J. Appl. Environ. Biol. Sci., 1(9)376-381, 2011

ISSN: 2090-4215
Journal of Applied Environmental and Biological Sciences
www.textroad.com

Applying of Management Tools to Determine Various Efficiencies at Farms of Jiroft City

Vahid Majazi Dalfard[1], Allahyar Ardakani[2], Tak nazalsadat banihashemi[3]

[1]Young Researchers Club, Kerman Branch, Islamic Azad University, Kerman, Iran
[2]Faculty of Management and Accounting, IslamicAzad University, Qazvin Branch, Qazvin, Iran
[3]Young Researchers Club, Qazvin Branch, Islamic Azad University, Qazvin, Iran

ABSTRACT

In order to have a study about efficiency of production units of farm products, we selected 24 sample units (Farms) from among all producers of Orange of Jiroft city. All statistic data, inputs and outputs of production of the mentioned 24 units have been estimated by questionnaire method in three fixed output conditions with (technical efficiency), managerial and output of variant to scale (Criteria efficiency). According to the results of estimations, it is obvious that average technical efficiency in appointed units is %55.3 from which only %8.3 of producing units are completely (%100) efficient. The average of scale efficiency at mentioned units was equal to %62.3 and different from technical efficiency. The interesting result of this study is very great average of managerial efficiency which is close to %89.6 which is a sign of high level of academic records of the beneficiaries.
Keywords: Producing unit, Output with fixed scale, Technical efficiency, Scale efficiency, Managerial efficiency.

INTRODUCTION

Production function, in minor economy, is based upon maximum products rate against specific amounts of inputs and a special level of technology. By the help of production theory it is assumed that some of the producers who are using special inputs accompanied with applying new technologies are unable to produce maximum rate of products. This group is named as Non-efficient producers. Economists are searching for a technical efficiency scale and its determination factors. This is because they want to know who are the most efficient producers. Which factors are effective on their efficiency and which criteria are applicable for better production efficiency. Some of the production factors which may be purchased from outside of producing unit including electricity, chemical fertilizers, transportation, consulting fee of agriculture specialist, withdrawal costs and so on make it difficult to calculate any costs of raw materials due to diffusion of farms, price of land, distance of producing units from purchase market and price of agricultural lands close to cities which are different amounts for any farms. Jiroft city is one of the most important areas in the field of farm products at Kerman Province. By preparing a questionnaire we will consider the production situation of 24 selected farms in agricultural year 2010 for an evaluation of their operations accordingly. There is a specific position for farm products in nutrition and health of people. These products not only are used in fresh form with further maintenance at Cold rooms but also we may change them into secondary products. Therefore they will find a special position among export products of the country. This study is presented in seven parts. There are a lot of studies about efficiency including the researches made by: Hassan Pour (1997) about technical efficiency of Fig farmers at Fars Province, An analysis of efficiency of Wheat farmers at Kohkiloyeh & Boyerahmad Province by Rahmani (2001), A study of Cotton farmers at 13 appointed provices of country by Faryad Ras et al. (2002) and the study made by Dehghanian & Ghorbani (2003) about en estimation of efficiency of Apple producers of Khorasan province. Production & Productivity are two economic and considerable concepts in agriculture with a lot of studies about it. For instance Korda (1987) evaluated technological changes as the main factor of productivity growth of work force in a sample group of Indian farmers. Maou & Koo (1997) stated any growth of sample productivity of Chinese farmers resulted from technology growth within 1984-1993. In another study, Gordin (2002) stated the share of capital is more important in productivity growth than work force in Kenya. Most of studies in Iran are based upon samples and products and only about productivity & production growth. For example, Mojaverian (2003) analyzed the productivity of total production factors in different products such as wheat, grain, cotton, rice and sugar. The results of this research show that any increase in productivity is mainly due to technology progress. The findings of Akbari & Ranjkesh (2003) are reporting about a lack of assistant of work force to the growth of productivity in agricultural sector.

THEOTETICAL PRINCIPLES & RESEARCH METHOD

Efficiency

Production function shows a relation between input level and obtained product out of it. This relation shows the average level of product against a special level of inputs. One of the clear theories in production function is no difference among agencies from the viewpoint of output and out of a specific quantity of inputs. In contrast, territorial production function shows the maximum rate of products out of a specific amount of inputs. Therefore with regard to territorial production function it is possible to obtain estimated group efficiency of special beneficiaries through a comparison of their production with ideal production level (Potential or territorial).

