Estimation of the technical efficiency of tomato crop for protected cultivation in Diyala Governorate in Iraq using Stochastic Frontier Production.

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Abstract

The aim of the research is to estimate the technical efficiency according to the traditional and modern irrigation system for the tomato crop for the agricultural season (2021). and to achieve the aim of the research was to select a random sample of farmers of the tomato crop and were collected data from (120) forms for tomato farmers according to the traditional irrigation system and (60) forms for tomato farmers according to the modern irrigation system using Stochastic Frontier Production (SFA), and that the technical efficiency rate reached (83%) for the traditional irrigation sample, and according to the modern irrigation system, the technical efficiency reached (88%), and this means that the sample farms according to the two systems can increase their production by (17%, 12%) using the same amount of existing resources. The resource coefficient indicated that the two samples are working in the first stage of production, as it reached (1.273 and 1.064) for the two systems, respectively. The amount of lost crop production due to inefficiency was estimated as (89.03, 54.12)/ton, and this leads to financial losses estimated at (44.515, 27.060) million dinars. The research recommended the need to provide government support to farmers by providing agricultural production requirements.

Keywords: Technical efficiency, tomato crop, irrigation system, Stochastic Frontier Production.

1. Introduction

Improving the economic performance of farms is a goal that different agricultural systems seek, and many developing countries, including Iraq, suffer from the misuse of available resources, which leads to a low level of farm production efficiency (Ali, 2015). The technical efficiency of the farm is part of the economic efficiency, which means the ability of the farm to use resources optimally to obtain the highest level of production by using modern technologies and technologies (Ahmed, 2018). The tomato crop is one of the most important vegetable crops and is widely cultivated in tropical, semi-tropical and temperate regions and the ten most productive countries for the tomato crop China India Turkey United States of America Egypt Iran Italy Spain Mexico and Brazil because it is a relatively short-term crop and gives a high return (Chetebo, 2020). As for the cultivation of the crop in Iraq and Diyala governorate, it is widely cultivated, but the economic, environmental and security conditions that the country suffers from caused fluctuation in the cultivation and production of the crop,

and Iraq's production of the crop reached (745670) kg in the year (2020), while Diyala governorate's production reached (24812) kg in the same year. general. However, these quantities do not keep pace with the population increase in the country, which is forced to fill the need through imports, and this leads to an increase in burdens on the state budget (Mishaal, 2017).

Research problem

The problem of the research was that the low levels of production in Diyala Governorate for unprotected agriculture is an indicator that reflects the inefficiency in the use of resources and the accompanying waste in the use of those resources, and then leads to a relative disparity between the actual production and the counterpart of the achiever of economic efficiency, which necessitates the need to use these resources In an economic way, the highest level of economic efficiency is achieved by studying the technical efficiency of tomato production farms to overcome the problems facing the farmers of the study sample.

Search Objective

The research aims to estimate the random border production function, calculate the technical efficiency of the sample farms, identify the factors affecting inefficiency, in addition to estimating the amount of losses from the production of the tomato crop.

Research Hypothesis

The research assumes that there is a discrepancy in achieving the economic efficiency of the tomato production farms. The application of modern methods in measuring the economic efficiency of crop production farms contributes to improving efficiency levels.

Review the sources

The subject of measuring economic efficiency has received great interest among researchers, because of its great importance in providing information that helps raise the level of economic efficiency of farms. The previous studies are the link between the current study and the previous studies, considering that the previous studies enrich knowledge with scientific and practical efforts and represent a balance of knowledge in terms of quantity and quality, and also contribute to determining research methods, analytical tools and the target area on which any new scientific study depends. Estimating economic efficiency using the random boundary function. **(Wahid & et al, 2017)** published a paper entitled (Analysis and Estimation of Technical Efficiency of Tomato Production Farms in Pakistan). A sample of (120) farmers was selected and the maximum potential was used to estimate the Stochastic Frontier Production Cobb-Douglas model. The results of the study showed that the technical efficiency ranged from (0.83) to (0.99) with an average technical efficiency of (0.93), which indicates that the farmer in the study area has high efficiency and uses resources efficiently. Artistic **(Ahmed, 2018)** published a paper entitled (Estimating the efficiency of technical vegetable production in Lattakia in the maximum production function), and the research was conducted on a random sample of 50 farms. Where the results of the production function analysis showed an inverse relationship between the technical efficiency and each of the quantity of

