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Research Paper

The Requirements of Establishing Innovative Rural Organizations to Improve Food Security from Rice Grower's Perspective

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Abstract

Rural innovative producing organizations can increase farmers' incomes and improve food security by providing services to farmers. The specific objectives of this paper were to identify the economic, social-cultural, infrastructural, political, educational, and technical requirements for innovations in rural institutions to improve food security of farmers in Mazandaran Province, Iran. The total population of this study was 113,141 farmers in Mazandaran Province and by using Cochran formula 216 were selected through cluster random sampling method. The Delphi method was used for qualitative part of analysis, which was done in a three-phase distribution of questionnaires and interviews with rice experts. For each of the requirements, items of interest were added and removed, and a table of items including the most points (to a maximum of 70%) was extracted. A Bayesian analysis was used for by using AMOS16and SPSS16 software. Based on the results of Bayesian analysis the economic requirements had the greatest impact on establishing innovative rural institutions to improve food security of rice growers. It was also found out that socio-cultural, political, infrastructural, educational, and technical requirements, respectively could play an important role in helping rural institutions to enhance food security in rural areas.

Keywords:
Food security; rice growers; rural innovation institutions; producer organizations

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INTRODUCTION

Food security is a major challenge, and increasing food prices as well as global economic crisis, resulted in malnourishments of large segment of the population in developing countries (Herbel et al., 2012). The World Bank defined food security as incorporating the following items which include sufficient food (adequate food), access, safety, and an active and healthy life. Thus, the concept of food security has followed an intellectual evolutionary path from "self-sufficiency" to "supply" and ultimately to "accessibility" (World Bank Group, 2012).The Food and Agriculture Organization (FAO), in 2010, stated that food security exists when all people at all times have a healthy and affordable diet that is sufficient and nutritious to meet dietary needs and have food preferences that enable an active and healthy life. Pereira and others (2014) have categorized food security into five components: sustainability, availability, accessibility, utility and safety. Most studies concentrate on only one element of food security, but a holistic view is essential to analyze food security in a country.

In Iran, like many developing countries, ensuring food security through agricultural and rural development approaches has been an essential element in development programs, and continuous efforts to improve the level of food quality in rural and urban communities have been undertaken. The most important challenges in terms of food security in the country include a lack of adequate food safety, inadequate legislation and laboratory facilities, inappropriate transportation, lack of trained manpower, low consumer knowledge, lack of organization or responsible institutions for the registration and tracking of food-borne diseases, lack of sufficient scientific understanding of biological resources and threats, dependency on production inputs, and water and environmental crises (Moradi and Papzan, 2014).Consequently, the major issues and problems due to a lack of focus on rural innovative institutions in achieving food security have been failure achieving in food security in following (Herbel 2012):

1. Problems in the five dimensions of availability, accessibility, utility, sustainability and safety;
2. Lack of small farmers 'access to natural resources, productive assets, markets, knowledge and information; and
3. Inappropriate management patterns in rural areas.

Rice as a basic product is constantly confronted by many challenges. The solutions to these challenges require an accurate understanding of the issues and a clearly defined timetable that would eventually improve the performance of national government in production of rice. Developing a strategic program to achieve self-sufficiency in basic products such as rice has been a cornerstone of policy in food self-sufficiency in Ministry of Agriculture (Yadegari, 2016, March 10).

Herbel et al. (2015) suggest that local innovative institutions can create permanent spaces for publishing and exchanging knowledge among farmers in identifying their problems, explore solutions and discuss results.

Sharafkhani et al. (2011) point out that achieving food security is a major socioeconomic issue which requires resources to obtain sufficient food. In this regard, households can access these resources through their own production systems, market and other sources. Table 1 shows that in establishing innovative rural institutions, five dimensions of availability, accessibility, utility, sustainability, and safety should be considered.

The International Center for Advanced Mediterranean Agronomic Studies (CIHEAM, 2013) believes that a rural innovative production organization will be able to increase farm income by providing services and eventually improve food security. These services include improved access to natural resources and their management and to information and technologies and facilitate the participation in the policy-making process.

