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Full Length Research Paper

The causal model role of ICTs in food utilization of Iranian rural households

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Access to desirable, sufficient, safe and nutritious food is one of the basic components of the development and health of a society. ICTs represent an important strategy that can be used in attaining food security. The main purpose of this research, performed in 2006 to 2007, was to identify the effectiveness of ICTs in improving the food utilization of Iranian 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 utilization in Iranian rural households was unsuitable, but that ICTs could play an important role in improving the food utilization. The results of stepwise regressions showed that informing rural people about food, improving decision making, improving the power of acquiring individual information, rural literacy, facilitators and content of old technologies were determined to account for 73% of the variance of the food utilization of rural Iranian households. Moreover, the path analysis technique demonstrated that facilitators had the greatest influence on determining the casual model of improving the food utilization of rural Iranian households (β = Õ.899).

Key words: Capabilities, information and communications technologies, food utilization, rural households, agricultural extension experts, causal model.

INTRODUCTION

Access to desirable, sufficient, safe and nutritious food is a basic component of development and health of a society. When developing country goals and priorities, food security is of utmost importance. Most observers of rural development believe that, 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. 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 (CTA, 2005). Food security for a household means access by all members at all times to enough food for an active, healthy life. 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 the 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 the basic principles of

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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).

Information and communications technologies have an important role in different aims, such as those of increasing rural decision power, extending rural markets, preserving the environment, increasing life quality and empowering the rural poor. It is also important in several domains including social development, research, education, extension, the management and control of organization, gender equality, hygiene, the environment, agriculture and nutrition.

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 (Chowdhury,2001; 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) focused on creating an agricultural communication network project in Italy has helped to ensure agricultural inputs and product marketing. The findings from the research of Fortier and Van Crowder (2000) 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) 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 are related to improving the power of acquiring individual information and attending to clientele needs (Fortier and Van Crowder, 2000). The results of PCARRD (2003) research regarding the Philippines' information services and agricultural technology were used to improve the marketing of agricultural products and to increase production.

The main purpose of this research was the identification of the effective capabilities of information and communications technologies for improving the food utilization of rural Iranian 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 situation of food utilization in rural Iranian households, from the extension experts' point of view.
(3) The examination role of ICTs in improving food utilization of Iranian rural households.
(4) The determination of the casual model role of ICTs in improving food utilization.

The theoretical framework has been showed in Figure 1.

ICT capabilities in improving food security:

1. Increasing production of agricultural products
2. Providing information about food
3. Improving rural and farmers' power of management
4. Helping to ensure agricultural inputs
5. Providing information about the planting and harvesting of agricultural products
6 Improving agricultural product marketing
7 Improving decision – making
8. Representing educational – sanitary services
9. Decreasing costs
10. Job creating
11. Informing farmers about market policies
12. Transferring technologies and new methods
13. Improving interactions and communications
14. Facilitating the acquisition knowledge
15. Consideration to clientele needs