fertilizer, the quantity of pesticides, the quantity of seeds and the age of the farmer, and this indicates the existence of wastage in the use of these quantities of resources, and also showed a direct relationship between the size of the farm and both manual work and automated work. The average technical efficiency was 66%. In (2018) **(Mamary & et al)** published aresearch entitled (Technical Efficiency for Vegetable Crops Production according to Different Irrigation Systems in Mali) 273 farmers were collected. This study found that with regard to tomato production, the technical efficiency degrees are the highest in drip irrigation, followed by sprinkler irrigation and least in the traditional irrigation system. As (93.22, 90.26, 75.46) and averaged for tomato crop (86.31), the research recommended the need to strengthen drip irrigation and sprinkler systems because they provide a good opportunity to achieve superior technical efficiency in the production of vegetable crops. **(Weldegiorgis & et al)** published aresearch in (2018) entitled (The use of agricultural resources in measuring the efficiency of tomato production for small farmers) a sample of 179 tomato producers was used. To estimate the technical and economic efficiencies a stochastic analysis model was used and farmers who produce irrigated tomatoes were technically ineffective in using labor and seed inputs and were not cost-effective in using land, labor, seed and fertilizer inputs. The average levels of technical and economic efficiency of tomato farmers were (0.75 and 0.67), respectively. The degree of education and experience in tomato production and the use of pesticides were variables that affect technical and economic efficiency positively. **(Mwangi & et al)** published in (2020) a paper entitled (Technical Efficiency in Tomato Production among Smallholder Farmers in Kenya) data was collected from 384 randomly selected producers. The stochastic production function was used. The results showed the inefficiency of the respondents with an average technical efficiency of 39.55%, with protected farms being more efficient than the open farm system. Bed size, production systems, seed type, fertilizer, extension and market information had a significant and positive impact on technical efficiency, while land size was large and adversely affected technical efficiency. **(Degefa & et al, 2020)** published a paper entitled (Economic Efficiency of Tomato Production in Ethiopia for Small Farmers) A sample of 113 tomato products was used, and the results showed that the elasticity modulus (1.96), which represents that production is in the first stage. The average technical, allocative and economic competencies reached were (72.88%, 67.17%, 50.13%), respectively. With regard to these producers, the age of the head of the family and educational level were important sources of technical and economic inefficiency, and the size of the family and experience in the tomato were also important sources of technical and allocative inefficiency. In the year (2020) **(Chefebo & et al)** published aresearch entitled (Estimating the technical efficiency of tomato farmers in southern Ethiopia for smallholders) a sample was taken from 175 farmers and the stochastic boundary production function model was applied. The results showed that the average technical efficiency was (81.7%), which indicates the possibility of increasing production by (19.3%) at the same level of the resources used, and the estimates of the inefficiency model showed that the factors (the gender of the head of the family, the hoeing process, the incidence of diseases, the type of variety used) significantly affect the level of technical efficiency of tomato producers. In (2020) **(Khan & et al)** published aresearch entitled (Estimating the Technical Efficiency of Tomato Crop Farms in Baluchistan). The research was based on (100) farms. The result indicates that all explanatory variables have a positive impact on the technical efficiency of farmers except for

pesticides. The average technical efficiency for the farmer (85%), which indicates that the farmer can increase tomato production by (15%) using the same resources, and the results of the inefficiency model showed that the farmers' experiences were negatively associated with technical inefficiency. **(Nakana & et al)** published in (2021) the economic efficiency of tomato production farms in South Africa. A sample was taken from 68 farmers. The experimental results show that the average levels of technical, allocative and economic efficiency are at 0.95, 0.41 and 0.39, respectively. The study also found that the land (farm size), seedlings, labor, pesticides and water had a positive significant relationship with tomato production in the study area.

METHODS OF RESEARCH

The production function method was used random limits to estimate the technical efficiency, a method that takes into account the random error and this method needs a prior description of the model in addition to the possibility of identifying the determinants of inefficiency **(Qasem, 2010**). The methodology is characterized by separating the residuals (E_i) into two parts that have a common variance equal to zero, the first part represents inefficiency and is symbolized by (U_i), while the second part represents other sources of errors and is symbolized by (V_i) and the random error is (**Radam, et al, 2008**).

$$E_i = V_i + U_i$$

V_i = error of measurement.

U_i = inefficiency error.

E_i = the original error of the model.

