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Estimating economic and technical efficiency of mango farms in new lands - Egypt

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Abstract

Mango is the most great economic importance and ranks third in trade after citrus and grapes, especially in the new reclaimed areas, The research aimed to achieve the most efficient use of economic resources available to produce mango crop in Shandorah village in Suez governorate, Egypt, by measuring both the technical efficiency (TE), and economic efficiency (EE), determining the amount of resources that can achieve economic efficiency and estimate the surplus and deficit in the economic resources used in producing this fruit, and assess the difference between the actual used quantities of resources and the optimum quantities that may achieve economic efficiency The research also aims to compare the categories of mango farms most efficient to determine the optimum areas. The research based of primary data, which collected from questionnaires in the concerned area in season 2019. A questionnaire had been made through interviewing 333 of mango responds in Shandora village. The sample have 4 categories according to the area of the farm, the first category less than 1 acer , second category from 1acer to 3 acer, third category from 3 acer to 5 acer and the fourth category more than 5 acer. The goal of the research was to compare the efficiency of these categories, and recommended the optimum size of the farm. The result showed that the fourth category was the best more than the others categories because the farms area in this category is the biggest more than the other farms in the others categories the fourth category was used all the technical efficiency under fixed and variable returns to scale, the best category in allocative efficiency, the optimal because of the farm age the trees stayed in the soil, because the mango is a perennial crop.

Keywords: Technical Efficiency; Economic Efficiency; Mango; Data Envelopment Analysis (DEAP).

1. Introduction

Mango is the most great economic importance and ranks third in trade after citrus and grapes. Mango cultivation is concentrated in Egypt in several governorates especially ELSuez governorate. Mango is native to India and Southeast Asia. It is grown throughout the tropics and subtropics worldwide Until recently, mango fruit was considered an exotic, specialty item in import markets such as the United States and Europe currently, many countries are shipping large volumes of fruit to these markets, and they must compete on the basis of price and quality. Mango is the queen of the fruits of the fruits in the tropics and subtropics. The mango fruit has a high nutritional value, it is rich in nutrients and it contains vitamin A, C and proteins, fats, malic acids, citric and carotene. Mango is a tropical fruit. Egypt was introduced during the reign of Muhammad Ali in 1825, and its cultivated area increased.

It is noticed that there is an annual increase in the cultivated areas of mango due to many factors such as the appropriate climatic conditions for mango production in most governorates of the Republic as well as the success of mango cultivation in different types of lands and the high return of income to farms as a result of mango cultivation if compared to many other fruits .The Scientific Name of(*Mangifera indica* LMango) belongs to the family(*Anacardiaceae*), to which pistachios, cashews, and French pepper trees are attached, mango follows the genus *Mangifera*, this genus includes 11 plant species, most of which are not suitable for consumption., the most important

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of this types is the Indicia type, which is followed by all common and known mango varieties. Mango occupies a prominent place among the fruits grown in Egypt because of its great utility, and is acknowledged as the king of tropical fruits. Various types of processed products are prepared from mango are pickles, chutneys, squash, jam, juices, mango leather and mango pulp. It is an outstanding source of vitamins A and C. Mango is an important crop in new lands, so the research aimed to achieve the most efficient use of economic resources available to produce mango crop in Shandorah village in Suez governorate, It is concedes one of the new lands in Egypt.

1.1. Study Area

Suez governorate from the governorates of Egypt and its capital Suez. Its coast is located on the northern end of the Gulf of Suez, and it has the southern entrance to the Suez Canal and its area is 9002 km². It is a civilized governorate with one city. Distinguished by its unique location, it is considered an entrance to Africa and the countries of southwest and east Asia, which made it a meeting place for international trade and a castle for industry and industrial investment. North of it is bordered by the Ismailia Governorate _ North Sinai Governorate South of it is bordered by the Red Sea Governorate. East is bordered by the South Sinai Governorate. West bounded by Cairo and Giza. The area of the county is 10,056.43 miles²The Suez Canal was named after the city. It was called Qalzam. It is located east of the Nile River Delta, at the southern entrance to the Suez Canal. It is bordered to the North by Ismailia Governorate, to the East by South Sinai, and to the West by Cairo.

Table(1) showed the cultivated areas and the relative importance of the reclamation areas in the Suez governorate the cultivated areas were about 16905acers in the Suez governorate , Shandorah village was selected as the study area because it had equipped reclaimed lands ,it had a agricultural water drained and represented the highest cultivated area on the level of reclamation lands in Suez governorate, Shandorah cultivated area about 3146 acers and the relative importance around 18.61% the Khareg ELzemam ELsharki region represented about 7357acers but didn't selected as a study area because it the desert lands ,didn't occupied lands ,there weren't agricultural water drained and It were consisted of several separated societies in the Suez governorate.

Table 1 The cultivated areas and relative importance of the reclamation areas in Suez governorate

Regions	Areas/Acers	%
Shandorah	3146	18.61
ELraed	770	4.55
Jeniva	1000	5.92
YousefELsebaie	131	0.77
Mohamed Abdo	131	0.77
Mohamed Koriem	1793	10.61
KharegELzemam ELsharki	7357	43.52
SHalofah,Dawliah	2577	15.24
Total	16905	100

Source: selected and collected from Shandorah association (2019).

1.2. Research problem

The mango farms areas differ, which has an impact on the average acre productivity, and this leads to different production inputs with the inability to determine the efficiency of resource use, which may affect the decline, average acre productivity of different areas of farms and the impact of that on total production of mango crop, especially in new lands.

1.3. Objective

The research aimed to achieve the most efficient use of economic resources available to produce mango crop in Shandorah village in Suez governorate, by measuring both the technical efficiency (TE), and economic efficiency (EE), determining the amount of resources that can achieve economic efficiency and estimate the surplus and deficit in the economic resources used in producing this fruit, and assess the difference between the actual used quantities of

resources and the optimum quantities that may achieve economic efficiency The research also aims to compare the categories of mango farms most efficient to determine the optimum areas.

2. Data and Methodology

The primary data collected from questionnaires in the concerned area in season 2019. A questionnaire had been made through interviewing 333 of mango responds in Shandora village. The farmers were divided into four categories; the first category less than 1 acer , second category from 1acer to 3 acer, third category from 3 acer to 5 acer and the fourth category more than 5 acer , The purpose of questionnaire is to know the efficiency of available agricultural resources used by the various levels of mango cultivated areas.

2.1. Meaning of Efficiency

The most common concept of efficiency is” technical efficiency” which means transferring physical inputs such as labor and capital into outputs at the best level of performance. TE is represented by a minimum combination of inputs necessary to produce specific level of outputs, and it measures the success of a firm to produce a maximum quantity of outputs from of a given set of inputs .Consequently, a firm is technically efficient when it cannot increase any output or decrease any input without reducing any other outputs or increasing any other inputs.