Table 1

Dimensions of Food Security through the Creation of Innovative Rural Institutions

Safety	Sustainability	Utility	Accessibility	Availability
Access to healthy and nutritious food	Diversifying agriculture and employment	Improving research and innovation in agriculture	Increasing small producers' income	Enhancing food supply for the most vulnerable
Improving food quality	Monitoring food security and vulnerability	Developing social rehabilitation programs	Enhancing access to productive assets	Improving rural food production particularly by small-scale farmers
Mechanisms to ensure healthy food	studying structural causes of food insecurity	Developing non-formal education programs	Improving access to natural resources (land, water)	Investing in rural infrastructure
	Reintegrating refugees and displaced people	Learning the proper use of natural resources and adaptation to climate change	Empowering women and improving their access to resources	Investing in rural markets
	Managing risks	Improving food security policies	Enhancing access to knowledge and information	Investing in new and adaptive technologies
	Protecting and managing resources, particularly water resources	Enabling small producers to participate in the policy- making process and dialogue	Improving access to input and output markets	Conserving resources
	Reviving access to credit systems and saving mechanisms			

Source: McInerney (2014)

As a result, organizations and institutions provide a wide range of services for their members and should be able to create a network of relationships among small producers, small-producer organizations and fundamental market actors and policy-makers. Figure 1 shows a set of constraints that small-scale farmers have encountered and organizations or institutions should develop strategies to encounter these constraints through innovation (CIHEAM, 2013).

The main purpose of this research was to find a set of requirements to create innovative rural institutions to improve food security from the perspective of farmers in Mazandaran Province. In this regard, the specific objectives were to identify the economic, social-cultural, infrastructural, political, educational, and technical requirements of rural innovation institutions to improve the food security of farmers in Mazandaran Province.

METHODOLOGY

This study used a mixed method (qualitative and quantitative) and the Delphi method was used to analyze the qualitative results. In the Delphi method, a group of experts reach a consensus after expressing their opinions on a specific issue. Although the collective judgment of experts appears subjective, it is more valid than individual statements because the results are more objective. Turoff and Linstone (2002) believe that Delphi method can be considered as a method for structuring a group communication process, allowing members, as a whole, to solve a