By characterizing the random border analysis model according to the logarithmic production function, the technical efficiency of tomato farms is estimated (**Sarwar, 2012**)

$$\ln Y = B_0 \ln X + (v_i - u_i)$$

The model includes estimating the tomato crop production function on the economic variables in addition to the variables that affect the inefficiency.

$$\ln(Yi) = \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \beta_4 \ln X_{4i} + \beta_5 \ln X_{5i} + \beta_6 \ln X_{6i} + \beta_7 \ln X_{7i} + \beta_8 \ln X_{8i} + (Vi - Ui)$$

where (Y) Quantities produced from the crop (tomato), β_0: represents the fixed term, β_i: represents the parameters which are unknown factors that can be estimated, Xi: which are the explanatory variables (independent) and include, X_1: the area (dunam), X_2: the amount of seeds (gm), X_3: organic fertilizer X_4: chemical fertilizer (kg), X_5: pesticide (liter), X6: Manual work (hours) X_7: Automated work (hours) X_8: Irrigation process (number of irrigations) in the traditional irrigation system and (number of hours) in the modern irrigation system. V_i: A random variable or measurement error due to variables outside the farm's control, such as weather conditions. U_i: A non-negative random variable related to variables that the farm can control, such as experience and educational level, for example, and it represents technical

inefficiency.

The inefficiency model is:

$$Ui = \delta_0 + \Sigma\delta_i Z_i$$

The inefficiency model in the study sample included the variables that include the social and economic characteristics of the farmers. The following equation shows the inefficiency model:

$$Ui = \delta_0 + \delta_1 Z_{1i} + \delta_2 Z_{2i} + \delta_3 Z_{3i} + \delta_4 Z_{4i}$$

where Z_1: age (years) Z_2: educational level (1 = He does not read and he does not write, 2 = elementary, 3 = middle, 4 = middle school, 5 = higher) Z_3: Number of family members (individual) Z_4: Years of experience in agriculture

Method of estimating lost production

To calculate the amount of lost production due to the inefficiency of the studied crops, the values of the possible production were extracted for each farm separately, according to the following mathematical relationship (**Abdel-Daaem, 2016**)

$$Y_i^* = \frac{Y_i}{TE_i}$$

Where:

Y* = Quantity of possible production for the farm (i)

Y = Quantity of actual farm production (i)

TE = Technical efficiency of production on the farm (i)

Accordingly, it is possible to estimate the amount of lost production, using the actual production from the possible production.

Amount of lost production per farm (i) = Possible Production – Actual Production**.**

Results and discussion

Descriptive statistical analysis of the economic resources of a sample of tomato crop farmers according to the traditional and modern irrigation system.

Table (1, 2) The results of the descriptive statistical analysis of the traditional irrigation sample of the tomato crop indicate that the production rate of one dunum was (12480.21) kg, while the modern irrigation sample reached (12493.33) kg/dunum, while the average amount of seeds used in the field was (14.88, 25) g/dunum in traditional and modern irrigation, respectively. And the rate of use of organic fertilizers in the cultivation of tomato crop for the sample of traditional and modern irrigation (1130.46, 1839.17) kg/dunum, where all the farmers of the sample tend to use this fertilizer as it is of great importance in addition to improving the properties of the soil. Chemical fertilizers, some farmers in the sample of

traditional and modern irrigation depend on compound fertilizers only in agriculture, while others depend on compound fertilizers and phosphate fertilizers. The table shows the rate of their use (275.4, 295.28) kg/dunum, respectively. High phosphorous, high potash, calcium, etc.) and that the difference in the quantities used of chemical fertilizers between one farmer and another is due to the culture of the farmer and the extent to which he adopted the instructions and instructions of the agricultural engineer in addition to his physical condition. The rate of use of fungicides and insecticides in traditional and modern irrigation reached (2.93, 4.24) liters/dunum. Through field visits to agricultural fields, it became clear to us that many farmers rely on preventive control of the field under the guidance of agricultural engineers and this is due to the culture of the farmer that adopts the instructions and guidance of the agricultural engineer. Manual work in the sample of traditional and modern irrigation, it was found that the rate of manual work amounted to (462.8, 609.33) hours/dunum, and the agricultural operations were represented by (cultivation of seedlings, fertilization, watering, hoeing, harvesting). The mechanized work in the traditional and modern irrigation sample amounted to (13.6, 15.36) hours/dunum, where the mechanized work is limited to the tillage and control process. Irrigation Process The average number of irrigations during the agricultural season amounted to (32.15) in the sample of traditional irrigation, and it turns out that the average of irrigation hours reached (90.88) hours/dunum in the sample of modern irrigation. The table shows a summary describing the economic and social variables affecting inefficiency. The average age of farmers for the sample of traditional and modern irrigation was (47, 44) years. The average experience of farmers was (27, 25), while the average number of family members was (9, 8). Individual respectively for both systems. As for the cultivated area of the traditional irrigation sample, it averaged (6.25) dunums, and it amounted to (1, 15) dunams as the lowest and highest cultivated area of the crop at the sample level. (1, 12) acres respectively.

