

The Study of Total Efficiency of Agricultural Productivity Factors In Iran (Using an International Frontier Analysis)

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ABSTRACT

The agricultural sector is one of the productive sectors which has so much importance in societies economy. The sector and its dependent industries specialize a crucial part of gross domestic product to itself, especially in less developed countries. The agricultural sector has a high virtual potential about societies employment, development and growth. Since the agricultural sector has a direct relation with the people nutritious necessity preparation, it has frequently been considered by politicians. Considering the importance and position of agricultural sector in Iran and other countries economy, the changes of the total efficiency of agricultural productivity factors in Iran and the worlds 75 other countries during the years 1989-1991 and 1999-2001 have been measured in this essay based on estimated product maximization by DEAP2 software by the use of malmquist index in variant to measure efficiency situations. The outcomes resulted of using this method show that the change in Iran agricultural sector efficiency growing has still been negative during the periods of 1989-1991 and 1999-2001 Saudi Arabia in the periods of 1989-1991 and Cuba in 1999-2001 had the highest efficiency changes growing.

JEL classification: D24; O47

KEYWORDS: agriculture, total efficiency of productivity factors, malmquist index

1. INTRODUCTION

Accessing to proficiency and efficiency is one of the essential matters in economy science besides accessing and economical growth and prices stability. Today, efficiency is the best and most effective accessing way to economical growth, considering the paucity of productivity factors and enhancing the competitiveness. Efficiency increasing has vast effects on the main political, social and economic phenomena of society like inflation decrease, public welfare level improving, employment level increasing, political competing potency and so on. Today almost all advanced countries and many advancing countries are investing a lot in order to improve efficiency. (Amini, Alireza)

Generally, the relative and absolute importance of agricultural section in economy expansion and growth is obvious to almost everybody.

This section acts an important role in national economy with regard to produce and make employment in most of developing countries in substructural point of view. According to developing economy theories, there should be a sectoral normal sequence among the three sections of agriculture, industry and services.

It means that in a long period of time, first the agricultural part, next the industry and finally the services grow.

So from this point of view, the agricultural section is considered as the growth initiation point and economical development.

One of the most important duties of this section is to supply a society nutritious need which has always been considered important by politicians.

During the past two decades, lots of structural changes have been done in agricultural sector. During this period, different policies like organization subsidy payment and price fixing policy have been used to increase the efficiency.

The purpose of the present study is to evaluate Iran's economical situation in the field of efficiency transformation of Iran's total product factors and its components and international comparison with the worlds 75 countries and tries to answer the below questions such as how the total efficiency of agricultural productivity factors and technical

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proficiency process in Iran have been in comparison with the worlds other countries and how the agricultural efficiency process of Iran's economy has been during the years 1980-2001 .

TOPIC LITERATURE

The agricultural section is one of the most important economy sections of every country which has an important role in producing, exporting , employing and supplying the nutritious need of countries .

Developing the agricultural section is the precondition and essential need of economical development in each country and the other sections won't achieve the flowering, growth and development unless the development barriers are obviated in this section .

Efficiency would be a way to countries economical expanding in economical different sectors such as agricultural sector. Efficiency also causes countries competitive advantage in the global field. Therefore, it has been considered as one of the most important strategic meanings in all levels.(Abdollahpour,Hakimeh)

Economical sector in making a correct relation between efficiency and its other goals. Since all the activities should be focused on proficiency and effectiveness increasing which are discussed in the shape of efficiency, efficiency measurement would be discussed as one of the process element in efficiency improvement and results in optimal use of sources and production quality increasing and effectively performs a basic role in this field.

In order to measure the efficiency in organization which use or have several product factors, the total factor productivity (TFP) is used which is identified as:

$$TFP = \frac{\text{The index of all products}}{\text{The index of all product factors}}$$

Reviewing on the performed studies shows that Piesse and partners Piesse and et al(2001) have analyzed agricultural efficiency and convergence in 18 regions and trade parts in Botswana by using malmquist index during the years 1996-1981. Results showed that firstly, the efficiency growth in regions including stockbreeding was more than other region, and secondly this growth is just beholden to technology changes because the technical proficiency has been reduced.

Rao and coelli(2003) have investigated agricultural efficiency in 93 improved and improving countries by using malmquist index and DEA way during periods 1980-2001. Results showed that the annual efficiency growth of total productivity factors is 2.1 percents and equally has a downswing efficiency of total productivity factors. As far as the efficiency growth changing, Iran is placed in the 54th rank among 93 countries.