It is necessary to mention that this concept of efficiency avoids the need to recourse the precise and the assumptions of weights which reflect the relative importance of the different inputs and outputs. But the existence of prices makes it able to discuss another meaning of efficiency:

There is the “Allocative efficiency” which refers to choosing of inputs to the specific level of outputs at specific level of the prices , where the cost of production is minimum.

Another concept of efficiency is called “cost efficiency “or” Economic efficiency”, which can be achieved when the firms find a combination of inputs that makes them able to produce the desired outputs at minimum cost .CE is the product or mixture of the technical and allocation efficiencies.

2.2. The DEA methodology [9]

There are two basic approaches to estimating a production function: the statistical (or econometric) approach and the non-statistical (or programming approach). Under the statistical approach, the production function can be represented by

$$y_k = f (X_{1k}; \dots ; X_{mk})e^{-u_k} \dots \dots \dots (1)$$

where y_k is the output of producer k ; x_{ik} is the amount of the i th input ($i = 1, \dots, m$) used by producer k ; $u_k \geq 0$ and u_k represents the inefficiency of producer k (Lovell,1993), and a specific distribution is assumed for the u_k [13].

Technical efficiency of firm k (TE_k) is then measured by:

$$TE_k = (X_{1k}, \dots, X_{mk}) = e^{-u_k} \dots \dots \dots (2)$$

particular functional form for the production function is also assumed. Eq. (1) and hence the measures of inefficiency (u_k) can be estimated using a variety of statistical techniques including corrected OLS, modified OLS and maximum likelihood estimation [13]. While these methods provide estimates of the parameters of the frontier, the significance of which can be tested, they are beset by the problem of possible misspecification, In addition, they are not easily applied in a situation where there are multiple inputs and multiple output.

DEA is a non-statistical and non-parametric approach which makes no assumptions regarding the distribution of inefficiencies or the functional form of the production function (although it does impose some technical restrictions such as monotonicity and convexity— see Fa` re, [8]. DEA is widely acclaimed as a useful technique for measuring efficiency, including production possibilities, which are deemed to be one of the common interests of Operational Research and Management Science [4] Instead, it uses the input and output data themselves to compute ,using linear programming methods, the production possibility frontier. The efficiency of each unit is measured as the ratio of weighted output to weighted input, where the weights used are not assigned a priori, but are calculated by the technique itself so as to reflect the unit at its most efficient relative to all others in the dataset. In a multi-output, multi-

input production context, DEA provides estimates of the distance function [10], which is a generalization of the single output production function. The advantages of the distance function approach are, first, that there is no need to make behavioral assumptions about the firms, such as cost minimization or profit maximization and, second, knowledge of input and output prices, in DEA regarding statistical distributions, however, means that there are no estimates or significance tests of the parameters of the production function, a potentially serious problem if results are sensitive to the specification of inputs and outputs.

2.3. DEA assumes constant returns to scale (CRS)

Consider a simple example of five farmers (A, B, C, D, E) producing two outputs, y_1 and y_2 using the input x (for example, the number of undergraduates). Fig. 1 plots the ratio of output y_1 to x against the ratio of output y_2 to x , and the piecewise linear boundary which joins up farmers A, B, C and D is the production frontier. All DMUs on the frontier are efficient since none can produce more of both outputs (for a given input level) than any other unit on the frontier. In contrast, farmer E, which lies inside the frontier, is inefficient, and the ratio O_E/O_{E0} measures farmer E's efficiency relative to the other DMUs in the data set.

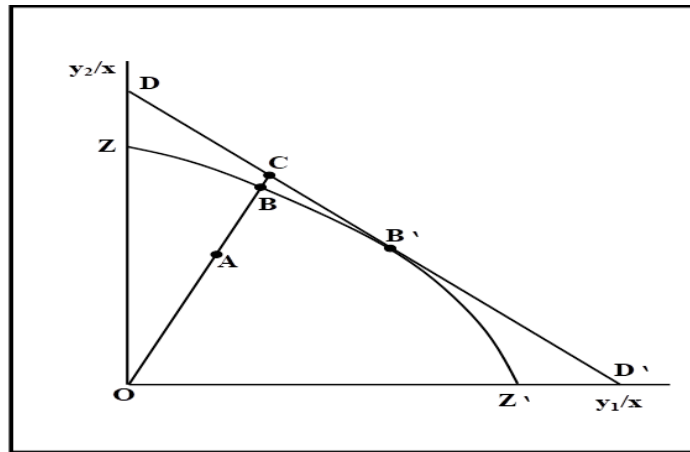


Figure 1 Diagrammatic representation of an output-oriented DEA.

2.4. DEA under variable returns to scale (VRS)

The CRS assumption can be relaxed and the DEA model can be easily modified to incorporate VRS [6]. While choice of orientation does not affect efficiencies under CRS, it does under the assumption of VRS [7], although it has been shown only to have a slight influence in many cases [8]. In an input orientation, outputs are assumed to be fixed and the possibility of proportional reduction in inputs is explored, whereas, in an output orientation, it is inputs which are fixed while the possibility of a proportional expansion of outputs is explored. The latter orientation is deemed the more appropriate in this study where the quantity and quality of the inputs are fixed.

In an output-oriented framework and under the assumption of VRS, the following linear programming model needs to be solved for each DMU in the data set in order to calculate DEA efficiencies.

$$\text{Maximize } \hat{\theta}_k + \varepsilon \sum s_r - s_r = 1 + \varepsilon \sum s_i - s_i = 1 \dots\dots\dots(3).$$

$$\text{subject to } \hat{\theta}_k y_{rk} - \sum \lambda_j n_j = 1 + s_r = 0, r = 1, \dots, s, \dots\dots\dots(4).$$

$$x_{ik} - \sum \lambda_j n_j = 1 - s_i = 0, i = 1, \dots, m, \dots\dots\dots(5).$$

$$\sum \lambda_j n_j = 1, \dots\dots\dots(6).$$

$$\lambda_j, s_r, s_i \geq 0, j = 1, \dots, n, r = 1, \dots, s, i = 1, \dots, m,$$

where there are s outputs and m inputs; y_{rk} is the amount of output r used by DMU k ; x_{ik} is the amount of input i used by DMU k ; and s_r, s_i are the output and input slacks, respectively. Technical efficiency of DMU k is measured by $1/\hat{\theta}_k$; DMU k is efficient if its efficiency score is 1 and all slacks are zero. The VRS dual differs from the CRS dual only by the

inclusion of the constraint in Eq. (6). Comparison of the efficiencies derived from the above with the CRS efficiencies allows the derivation of measures of pure technical efficiency and scale efficiency.