Table (1) Descriptive statistical analysis of the economic variables affecting the production of tomatoes for a sample of traditional irrigation

Variables	Unit	traditional irrigation (n = 120)			
		Mean	St. De	Min	Max
Output	Kg	12480	2852.02	5850	19200
Seeds	Gm	14.88	1.416	10	20
organic fertilizer	Kg	1130.4	252.347	665	1600
chemical fertilizer	Kg	275.40	47.962	185	512
Pesticides	L	2.95	.641	1	5
Handwork	Hour	462.80	142.798	239	1169
Automation	Hour	13.60	5.227	6	32
Irrigation	Number of irrigations	32.15	2.364	26	35
Area	Dunum	6.25	3.491	1	15
the age	Years	47.00	13.344	20	82
Experience	Years	27.03	11.972	5	60
family size	number for people	9.17	5.527	2	40

Source: Prepared by researchers based on the outputs of SPSS V.22

Table (2) Descriptive statistical analysis of the economic variables affecting the production of tomatoes for a sample of modern irrigation

Variables	Unit	modern irrigation (n = 60)			
		Mean	St. De	Min	Max
Output	Kg	12493.3	2433.00	8500	18750
Seeds	Gm	19.92	2.434	15	25
organic fertilizer	Kg	1839.17	507.370	1000	3000
chemical fertilizer	Kg	295.28	62.028	180	415
Pesticides	L	4.24	.847	2	6
Handwork	Hour	609.33	103.549	325	842
Automation	Hour	15.36	3.869	9	27
Irrigation	Hour	90.88	15.845	63	133
Area	Dunum	4.25	1.536	1	12
the age	Years	44.60	13.417	23	75
Experience	Years	25.17	12.796	10	50
family size	number for people	8.42	6.138	2	40

Source: Prepared by researchers based on the outputs of SPSS V.22

Estimation of function Stochastic Frontier Production of the tomato crop according to the traditional and modern irrigation systems.

The product of the analysis of the production function indicates that the factors that have a positive effect on tomato production are (area, seeds, organic fertilizer, chemical fertilizer, pesticides, manual work) and the positive effect of the variables means that an increase in the use of these variables by 1% leads to an increase in quantities Produced from the crop (0.4%, 0.1%, 0.2%, 0.1%, 0.008%, 0.3%) respectively. While the automatic variable and the irrigation process had a negative impact on the production of the tomato crop. As for the modern irrigation system, it turns out that the variables that had a positive effect are (area, seeds, organic fertilizer, pesticides, manual work, irrigation), whereby an increase in the use of these variables by 1% leads to an increase in production by (0.9%, 0.1%, 0.2 %) Both the chemical fertilizer variable and the automated work had a negative impact on the production of the crop, and this indicates an increase in the use of this resource by 1%, which leads to a decrease in the quantities produced from the crop, and this is due to the fact that farmers do not use chemical fertilizer in an optimal manner, which leads to a waste of the resource As for the automated work variable, the protected tomato farms do not require large automated work, since most of the operations are automated, but the sample farmers use the resource greatly, which causes a waste of working hours, which is negatively reflected on the quantities produced. The results of the inefficiency model showed the negative impact in the model for each of the age and educational level of farmers, which shows the positive impact on technical efficiency, that is, farmers with the oldest age and the highest level of education are more efficient than their peers within the traditional irrigation sample, while in the modern