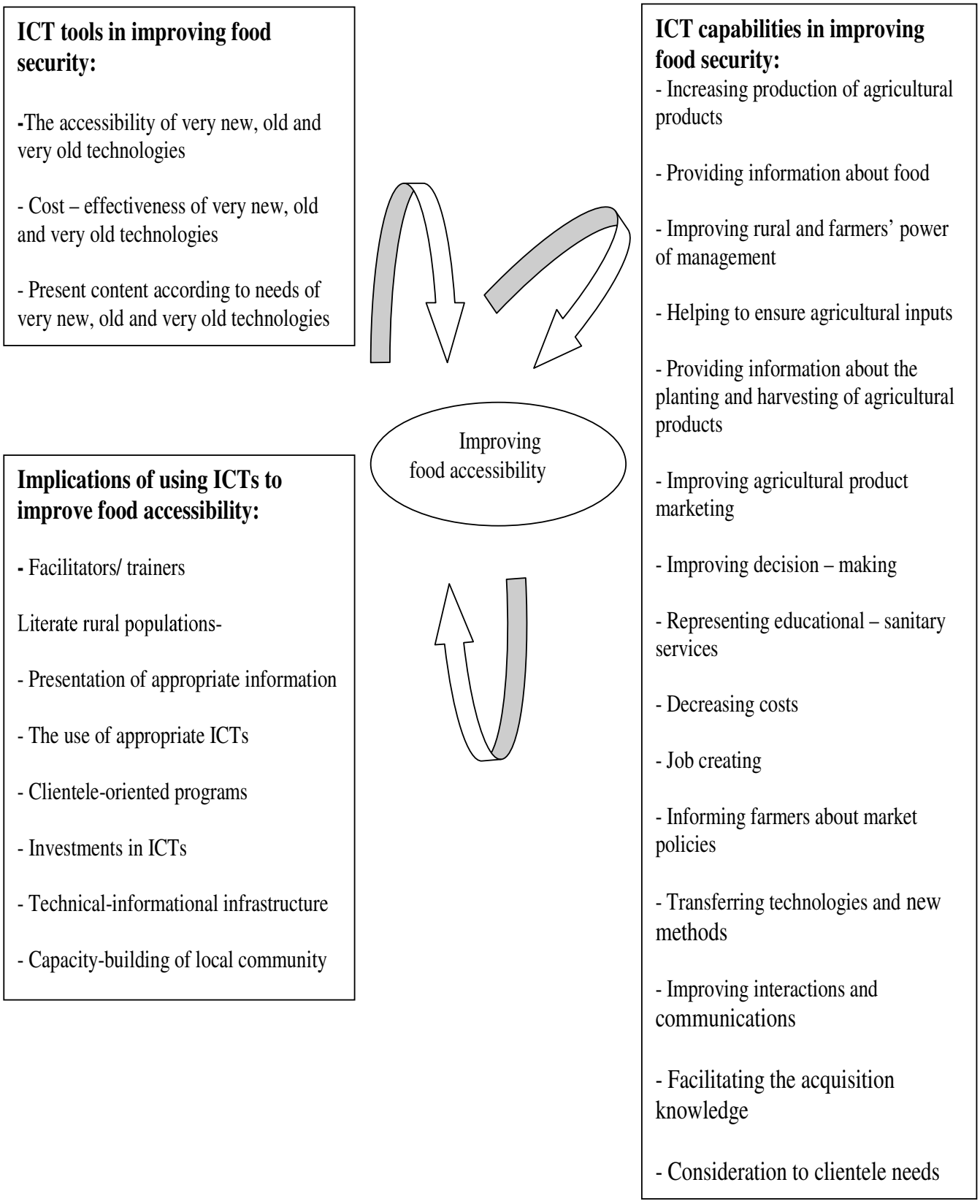

Figure 1. The theoretical framework of research.

ICT tools in improving food security:

1. The accessibility of very new, old and very old technologies.
2. Cost – effectiveness of very new, old and very old technologies.
3. Present content according to needs of very new, old and very old technologies.

Implications of using ICTs to improve food security:

1. Facilitators/ trainers
2. Literate rural populations
3. Presentation of appropriate information
4. The use of appropriate ICTs
5. Clientele-oriented programs
6. Investments in ICTs
7. Technical-informational infrastructure
8. Capacity-building of local community
10. Improving food utilization

MATERIALS AND METHODS

The methodology of this research was descriptive (non experimental), and it was carried out as a survey. The instrument that was used for data collection was a questionnaire. 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's Alpha score was 90.0%, which indicated that the questionnaire was highly reliable.

The research independent variables consisted of: (A) ICT capability in improving food accessibility (B) ICT tools (C) implications of the use of ICTs for improving food accessibility (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 utilization; to assess it, 10 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.

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 utilization) 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.

$$n = \frac{N^2 t s^2}{N^2 d + t^2 s^2} \quad , n = 170$$

The research sampling method was stratified. Thus, initially, among the 30 provinces of Iran, the 8 provinces as listed were chosen randomly (Table 1). 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 analysis, regression and path analysis were used.

RESULTS

First purpose: The study of the personal and technical characteristics of extension experts

The results of this research showed that 131 of the experts were men (77.1%) and 39 persons were women (22.9%). The major of most respondents was agricultural extension (36%). Most of the experts were working in Tehran (27.67%). Of all the experts, 116 experts (68.2%) had a Bachelor's degree, and 53 persons (31.2%) had Master's degrees. Most respondents (41.8%) had 12 – 17 years of job experience; the mean was 12 years, and the values ranged from 1 to 29 years.

