Determining Causal Model Role of ICTs in Improving Food Security of Iran's Rural Households

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Abstract: Access to desirable, sufficient, safe and nutritious food is one of the basic components of the development and health of a society. Information and communications technologies (ICTs) represent an important strategy that can be used in attaining food security. The main purpose of this research, performed in 2006-2007, was to identify the effectiveness of ICTs in improving food security of Iran's rural households. A descriptive methodology was applied in this research, through questionnaires. The statistical population for the study included 253 agricultural extension experts; from this population, 170 persons were selected. The results showed that, according to the experts' point of view, the situation of food security in Iran's rural households was unfavorable, but that ICTs could play an important role in improving this situation. The results of stepwise regressions showed that providing information about food, increasing food production, helping to market agricultural products, considering clientele needs, improving interactions and communications, ensuring appropriate ICTs, providing access to old technology and accessing the content of this type of technology, were determined to account for 78% of the variance of the food security of Iran's rural households. Moreover, the path analysis technique demonstrated that the improvement of interactions and communications had the greatest influence on determining the causal model of improving food security of Iran's rural households (β =0.992).
[Farhad Lashgarara, S. Mehdi Mirdamadi, S.Jamal Farajollah Hosseini. Department of Agricultural Extension, Science and Research Branch, Islamic Azad University, Tehran, Iran. Journal of American Science 2011;7(3):520-525]. (ISSN: 1545-1003). http://www.americanscience.org.

Key words: Information and communications technologies, food security, rural households, Iran

1. Introduction

Access to desirable, sufficient, safe and nutritious food is a basic component of development and health of a society. Thus, when developing country goals and priorities, food security is of utmost importance. Most observers of rural development believe that, currently, the necessary condition for obtaining food security is information. Knowledge and information are important factors to ensure food security, and ICTs have the ability to present the information required for improving food security. According to the definition determined by the World Food Summit (1996), Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. Food security for a household means access by all members at all times to enough food for an active, healthy life (CTA 2005). In other words, food security is the guarantee of the physical availability of and economical accessibility to sufficient food (produced with bioenvironmental and sustainable social methods) in terms of quantity (amount, distribution, calories) and quality (safe, nutritious, balanced), while cultural admittance for all people at all times means having healthy and active lives to preserve human places and degrees (Temu and Msuya 2004).

Food security can be summarized according to three factors: food availability, food accessibility and food utilization. Food availability is achieved when a sufficient amount of food is constantly available for all members of society. This kind of food can be obtained through household production, local production, imports or food aids. Food accessibility is obtained when households and individuals have sufficient sources to consume a suitable diet. In other words, food accessibility is possible if the household income allows for the preparation and purchase of enough food (Bakhtiari and Haghi 2003). Food utilization refers to suitable biological uses of food that depend on a household knowledge of techniques for storing and processing food and basic principles of nutrition and caring for children (Sustainable Development Department 2006).

Different strategies exist for obtaining food security; the use of information and communications technology is one of these strategies. ICTs consist of various collections of resources and technical tools that are used for connecting, spreading, storing and managing information (Pigato 2004). In other words, ICT represents the collection of hardware and software that is used for producing, preparing, transferring and storing data via devices such as computers, radios, televisions, etc., and it includes an

extensive scope of traditional and modern media (Norad 2002). In general, ICTs can be classified into three groups:

1. New ICTs: This group consists of computers, satellites, one-on-one connections, wireless phones (mobile), the internet, e-mail, the web, internet services, video conferences, CD-ROMs, personal computers (PC), distance control systems, informational-geographical systems, global positioning systems (GPS), electronic cameras, databases, etc. The hidden concept behind these technologies is that they are not automatically considered to be new, but their common and inexpensive availability has resulted in them being regarded as new.

2. Old ICTs: This group consists of radios, televisions, telephones, telegraphs, audio and video cassettes, films and slides. This group of technologies has been used for several decades.

3. Very Old ICTs: This group of technologies has been used for several centuries and includes newspapers, books, photo albums, posters, theater, human interactions, markets and plays (Obayelu and Oyunlade 2006).