3. Results and discussion

Table (2) presented the development of the cultivated area and production of the mango crop at the level of Suez governorate and at the level of new lands during (2008/2018); the total fruitful area of the mango crop in new lands and Suez governorate levels estimated about 512112, 58123 (acer), respectively, with in average about 26953.26, 3059.105 in the Suez governorate and new lands levels respectively, mango crop cultivated area between the minimum about 8358 acer in 2000 and the maximum of the mango crop cultivated area around 76373 acer in 2011 in new lands level, the minimum of the mango crop in 2000 It was estimated about 120 acer, the maximum cultivated area of mango in 2018 was estimated around 10304 acer.

Table (3) showed the general trend equations for the development of cultivated area of the mango crop in Suez governorate during (2000 - 2018), it has been found from equation (1) the development mango crop cultivated area in new lands level (acer) amounted to 2727.172 by annual increase rate about 0.010, Suez governorate level acer amounted to around 574.6332 by annual increase about 18.78 from the equation (2).

Table 2 Evolution of the cultivated area (acre) and production (ton) of mango crop at the level of and new lands and Suez governorate during (2000 - 2018).

Year	The cultivated area on new lands level(acer)*	The cultivated area on Suez governorate level (acer)*
2000	8358	120
2001	8370	110
2003	8378	142
2004	9938	142
2005	12249	142
2006	13476	220
2007	15282	650
2008	16018	680
2009	17756	2025
2009	19190	1605
2010	15189	1647
2011	76373	2463
2012	20088	2055
2013	48231	4674
2014	37522	5089
2015	39633	5089
2016	42402	10125
2017	50545	10304
2018	53114	10841
Total	512112	58123
Average	26953.26	3059.105

Source: Ministry of Agriculture and Land Reclamation - Economic Affairs Sector - Agricultural Economics Publications, separate numbers

*Acer = 4200m²

Table 3 The development Trend equations of the of mango crop cultivated area (acer) and the production (ton) at the level of Suez governorate and new lands during (2000-2018)

Item	The equation	R\2	F
1 The cultivated area on new lands level(acre)	$Y=-318.456+2727.172$	0.60	8.02**
2 Thecultivatedarea on Suezgovernerate level(acre)	$Y=-2687.53+574.6332$	0.76	6.54**

Y = the estimated value of the dependent variable; X = time during the study period, where T = 1,2,3,
 % Relative change = amount of change / average * 100; Source: calculated from Table (2)

The research estimated scale efficiency of Mango in Shandora and estimate technical efficiency under constant and variable return to scale, estimate economic efficiency and optimum use of the economic resources of the farm.

3.1. Estimating economic scale efficiency for Mango in Shandora village

Estimating scale efficiency for Mango crop and measuring technical efficiency under constant and variable return to scale required using data envelopment analysis (DEA) were explained as follows:

3.1.1. Technical Efficiency

The data collected from willful sample of 333 Mango responds, the farms were divided into four categories; the first category less than 1 acre, second category from 1acres to 3 acres, third category from 3 acres to 5 acres and finally the fourth category more than 5 Acers.

Estimating technical efficiency indicators under fixed and variable returns to scale at the level of the study were showed in table (4).

3.1.2. Technical efficiency for the First Category

It was cleared from table (4)First category included 111 farms ranging in size less than one acres , under fixed return the technical efficiency ranged between 50% and 100% ,the average technical efficiency reached 81%, so the same level of production could be achieved by using only 81% of the used resources and saving 19% of the resources without affecting the level of production, otherwise, under variable return that the technical efficiency ranged between 52% and 100% , the average achieved 88% and could save 12% of the resources without that affected the level of production, the efficiency of capacity for this category ranged between 96% and 100%, the average efficiency of capacity was 93% that it could save 7% of the resources without affecting the level of production, so this category farms lose a part of its used economic resources in the production of mango crop, resulting an increasing in production costs by 7%.

As the results of the study ,under decreasing the efficiency of capacity (Drs) in 36.04% of this category farms, the average fixed return to scale for those farms reached about 87%, The average variable return to scale achieved about 88% and the average capacity efficiency reached about 99% which required reducing those farms production to achieve full technical efficiency, While under increasing the efficiency of capacity in 49.55% of this category farms, where the average fixed return to scale for those farms was 75% and the average variable return to scale reached 87% and the average capacity efficiency was 86%, which required increasing these farms production to achieve full technical efficiency while there were about 14% of this category farms had achieved full technical efficiency and the efficiency of capacity by reached one, these farms would continue at the same level of current production. While there were farms with optimum efficiency of capacity in 14.4%.

So the fourth category was the best more than the others categories because the farms area in this category is the biggest more than the other farms in the others categories the fourth category was used all the technical efficiency under fixed and variable returns to scale.

Table 4 Technical efficiency standards and return of mango crop capacity possessory categories in Shandorah village areas

category	return to scale	crste	vrste	scale	number of farms	%
first category	Drs	0.87	0.88	0.989	40	36.04
	Irs	0.75	0.87	0.862	55	49.55
	constant	1	1	1	16	14.41
	average	0.81	0.88	0.93	111	100
	Max	1	1	1	-	-
	Min	0.5	0.52	0.96	-	-
	Drs	0.97	0.99	0.98	35	22.01
second category	Irs	0.98	0.99	0.99	77	48.43
	constant	1	1	1	47	29.56
	average	0.975	0.99	0.98	159	100
	Max	1	1	1	-	-
	Min	0.48	0.71	0.68	-	-
Thirdcategory	Drs	0.95	0.98	0.97	9	25
	Irs	0.78	0.88	0.89	17	47
	constant	1	1	1	10	28
	average	0.87	0.93	0.93	36	100
	Max	1	1	1	-	-
	Min	0.61	0.68	0.72	-	-
	Drs	0.98	0.99	0.99	9	38
Fourth category	Irs	0.95	0.97	0.98	8	33
	constant	1	1	1	7	29
	average	0.97	0.98	0.98	24	100
	Max	1	1	1	-	-
	Min	0.95	0.96	0.98	-	-

Source: calculated from questionnaire data 2019.

3.1.3. Technical efficiency for the second Category

Second category included 159 farms ranging in size from (1- 3) acres, under fixed return the technical efficiency valid between 48% to 100% ,the average technical efficiency reached 98%, so the same level of production could be achieved by using only 98% of the used resources and saving 2% of the resources without affecting the level of production, otherwise, under variable return It is clear from table (1) that the technical efficiency ranged between 71% to 100% , the average achieved 99% and could save1 % of the resources without that affected the level of production, the efficiency of capacity for this category ranged between 68% and 100%, the average efficiency of capacity was 98% that it could save 2% of the resources without affecting the level of production, so this category farms lose a part of its used economic resources in the production of mango crop, resulting an increasing in production costs by 2%.