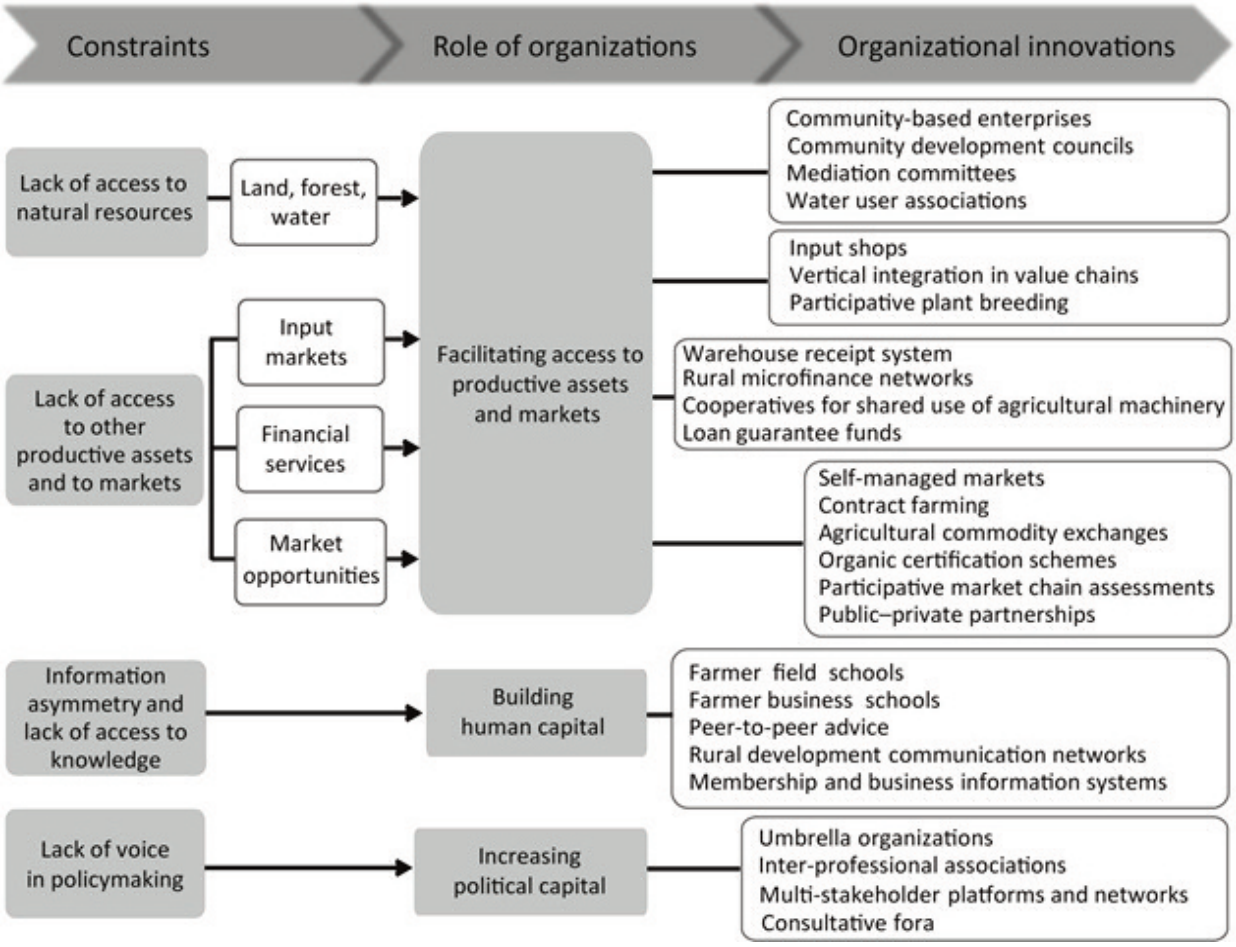

Figure 1. The wide range of innovation in producer organizations
Source: CIHEAM (2013)

complex problem in an effective manner. The Delphi method steps are as follows:

1. Pick a facilitation leader
2. Select a panel of experts
3. Identify a straw man criteria list from the panel
4. Have the panel rank the criteria
5. Calculate the mean and deviation
6. Rank the criteria
7. Identify project constraints and preferences
8. Analyze the result and obtain feedback from the panel
9. Re-rank the results until the ranking stabilizes

A questionnaire was developed consist of close and open-ended questions. The close ended questions section used the Likert scale included eight sections: economic requirements (10 items); social-cultural requirements (10 items); infrastructural requirements (5 items); policy-making requirements (4 items); educational requirements (5 items); technical requirements (6 items); personal characteristics (16 items) and food security dimensions including accessibility (8 items), availability (5 items), utility(4 items), sustainability(5 items), and safety (4 items).

In order to test the validity of questionnaire, a panel of experts examined the questionnaire and necessary changes were done in the final version. The reliability of questionnaire was tested by using chronbach coefficient and the results were between 0.83 to 0.94.

The total population of the study was 113141 rice growers with less than one hectare of land under rice production in Mazandaran Province. Based on the Cochran Formula 216 samples were selected by using cluster random sampling. The quantitative data was analyzed by using AMOS16and $SPSS_{16}$ software.

RESULTS

Table 2 shows the results of interviews with experts and professionals and the items in seven requirements with score 70 percent and more were included in the table.