There are a lot of definitions for efficiency. But Farl (1957) stated the relevant discussions of efficiency for the first time. Generally we can say that efficiency would be specified in a complete competition form. Farl (1957) determined

***Correspondence Author:** Vahid Majazi Dalfard, Young Researchers Club, Kerman Branch, Islamic Azad University, Kerman, Iran.
Email: vmd_60@yahoo.co.nz

efficiency with maximum rate of production and with regard to a special level of inputs. He has divided efficiency into three types of technical efficiency, Special efficiency and Economic one. Technical efficiency speaks about possible production rate out of a special quantity of inputs. Special efficiency is about the ability of producing unit for allocation the best resources in accordance with final value of resources and price of products. The multiple amounts of these two types of efficiencies is recognized as the economic efficiency. Then it may show the ability of the unit in obtaining the maximum possible profit with regard to the price and levels of the inputs. In order to measure these three types of efficiencies, Farl benefits from production territory and assumes an output against three-fold criteria of efficiency as follows:

Regarding Figure (1), if a producing unit has two inputs of X_1 & X_2 for producing of product Y, then if we assume that p is a point of operation of producing unit, it is possible to calculate technical efficiency of producing unit by the use of OQ/OP formula.

Since ss' curve shows the production territory, a producing unit is able to reduce input consumption to reach to point Q without any further changes in production amount. Q is a point in which the producing unit is completely efficient from technical viewpoint. Regarding the curve of AA' equal costs, it is possible to measure special efficiency of producing unit through OR/OQ formula. Q' is a point in which producing unit is completely efficient from special viewpoint.
It is possible to calculate economic efficiency through the rate of OR/OP and by multiplying of technical efficiency in special one. Needless to state technical, special and economic efficiencies will be a number between zero and one (Farl, 1957). In order

To specify efficiencies, it is possible to benefit from efficiency indexes methods, production function, territory production function, mathematical programming and profit method.

From among all mentioned methods, territory production function has been used more than other up to now. There is a wide range of other methods based upon mathematical programming. In this study we may also benefit from wide range of data analysis based upon mathematical programming.

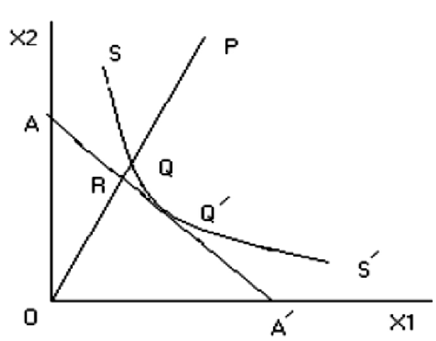

Figure (1): Technical & Special efficiency

Data Expansion Analysis for efficiency measurement

Carnes, Copper and Rhodes introduced Data Expansion Analysis for the first time in 1978. This is a non-parameter technique with assumption of non-specified production function. According to the study of Farl (1957) , the major idea of this method is to measure the efficiency through comparing a single producing unit with all other units and/or a possible combination of units in sample data, Data Expansion Analysis includes a linear programming for problem solving which may resulted in explanation of a broken linear territory production function.

The efficiency of one unit will be calculated by comparing its products and used inputs on relevant territory production function (The best possible observation). If we have production on territory production function, then it will find one efficiency and if its production rate is below the territory production function its efficiency will be lower than 1 as well (Koeli et. al 2002).

The other point is that Data Extended Analysis is a method not a pattern. It is possible to use Data Extended Analysis with different methods according to the problem situation. The pattern of Data Extended Analysis is based upon a special mathematical formulation.

One of the most interesting aspects of DEA is providing an individual index of product for specifying and/or recognition the efficiency of a producing agency and/or one or different products of a collection of inputs. DEA will present estimated efficiency of a producing point based upon total weight product in total weight input and in accordance with product amounts and observed inputs. A linear programming code may select any used weights for the inputs and/or products.

Mathematical pattern of DEA

Assume that n is a considerable producing condition. Different amounts of m inputs will be applied for each condition and for producing of s different products. Therefore it is possible to calculate j^{nd} producing condition through the following formula:

(1)

$$h_i = \sum_{r=1}^{s} u_{rj} y_{rj} \,/\, \sum_{i=1}^{m} v_{ij} x_{ij}$$

The above-mentioned formula is in fact total weight rate of products to total weight of producing inputs in which we have:

x_{ij}= positive observe amount of i[nd] input out of i[nd] producing point.
y_{rj}= is the r[nd] observed quantity of r[nd] output out of i[nd] producing point.
In DEA pattern presented by Charnes, Cooper and Rhod al weights of u_{rj} and v_{ij} obtained from following goal function provided that the preence of mentioned limitations