Second purpose: The study of situation of food utilization of Iranian rural households according to agricultural extension experts' point of view

In order to assess the current food utilization situation of Iranian rural households, 10 statements were used. The scores for these statements were added together and then recoded. According to the number of statements and the Likert scale for examining food utilization (1- very unsuitable, 2- unsuitable, 3- medium, 4- suitable, 5- very suitable), the lowest and the highest scores for one respondent were 10 = (10 × 1) and 50 = (10 × 5). After recoding, the score of a very unsuitable situation was (1 - 10), the score of an unsuitable was (11 - 21), the medium was (22 - 32), suitable was (33 - 43) and very suitable was (44 - 54). The results of the research indicated that most of the respondents (73.5. %) assessed the food utilization situation of rural Iranian households as unsuitable (Table 3).

The priority settings of food utilization statements were determined using coefficient variation statistics. In this way, each statement that had a lower coefficient variation was related to a more important situation. According to the results shown in Table 4, in the experts' point of view, the amount rate of food absorbed by rural household (0.2808), quality of provided health-educational services to rural (0.3177) and situation of food safety of rural households (0.3201) However, percent of literacy rural households (0.4739), family planning programs (0.351) and health situation of rural households faced serious problems.

Third purpose: The examination of role of ICTs in improving food utilization of Iranian rural households

To determine the role of ICTs in improving the food utilization of Iranian rural households, a total of 48 statements were used. These statements were computed

Table 1. Divisiveness of provinces of Iran according to influence coefficient of rural ICTs.

Rank	Province	Coefficient of rural ICTs	Range
1	Qom	96	
2	Mazandaran	78.49	75 -100%
3	Golestan	75.09	
4	Kermanshah	63.59	
5	Chaharmahal	61.15	
6	Ilam	59.26	50 - 75%
7	Southern Khorasan	53.65	
8	Isfehan	48.14	
9	Kerman	43.37	
10	Northern Khorasan	42.40	
11	Fars	38.60	
12	Boshehr	37.38	
13	Semnan	37.19	
14	Sistan	36.78	
15	Kohkiloye	36.51	25 - 50%
16	Qazvin	36.19	
17	Khozestan	35.43	
18	Western Azerbaijan	34.44	
19	Kordestan	34.21	
20	Khorasan	29.21	
21	Eastern Azerbaijan	28.72	
22	Yazd	28.44	
23	Ardebil	26.00	
24	Tehran	24.46	
25	Hormozgan	22.85	
26	Zanjan	21.67	
27	Markazi	20.66	Lower 25%
28	Hamedan	19.46	
29	Lorestan	7.34	
30	Gilan	5.25	

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 (Table 2).

Table 2. Number of chosen agricultural extension experts on selected provinces.

Province	Total number of experts	Number of chosen experts
Qom	21	14
Ilam	24	16
Kerman	32	21
Semnan	33	22
Qazvin	18	12
Kordestan	32	21
Tehran	67	47
Lorestan	26	17
Total	253	170

and then recoded. According to 48 effective ICT capabilities and the Likert scale for testing the role of ICTs in improving food availability (1- very little, 2- little, 3- medium, 4- much/ many, 5- very much / many), the lowest and the highest scores for each respondent were 48 (48x1) and 240 (48 × 5). After recoding, the very little score was (1 - 48), little (49 - 97), medium (98 - 145), much/ many (146 - 194) and very much / many (195 – 243). The results shown in Table 5 indicate that most respondents (3õ5%) assigned an important role to ICT capabilities in improving the food accessibility of rural Iranian households.

On the other hand, the food utilization of rural Iranian households was examined with 10 statements and the 5-point Likert scale that, after being computed, became a quantitative variable. According to the results shown in Table 6, providing information about food, improving decision-making, improving individual power of acquiring knowledge, facilitators, literacy rural and content of old technologies had a positive and significant relationship at the 99% level and, delivering health-educational services, considering to clientele needs, community capacity building, informing rural about ICTs and access to old technologies had a positive and significant relationship at the 99% level with improving the food utilization of rural households. The other variables did not have any significant relationships with the improvement of food utilization of rural households. Both the food utilization and the independent variables shown in Table 6 were measured in intervals, thus the Pearson correlation coefficient was used.

In order to determine the improvement of food utilization of rural Iranian households, all of the variables shown in Table 6 were entered into a stepwise regression analysis. The analysis results are shown in Tables 7 and 8. According to Table 7, informing rural about food, improving decision-making, improving individual power of acquiring knowledge, rural literacy, facilitators and content of old technologies were entered as stepwise regressions.