Table 2
Requirements and Items with Top Score

Requirements	Items
Economic	Improving rice growers' access to the input markets, to the output markets), to financial services and credit capital from the government such as loan, inputs subsidies. Reducing rice growers' transaction costs.
Socio-cultural	Empowering small-scale producers to participate in policy-making and decision-making processes, reducing poverty through self-sufficiency in rice production, improving social capital (trust, honesty, amity, self-esteem, empathy, friendship, solidarity, and sacrifice), capacity building, creating an institutional network (interaction and cooperation between institutions), improving eating patterns and food preferences, and improving nutritional quality and food safety
Infrastructural	Strengthening rice growers' access to natural resources and resource management, improving rice growers' access to suitable agricultural land, improving rice growers' access to proper equipment to prepare and modernize land farm
Policy-making	Providing the small-scale producers' voice with access to authorities for participation in policy-making and decision-making processes, providing recommendations for the enactment of appropriate legislation to reduce conflict on land, and providing recommendations for a purposeful, coordinated and integrated planning system for rural authorities
Educational	Enhancing access to knowledge and information, various local classes and extension classes; increasing human capital through education and providing workshops in the field of rice crop farm operation
Technical	Mechanizing and using new and appropriate technologies in agriculture, in planting and harvesting, irrigation systems and using hybrid seeds, improved varieties, and machinery in planting
Food security	Availability: improving food production particularly through small-scale farmers, investing in infrastructure in rural area, investing in rural markets, investing in new and adaptive technologies, and improving and renewing resourcesAccessibility: improving food supply for the most vulnerable people, increasing small-scale producers' income, strengthening resource access(land and water), empowering women and improving their access to resources, clarifying access to knowledge and information, improving access to input and output markets, and improving access to credit and saving systemsUtility: improving research and innovation, improving consumption patterns through educational programs, training in the proper use of natural resources and adapting to weather conditions, improving food security policies in terms of cultural preferences and patterns, diversifying in agriculture and employment, monitoring food security and vulnerability, addressing structural causes of food security, managing risk, and managing and protecting resources, particularly water resources, for sustainable livelihoodsSafety: ensuring access to healthy and nutritious food, improving food quality, ensuring mechanisms for food security, and improving the quality of rice seeds through training in new farming practices

Table 2 shows that some factors are very useful and could be considered by rural innovative institutions because they will bring new horizons for improve food security in rural areas and especially in rice grower's households. So, in this research used from innovative thoughts for prospective views about rural area's situation and improve their future with good governance of rural institutions. Meanwhile, a few suggestions after the in-depth interviews with experts and professionals were proposed for each requirement. Therefore, a few revisions were performed in the questionnaire, and certain items were deleted or added. In this regard, the items that were added to the questionnaire are as follows (Table 3):

Table 3
Items Proposed By Experts in Conjunction with Any of the Requirements

Requirements	Items
Economic	Establishing permanent markets for selling rice, understanding the effect of institutions on determination of the purchase price guarantee
Social-cultural	Understanding the effect of institutions on promoting local innovation capacity through the creation of exhibitions, crafts, food, festivals and rice
Infrastructural	Strengthening farmers' access to water resources and their optimal management and establishing processing and supplementary industries and factories in rural areas
Policy-making	Providing integration policies for rice lands, affecting price determination policies, affecting lending policies with subsidies to farmers, affecting supportive policies in savings and energy supply, and affecting export-import policies for rice
Educational	Promoting the correct use of local knowledge, using the FFS method and holding rice farm days, increasing human capital through training experts
Technical	Using new technologies in agriculture such as nanotechnologies, and using multi-purpose cultivation such as rice growing with duck and fish cultivation

After completing the revision of the third level of the questionnaire distribution, the experts confirmed that all items represented high-degree requirements for establishing innovative rural institutions to improve the food security of rice growers. This information was used as a prior distribution in Bayesian analysis. Based on a literature review of the research and on interviews with experts in this field, the research model was extracted (Figure 2).

Table 4 shown the two of most affective factors for each requirement that could create a suitable framework for rural institutions to manage the situation and have an important role in food security of rice growers and their households.

In the next section, we used $Amos_{16}$ software and data analysis with Bayesian methods to perform analysis on the data table (Table 4). The paths extracted, which are shown in the table with a 95 percent confidence interval, were significant.

The results showed that the economic requirements have the greatest impact on establishing innovative rural institutions for improving food security. And also, based on the literature review of the research some paths were fixed(=1). For economic requirements the paths were fixed include: Improving physical and financial access to input markets (seeds, fertilizers, and pesticides)