Lee(2005) evaluated Korea's growth experience in a study entitled "The efficiency and human capital to support and reinforce Korea's economical growth." Solo way (1957) was used in this study to obtain the total efficiency growth. Results showed that the product rift has been reduced in more than three decades per each worker between Korea and the united states of America and this rapid growth has been related to human and physical capital saving.

Guy blaise and Nkamleu(2008) have investigated the economical function of numerous Africa countries in this study which are concentrated on total efficiency growth of proficiency changing's and factors of 16 countries during the years 1970-2001. The total efficiency factors in sample countries have experienced a positive growth during this period which has been a representative of a good function in agricultural sector that is beholden to technical proficiency changes.

Kent olson and linh vu (2009) have done the farm lands efficiency growth of south minnesota states during the periods of 1993-2006 by the use of DEA way and panel data in which different factors are effective on farm lands efficiency growth. The first factor is the farm land dimension which has a positive effect on efficiency growth. The efficiency growth is much more in larger farmlands than the small ones and another factor is the non-agricultural incomes which have a positive effect on efficiency growth and the last factor is the government agricultural subsidies which have had the negative effect on efficiency growth.

Yahya abtahi (1386) has studies the proficiency changes and economy efficiency of Iran in an international criterion by using the estimation of function in random boundary product and boundary chart of product proficiency. The results show that the efficiency of investment factor in Iran economy has possessed a desirable process by running expanding programs, though this factor's efficiency is so low, in comparison with the other economies. And the average technical proficiency of Iran's economy is below the global economy while the average technological proficiency of Iran's economy is above the global economy and the total efficiency of the product factor in Iran's economy show a great relationship with technical proficiency changes. Thus, the low technical proficiency is considered as one of the key factors in decreasing the total efficiency of Iran's economy factors during some years.

In another research, Abbasian(1386) has calculated the efficiency in different economical sections by the use of statistics, related to increased price. Resulted show that although the country's economical efficiency process has totally been increased with a slight process, the general function of so many economical activities are not justifiable, considering the considerable human and financial sources they have. In this field, the services part would suffer much more problems, because of activities range spread and numerous deluge of working powers.

Data:

In the present research, global grocery organization data was used to investigate and calculate the efficiency index of Iran and other world's countries agriculture (FAO) .

FAO contains a table having different countries statistical data and information in which the present studies have been limited to 75 countries during 1989-1991 and 1999- 2001 , because of locking of being necessary statistical information in this research and Data Envelopment Analysis Was used to measure the efficiency . It should be mentioned that the target function(output) can be maximized in this method according to some specific input or minimize the product factors according to the product specific amount and the efficiency can be calculated for each of these countries individually by the use of Malmquist index .

The efficiency changes can be divided into two sections , the changes resulted from technical and technological proficiency .

Efficiency would be calculable, considering some special inputs and outputs.

Land organization to a force, fertilizer, tractor, farm animals, irrigation and outputs, including making (product) would be agricultural organization in this research.

METHODOLOGY

The quantitative method of efficiency calculating was first introduced to the world by organization of European Economic Co- operation and Development (OECD) in 1950 . These indexes which were presented in a general figure

$$X \text{ factor efficiency} = \frac{\text{output}}{X \text{ factor}}$$

Was used to evaluate institutes, organizations and productive sections function. These criteria which were even being used up to the recent measuring years had some defects and deficiencies.

Cases like the product mode according to different scales (physical dimension, amount and value) , Capital amount , the lack of comparing capability of these indexes with eachother and consequently the lake of possibility in presenting a specified judgement about the function method of institute were the deficiencies in using negligible efficiency indexes . In order to obviate these deficiencies and presenting a suitable method to measure the efficiency of a decision maker section , economists presented the economy measuring method or Stochastic Frontier Analysis function(SFA) base on Farreltable in 1997 . After a while, the data envelopment Analysis method (DEA) was introduced to economical literature base on mathematical programming technique by charnes , cooper and Rhodes(CCR) .

Malmquist index has been used in this essay to calculate efficiency. Efficiency also includes technology changes of an organization besides proficiency changes. Organizations, which are efficient in technical viewpoint (are placed on proficiency boundary) may increase their efficiency by using the profits resulted from criterion or technology change. So, efficiency changes can be divided according to the below relation:

The total efficiency changes of productivity factors = technical proficiency changes × technology changes

And if malmquist index is less than a unit according to the product maximization and each of its components, it means to worsen the organization's function and if it is above one, it will show the organization's improvement.