In the first step, informing rural about food was entered in the regression equation and it was determined that 38% of the variance of the dependent variable (food utilization). In the second step, improving decision-making and the previous variable represented 47% of the changes. In the third step, improving individual power of acquiring knowledge and the two previous variables were determined to represent 59% of the changes. In the fourth step, rural literacy and the three previous variables were determined as 63%, and in the fifth and sixth steps, the facilitators and content of old technologies and the previous variables were determined 67% and 73% of the food utilization, respectively. In total, when entering all of these variables, the result was $R^2 = 0.737$. This coefficient shows that 73.7% of the food utilization of rural households' variance was related to these six variables. The regression significance was also calculated by the F-test; it was significant at the 99% level (sig = 0.000). The

Table 3. Agricultural expert's point of view about food utilization of rural households (n = 170).

Situation	Frequency	Percent	Cumulative percent
Very unsuitable(1 – 10)	1	6.0	6.0
Unsuitable(11 – 21)	125	5.73	1.74
Medium (22 – 32)	24	1.14	2.88
Suitable (33 – 43)	20	8.11	100

Mean: 23, Median: 27, Mode: 24.

Table 4. Priority setting of food utilization of rural households in agricultural expert's point of view.

Priority	Statements	Coefficient of variation
1	Food absorbed by rural household	0.2808
2	Quality of provided health-educational services to rural	0.3177
3	Situation of food safety of rural households	0.3201
4	Quality of food process in rural households	3236.0
5	Pattern nutrition of rural households	0.32420
6	Quality of food saving in rural households	0.32430
7	Quantity and quality of educational programs about nutrition of households	0.32710
8	Percent of literacy rural households	0.4739
9	Family planning programs	0.3510
10	Health situation of rural households faced serious problems	0.4160

Table 5. The role of ICTs in improving food utilization of Iranian rural households.

Role	Frequency	Percent	Cumulative percent
Little	15	8.8	8.8
Medium	60	35.3	44.1
Much	62	36.5	80.6
Very much	33	19.4	100

Table 6. Pearson correlation coefficient between research variables and food utilization.

Variables	r	p
Providing information about food	0.327**	0.000
Improving decision-making	0.291**	0.001
Delivering health-educational services	0.111*	0.04
Improving individual power of acquiring knowledge	0.243**	0.002
Clientele-oriented programs	0.106*	0.03
Facilitators	0.193**	0.000
Rural literacy	0.211**	0.000
Community capacity building	0.96*	0.02
Informing rural about food	0.84*	0.01
Access to old technologies	0.76*	0.03
Content of old technologies	0.138**	0.000

* = $P < 0.05$, ** = $P < 0.01$.

Table 7. Stepwise multiple regression in improving food utilization of rural households.

Steps	R	R^2	Adjusted R^2	Standard error of the estimate
1	0.66	0.438	0.384	3.63
2	0.74	0.542	0.472	3.11
3	0.79	0.619	0.593	2.97
4	0.82	0.669	0.632	2.62
5	0.85	0.729	0.674	2.46
6	0.89	0.793	0.737	2.14

variables that were entered in the regression equation were the main part of the regression analysis and are shown in Table 8.

According to the results shown in Table 8, the regression equations according to B and β quantities were, respectively:

$$Y= 20.999 + 0.523x_1 + 0.424x_2 + 0.394x_3 + 0.294x_4 + 0.221x_5 + 0.188x_6$$

$$Y= 0.702x_1 + 0.645x_2 + 0.593x_3 + 0.495x_4 + 0.382x_5 + 0.311x_6$$

Figure 2 shows collections of determining and effective factors in improving the food utilization of rural Iranian households. This research confirmed the results of Fortier and Van Crowder (2000), Gerster and Zimmermann (2003), PCARRD (2003),

Fourth purpose: The determination casual model of role of ICTs in improving food utilization of Iranian rural households

To determine the casual model of effective capabilities of ICTs in improving food utilization 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.

Then, after obtaining the β coefficients, the indirect influences of each independent variable on the dependent variable can be calculated. To calculate the indirect influences, the β coefficients of each path were multiplied by each other until reaching the dependent variable. Each variable had both direct and indirect influences such that casual influences were obtained from all of them. After calculating of direct and indirect influences of all variables, all of these influences are summarized in Table 9.According to Table 9, Informing rural about food (X_1) had the most direct influence (0.702), facilitators (X5) had the most indirect influence (0.517), and overall, facilitators (X5) had the most influence on determining the casual model of improving rural household food utilization (0.899). The causal model role of ICTs in food utilization of rural Households has been shown in Figure 3.

