INTERNATIONAL FOOD & AGRIBUSINESS MANAGEMENT ASSOCIATION

The Role of Technology in Food Security (case study: Iran)

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Abstract

Food security is an issue that directly or indirectly discussed in all countries of the world. Using the existing body of research related to food security and applying results of cost-income urban and rural families during the period of 1989 to 2014, this study determines food security of the country by AHFSI (Aggregate household food security index). After, this study investigates the effect of Technology on food security of Iranian families. It also uses time series methods, vector autoregressive model & vector error correction model, and EXCEL & EVIEWS software. Our findings indicated that in the short run, Technology in agricultural sector has positive effect on rural and urban household food security. In the long run, it has significant positive correlation with urban household food security. Based on the results and the appropriateness of the technology effect on household food security, providing facilities for investment in the provision of

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improved seeds and mechanization of planting, harvesting and farmer training recommended.

Keywords: Technology, Agriculture, Food security, AHFSI (Aggregate household food security index), Technology, Iran.

JEL: S2, S7, HT9.

Introduction

Food security is one of the main problems of the world in the 21st century. Enumerate the importance of food security, as a critical problem requires a global deal with this crisis. Food security and its adverse consequences is an issue that directly or indirectly backfire all nations. Identification of vulnerable groups and the reason of susceptibility to malnutrition are the most important issues that relate to food security. The monitoring food security and tackling food insecurity and hunger in the community seems to be necessary.

Causes of food insecurity are in a wide range. Inadequate production of food, poverty, lack of nutrients, declining ability to purchase food and misleading beliefs can all be causes of malnutrition and food insecurity in society. Food security requires not only adequate supply of nutrients, but also oversees the distribution of food to meet everyone in it as well. Food security requires not only adequate supply of nutrients, but also oversees the distribution of food to access for all as well. This concept has important consequences on the food security policies and strategies.

This set of factors such as policies, agricultural production, food distribution system, the country's natural resources, consumption; subsidies of basic goods, employment, income distribution and foreign trade policy have effect on food security. On the other hand, secure online access to food is not a process that can be achieve in the abstract, but directly with issues such as poverty reduction and mechanisms to protect the vulnerable groups are concerned. The main responsibility of any government is immediately take the necessary measures to achieve the right to adequate food.

Since household food security supply is one of the most important goal of economic, social and cultural development of the country, the level of household food security is very important issue. Since the agricultural sector plays a major role in providing food, it is been supported during the last three decades by governments, especially in developing countries. Therefore, appropriate supportive policies in long run is necessary for the formation of strong sector. Food security and quality of the food industry, requires increasing the quality and excellence in agriculture sector. Technology development can reverse food security challenges in agriculture sector. It can increase food quality, optimal use of resources, productivity, and volume of exports in this sector.

Andersen and Rajul (1995), had cited six issues for consider in their article. Policy-related variables could improve the nutritional status of children. world prices for major cereals were their lowest real level of the century, which might threaten production; poor countries risked losses if they could not negotiate effectively in the forthcoming trade negotiations; agro ecological approaches, biotechnology, and information technology and precision farming offered potential for increasing productivity on small-scale farms in developing countries.

Sharma (1992), the issue of access to food and household food security seeks to identify the indicators due to order and stability. He stated that the appropriate indicators to estimate household food security must be appropriate to the requirements of society and the availability of data and the indexes to three factors-physical, economic, and the combined division. The factors such as income and food prices on household access to adequate food of which were positive and negative effects on it.

Smith and et all (1999), to investigate the causes of food insecurity in developing countries, introduced two main factor affecting food security: adequate food supply & purchasing power. The result showed unlike purchasing power, the food supply has little interaction with food security and extreme poverty is the most important factor in food insecurity. Their proper implementation of specific political goals in order to improve food security was useful.

Gulliford and et all(2004), the issue of trust and credibility of household food security in social-related, showed that short-term increase in income, education and job status of head of household affect household consumption patterns that increase any positive effect on food security.