irrigation sample it was for both the educational level and family size The negative impact on the inefficiency model, that is, the positive effect on technical efficiency, as farmers with a higher level of education and larger families are more efficient than their peers in producing tomato. The logarithmic function of the maximum probability reached (43.997) in the traditional irrigation system and reached (16.039) in the modern irrigation system, which indicates the positive impact of technical changes in the random variable and thus on technical efficiency. And the value of (γ)-gamma amounted to (0.609, 0.975) under the conditions of traditional irrigation and modern irrigation, respectively, and it is significant at the level of 5% and 1%, and this means that about 60% and 97% of the differences in inefficiency were due to factors under the control of the farmer and 40% and 3% were due to random factors outside their control, which explains why least squares estimates will not be sufficient in explaining the inefficiency differences between farmers. The value of variance (δ^2) reached (0.036 and 0.669) in the traditional and modern irrigation systems, respectively, and it is statistically significant at a level of significance of 1%, and indicates that the effects of technical inefficiency were the most important component in the total change in production. The results of the analysis indicate that the total flexibility of the variables under study amounted to (1.273, 1.064) in the traditional and modern irrigation systems, respectively, that is, in the phase of increasing returns to farm capacity, meaning that production takes place in the first stage of the production process.

Table (3) Estimation of Stochastic Frontier Production function of the tomato crop according to the traditional and modern irrigation systems.

Variables	traditional irrigation				modern irrigation		
	Par	Cof.	St.	t-r	Cof.	St.	t-r
Constant	β_0	4.244	1.127	3.765***	7.893	1.129	6.989***
Area	β_1	0.400	0.207	1.930**	0.958	0.248	3.867***
Seeds	β_2	0.193	0.207	0.930	0.028	0.210	0.134
organic fertilizer	β_3	0.235	0.081	2.891***	0.140	0.091	1.532*
chemical fertilizer	β_4	0.122	0.108	1.135	-0.114	0.114	-1.004
Pesticides	β_5	0.008	0.100	0.810	0.093	0.118	0.785
Handwork	β_6	0.343	0.094	3.645***	0.285	0.135	2.111**
Automation	β_7	-0.019	0.059	-0.320	-0.343	0.177	-1.942**
Irrigation	β_8	-0.009	0.235	-0.038	0.017	0.188	0.091
inefficiency model							
Constant	δ_0	0.198	0.197	1.004	-2.992	2.354	-1.271
the age	δ_1	-0.001	0.005	-0.270	0.030	0.038	0.794
Education	δ_2	-0.020	0.030	-0.679	-0.062	0.177	-0.351
Experience	δ_3	0.003	0.004	0.723	0.060	0.047	1.282
family size	δ_4	0.001	0.006	0.262	-0.115	0.084	-1.365*
Sigma-squared	$^2\delta$	0.036	0.015	2.425**	0.669	0.491	1.361*
Gama	γ	0.609	0.314	1.937**	0.975	0.021	***

							46.013
LR test	2.219				15.215		
Log likelihood function	43.997				16.039		
RTS	1.273				1.064		

Source: Prepared by researchers based on analysis outputs (Frontier V 4.1)

*** indicates a level of significance at 1%, ** indicates a level of significance at 5% and * indicates a level of significance at 10%

Comparing the technical efficiency of tomato production farms according to the traditional and modern irrigation systems.

The average technical efficiency in the traditional irrigation sample was (0.83), and this indicates that there is an opportunity to increase technical efficiency by (17%) using the same amount of production resources, and the sample was represented by four categories of efficiency, the lowest level was (60%) and the highest level of technical efficiency (96%) and the third category with a level (80% - 89%) included the highest percentage of farms. In the modern irrigation sample, the average technical efficiency was (0.88), which means that farmers within the sample can increase their production by 12% using the same amount of productive resources, and it turns out that there is a deviation from the optimal production by 12%. The technical efficiency categories for the irrigation sample were the talk is in four categories, as it is in traditional irrigation, but the category that included the highest percentage of farms is the fourth category (90% - 99%) with a percentage of 50%. And that the lowest efficiency was (60%) and the highest technical efficiency was (97%), and accordingly, the tomato production farms according to the modern irrigation system are more efficient than traditional irrigation farms.

Table (4) Frequency distribution of technical efficiency.

Efficiency level	**traditional irrigation**		**modern irrigation**	
	Frequency	**%**	**frequency**	**%**
0.60 – 0.69	**5**	**4.2**	**1**	**1.7**
0.70 – 0.79	**33**	**27.5**	**7**	**11.6**
0.80 – 0.89	**59**	**49.2**	**22**	**36.7**
0.90 – 0.99	**23**	**19.1**	**30**	**50**
Total	**120**	**100**	**60**	**100**
Mean	**0.83**		**0.88**	
Minimum	**0.96**		**0.97**	
Maximum	**0.64**		**0.60**	

Source: Prepared by researchers based on analysis outputs in SPSS V22 and Frontier V4.1.