As the results of the study ,under decreasing the capacity efficiency (Drs) in 22,01% of this farms category, the average fixed return to scale for those farms reached about 97%, The average variable return to scale achieved about 99% and the average capacity efficiency reached about 98% which required reducing those farms production to achieve full technical efficiency, While under increasing the capacity efficiency (Irs) in 48.43% of this farms category,

where the average fixed return to scale for those farms was about 98% and the average variable return to scale was reached around 99% and the average capacity efficiency was reached about 99%, While there were farms with optimum efficiency of capacity in 29.65%.

3.1.4. Technical efficiency for the third Category

Third category included 36 farms ranging in size from (3- 5) acres, under fixed return the technical efficiency valid between 61% and 100% ,the average technical efficiency reached 87%, so the same level of production could be achieved by using only 89% of the used resources and saving 13% of the resources without affecting the level of production, otherwise, under variable return It is clear from table (4) that the technical efficiency had ranged between 68% and 100% , the average achieved 93% and could save 7 % of the resources without that affected the level of production, the efficiency of capacity for this category ranged between 72% and 100%, the average efficiency of capacity was 93% that it could save 7% of the resources without affecting the level of production, so this category farms lose a part of its used economic resources in the production of mango crop, resulting an increasing in production costs by 7%.. As the results of the study ,under declining the efficiency of capacity (Drs) in 25 % of this category farms, the average fixed return to scale for those farms reached about 95%, The average variable return to scale achieved about 98% and the average capacity efficiency reached about 97% which required reducing these farms production to achieve full technical efficiency, While under increasing the efficiency of capacity (Irs) in 47% of this category farms, where the average fixed return to scale for these farms was 78% and the average variable return to scale reached 88% and the average capacity efficiency was 89%, which required increasing these farms production to achieve full technical efficiency while there were about 11% of this category farms had achieved full technical efficiency and the efficiency of capacity reached one, these farms will continue in producing the same level of current production. While there were farms with optimum efficiency of capacity in 28%.

3.1.5. Technical efficiency for the fourth Category

Third category included 27 farms ranging in size more than (5) acres, under fixed return the technical efficiency valid between 95% and 100% ,the average technical efficiency reached 97%, so the same level of production could be achieved by using only 97% of the used resources and saving 3% of the resources without affecting the level of production, otherwise, under variable return It was cleared from table (4) that the technical efficiency had ranged between 96% and 100% , the average achieved 98% and could save 2 % of the resources without that affected the level of production, the efficiency of capacity for this category ranged between 98% and 100%, the average efficiency of capacity was 98% that it could save 2% of the resources without affecting the level of production, so this category farms lose a part of its used economic resources in the production of mango crop, resulting an increasing in production costs by 2%. As the results of the study ,under decreeing the efficiency of capacity (Drs) in 38 % of this category farms, the average fixed return to scale for those farms reached about 98%, The average variable return to scale achieved about 99% and the average capacity efficiency reached about 99% which required reducing these farms production to achieve full technical efficiency, While under increasing the efficiency of capacity (Irs) in 33% of this farms category, where the average fixed return to scale for these farms was 95% and the average variable return to scale reached 97% and the average capacity efficiency was 98%, which required increasing these farms production to achieve full technical efficiency while there were about 2% of this category farms had achieved full technical efficiency and the efficiency of capacity reached one, these farms will continue in producing the same level of current production. While there were farms with optimum efficiency of capacity in 29%.

So the second category was the best in using the agricultural resources technical efficiency comparing with the others categories under fixed and variable returns to scale.

4. Estimating Allocative and Economic efficiency for Mango in Shandora village

4.1. First category economic efficiency

Table (5) showed first category the economic efficiency for this category ranged between 62% and 100%,the average economic efficiency was 92% under the fixed return to scale , This means the same level of production could achieved under reduction the production costs by 8%. Under the variable return for this category ranged between 65% and 100%,the average economic efficiency was reached about 95%, , means that the same level of production could reached by reducing the costs by 5%.

4.2. Second category economic efficiency

The economic efficiency for second category ranged between 75% and 100% the average economic efficiency was 0.98% under the fixed return to scale, this means the same level of production could achieved under reduction the production costs by 2%. Under the variable return to scale, the economic efficiency of resources ranged between 78% and 100% ,the average economic efficiency reached about 95%, this means that the same level of production could reached by reducing the costs by 5%.

4.3. Third category economic efficiency

Under the fixed return to scale the economic efficiency for third category ranged between 65% and 100% the average economic efficiency was 86%, this means the same level of production could achieved under reduction the production costs by 14%. Under the variable return to scale, the economic efficiency of resources ranged between 75% and 100% ,the economic efficiency average reached about 0.88%, this means that the same level of production could reached by reducing the costs by 12%.

4.4. Fourth category economic efficiency

Under the fixed return to scale the economic efficiency for fourth category ranged between 85% and 100%, the average economic efficiency was 88%, this means the same level of production could achieved under reduction the production costs by 12%. Under the variable return to scale, the economic efficiency of resources ranged between 86% and 100%, the economic efficiency average reached about 0.89%, this means that the same level of production could reached by reducing the costs by 11%.So the second category was the best which used the agricultural resources economic effcincy comparing with the others categories under fixed and variable returns to scale.

Table 5 The economic efficiency of groups sample study in Shandora Village

category	number of farms	TE		AE		CE	
		constant scale	variable scale	constant scale	variable scale	constant scale	variable scale
first category	average	0.92	0.95	0.82	0.83	0.75	0.79
	Max	1	1	0.99	1.00	0.99	1
	Min	111	0.62	0.65	1.00	0.92	0.62
second category	average	0.98	0.95	1.00	0.99	0.98	0.94
	Max	1	1	1.00	1.00	1	1
	Min	159	0.75	0.78	0.73	0.76	0.55
third category	average	0.86	0.88	1.00	1.00	0.86	0.88
	Max	1	1	1.00	1.00	1	1
	Min	36	0.65	0.75	1.00	0.93	0.65
Fourth category	average	0.88	0.89	1.00	1.00	0.88	0.89
	Max	1	1	1.00	1.00	1	1
	Min	24	0.85	0.86	1.00	1.02	0.85

Source: calculated from questionnaire data 2019 & analysis by DEAP.
TE= technical efficiency; AE= Allocative Efficiency = CE/TE; CE = Cost Efficiency

5. Estimating allocative efficiency

5.1. Allocative efficiency about amount of manure for the first category

Table (6) showed the, allocative efficiency of resources used for this category ranged between 10% and 36.7%, the actual average allocative efficiency was 22% under the fixed return to scale which means reallocating the economic resources will save 78% of the production costs in this category, the optimal average allocative efficiency was 20% under the fixed return, so this category farms were used efficiency resources inputs for the mango crop production, resulting an increasing in production inputs by 3.18%.

Under the variable return table (7) presented that, allocative efficiency ranged between 10% and 36.7%, the average allocative efficiency was 22% under the variable return to scale which means reallocating the economic resources

about 78% from amount of manure^{m3} in this category, the optimal average allocative efficiency was 20% under the variable return so this category farms lose a part of its used efficiency resources inputs for mango crop production, resulting an increasing in production costs by 9.09%.

