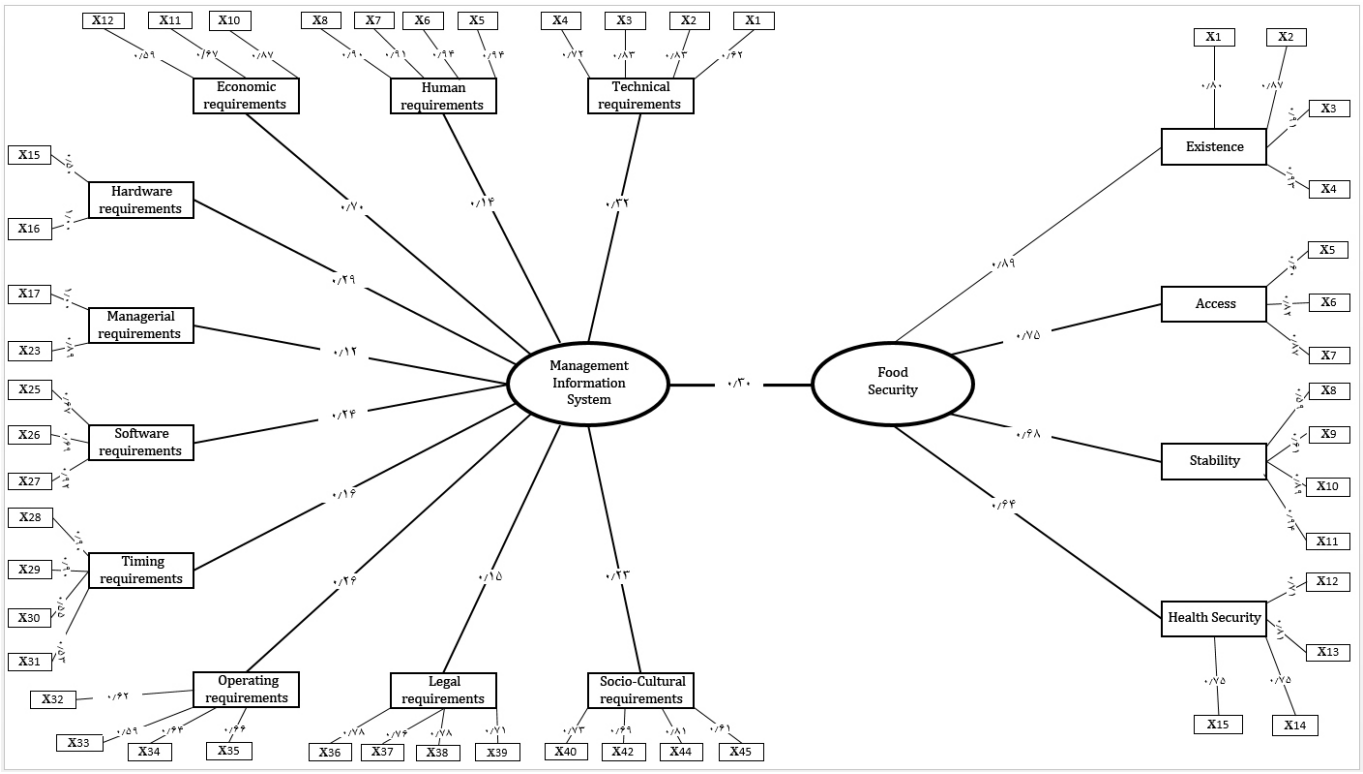

Figure 4: Experimental model of research

centers including point, location, village, person and agricultural companies and create durable technical infrastructures using the up-to-date technology (optical fiber, telecommunication networks, etc.). Also, by using the capacity of educated and specialized youth in IT, the government can develop applications compatible with this system and structures.

3. Third recommendation, Hardware requirements: It is necessary for the government to install up-to-date operating systems and up-to-date servers and to provide the Internet with adequate bandwidth for the users.

4- Fourth recommendation: Operational requirements: It is important to build trust in the interaction between the public and private sectors that are simultaneously deploying and operating this system and it should be planned as the private sector with the assistance of experts and graduates in agriculture and other related science centers have the motivation to continue activity and management effectively in this system.

5. Fifth recommendation, software Requirements: It is recommended that the government provides the necessary facilities for the development of efficient and effective companies that provide information management software. By introducing software products and services related to management, and in particular, information management, by understanding the current market situation and its future prospect, these companies can introduced their new world-class services and products in managerial software domain. It is required to launch the sites in accordance to the needs of rural communities in different regions that by timely information, the digit gap between the city and village is reduced and this fulfills the goals of food security.