EMPIRICAL RESULTS

In this section, efficiency changes and effective factors on agricultural part efficiency during the years 1989-1991 and 1999-2001 have been calculated by malmquist index with variant to measure efficiency presumption based on product maximization which the achieved results of DEAP2¹ software have been shown in tables (1) and (2).

¹ Data Envelopment Analysis Program

But it should be mentioned that there is no difference in efficiency measurement whether to choose fixed or unstable efficiency choice, in comparison to (CRS, VRS) product measurement because indeed, both would be used in different distances calculating to make malmquist index. Because all indexes are according to previous year in efficiency calculating and the first year is considered as a basic year, the efficiency indexes would be presented for the second year on.

The total efficiency index of productivity factors are shown in table (1) during the years 1989-1991 by its components separation of product maximization presumption in this direction.

As we know, it will show the efficiency improvement in that period if the malmquist index and its components have the amounts of more than one in product maximization presumption. The achieved results of calculating the components of total efficiency of productivity factors show that Saudi Arabia has had the highest efficiency changes with 7.645 among these countries which this change is beholden to the technical proficiency 4.172 that represent the product as efficient in this country and is also beholden to the management proficiency 3.239.

As it is considered, the world's average agricultural efficiency index is 1.042 during the years 1989-1991 which is an additional change and it means that the product has been increased 4 percents by the same level of expressed consumer organization which relates much more to technological changes level in efficiency. Technological changes level index was calculated 1.080 in this period which represents the increasing change of technological changes level in this period and slight decreased in technical proficiency 0.965, management proficiency 0.991 and measurement proficiency 0.9745 also results in neutralizing some parts of this increase, but it has totally made a 4 percent increase in the product.

So the increase in technological changes level has resulted in efficiency level increase.

Table (1): Efficiency, proficiency and technological index changes of each country in 1989-1991

country	Technical proficiency changes	Technology changes	Management proficiency changes	Measurement proficiency changes	Efficiency changes
Albania	0/682	1/160	0/569	1/034	0/790
Algeria	1/523	1/155	1/623	0/939	1/759
Argentina	1	0/687	1	1	0/687
Australia	0/926	1/122	0/899	1/030	1/039
Austria	1	1/142	1	1	1/142
Blize	0/434	1/125	1	0/434	0/489
Bolivia	1/055	0/810	1/011	1/044	0/855
Botswana	2/444	0/880	1/083	2/257	2/151
Brazil	0/860	1/064	0/860	1/001	0/915
Bulgaria	0/805	1/684	0/811	0/992	1/355
Burundi	1/189	0/916	1	1/189	1/089
Canada	1	1/355	1	1	1/355
Chile	0/898	1/052	0/896	1/002	0/945
China	1	0/980	1	1	0/980
Colombia	0/697	1/035	0/684	1/019	0/721
congo	0/470	1/144	1	0/470	0/538
Costa Rica	0/944	0/778	1	0/944	0/734
Cote D'Ivoire	1/153	1/086	1/426	0/808	1/252
Cuba	0/789	1/125	0/788	1/001	0/888
Denmark	0/861	0/950	0/877	0/982	0/818
Ecuador	0/320	1/053	0/313	1/021	0/337
El Salvador	0/888	1/043	1	0/888	0/926
Finland	1/407	1/019	1/430	0/984	1/433
Frnce	1/034	1/313	0/972	1/064	1/357
Gambia	1/520	1/026	1	1/520	1/559
Germany	1/095	1/106	1/036	1/057	1/211
Ghana	1/073	1/107	1/072	1/001	1/187