5.2. Allocative efficiency about amount of manure for the Second Category

Table (6) showed the allocative used efficiency production resources for this category ranged between 45% and 135% , the average allocative efficiency was 99% under the fixed return to scale which means that reallocating the economic resources was about 1% of the production resources in this category ,so reused about 3.48%from output production the optimal average was 95.6% table (7)showed under the variable return the allocative efficiency of resources used for this category ranged between 45%and135% the average allocative efficiency reached about 99% this means reallocating the economic resources will save 1% of the production costs so reused about 7.42%from output production the optimal average was about92% from amount of manure^{m3} in this category, so this category farms lose a part of its used economic resources in the production of mango crop, resulting an increasing in production costs by 7.42%.

5.3. Allocative efficiency about amount of manure for the third Category

Table (6) showed the allocative used resources efficiency for this category ranged between 120% and 100% , the average allocative efficiency was 160% which means used the efficiency inputs resources production about 60% the optimal average was 150.15% under the fixed return to scale which means that reallocating the economic resources 60% of the input production in this category, Table(7)presented the allocative efficiency of resources used for this category ranged between 120% and 160% under the variable return to scale, the average allocative efficiency reached about 0.956this means the reallocating the economic resources will save 4% of the production costs, the optimal average was 140.14%, so this category farms lose a part of its used economic resources in the production of mango crop, resulting an increasing in production costs by 12.41%.

5.4. Allocative efficiency about amount of manure for the fourth category

Table (6) showed the, allocative efficiency of resources used for this category ranged between 200% and 880%, the actual average allocative efficiency was 459% under the fixed return to scale which means reallocating the efficiency economic resources was about 359%from resources production inputs will save 78% of the production costs in this category, the optimal average allocative efficiency was 451.71% under the fixed return, so this category farms reused about1.6% from economic resources inputs in the mango crop production,

Under the variable return table (7) presented that, allocative efficiency ranged between200% and 880%, the average allocative efficiency was 459% under the variable return to scale which means reallocating the economic resources about 78% from amount of manure^{m3} in this category, the optimal average allocative efficiency was 351.6% under the variable return so o this category farms reused about23.41% from economic resources inputs in the mango crop production.

-So the fourth category was the best in using the agricultural resources allocative efficiency about amount of manure comparing with the others categories.

5.5. Allocative efficiency about farm age for the first category

Table (6) showed the, allocative efficiency of resources used for this category ranged between 3% and7%, the actual average allocative efficiency was 4.52% under the fixed return to scale which means reallocating the economic resources will save about 95.5% of the production costs in this category, the optimal average allocative efficiency was 4.4% under the fixed return, so this category farms reused about 2.71% economic resources inputs in the mango crop production.

Under the variable return table (7) presented that, allocative efficiency ranged between3% and 7%, the average allocative efficiency was 4.5%under the variable return to scale which means reallocating the economic resources about 95% from amount farm age in this category, the optimal average allocative efficiency was 20% under the variable return so this category farms lose a part of its used economic resources in the production of mango crop, resulting an increasing in production costs by 9.09%.

5.6. Allocative efficiency about farm age for the second category

Table (6) showed the, allocative efficiency of resources used for this category ranged between 7% and 10%, the actual average allocative efficiency was 7.97% under the fixed return to scale which means reallocating the economic resources will save about 92.03% of the production costs in this category, the optimal average allocative efficiency was 7.5% under the fixed return, so this category farms reused about 5.95% from economic resources inputs in the mango crop production.

Under the variable return table (7) presented the allocative efficiency ranged between 7% and 10%, the average allocative efficiency was 7.97% under the variable return to scale which means reallocating the economic resources about 92.03% from amount farm age in this category, the optimal average allocative efficiency was 5.95% under the variable return so this category farms lose a part of its used economic resources in the production of mango crop, resulting an increasing in production costs by 5.95%.

5.7. Allocative efficiency about farm age for the third category

Under the fixed return to scale table (6) showed the, allocative efficiency of resources used for this category ranged between 8% and 10%, the actual average allocative efficiency was 9.28% which means reallocating the economic resources will save about 90.72% of the production costs in this category, the optimal average allocative efficiency was 9% under the fixed return, so this category farms reused about 3.02% from economic resources inputs in the mango crop production.

Under the variable return table (7) presented the allocative efficiency ranged between 8% and 10%, the average allocative efficiency was 8.3% under the variable return to scale which means reallocating the economic resources about 91.7% from amount farm age in this category, the optimal average allocative efficiency was 9% under the variable return so this category farms lose a part of its used economic resources in the production of mango crop, resulting an increasing in production costs by 3.02%.

5.8. Allocative efficiency about farm age for the fourth category

Under the fixed return to scale table (6) showed the, allocative efficiency of resources used for this category ranged between 10% and 19%, the actual average allocative efficiency was 13.9% which means reallocating the economic resources will save about 86.1% of the production costs in this category, the optimal average allocative efficiency was 13.77% under the fixed return, so this category farms reused about 0.59% from economic resources inputs for the mango crop production.

Under the variable return table (7) presented the allocative efficiency ranged between 10% and 19%, the average allocative efficiency was 13.85% under the variable return to scale which means reallocating the efficiency production resources inputs around 86.15% from amount farm age in this category, the optimal average allocative efficiency was 13.77% under the variable return so this category farms lose a part of its used economic resources in the production of mango crop, resulting an increasing in production costs by 0.59%.

5.9. Allocative efficiency about human labor number for first category

Under the fixed return to scale table (6) showed the, allocative used efficiency of resources inputs for this category ranged between 6% and 22%, the actual average allocative efficiency was 13% which means reallocating the resources inputs will save about 87% from the human labor in this category, the optimal average allocative efficiency was 12% under the fixed return, so this category farms used about 7.7% from efficiency resources inputs for the mango crop production.

Under the variable return table (7) presented the allocative efficiency ranged between 6% and 22%, the average allocative efficiency was 12% under the variable return to scale which means reallocating the efficiency production resources inputs around 88% from human labor number in this category, the optimal average allocative efficiency was 7.7% under the variable return so this farm category were used efficiency resources inputs for the mango crop production.

5.10. Allocative efficiency about human labor number for second category

Under the fixed return to scale table (6) showed the, allocative used efficiency of resources inputs for this category ranged between 24% and 72%, the actual average allocative efficiency was 53% which means reallocating the resources inputs will save about 47% from the human labor in this category, the optimal average allocative efficiency

was 52% under the fixed return, so this farm category used about 1.9% from efficiency resources inputs for the mango crop production.