According to Chowdhury (2001), ICTs play an important role in food security through facilitating accessibility to related policies and information for market communication, improving market profitability, helping farmers to make decisions, increasing diversity in rural economies and reducing the cost of living. In general, some of the important capacities of ICTs in food security are related to improving communications between research systems, farmers and extension, improving accessibility to information regarding inputs, introducing technologies, providing more rapid accessibility to high quality information, ensuring information about the appropriate times and places for optimized sales of agricultural products, increasing agricultural products and decreasing agricultural waste products (Balakrishna, 2003, Maoz, 2004, Temu and Msya 2004).

Many studies have been carried out in relation to the role of ICTs in improving the food security of rural households. The main result of the FAO research (1998:9) focused on creating an agricultural communication network project in Italy has helped to ensure agricultural inputs and product marketing. The results of Indonesia's participatory video project (1998:11) have been considered to help with clientele needs. The findings from the research of Fortier and Van Crowder (2000:4) about the electronic diffusion of agricultural information projects in rural communities of Kenya can improve the ability for individuals to acquire information, increase food production and develop the local capacity of rural community building. The research of Gerster and Zimmermann (2003:6) focused on a radio program project aimed at improving financial decisions and increasing food production. The findings of Uganda's knowledge system and agricultural information project (2000:7) are related to improving the power of acquiring individual information and attending to clientele needs. The results of PCARRD (2003:4) research regarding the Philippines' information services and agricultural technology were used to improve the marketing of agricultural products and to increase production. The findings of Bangladesh's rural ICT project (2001:9) resulted in better marketing of agricultural products, decreased costs of accessing information and the creation of jobs. The main results of Malaysia's E-bario project pertained to the improvement of interactions and communications and responses to clientele needs.

In development fourth program of Iran, 10000 ICT rural offices have been predicated, but 2500 ICT office has been mobilized at the present. There was no ICT rural office in Iran in 2000, but the quantity of ICT office in 2005 was 963, in 2006, 2287 and in 2007, 2446 (information technology company, 2007:23).

The results of FAO research in relation to situation of food security in Iran showed that food security indicator in rural households has been decreased during 1985-2005. Therefore, in recent years for ensuring food security in Iran, different programs have been carried out, including increasing food production in 1945-1948, ensuring rate of strategic products in 1973-1981 and investing in agricultural sector in 1983-1987 (ministry of hygiene, remedy & medical education 2004).

In addition, above mentioned solutions, using ICT for improvement food security of rural households can be an important option, because the key element in rural development in general and food security in particular, is information.

The main purpose of this research was the identification of the effective capabilities of information and communications technologies for improving the food security of rural Iran's households. With this purpose in mind, the following objectives were compiled:

1- The study of the personal and professional characteristics of extension experts.

2- The study of the situation of food security in rural Iran's households, from the extension experts' point of view.

3- The examination of the role of information and communications technologies in improving the food security of Iran's rural households.

4- The determination of the causal model role of information and communications technologies in improving the food security of Iran's rural households

2. Material and Methods

The methodology of this research was descriptive, and it was carried out as a survey. The instrument that was used for data collection was a questionnaire. The research independent variables consisted of: (A) ICT capability in improving food security (B) ICT tools(C) implications of the use of ICTs for improving food security (as you see in figure 1) and (D) personal characteristics of extension experts: gender, age, job record, level of education, major and workplace. The dependent variable was the experts' point of view about food security; to assess it, forty-four statements were used in the form of a five-point Likert scale (from very unsuitable to very suitable), and the mean score of the answered questions was identified as the respondent's attitude. After computing the statements, they were examined on an interval scale. Some of these statements were related to the rate of food production by rural households, the rate of government investments in agricultural sectors, the amount of farming lands, the yield per hectare of agricultural products, government policies regarding the avoidance of changes in farm operations, government functions related to land consolidation, government policies related to the guaranteed sales of agricultural products, the rate of the application of scientific principles in agricultural production, the amount of foreign food imports, the volume of agricultural waste products, etc.

Content and face validity were established by a panel of experts consisting of faculty members at Islamic Azad University, Science and Research Branch and some specialists in the Ministries of Agriculture and Health. Minor wording and structuring of the instrument were made based on the recommendation of the panel of experts. A pilot study was conducted with 30 persons who had not been interviewed before the earlier exercise of determining the reliability of the questionnaire for the study. Computed Cronbach Alpha score was 90.0%, which indicated that the questionnaire was highly reliable.