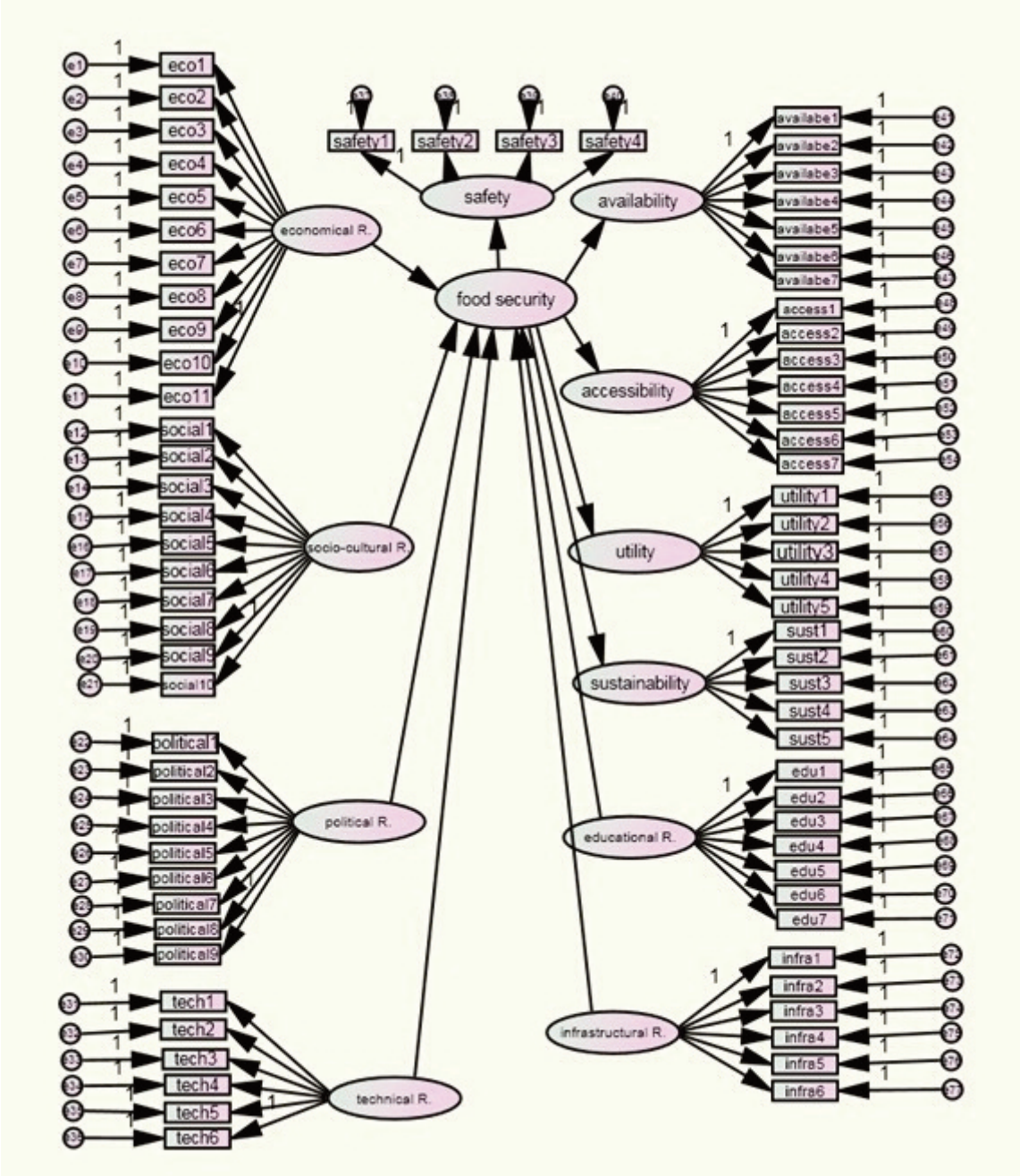

Figure 2. Structural equation model (SEM) of research

and improving physical and financial access to output markets (products), the other factors that most effective on the requirements were shown on the Table 4.

Thereafter, the following requirements after economic requirements that had the most impact respectively include: socio-cultural, political, infrastructural, educational and technical requirements. These impacts are examined from the perspective of rice growers in the Mazandaran Province with the goal of creating innovative rural institutions to improve their food security.

Also, with respect to food security in this study, five dimensions are considered: availability, accessibility, utility, sustainability and safety. In Table 5 the most two effective factors of each dimension were presented.