Under the variable return table (7) presented the allocative efficiency ranged between 24% and 72%, the average allocative efficiency was 53% under the variable return to scale which means reallocating the efficiency production resources inputs around 47% from human labor number in this category, the optimal average allocative efficiency was 50% under the variable return so this farm category were used efficiency resources inputs for the mango crop production was about 5.66%.

5.11. Allocative efficiency about human labor number for third category

Table (6) showed under the fixed return to scale, allocative used efficiency of resources inputs for this category ranged between 72% and 120%, the actual average allocative efficiency was 96% which means reallocating the resources inputs will saved about 4% from human labor number in this category, the optimal average allocative efficiency was 95% under the fixed return, so this farm category used about 1.9% from efficiency resources inputs for the mango crop production.

table (7) presented return allocative efficiency under the variable ranged between 72% and 120%, the average allocative efficiency was 96% under the variable return to scale which means saved around 4% from human labor number in this category, the optimal average allocative efficiency was 90% under the variable return so this farm category were used efficiency resources inputs for the mango crop production was around 6.25%.

5.12. Allocative efficiency about human labor number for fourth category

Table (6) showed under the fixed return to scale, allocative used efficiency of resources inputs for this category ranged between 120% and 528%, the actual average allocative efficiency was 275% which means reallocating the resources inputs will save about 175% from the human labor number in this category, the optimal average allocative efficiency was 275% under the fixed return., table (7) presented return allocative efficiency under the variable ranged between 120% and 528%, the average allocative efficiency was 275% under the variable return to scale this category, the optimal average allocative efficiency was 274% which means saved around 1% from human labor number in under the variable return so this farm category were used efficiency resources inputs for the mango crop production was about 0.36%.

5.13. Allocative efficiency about chemical fertilizers for first category

Table (6) showed under the fixed return to scale, allocative used efficiency of resources inputs for this category ranged between 100% and 366.7%, the actual average allocative efficiency was 211.5% which means reallocating the resources inputs were saved about 111.5% from the chemical fertilizers in this category, the optimal average allocative efficiency was 210.77% under the fixed return, which means saved about 0.345% from production resources inputs. Table (7) presented return allocative efficiency under the variable ranged between 100% and 366.7, the actual average 211.5% which means saved around 111.5% from inputs, the optimal average allocative efficiency was 189.8% which means saved around 89.8% from inputs under the variable return so this farm category were used efficiency resources inputs for the mango crop production was about 6.02%.

5.14. Allocative efficiency about chemical fertilizers for second category

Table (6) showed under the fixed return to scale, allocative used efficiency of resources inputs for this category ranged between 400% and 1200%, the actual average allocative efficiency was 881.8% which means reallocating the resources inputs were saved about 781.8% from the chemical fertilizers in this category, the optimal average allocative efficiency was about 837.73% under the fixed return, which means saved about 5% from production resources inputs. Table (7) presented return allocative efficiency under the variable ranged between 400% and 1200% the actual average 881.8% which means saved around 781.8% from inputs, the optimal average allocative efficiency was 773.7% which means saved around 673.7% from inputs under the variable return so this farm category were used efficiency resources inputs for the mango crop production was about 16.33%.

5.15. Allocative efficiency about chemical fertilizers for third category

Table (6) showed under the fixed return to scale, allocative used efficiency of resources inputs for this category ranged between 1200% and 2000%, the actual average allocative efficiency was 1601.111% which means reallocating the resources inputs were saved about 1501.111% from the chemical fertilizers in this category, the optimal average

allocative efficiency was 1499% under the fixed return, which means saved about 1399% from production resources inputs this category used about 6.38% from resources inputs of mango production .

Table (7) presented return allocative efficiency under the variable ranged between 1200% and 2000% the actual average around 1099% which means saved around 999. % from resources inputs, the optimal average allocative efficiency was 502.21% which means saved around 402.21% from resources inputs under the variable return so this farm category were used efficiency resources inputs for the mango crop production was about 31.37%.

5.16. Allocative efficiency about chemical fertilizers for fourth category

Table (6) showed under the fixed return to scale, allocative used efficiency of resources inputs for this category ranged between 120% and 528%, the actual average allocative efficiency was 275.6% which means reallocating the resources inputs was saved about 175.6% from the chemical fertilizers in this category, the optimal average allocative efficiency was 256% under the fixed return, which means saved about 156% from production resources inputs in this category was used about 25.4% from resources inputs of mango production .

Table (7) presented allocative efficiency under the variable return ranged between 120% and 528% the actual average was around 275.6% which means saved around 175.6% from resources inputs, the optimal average allocative efficiency was 205. 7% which means saved around 105.7% from resources inputs under the variable return so this farm category were used efficiency resources inputs for the mango crop production was about 25.4%.

So the third category was the best in using the agricultural resources economic efficiency comparing with the others categories under fixed and variable returns to scale.

5.17. Allocative efficiency about trees numbers for first category

Table (6) showed under the fixed return to scale, allocative used efficiency of resources inputs for this category ranged between 62.5% and 229.17%, the actual average allocative efficiency was 132.23% which means reallocating the resources inputs was saved about 32.23% in this category, the optimal average allocative efficiency was 138.8% under the fixed return, which means saved about 38.8% from production resources inputs in this category ,this category was used about 1.97% from resources inputs of mango production .

Table (7) presented allocative efficiency under the variable return ranged between 26.5% and 229.17% the actual average was around 132.23% which means saved around 32.23% from resources inputs the optimal average allocative efficiency was 130.8% which means saved around 30.8% from resources inputs under the variable return so this farm category were used efficiency resources inputs for the mango crop production was about 1.08%.

5.18. Allocative efficiency about trees numbers for second category

Table (6) showed under the fixed return to scale, allocative used efficiency of resources inputs for this category ranged between 250% and 750%, the actual average allocative efficiency was 551.10% which means reallocating the resources inputs was saved about 451.10% in this category, the optimal average allocative efficiency was 550.45% under the fixed return, which means saved about 450.45% from production resources inputs in this category ,this category was used about 2.20% from resources inputs of mango production.

Table (7) presented allocative efficiency under the variable return ranged between 250% and 750% the actual average was around 551.10% which means saved around 451.10% from resources inputs the optimal average allocative efficiency was 550% which means saved around 450% from resources inputs under the variable return so this farm category were used efficiency resources inputs for the mango crop production was about 0.20%.

5.19. Allocative efficiency about trees numbers for third category

Table (6) showed under the fixed return to scale, allocative used efficiency of resources inputs for this category ranged between 750% and 1250%, the actual average allocative efficiency was 1000.69 % which means reallocating the resources inputs was saved about 900.69% in this category, the optimal average allocative efficiency was 990.6% under the fixed return, which means saved about 890.6% from production resources inputs in this category ,this category was used about 1.01% from resources inputs of mango production .