The statistical research personnel consisted of 253 extension experts from agricultural organizations in eight provinces of Iran: Qom, Ilam, Kerman, Semnan, Qazvin, Kordistan, Tehran and Lorestan. The required research sample size was also calculated to be 170 people by using the Cockran formula. Thus, in a pre-test, 30 questionnaires were distributed, and the variance of the dependent variable (food security) was calculated as $S^2 = 0.26$. Using N = 253, d = 0.05 and t = 1.96, the required sample size was determined to be 155 persons; to increase certainty; it was increased to 170 persons. The research sampling method was stratified.

A series of in-depth interviews were conducted with some senior experts in the Ministries of Agriculture and Health to examine the validity of questionnaire. A questionnaire was developed based on these interviews and relevant literature. The questionnaire included both open-ended and fixed-choice questions. The open-ended questions were used to gather information not covered by the fixed-choice questions and to encourage participants to provide feedback.

The final questionnaire was divided into several sections. The first section was designed to gather information about personal characteristics of respondents. The second section was designed to measure the attitudes of extension experts about potential of ICTs in improving food security. The respondents were asked to indicate their agreements by marking their response on a five point Likert-type scale. The next section explored the impact of using ICTs on improving food security were presented in a 5-point Likert format with responses from 1—completely disagree to 5—completely agree. Eight attitudes were presented in a 5-point Likert format.

To maintain the proportion between research personnel size N = 253 and sample size N = 170 in each province, the necessary sample size was chosen randomly, according to the number of experts in those provinces.

To analyze the collective data, the software SPSS 13 was used. For descriptive statistics, mean, median, mode and coefficient of variation and inferential statistics methods such as correlation, regression and path analysis were used.

3. Results

In order to assess the current food security situation of rural Iran's households, 44 statements were used. The results of the research indicated that most of the respondents (81.2%) assessed the food security situation of rural Iran's households as unsuitable.

To determine the role of ICTs in improving the food security of rural Iran's households, a total of 48 statements were used. The results indicate that most respondents (36.5%) assigned an important role to ICT capabilities in improving the food security of rural Iran's households.

In order to determine the variance in the improvement of food security of rural Iran's

households, stepwise regression analysis was used. The analysis results are shown in Tables 1 and 2.

According to Table 1, the providing information about food, increasing food production, helping to market agricultural products, considering the clientele needs, improving interactions and communications, ensuring appropriate ICTs, providing access to old technologies and accessing the content of old technologies were entered as stepwise regressions.

In the first step, the practice of providing information about food was entered in the regression equation, and it was determined that 24% of the variance changed with respect to the dependent variable (food security).

In the second step, the increasing food production and the previous variable represented 32% of the changes, and in the third step, the practice of assisting in the marketing of agricultural products and the two previous variables were determined to represent 41% of the changes.

In the third step, the variable related to considering the clientele needs and the three previous variables were determined as 48%, and in the fifth step, the variable related to improving interactions and communications and the previous variables were determined as 57%; in the sixth, seventh and eighth steps, the practices of ensuring appropriate ICTs, providing access to old technologies and accessing the content of old technologies were determined as 63%, 69% and 78% of the variance changes in food security, respectively.

In total, when entering all of these variables, the result was $R^2 = 0.783$. This coefficient shows that 78.3% of the food security of rural households' variance changes was related to these eight variables.

Table 1- Stepwise regression in improving food security of Iran's rural households

Steps	R	R Square	Adjusted R Square
1	0.56	0.311	0.245
2	0.63	0.391	0.323
3	0.66	0.433	0.416
4	0.73	0.533	0.485
5	0.77	0.598	0.573
6	0.82	0.682	0.636
7	0.87	0.751	0.697
8	0.91	0.836	0.783

According to the results shown in Table 2, the regression equation according to the B and β quantities were, respectively:

$$Y= 89.667 + 0.865x_1 + 0.774x_2 + 0.694x_3 + 0.612x_4 + 0.531x_5 + 0.472x_6 + 0.384x_7 + 0.311x_8$$

$$Y = 0.794x_1 + 0.732 x_2 + 0.684 x_3 + 0.592 x_4 + 0.481x_5 + 0.374 x_6 + 0.284x_7 + 0.211x_8$$