Table 4

Table of Tracks for Two of the Most Affective Factors on Each Requirement

Paths	Mean	S.E.	S.D.	C.S.	95% lower bound	95% upper bound	Skewness	Kurtosis	Min.	Max.
Strengthening farmers' access to financial services (insurance)<—economical R.	1.682	0.004	0.208	1.000	1.288	2.094	0.101	-0.075	0.890	2.596
Improving collective investment <—economical R.	1.627	0.001	0.079	1.000	1.477	1.785	0.169	0.078	1.307	1.985
Reducing poverty through self-sufficiency <—socio-cultural R.	3.197	0.018	0.306	1.002	2.623	3.786	0.031	-0.184	2.012	4.322
Strengthening social capital <—socio-cultural R.	1.713	0.002	0.098	1.000	1.530	1.902	0.151	-0.054	1.330	2.144
Empowering local governance and decentralization <—political R.	1.954	0.002	0.102	1.000	1.765	2.163	0.222	0.080	1.565	2.409
Enacting appropriate legislation to reduce the conflict on land <—political R.	1.722	0.002	0.093	1.000	1.545	1.917	0.183	0.198	1.372	2.182
Offering various local courses such as extension courses <—educational R.	1.747	0.002	0.097	1.000	1.569	1.945	0.212	0.088	1.375	2.184
Increasing human capital through training skilled workers <—educational R.	1.730	0.002	0.098	1.000	1.551	1.927	0.184	-0.040	1.362	2.213
Improving rice growers' access to arable and suitable land for cultivation <—infrastructural R.	1.910	0.002	0.100	1.000	1.721	2.115	0.137	0.057	1.501	2.413
Improving the access of rice growers to appropriate equipment <—infrastructural R.	1.565	0.002	0.090	1.000	1.396	1.745	0.152	0.057	1.206	1.972
Using hybrid seeds and modified varieties <—technical R.	1.565	0.001	0.086	1.000	1.407	1.743	0.246	0.118	1.237	1.983
Using machines in transplanting<—technical R.	1.365	0.002	0.080	1.000	1.215	1.528	0.168	0.063	1.065	1.728

Table 5

Table of Tracks for Two of the Most Affective Factors on Each Dimension of Food Security

Paths	Mean	S.E.	S.D.	C.S.	95% lower bound	95% upper bound	Skew-ness	Kurto-sis	Min	Max
improvements in research and innovation in agriculture <—availability	1.701	0.003	0.099	1.000	1.511	1.906	0.176	0.049	1.349	2.152
improved consumption patterns <—availability	1.687	0.002	0.098	1.000	1.498	1.885	0.172	0.083	1.346	2.142
increase the income of small producers <—accessibility	1.603	0.001	0.087	1.000	1.439	1.782	0.186	0.240	1.267	2.026
improve access to natural resources (land and water)<—accessibility	1.600	0.002	0.087	1.000	1.438	1.781	0.208	0.164	1.248	1.992
improve food quality <—Safety	1.641	0.002	0.101	1.000	1.450	1.846	0.185	0.136	1.269	2.077
offer mechanisms to ensure food safety <—Safety	1.531	0.002	0.099	1.000	1.347	1.735	0.162	0.019	1.114	1.968
improve the skills of high-quality product recognition <—Utility	1.708	0.002	0.099	1.000	1.522	1.906	0.170	0.071	1.350	2.257
teach the proper use of water resources <—Utility	1.616	0.002	0.097	1.000	1.436	1.816	0.172	-0.027	1.193	2.093
address the structural causes of food insecurity <—sustainability	1.780	0.002	0.100	1.000	1.594	1.986	0.219	0.106	1.423	2.267
enable risk management in rice production <—sustainability	1.646	0.002	0.096	1.000	1.466	1.844	0.196	0.052	1.285	2.103

According to the Table 5, among the five dimensions that mentioned before, Availability had the most effect on food security and also among the factors of availability (beside the path that fixed(=1) based on literature review that include: Improve food production in rural areas, particularly through small-scale farming) the two other effective factors were shown.

DISCUSSIONS

Innovative rural institutions play an important role in creating sustainable rural livelihoods and improving food security. Based on the results and findings from the research background as well as from experts and specialists, the most important requirements for establishing rural innovative institutions to improve the food security of rice growers respectively are economic, socio-cultural, infrastructural, political, educational and technical.