Table (7) presented allocative efficiency under the variable return ranged between 750% and 1250% the actual average was around 1000.69% which means saved around 900.69% from resources inputs, the optimal average

allocative efficiency was 990% which means saved around 890% from resources inputs under the variable return so this farm category were used efficiency resources inputs for the mango crop production was about 1.07%.

5.20. Allocative efficiency about trees numbers for fourth category

Table (6) showed under the fixed return to scale, allocative used efficiency of resources inputs for this category ranged between 2000% and 8800%, the actual average allocative efficiency was 4592.6% which means reallocating the resources inputs was saved about 4492.6% in this category, the optimal average allocative efficiency was 4490% under the fixed return, which means saved about 4390.45% from production resources inputs in this category ,this category was used about 2.23% from resources inputs of mango production.

Table (7) presented allocative efficiency under the variable return ranged between 2000% and 8800% the actual average was around 4592.6% which means saved around 4492.6%from resources inputs, the optimal average allocative efficiency was 4450% which means saved around 4350% from resources inputs under the variable return so this farm category were used efficiency resources inputs for the mango crop production wasabout. 3.10%.

So the fourth category was the optimal because of the farm age the trees stayed in the soil, because the mango is a perennial crop.

5.21. Allocative efficiency about area for first category

Table (6) showed under the fixed return to scale, allocative used efficiency of resources inputs for this category ranged between 6% and 22%, the actual average allocative efficiency was 12.7% which means reallocating the resources inputs was saved about 87.3% in this category, the optimal average allocative efficiency was 12% under the fixed return, which means saved about 88% from production resources inputs in this category ,this category was used about 5.5% from resources inputs of mango production.

Table (7) presented allocative efficiency under the variable return ranged between 6% and 22% the actual average was around 12.7% which means saved around 87.3%from resources inputs, the optimal average allocative efficiency was 12% which means saved around 88% from resources inputs under the variable return, so this farm category were used efficiency resources inputs for the mango crop production was about 5.5%.

5.22. Allocative efficiency about area for second category

Table (6) showed under the fixed return to scale, allocative used efficiency of resources inputs for this category ranged between 1% and 3%, the actual average allocative efficiency was 2.20% which means reallocating the resources inputs was saved about 97.8% in this category, the optimal average allocative efficiency was 2% under the fixed return, which means saved about 98% from production resources inputs in this category ,this category was used about 9.3% from resources inputs of mango production.

Table (7) presented allocative efficiency under the variable return ranged between 1% and 3% the actual average was around 2.2% which means saved around 97.8%from resources inputs, the optimal average allocative efficiency was 2% which means saved around 98% from resources inputs under the variable return, so this farm category were used efficiency resources inputs for the mango crop production was about 9.3%.

5.23. Allocative efficiency about area for third category

Table (6) showed under the fixed return to scale, allocative used efficiency of resources inputs for this category ranged between 3% and 5%, the actual average allocative efficiency was 4% which means reallocating the resources inputs was saved about 96% in this category, the optimal average allocative efficiency was 4% under the fixed return, which means saved about 96% from production resources inputs in this category ,this category was used about 0.07% from resources inputs of mango production.

Table 6 compared between actual and optimal use of the most important economic resources under the constant return to scale for mango crop in Shandora village.

categories		The amount of manure m3			Age of farm			Number of human labor man/day					
		actual	optimal	surplus or deficit	surplus or deficit%	actual	optimal	surplus or deficit	surplus or deficit%	actual	optimal	surplus or deficit	surplus or deficit%
first category	AV	22	22.7	-0.7	-3.18	4.52	4.4	0.12	2.71	13	12	1	7.69
	MAX	36.7	29	7.7	20.98	7	7	0	0.00	22	21	1	4.55
	MIN	10	9.35	0.65	6.50	3	3	0	0.00	6	5	1	16.67
second category	AV	99	95.55	3.45	3.48	7.97	7.5	0.47	5.95	53	52	1	1.89
	MAX	135	120.9	14.1	10.44	10	9.8	0.2	2.00	72	71.5	0.5	0.69
	MIN	45	43	2	4.44	7	6.99	0.01	0.14	24	23.19	0.81	3.37
third category	AV	160	150.15	9.85	6.16	9.28	9	0.28	3.02	96	95	1	1.04
	MAX	200	190.54	9.46	4.73	10	9.9	0.1	1.00	120	120.5	-0.5	-0.42
	MIN	120	99	21	17.50	8	7.5	0.5	6.25	72	75.1	-3.1	-4.31
Fourth category	AV	459	451.77	7.23	1.58	13.9	13.77	0.08	0.59	275	275	0	0.00
	MAX	880	870.95	9.05	1.03	19	18.89	0.11	0.58	528	521.5	6.5	1.23
	MIN	200	198.27	1.73	0.86	10	9.88	0.12	1.20	120	118.5	1.5	1.25

Continue table 6 Compared between actual and optimal use of the most important economic resources under the constant return to scale for mango crop in Shandora village

categories		chemical fertilizers kg				Number of tree				Aera (acer)*			
		actual	optimal	surplus or deficit	deficit%	actual	optimal	surplus or deficit	deficit%	actual	optimal	surplus or deficit	deficit%
first category	AV	211.5	210.77	0.73	0.345	132.226	138.8	-6.57402	-4.97	12.69	12	0.69369	5.46
	MAX	366.7	352.5	14.2	3.872	229.167	210.6	18.56667	8.10	22	21	1	4.55
	MIN	100	90	10	10.000	62.5	61	1.5	2.40	6	6	0	0.00
second category	AV	881.761	837.73	44.03101	4.994	551.101	550.45	0.650629	0.12	2.204	2	0.2044	9.27
	MAX	1200	1088	112	9.333	750	720	30	4.00	3	3	0	0.00
	MIN	400	358	42	10.500	250	230	20	8.00	1	1	0	0.00
third category	AV	1601.111	1498.9	102.2111	6.384	1000.69	990.55	10.14444	1.01	4.003	4	0.00278	0.07
	MAX	2000	1831.34	168.66	8.433	1250	1210	40	3.20	5	4.9	0.1	2.00
	MIN	1200	1111	89	7.417	750	745	5	0.67	3	2.9	0.1	3.33
Fourth category	AV	275.5556	255.7	19.85556	7.206	4592.59	4490	102.5926	2.23	11.48	11.5	-0.01852	-0.16
	MAX	528	522.9	5.1	0.966	8800	8780	20	0.23	22	21	1	4.55
	MIN	120	110	10	8	2000	1980	20	1.00	5	4.9	0.1	2.00

Source: calculated from questionnaire data 2019.