Estimation of the amount of lost production of tomato for the traditional and modern irrigation systems as a result of technical inefficiency.

Table (5) shows the actual production, the possible production and the amount of losses from

the production of the tomato crop. In the traditional irrigation system, the total average of the actual production according to the efficiency level amounted to (329662) kg. The possible production amounted to (418692) kg, and this shows that there is a waste in production amounted to (89030) kg, and the selling price of the crop during the study period was (500) / kg, which means that the amount lost at the sample level is (44,515,000) dinars, and in the modern irrigation system, the total average actual production reached (195,259) kg, while the total average possible production (249379) kg, and the difference between them shows the amount lost in the production of the crop, which amounted to (54120) kg, and through the average selling price of the crop of (500) dinars / kg, the lost amount is (27060000) dinars, and accordingly, access to the possible production must The sample farmers should modify the use of their inputs in agricultural operations in order to achieve an increase in production, and this can only come with continuous training and guidance for farmers in the crop management process.

Table (5) The actual and possible production and the amount of lost production.

Efficiency level	traditional irrigation			modern irrigation		
	actual output (Kg)	possible output (Kg)	lost production (Kg)	actual output (Kg)	possible output(Kg)	lost production (Kg)
0.60 – 0.69	83390	126692	43302	42500	70833	28333
0.70 – 0.79	68412	90701	22289	42643	55602	12959
0.80 – 0.89	85695	100467	14772	51141	59602	8461
0.90 – 0.99	92165	100832	8667	58975	63342	4367
sum	329662	418692	89030	195259	249379	54120

Source: Prepared by researchers based on the data of the questionnaire and on the results of competency levels.

Discuss the results

The tomato crop is one of the important crops that the Iraqi citizen depends on for his daily consumption. The crop is grown in Diyala governorate in a large and wide manner. Farmers rely more on traditional methods of agriculture than modern methods because of the high costs of the modern irrigation system and the low selling prices of the crop led to most farmers resorting to dependence On traditional tourist irrigation, this leads to a great waste of agricultural resources used, as a technical efficiency analysis was conducted for two samples of protected tomato farmers for the agricultural season (2021) and that farmers achieve a good level of efficiency, but farmers who adopt modern methods of irrigation are more technically efficient than farmers who They depend on traditional irrigation, where the average technical efficiency of both samples was (83%, 88%) for traditional and modern irrigation, respectively, and this is consistent with the study of (**Chefebo, 2020**) and the study of (**Khan, 2020**), The results of the analysis also showed that some of the sample farms did not produce on the production possibilities curve, but rather moved away from it in varying proportions, and that farmers did not make optimal use of agricultural resources, resulting in a waste of resources by (27%, 22%) respectively, and this is consistent with the study (**Ali, 2016**). The results of

estimating the factors affecting tomato production indicated that the area of land, the quantity of seeds, the use of fertilizers, and manual work greatly affect the production of tomatoes, and this is consistent with the study (**Asfaw, 2021**) and that automated work and the traditional irrigation method had a weak effect on the production of tomatoes for the sample of traditional irrigation. In the modern irrigation sample, the most influential factors on tomato production were the area of cultivation, the amount of seeds and fertilizers used, manual work and the irrigation process, and this is consistent with the study of (**Malawal, 2020**) The effect of mechanical work and pesticides was not significant on tomato production, and this is consistent with the study (Ahmed, 2018).

Conclusions and Recommendations

The farmers of the modern irrigation sample have a higher efficiency than the farmers of the traditional irrigation sample, as they have the ability to control the agricultural resources used in production, since the drip irrigation system is one of the modern systems that help distribute fertilizers on a regular and equal basis, and this made the modern irrigation sample more efficient, and by estimating The lost quantities of production due to technical inefficiency showed that there are large financial losses, as it was estimated in conventional irrigation (44,515) million dinars. As for modern irrigation, losses due to technical inefficiency amounted to (27,060) million dinars. The research also concluded the absence of government support for production requirements for vegetable crops in general and the tomato crop in particular, and this leads to an increase in the prices of production requirements that incur large costs for farms. The research recommended the need to provide government support to farmers and provide production requirements at reasonable prices, as well as support the selling prices of the crop during the production period and reduce the quantities imported from the tomato crop due to the inability of local production to compete with the prices of imported crops, and activating the role of agricultural extension through the establishment of extension courses and seminars jointly With the agricultural associations to educate farmers about the optimal quantities that can be used to reach full efficiency.

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