Informing about food (X_1), Improving decision-making (X_2), Improving individual power of acquiring knowledge (X_3), Rural literacy (X_4), Facilitators (X_5), Content of old technologies (X_6).

DISCUSSION

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).

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 and medical education, 2004).

This research, carried out to study the role of information and communications technologies in improving the food utilization of rural Iranian households, has shown that the food utilization situation of rural households is unsuitable. This means that factors such as amount rate of food absorbed by rural households, quality of provided health-educational services to rural and situation of food safety of rural households not only problematic but that they also threaten the food utilization situation of rural Iranian households. In the experts' view, information and communications technologies can have an important role in improving the food utilization of rural households. ICTs have an important role in improving the food utilization of rural households through providing information about food, improving decision-making, improving individual power of acquiring knowledge, facilitators, literacy rural and content of old technologies. It can be concluded that:

1. In considering that the situation of food utilization of rural households is unsuitable, to achieve improvements in the food utilization of rural households, more consideration should be paid to eradication of illiteracy amongst rural people, appropriate family planning for rural and improvement of health situation of rural households.

Table 8. Standardized and unstandardized coefficients of improving food utilization.

Variables	Unstandardized coefficients Beta	Std. error	Standardized coefficients Beta	t	Sig.
Constant	999	1.319	-----	15.919	0.000
Informing about food (X_1)	0.523	0.137	0.702	3.002	0.003
Improving decision-making (X2)	0.424	0.224	0.645	2.98	0.002
Improving individual power of acquiring knowledge (X3)	0.394	0.196	0.593	2.22	0.001
Rural literacy (X4)	0.294	0.137	0.495	2.11	0.002
Facilitators (X6)	0.221	0.134	0.382	1.95	0.003
content of old technologies (X6)	0.188	0.117	0.311	1.74	0.004

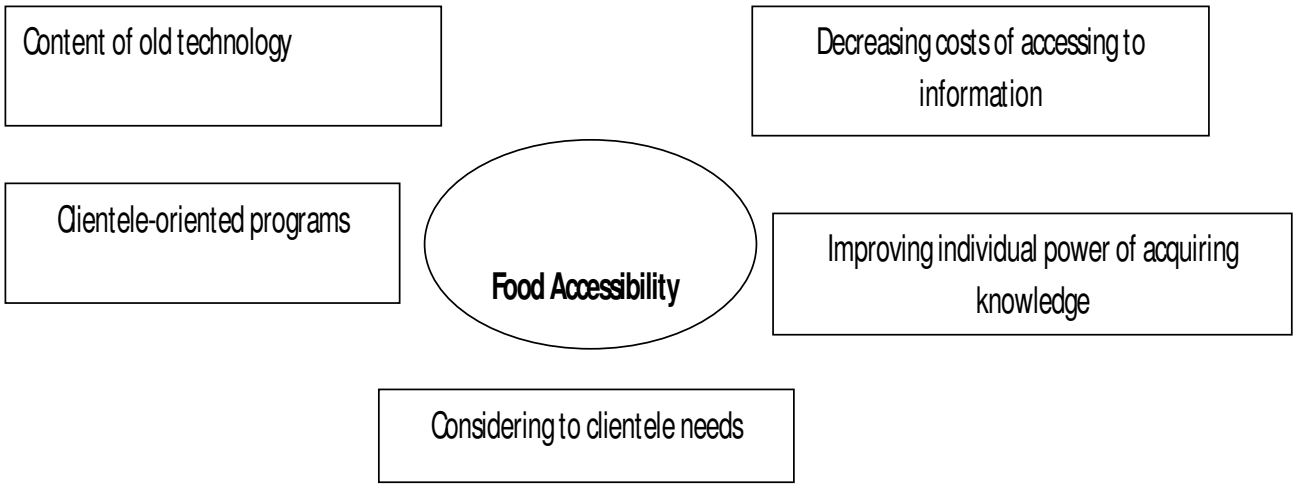

Figure 2. The factors determining food utilization of Iran's rural households.

Table 9. Direct and indirect influences of independent variables on food utilization.

Independent variables	Indirect influences	Direct influences	Total direct and Indirect influences
Informing about food (X_1)	139.0	702.0	0.841
Improving decision-making (X2)	----	645.0	0.645
Improving individual power of acquiring knowledge	239.0	593.0	0.832
Rural literacy (X4)	268.0	495.0	0.763
Facilitators (X_5)	517.0	382.0	0.899
Content of old technologies (X6)	49.0	311.0	0.801

2. Base on regression analysis and in according to most of the experts' point of view believed that the situation of food utilization of rural households is unsuitable, much more precise considerations regarding the use of ICT in improving the food utilization 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.