6. Sixth recommendation, Cultural and social requirements: Design promotional plans to use this system and homogenizing the people of different regions to use and improve the impact factor of the plan among the users and the consistency of this issue with the culture of using cyber space

as developed today can be all useful factors. Production in agriculture based on climate issues is on priority across the country. Regarding the structural and affective relationship of each region to another, especially from the point of view of uniform supply of products to the consumer market, the system needs to be designed as it present a plan consistent with the data of these regions and their communication analysis in the country to create continuous production for the consumers and feasible and economic production for the producers. Also, the users of each region can provide their special reports easily and compare their production status with others regions and then perform production based on it.

7- Seventh recommendation, timing requirements: By applying up-to-date knowledge and expertise to establish the suitable ground, the information is given to the users on time and with respect to all safety and security requirements. Also, attention should be given to create balance between security and easy access of users via personal computer (PC), smart phones and other information exchange contexts. The system should be designed in such a way that it is possible to produce comprehensive reports with appropriate details at different times and in accordance with the crop calendar of each region.

8- Eights recommendation, Legal requirements: In order to design and operate the system, permits at both technical and security levels need to be obtained. It is recommended that by complete coordination with the authorities responsible for obtaining these permits, some measurements should be taken that the existing administrative system and bureaucracy don't prevent the development of this plan.

9- Ninth recommendation, Human Resource Requirements: For the dynamics of the plan, the authorities can educate human resources, perform training and update the information of users at three levels.

- Training of specialized resources to enter the information into the system and monitor it through regular and continuous use
- Training of users for continuous and effective communication with the system
- Continuous re-training

Educating managers who are interested and aware of the application of IT in today's world is essential for the continued operation of this system.

Tenth recommendation: Managerial requirements: Establish specialized teams for the monitoring and creation of the basic agricultural database for all sub-sectors and the ability of the user (farmer) to update the system are of great importance. The design of structure of this data bank should be consistent with the national planning and operating system in this sector.

References

[1] Bagherzadeh Azar, F., Ranjpour, R., Karimi Takanloo, Z. 2017. Estimate the level of food security of the country with the new Index of World Food Security. Journal of Health Research, Volume 16, Number 2, pp. 243-236.

[2] Davis, Gordon Biter and Olsson, Margaret H. 2005. "Management Information System - Conceptual Frameworks, Structure and Development", Translated by Amir Hossein Tabatabai and Elham Alaei, Tehran, Iran University of Science and Technology, Publications center.

[3] Lashgarara, F. 2008. Identification of appropriate ICT tools to improve food security of rural households from the perspective of agricultural promotion experts. Journal of Agricultural Promotion and Economics. First Year, No. 2, pp. 13-26.

[4] Malek Saeedi, Hamideh and Maryam Hossein Mohammadi, 1, The Role of Information and Communication Technologies in Achieving Sustainable Agricultural and Rural Development, First National Conference on Sustainable Agricultural Management and Development in Iran, Ahwaz,

Higher Education and Science Institute
[5] Zhai, K, (2013) Vision of Resource, Structure, System and Chinese Food Security. IERI Procedia, 4: 408-416.
[6] Costa, L., V., Gomes, M. F. M. and Davi, A. S. L. (2013) Food Security and Agricultural Productivity in Brazilian Metropolitan Regions. Procedia Economics and Finance 5: 202-211.
[7] Bakhsizadeh, V., Y. Hasanzadeh., and B. Gholizadeh.2012. Survey of ICT Effects on Rural Development, Case Study: Sarei County. Journal of IT, 5 (5), 24-65. (In Persian).
[8] Bashir, M. K., Schilizzi, S. and Pandit, R. (2012) The determinants of rural household food security in the Punjab, Pakistan: an econometric analysis. Working Paper No.122526, School of Agricultural and Resource Economics, University of Western Australia, Crawley, Australia.
[9] Di Falco, S., & Chavas, J. P. (2009). On crop biodiversity, risk exposure, and food security in the highlands of Ethiopia. American Journal of Agricultural Economics, 91(3), 599-611.
[10] Seyyed Hamze, Sh and Dammari, b. 2017. Conceptual Model of Food and Nutrition Security in Iran. Journal of Research Center for Effective Social Factors on Health. Volume 4, Issue 3, pp. 223-232.
[11] Shakuri, A. 2004. Food Security and Access to it in Iran. Journal of Social Sciences. No. 24, p.133-160.