<i>Greece</i>	0/806	1/702	0/808	0/997	1/371
<i>Guatemala</i>	0/929	1/048	0/919	1/011	0/974
<i>Guinea</i>	1	0/580	1	1	0/580
<i>Guyana</i>	1	0/884	1	0/596	0/527
<i>Hungary</i>	1	1/392	1	1	1/392
<i>india</i>	0/991	0/739	1	0/991	0/732
<i>Indonesia</i>	1	0/864	1	1	0/864
<i>iran</i>	0/762	1/092	0/808	0/943	0/832
<i>Israel</i>	0/769	1/503	0/849	0/906	1/155
<i>Italy</i>	0/744	1/409	0/776	0/959	1/048
<i>Japan</i>	1	1/013	1	1	1/013
<i>Jordan</i>	0/560	1/710	1	0/560	0/958
<i>Kenya</i>	0/801	1/063	0/808	0/992	0/852
<i>Korea, Republic of</i>	0/793	0/924	0/807	0/983	0/733
<i>Lebanon</i>	1/079	1/692	2/385	0/453	1/826
<i>Lesotho</i>	0/993	0/743	1	0/993	0/738
<i>Libya</i>	0/544	1/587	0/531	1/025	0/863
<i>Madagascar</i>	1	1/005	1	1	1/005
<i>Mali</i>	1/321	0/970	1/281	1/031	1/282
<i>Mexico</i>	0/825	0/897	0/830	0/995	0/740
<i>Morocco</i>	1/523	0/994	1/643	0/927	1/514
<i>New Zealand</i>	0/855	1/324	0/803	1/065	1/132
<i>Oman</i>	1/027	0/953	1	1/027	0/979
<i>Panama</i>	1/669	0/867	1	1/669	1/447
<i>Philippines</i>	1/116	0/822	1/114	1/002	0/917
<i>Poland</i>	1	1/465	1	1	1/465
<i>Portugal</i>	1/030	1/295	1/022	1/008	1/334
<i>Romania</i>	0/816	1/295	0/813	1/004	1/057
<i>Saudi Arabia</i>	4/172	1/833	3/239	1/288	7/645
<i>Senegal</i>	1/058	0/996	1	1/058	1/054
<i>Sierra Leone</i>	1	1/050	1	1	1/050
<i>South Africa</i>	1/039	1/099	1/057	0/983	1/142
<i>Spain</i>	0/684	1/683	0/967	0/707	1/151
<i>Sri Lanka</i>	1/323	0/799	1/325	0/999	1/057
<i>Sudan</i>	1/815	0/516	1/968	0/922	0/937
<i>Sweden</i>	0/773	1/215	0/766	1/010	0/940
<i>Switzerland</i>	1/313	1/270	1/321	0/994	1/667
<i>Syria</i>	0/392	1/373	0/395	0/992	0/538
<i>Thailand</i>	1	0/517	1	1	0/517
<i>Tunisia</i>	2/271	1/257	2/170	1/046	2/855
<i>Turkey</i>	0/898	1/095	0/865	1/038	0/984
<i>Uganda</i>	1	2/185	1	1	2/185
<i>England</i>	1	1/067	1	1	1/067
<i>USA</i>	1	1/040	1	1	1/040
<i>Uruguay</i>	1/085	0/969	1/106	0/981	1/051
<i>Venezuela</i>	0/735	1/065	0/733	1/003	0/783
<i>Zambia</i>	1/211	1/056	1/156	1/048	1/297
<i>Zimbabwe</i>	0/905	1/062	0/898	1/007	0/960
<i>Mean</i>	0/965	1/080	0/991	0/974	1/042

Source: Researcher's calculation

Table (2) shows the efficiency and its components changes during 1999-2001. The highest efficiency changes growth relates to Cuba 3.553, according to this table and increasing in technical proficiency 3.111 and management proficiency 3.114 has resulted to the increase of efficiency changes level and the world's average agricultural efficiency index equals 0.951 that these changes are reductive and it means that the product has been decreased 5 presents by the same level of expressed consumer organizations.

This decrease in efficiency relates much more to management proficiency changes. Management proficiency changes index has been calculated 0.925 and an increasing change is also observed in measurement proficiency 1.040 which some parts of these changes are neutralized by a slight reduce in technical and technological proficiency and has totally made a 5 percent decreasing in production. So the decrease of management proficiency changes has resulted to efficiency decreasing.

Table (2): Efficiency, proficiency and technological index changes of each country in 1999-2001