Improving physical and financial access to input markets (seeds, fertilizers, and pesticides) and improving physical and financial access to output markets (products) was found the most important in economic requirement. This finding is in accordance with the findings of previous researchers: IFAD, (2008); Herbel et al. (2012); CIHEAM (2013);

McInerney (2014); Silvestri et al. (2015); Mumuni and Oladele (2016).

The results show that empowering small producers to participate in policy-making and decision-making was the most important socio-cultural requirement. These findings match the results of IFAD (2008); Herbel et al. (2012); FAO (2012); FAO (2016).

The most important infrastructural requirements was strengthening rice growers' access to water resources and optimizing the management of these resources. This result is consistent with the research findings by Herbel et al. (2012); CIHEAM (2013); John and Fielding (2014); McInerney (2014); FAO (2016).

It was found out that the most important policy-making requirements was facilitating dialogue between small producers with the authorities for participation in policy-making and decision-making. These results are in accordance with the findings of IFAD (2008); Herbel et al. (2012); FAO (2014); FAO (2016).

The most important educational requirements were strengthening access to knowledge and information. These findings correspond with the findings of Herbel et al. (2012); John and Fielding (2014); Silvestri et al. (2015); Mumuni and Oladele (2016).

The results indicated that the most important technical requirements were using new technologies in agriculture, such as nanotechnology; hybrid seeds and modified varieties and machines in transplanting, and engaging in the multi-purpose use of rice production such as the co-culture of rice with duck and fish farms. These findings match the research findings of Uphoff and Buck (2006); Mbaga (2013); John and Fielding (2014); Keshavarz and Karami (2014); Herbel et al. (2015).

The most important factors in improving food security according to the five dimensions of food security was to improve food production in rural areas, particularly through small-scale farming, improvements in research and innovation in agriculture, improved consumption patterns through a variety of educational programs, investment in infrastructure in rural areas, investment in rural markets, investment in new and adaptive technologies and improvements and revival of resources, particularly land.

Improving the supply of food for the most vulnerable, increase the income of small producers, improve access to natural resources (land and water), empower women and improve their access to resources, promote access to knowledge and information, improve access to input and output markets, improve access to credit and savings systems were found the most important factors in access to food products.

The results show in area of utility, increasing farmers' knowledge regarding product use, improve the skills of high-quality product recognition, and teach the proper use of water resources, modern irrigation techniques, the proper use of natural resources, and adaptation to climate change; improve the policies for food security to improve dietary patterns and cultural patterns was also the important factors.

In area of sustainability of food, the results indicated that the diversifying agriculture and employment, monitoring food security and identifying the factors influencing farmer's vulnerability, addressing the structural causes of food insecurity, enabling risk management in rice production and managing resources, particularly water resources, to create sustainable livelihoods were the most important factors in sustainability of food products..

Respondents indicated that in order to improve the food quality, it is important to ensure access to safe and nutritious food, improve food quality, offer mechanisms to ensure food safety, and improve the quality of rice seeds through training in new growing techniques.

CONCLUSIONS AND RECOMMENDATIONS

Powerful rural institutions and organizations such as producer groups and cooperatives are crucial for reducing poverty and hunger. These types of institutions allow pro-

ducers to play a greater role in estimating the growing demand for food in local, national and international markets, while they improve their economic, social and political opportunities (FAO, 2012). Therefore, strengthening these organizations' capacity to adopt sustainable methods, technologies, innovation and effective policies that will benefit their livelihoods and to have positive effects on the environment is crucial (World Agroforestry Center, 2014).

The findings of this research show that the economic requirements have the most impact on food security so the rural innovative institutions should invest resources to improve access to physical and financial resources and necessary inputs. It is important to provide access to capital, markets, credit, knowledge and risk management tools.

Support networks in the country should be created by rural cooperatives in different rural areas, making food products locally much cheaper to the people of the same area. Agricultural policies, which generally take into the account macroeconomic interests, should pay attention to the food security of people in deprived areas at a micro level, as the development of these areas will play a major role in the development of the country in the future.

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