Considering the importance of this subject, comprehensive and targeted studies need based on scientific analysis in order to determine the impact of technology on household food security. In this study, we follow these two objectives**:**

1- Estimates of the overall food security of Iranian households with Aggregate household food security index (AHFSI)
2- Investigation of the impact of technology on food security of Iranian households**.**

Methodology

Food security of the country is calculated by AHFSI (Aggregate household food security index) based on FAO' formula; this formula has been proposed by Sen (1976) and Bigman (1993).

$$AHFSI = 100 - \left[H\left(G + (1-G)I^{P}\right) + \frac{1}{2}CV\left(1 - H\left(G + (1-G)I^{P}\right)\right)\right] \times 100$$

$$G = \frac{C_S - C_{AU}}{C_S \times H}$$

$$H = \frac{P_U}{P_T}$$

$$CV = \frac{S}{\bar{X}}$$

In these formulas H and P_U are percentage and the number of people who receive less energy than standard amount respectively, P_T is the total number of studied population, G is the intensity of nutritive poverty, C_S is the standard energy, C_{AU} is the average of energy less than standard and I^P is Gini index of distribution energy between poor people; CV shows changes of energy distribution during the time and it is calculated by the deviation (S) and average of energy distribution (X) over time period. This index has been introduced by FAO (1998) and it is originated from three elements: nutritive poverty level, distribution of food between poor people & intensity of nutritive poverty. Change domain of this index is between 0 to 100 percent (Thomson & Metz, 1998). This study investigates the impact of technology on food security of Iranian families by using time series methods, Vector Auto-Regressive Model & Vector Error Correction Model.

Results

Tables 1 and 2 show Aggregate household food security index(AHFSI) for rural and urban households during 1989-2014. The two indices for rural and urban areas, respectively, in the form of two variables F_{RU}, F_{UR} were used.

Table 1: Aggregate household food security index of rural households

AHFSI (F_{RU})%	I^P	CV	G	H%	year
85.54	0.43	0.34	0.0235	39.1	1991
84.55	0.43	0.34	0.0222	41.3	1992
84.3	0.43	0.34	0.0216	42.6	1993
86.68	0.46	0.34	0.0274	33.5	1994
87.69	0.41	0.34	0.0269	34.2	1995
87.64	0.41	0.34	0.0262	35.1	1996
86.76	0.42	0.34	0.0252	36.4	1997
85.84	0.44	0.34	0.0246	37.4	1998
86.55	0.44	0.34	0.0264	35.2	1999
85.08	0.44	0.34	0.0233	39.4	2000
88.94	0.43	0.34	0.0301	29.6	2001
88.74	0.43	0.34	0.0304	30.2	2002
89.89	0.42	0.34	0.034	27	2003
89.4	0.43	0.34	0.0326	28.2	2004
89.73	0.4	0.34	0.0316	29.1	2005
92.17	0.42	0.34	0.0442	20.8	2006
90.68	0.41	0.34	0.036	25.5	2007
90.85	0.41	0.34	0.0363	25.3	2008
89.71	0.4	0.34	0.0316	29.1	2009
92.14	0.39	0.34	0.0414	22.2	2010
92.67	0.4	0.34	0.0457	20.1	2011
92.28	0.42	0.34	0.0455	20.2	2012
93.83	0.43	0.34	0.0582	15.8	2013
93.77	0.43	0.34	0.0585	15.7	2014

Reference: calculated in this research

Table 1 and 2 showed an improvement in food security in rural and urban areas. The average of urban household food security is more than of rural households. Food poverty level and the Gini coefficient are the main variables affecting the aggregate household food security index. Due to the livelihoods of rural households, live below the food security by the proportion of urban households. Years after because of further improvements and addressing domestic issues for both household food security has taken a bullish trend. The likely reason is the following. In these years, the level of rural poverty was higher than urban poverty, which in turn can be

sufficient reasons such as lack of employment, low income because of crises caused by war, sanctions and other factors. However, in most years the Gini coefficient of urban households are less than rural households that shows fair income distribution in urban. As noted above, this is not always true, and it may be significant differences in the level of household poverty so that the food security of households affected.