country	Technical proficiency changes	Technology changes	Management proficiency	Measurement proficiency	Efficiency changes
<i>Albania</i>	1/890	1/123	1/871	1/006	2/123
Algeria	0/740	1/067	0/682	1/084	0/789
Argentina	1	0/689	1	1	0/689
Australia	1/025	1/054	1/113	0/921	1/081
Austria	1	0/976	1	1	0/976
Blize	2/003	0/874	1	2/003	1/751
<i>Bolivia</i>	1/314	0/640	1/273	1/033	0/842
Botswana	0/167	1/173	1	0/167	0/196
Brazil	1/286	0/989	1/287	1	1/273
Bulgaria	1/343	1/022	1/462	0/919	1/373
Burundi	0/882	0/961	1	0/882	0/848
Canada	1	0/912	1	1	0/912
Chile	0/486	1/245	0/496	0/980	0/605
China	1	0/982	1	1	0/982
Colombia	0/979	0/903	0/947	1/033	0/883
<i>congo</i>	0/326	1/056	1	0/326	0/344
Costa Rica	0/849	0/980	0/815	1/041	0/832
Cote D'Ivoire	1/555	0/798	1/262	1/233	1/242
Cuba	3/111	1/142	3/114	0/999	3/553
Denmark	1/161	1/052	1/141	1/018	1/222
Ecuador	2/656	0/894	2/596	1/023	2/375
El Salvador	1/359	0/806	1	1/359	1/095
Finland	1/007	0/846	1/015	0/992	0/852
<i>Frnce</i>	1/421	0/875	1/021	1/392	1/243
Gambia	1/027	1/277	1	1/027	1/312
<i>Germany</i>	1/119	1/164	1/086	1/030	1/302
Ghana	1	0/989	1	1	0/989
<i>Greece</i>	0/774	1/281	0/790	0/980	0/992
Guatemala	0/642	0/849	0/665	0/966	0/545
Guinea	1	0/951	1	1	0/951
Guyana	1/678	1/349	1	1/678	2/265
Hungary	1	1/072	1	1	1/072
india	1/038	0/762	0/953	1/090	0/791
Indonesia	1	0/890	1	1	0/890

<i>iran</i>	1/078	0/879	1/016	1/061	0/948
Israel	0/478	1/176	0/449	1/064	0/561
Italy	1/282	1/185	1/590	0/806	1/518
Japan	1	1/213	1	1	1/213
Jordan	0/223	1/325	0/226	0/987	0/295
Kenya	0/750	0/952	0/788	0/952	0/714
Korea, Republic of	0/743	1/065	0/740	1/005	0/792
Lebanon	0/767	1/412	0/328	2/341	1/083
Lesotho	0/601	1/066	1	0/601	0/641
Libya	0/695	1/391	1/001	0/694	0/966
Madagascar	1	1/069	1	1	1/069
Mali	1	0/885	1	1	0/885
Mexico	1/194	0/998	1/196	0/999	1/191
Morocco	0/493	0/944	0/458	1/076	0/456
New Zealand	0/602	0/973	0/591	1/019	0/586
Oman	0/910	1/041	0/013	69/916	0/947
Panama	0/940	0/936	1	0/940	0/880
Philippines	0/933	1/006	0/941	0/991	0/938
Poland	1	1/441	1	1	1/441
Portugal	0/924	1/222	0/923	1/001	1/130
Romania	1/665	1/130	1/656	1/005	1/881
Saudi	1	0/473	1	1	0/473
Senegal	0/741	0/879	0/912	0/812	0/652
Sierra	1	0/655	1	1	0/655
South Africa	1/127	0/978	1/115	1/010	1/102
Spain	0/991	0/982	1/001	0/991	0/973
Sri Lanka	0/960	0/942	1/001	0/959	0/904
Sudan	1/345	0/984	1/161	1/158	323
Sweden	1/254	0/895	1/262	0/994	1/122
Switzerland	1/196	1/092	1/202	0/995	1/305
Syria	1/310	1/268	1/302	1/006	1/661
Thailand	1	1/048	1	1	1/048
Tunisia	0/624	1/194	0/619	1/007	0/745
Turkey	1/181	0/966	1/320	0/894	1/141
Uganda	1	0/314	1	1	0/314
England	1	0/972	1	1	0/972
USA	1	1/232	1	1	1/232
Uruguay	0/971	1/036	0/983	0/988	1/006
Venezuela	1/818	1/028	1/829	0/994	1/869
Zambia	0/608	0/932	0/616	0/986	0/566
Zimbabwe	0/814	0/985	0/843	0/965	0/801
<i>Mean</i>	0/962	0/988	0/925	1/040	0/951