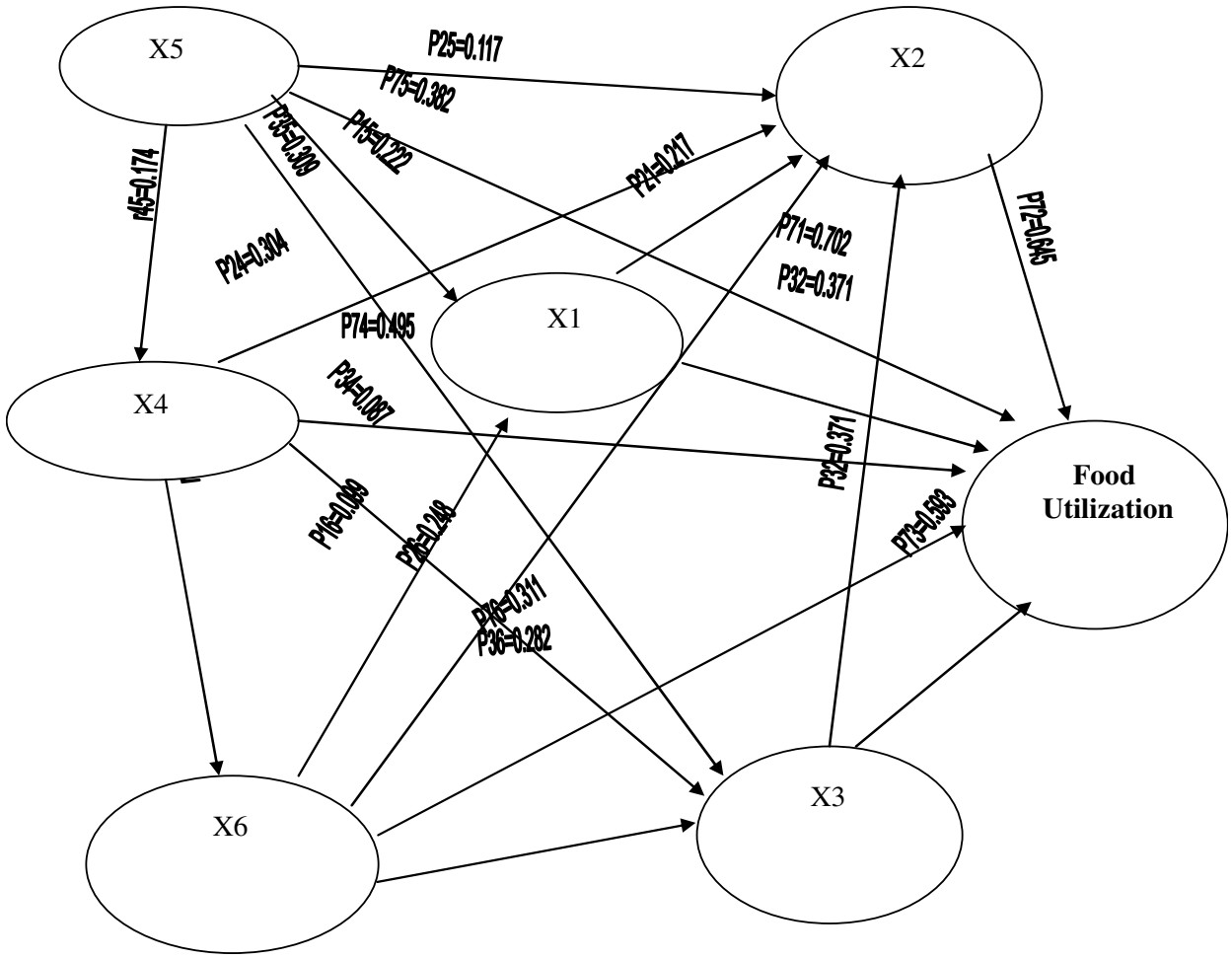

Figure 3. Diagram of the path analysis of the improvement in Iranian rural household of food utilization with β coefficients.

(3) As path analysis showed that facilitators had the greatest influence on determining the casual model of improving food utilization. Therefore, being of experienced facilitators for vulgarization and preparing condition for using ICTs among rural households, on the other hand, quantitative and qualitative development of extension workers for more education rural households is very important.

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