Table 2: Aggregate household food security index of urban household food security

AHFSI F_{UR}	I^P	CV	G	H%	year
85.65	0.43	0.3	0.0259	37.2	1991
85.13	0.43	0.3	0.0244	39.4	1992
84.19	0.42	0.3	0.024	40.1	1993
88.15	0.43	0.3	0.031	31	1994
87.74	0.44	0.3	0.0306	31.4	1995
87.95	0.42	0.3	0.0299	32.2	1996
87.96	0.42	0.3	0.0287	33.5	1997
79.52	0.69	0.3	0.0282	34.1	1998
78.96	0.75	0.3	0.0298	32.3	1999
84.01	0.77	0.3	0.0402	23.9	2000
90.74	0.77	0.3	0.0702	13.7	2001
85.16	0.76	0.3	0.0431	22.3	2002
87.27	0.76	0.3	0.0504	19.1	2003
84.51	0.76	0.3	0.0411	23.4	2004
90.69	0.42	0.3	0.0396	24.3	2005
93.76	0.41	0.3	0.0605	15.91	2006
93.46	0.41	0.3	0.0571	16.83	2007
91.22	0.41	0.3	0.0413	23.3	2008
89.76	0.42	0.3	0.0355	27.1	2009
92.19	0.42	0.3	0.0476	20.2	2010
92.76	0.42	0.3	0.0532	18.4	2011
92.31	0.42	0.3	0.0483	19.9	2012
93.96	0.4	0.3	0.0611	15.75	2013
94.01	0.4	0.3	0.0617	15.6	2014

Reference: calculated in this research

Due to the lack of co-integration relationship between variables, Vector Auto Regressive (VAR) model is used. The results autoregressive model of the relationship between technology and food security in rural and urban households respectively in equations (1) and (2) are presented.

$$F_{RU} = 0.85*F_{RU}(-1) + 0.0066*Tech(-1) + 0.58 \quad (1)$$

$$F_{UR} = 0.67*F_{UR}(-1) + 0.0081*Tech(-1) + 1.4 \quad (2)$$

The impact of technology on food security of rural and urban areas in the short-term is positive. Technology cause increasing the Acreage so supply is sufficient. In this case, surplus farmers to increase supply and saving in the cost of factors of production increases. All these factors according to their aspects of livelihood of farmers in improving food security of rural households are effective. Agricultural technologies are really at the heart of food productivity growth.

Conclusions and recommendations

Our findings indicated that in the short run, technology of agricultural sector has positive effect on rural and urban household food security. In the long run, it has significant positive correlation with urban household food security. Based on the results and the appropriateness of the technology effect on household food security, providing facilities for investment in the provision of improved seeds and mechanization of planting, harvesting and farmer training recommended. These 11 agricultural technologies ranging from traditional low-tech practices to more advanced technologies recommended:

1-No-till – minimum or no soil disturbance, often in combination with retention of residues, crop rotation, and use of cover crops.

2-Integrated soil fertility management – a combination of chemical fertilizers, crop residues, and manure/compost

3-Precision agriculture – GPS-assisted delivery of agricultural inputs, as well as low-tech management practices that aim to control all field parameters, from input delivery to plant spacing to water level.

4-Organic agriculture – cultivation with exclusion of or strict limits on the use of manufactured fertilizers, pesticides, growth regulators, and genetically modified organisms.

5-Water harvesting – water channeled toward crop fields from macro- or micro-catchment systems, or via earth dams, ridges, or graded contours

6-Drip irrigation – water applied as a small discharge directly around each plant or to the root zone, often using micro tubing.

7-Sprinkler irrigation – water distributed under pressure through a pipe network and delivered to the crop via overhead sprinkler nozzles.

8-Heat tolerance – improved varieties allowing the plant to maintain yields at higher temperatures.

9-Drought tolerance – improved varieties allowing better yields due to enhanced soil moisture uptake capabilities and reduced vulnerability to water deficiency.

10-Nitrogen-use efficiency – plants that respond better to fertilizers.

11-Crop protection – the practice of managing pests, plant diseases, weeds, and other pest organisms that damage agricultural crop

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