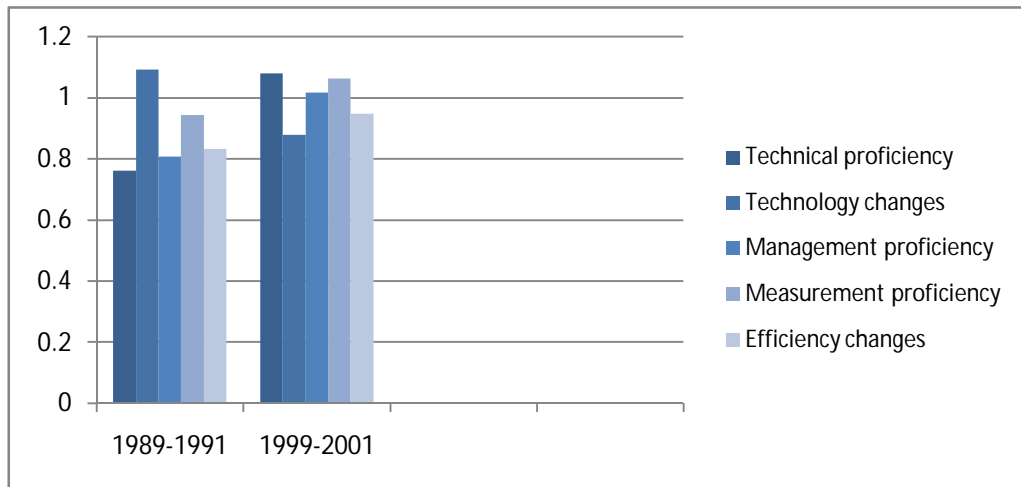
Source : Resercher's calculations

The comparison of total efficiency changes of productivity factors, technical proficiency changes and technological changes in Iran's economy has been shown in chart number (1).

Chart (1) shows that Iran's agricultural efficiency changes have been evaluated negative in periods 1989-1991. The technical proficiency changes index of agricultural part was evaluated 0.762 which represent that the technical proficiency has been reduced in this period and the proficiency decreasing is due to measurement and net technical

(management) inefficiency, considering the change in technology growth which was positive and couldn't have any effect no total efficient growth, and Iran's agricultural production has become much more proficient by passing time during 1999-2001 but couldn't recover the decreasing resulted of technology changes(the product chart decreasing).Both of measurement proficiency changes 1.061 and the changes of net technical proficiency 1.016 have caused the increasing in Iran's agricultural level in this period and the changes in the growth of agricultural sector efficiency have still been negative.

Chart (1). The changes in total efficiency of productivity factors and its components in Iran's economy during the years 1989-1991 and 1999-2001.



Source: Researcher's calculation

Conclusion and suggestions

The study of total efficiency of productivity factors and its organizer components has a worthy importance as the most important economic factors. In the present study, the total efficiency of productivity factors and the technical and technological proficiency changes of Iran's economy have been analyzed in an international measurement by using data and information related to the worlds 75 countries and nonparametric ways.

The result achieved of using this way show that Iran's agricultural efficiency changes have been negative during 1989-1991 and technical proficiency has been reduced in this period and proficiency decreasing was because of measurement and net technical (management) inefficiency, and the change in technology growth had no effect on total efficiency growth, although it was positive. And Iran's agricultural production has become much more proficient by passing time during 1999-2001 but couldn't recover the decrease, resulted of technology changes (the product chart decreasing) and the growth of agricultural sector efficiency has still been negative.

The total efficiency of productivity factors during the years 1989-1991 also shows that the technological changes did result in efficiency level increasing and Saudi Arabia has had the highest growth of efficiency changes during the years 1999-2001 that the decreasing in management proficiency changes has resulted to efficiency and Cuba has had the highest growth in efficiency changes

This thesis suggestion to improve the efficiency of agricultural section includes the below cases:

- 1) The efficiency amounts for Iran's agriculture should be measured annually and the reason should be found in case of efficiency decreasing and try to obviate that problem and the developing factors of efficiency should be reinforced and perpetuated if the efficiency was increased during years.
- 2) Because of the weakness of technology of agricultural section, Iran can have a growth if technological changes are pursued seriously and if it can increase the efficiency and production of agricultural economy by utilizing the appropriate technology with the country situations.
- 3) Attracting and encouraging specialist employees in the course of efficient use of machinery, equipment, etc. of available capacities and utilizing new technologies in agricultural section.
- 4) Utilizing and assigning the rare production sources according to the efficiency criteria .

- 5) Decreasing the distance between effective and virtual production by revealing managers knowledge to have a better combination of sources and consequently reaching to more products and increasing the efficiency of product factors should be considered.
- 6) Considering the capital stock amount which is increasing, investment and presenting Banks facilities and credits cause the efficiency increase in agricultural section product.

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