acer=4200m² *

Table 7 Compared between actual use and optimal use of the most important economic resources under variable return to scale for Mango crop in Shandora Village

categories	Amount of manure (m3)			Farm age			Human labor number (man/day)						
	actual	optimal	surplus or	actual deficit%	actual	optima	surplus or	optimal	actual	optimal	surplus or	surplus or	
			deficit				deficit%				deficit		deficit%
first category	AV	22	20	2	9.09	4.52	4.5	0.02	0.50	13	12	1	7.69
	MAX	36.7	22.75	13.95	38.01	7	7	0.00	0.00	22	20	2	9.09
	MIN	10	10.35	-0.35	-3.50	3	3	0.00	0.00	6	4	2	33.33
second category	AV	99	91.65	7.35	7.42	7.97	7.5	0.47	5.95	53	50	3	5.66
	MAX	135	122.6	12.4	9.19	10	9.8	0.20	2.00	72	70.2	1.8	2.50
	MIN	45	40	5	11.11	7	6.99	0.01	0.14	24	20.19	3.81	15.88
third category	AV	160	140.14	19.86	12.41	9.28	9	0.28	3.02	96	90	6	6.25
	MAX	200	150.25	49.75	24.88	10	9.9	0.10	1.00	120	110.5	9.5	7.92
	MIN	120	95	25	20.83	8	7.5	0.50	6.25	72	70.8	1.2	1.67
Fourth category	AV	459	351.57	107.43	23.41	13.85	13.77	0.08	0.59	275	274	1	0.36
	MAX	880	800.05	79.95	9.09	19	18.89	0.11	0.58	528	520.5	7.5	1.42
	MIN	200	199.77	0.23	0.11	10	9.88	0.12	1.20	120	119	1	0.83

Source: calculated from questionnaire data 2019

Continue table 7 Compared between actual and optimal use of the most important economic resources under variable return to scale formango crop in Shandorah village

categories	Chemical fertilizers (kg)				Trees number				Aeras (acer)*				
	actual	optimal	surplus or	actual	actual	optimal	surplus or	optimal	actual	optimal	surplus or	surplus or	
			deficit	deficit%			deficit	deficit%			deficit	deficit%	
first category	AV	211.5	198.77	12.73	6.019	132.226	130.8	1.425976	1.08	12.69	12	0.69369	5.46
	MAX	366.7	252.5	114.2	31.143	229.167	220.6	8.566667	3.74	22	20	2	9.09
	MIN	100	50	50	50.000	62.5	60	2.5	4.00	6	6	0	0.00
second category	AV	881.761	737.73	144.031	16.334	551.101	550	1.100629	0.20	2.204	2	0.2044	9.27
	MAX	1200	988	212	17.667	750	700	50	6.67	3	3	0	0.00
	MIN	400	328	72	18.000	250	200	50	20.00	1	1	0	0.00
third category	AV	1601.11	1098.9	502.2111	31.366	1000.69	990	10.69444	1.07	4.003	4	0.00278	0.07
	MAX	2000	1531.34	468.66	23.433	1250	1200	50	4.00	5	4.9	0.1	2.00
	MIN	1200	1011	189	15.750	750	740	10	1.33	3	2.9	0.1	3.33
Fourth category	AV	275.56	205.7	69.85556	25.351	4592.59	4450	142.5926	3.10	11.48	11	0.48148	4.19
	MAX	528	512.9	15.1	2.860	8800	8750	50	0.57	22	21	1	4.55
	MIN	120	0	120	100.000	2000	1990	10	0.50	5	4.9	0.1	2.00

Source: calculated from questionnaire data 2019.

Table (7) presented allocative efficiency under the variable return ranged between 3% and 5% the actual average was around 4% which means saved around 96% from resources inputs, the optimal average allocative efficiency was 4% which means saved around 96% from resources inputs under the variable return, so this farm category were used efficiency resources inputs for the mango crop production was about 2%.

5.24. Allocative efficiency about area for fourth category

Table (6) showed under the fixed return to scale, allocative used efficiency of resources inputs for this category ranged between 5% and 22%, the actual average allocative efficiency was 11.48% which means reallocating the resources inputs was saved about 88.52% in this category, the optimal average allocative efficiency was 11.5% under the fixed return, which means saved about 88.5% from production resources inputs in this category ,this category was used about 0.16% from resources inputs of mango production.

Table (7) presented allocative efficiency under the variable return ranged between 5% and 22% the actual average was around 11.48% which means saved around 88.52% from resources inputs, the optimal average allocative efficiency was 11% which means saved around 89% from resources inputs under the variable return, so this farm category were used efficiency resources inputs for the mango crop production was about 4.2%.

6. Conclusion

Mango is the most great economic importance and ranks third in trade after citrus and grapes, especially in the new reclaimed areas, The research aimed to achieve the most efficient use of economic resources available to produce mango crop in Shandorah village in Suez governorate a, by measuring both the technical efficiency (TE), and economic efficiency (EE), determining the amount of resources that can achieve economic efficiency and estimate the surplus and deficit in the economic resources used in producing this fruit, and assess the difference between the actual used quantities of resources and the optimum quantities that may achieve economic efficiency The research also aims to compare the categories of mango farms most efficient to determine the optimum areas. Shandorah village was selected as the study area because it had equipped reclaimed lands ,it had a agricultural water drained and represented the highest cultivated area on the level of reclamation lands in Suez governorate, Shandorah cultivated area about 3146 acers and the relative importance around 18.61% the Khareg ELzemam ELsharki region represented about 7357acers but didn't selected as a study area because it the desert lands ,didn't occupied lands ,there weren't agricultural water drained and It were consisted of several separated societies in the Suez governorate. A questionnaire had been made through interviewing 333 of mango responds in Shandora village. The sample have 4 categories according to the area of the farm, the first category less than 1 acer , second category from 1acer to 3 acer, third category from 3 acer to 5 acer and the fourth category more than 5 acer. The goal of the research was to compare the efficiency of these categories, and recommended the optimum size of the farm. The results of the research showed that the technical efficiency under fixed return to scale reached 98 % for second category and reached about 97% for fourth category, while it was about 81% , 87% for the first and for the third categories respectively. With the assumption of variable return to scale, technical efficiency was about 99% for the second category, 98% for fourth category and about 93% &88% for the third and first categories, respectively. The economic efficiency for the categories showed that, the second category was more than the firth category by 23%, 15% and more than the third category by 12%, 6% under fixed and variable return to scale, respectively. And more than the fourth category by 10%, 5% under fixed and variable return to scale, respectively. The fourth category should be reduce about 1.58% under fixed to scale, the amount of reduced fertilize about 0.35%, that is minimum amount can be reduced in different categories, while in the return to scale, the second category is saved about 7.42% of manure than other categories, but in the fourth category is saved about 0.39% of labor than other categories. So the third category was the best in using the agricultural resources economic efficiency comparing with the others categories under fixed and variable returns to scale. While the fourth category was the optimal because of the farm age the trees stayed in the soil, because the mango is a perennial crop. From here it can be said that to achieve the full technical efficiency of such farms requires the need to intensify guidance and agricultural extension efforts of these farmers groups possessory access to technical competence Full.

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