Table 2- Standardized & unstandardized coefficients of improving food security

Variables	Unstandardized Coefficients B	Standardized Coefficients Beta	Sig
Constant	89.667	----------	
Informing about food (X_1)	0.865	0.794	
Increasing food producing (X_2)	0.774	0.723	
Agricultural marketing (X_3)	0.694	0.684	
Considering to clientele needs (X_4)	0.612	0.592	
Improving interactions & communications (X_5)	0.531	0.481	
Ensuring appropriate ICTs (X_6)	0.472	0.374	
Accessing to old technologies (X_7)	0.384	0.284	
content of old technologies (X_8)	0.311	0.211	

To determine the causal model of effective capabilities of ICTs in improving the food security of rural households, a path analysis technique was used. To determine the path coefficients and calculate the direct and indirect influences of the variables, a regression technique was used. In each step, one variable is the dependent variable, and the other variables of the regression analysis are independent variables, thus allowing for the calculation of the direct and indirect influences (Table 3).

Table 8- Direct & indirect influences of independent variables on food security

Independent variables	Indirect influences	Direct influences	Total influences
Informing about food (X_1)	046/0	947/0	0.841
Improving food production (X2)	----	723/0	0/723
Agricultural marketing (X3)	134/0	684/0	818/0
Consideration to clientele needs (X4)	272/0	592/0	846/0
interactions and communications (X5)	51/0	481/0	991/0
Ensuring appropriate ICTs (X6)	43/0	374/0	804/0
Accessing to old technologies (X7)	----	284/0	284/0
Content of old technologies (X8)	126/0	0/85	211/0

4. Discussions

This research, carried out to study the role of information and communications technologies in improving the food security of rural Iran's households, has shown that the food security situation of rural households is unsuitable. This means that factors such as the rate of unemployment in agricultural sectors, the rate of inflation in the country and also the volume of agricultural waste products are not only problematic but that they also threaten the food security situation of rural Iran's households. In the experts' view, information and communications technologies can have an important role in improving the food security of rural households. The practices of providing information about food, increasing food production, helping to market agricultural products, considering clientele needs, improving interactions and communications, ensuring appropriate ICTs, providing access to old technologies and accessing the content of old technologies could play an important role in improving the food security of rural households. Information about food related to the manner of storing food processing food, optimizing food consumption, improving food distribution, supplying food and providing food safety played a direct and important role. On the other hand, the improvement of the food security of rural households was strongly influenced by the improvement of interactions and communications; this rural means that practices such as increasing the quality of studies in the agricultural section, improving interactions and communications among various production factors, improving presentations of extension services, improving communications among researchers, extension personnel and farmers, and decreasing the gap between rural people and researchers can increase and improve the food security of rural Iran's households. This research confirmed the results of Fortier (2000), Zimmermann and Gerster (2003), PCARRD (2003), rural ICT of Bangladesh (2001) and E-bario Malaysia (2003). The results obtained here are consistent with the results of the VERCON project in Egypt (2000), the Indian global center of agricultural information (2000) and E-bario in Malaysia. It can be concluded that:

To achieve improvements in the food security of rural households, more consideration should be paid to creating jobs in the agricultural section, to controlling and decreasing the rate of inflation in the country and also to managing the agricultural waste products.

According to most of the experts' point of view, much more precise considerations regarding the use of information and communications technologies in improving the food security of rural households are completely necessary and logical. Actions such as identifying and assessing appropriate ICTs for fulfilling participatory needs, ensuring appropriate ICTs for improving food security, ensuring appropriate software and hardware, providing equal access to ICTs for all people, considering clientele needs in presenting programs and information, investing in ICTs and promoting technical-information infrastructures for this purpose are essential.

To improve the role of information and communications technologies in increasing the food security of rural households, solutions such as the use of appropriate content from old technologies, for example, radios and televisions, for presenting information about storing food, processing food, optimizing food consumption, ensuring the safety of food, increasing food production, marketing agricultural products and considering clientele needs are highly recommended; this requires that rural households have access to old technologies.

Acknowledgements:

Authors are grateful to all of the extension experts of the eight provinces who answered our questions patiently and accurately.

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02/17/2011