(2)
Maximize: $h_{u,v}^{o} = \sum_{r=1}^{s} u_{ro} y_{ro} \,/\, \sum_{i=1}^{m} v_{io} x_{io}$

(3) $\sum_{r=1}^{s} u_{rj} y_{rj} \,/\, \sum_{i=1}^{m} v_{ij} x_{ij} < 1;\;\; j = 1,2,\ldots,j_o,\ldots,n$
Subject to: $-u_{ro} \leq o;\;\; r = 1,\ldots,s$
$-v_{io} \leq o;\;\; r = 1,\ldots,m$

Also the optimized amounts of u_r^o and v_r^o are named as virtual changes rate and/or additional coefficients. We mach change the above-mentioned linear programming into a normal linear and solvable programming as follows:
(4)
Maximize: $h_{u,v}^{o} = \sum_{r=1}^{s} u_{ro} y_{ro}$
(5)
Subject to: $\sum_{i=1}^{m} v_{io} x_{io} = 1$

$$\sum_{r=1}^{s} u_{ro} y_{ro} - \sum_{i=1}^{m} v_{io} x_{io} \leq o;\;\; j = 1,\ldots.,n$$
$$-u_{ro} \leq o;\;\; r = 1,\ldots,s$$
$$-v_{io} \leq o;\;\; r = 1,\ldots,m$$

The above-mentioned pattern is a normal linear programming problem which is known as Carnes, Copper and Rhodes pattern. Also it is named as a wide program as well. Although primary Carnes, Copper and Rhodes may provide similar results to secondary Carnes, Copper and Rhodes, but primary Carnes, Copper and Rhodes will be applied in relevant literature of DEA. This is probably due to the primary Carnes, Copper and Rhodes which is more compatible with production theory. Following is a summary of primary Carnes, Copper and Rhodes pattern:
(6)
Minimize: $W_0 = w_o$

$$w_o x_{io} \geq \sum_{r=1}^{s} \lambda_j x_{ij}, \qquad i = 1,\ldots,m$$

(7)
Subject to: $\sum_{r=1}^{s} \lambda_j y_{rj} \geq y_{r0}, \qquad r = 1,\ldots,s$

$$\lambda_j \geq 0,\quad j = 1,\ldots,n, \qquad 0 \in \{1,\ldots.,n\}$$

In this criteria pattern we can submit the efficiency by decision variant W_0 which is a numerical criterion and could be interpreted according to the Farl interval criteria. Optimized solution is the minimum W_0 in which we have the optimum by multiplying of it in input x which may resulted in maximum reduction. (Further to keep the product in the same previous level). The quantity of W_0 is always 1 or lower than 1.

λ_j is the density variant and based upon this assumption that certainly it is possible to create a virtual producing point from considered producing points (as a combination of other producing points). It is necessary to calculate λ_j for all n producing conditions in a real set. λ_j in efficient units is equal to 1 because the pattern could not find any combination of other units in a way to be more efficient than mentioned units.

The bases of DEA are fixed output assumptions against production criterion. Any acceptance of this assumption explains that the size of a producing unit should not be effective on its efficiency. In fact the numerical amount of efficiency resulted from this pattern may compare both the criterion efficiency and technical efficiency as well. Benker, Carnes and Kooper (1984) presented a pattern of DEA which is compatible with output variant theory against the considered criterion. It is known as BCC pattern (Koeli et al. 2002).

(8)
Minimize: $W_0 = w_o$

$$w_o x_{io} \geq \sum_{r=1}^{s} \lambda_j x_{ij}, \qquad i = 1,\ldots,m$$

(9)
Subject to: $\sum_{r=1}^{s} \lambda_j y_{rj} \geq y_{r0}, \qquad r = 1,\ldots,s$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j \geq 0,\quad j = 1,\ldots,n, \qquad 0 \in \{1,\ldots.,n\}$$

By comparing above-mentioned relation and previous pattern, it is obvious that this pattern has a new limitation which may cause that all reference points of comparing other producing points changed into a convex combination of real observations. Any development of recent pattern in the field of economy may cause creation of a territory production function including different parts such as increasing, decreasing output and also different parts with fixed output against the criterion. In general analysis of efficiency DEA against te[illegible]efficiency may crate important understandings for policy making analysis.

Agricultural specifications of Jiroft city

Jiroft city with an area of 7421 Km^2 is one of the most important area in agricultural productions at Kerman province. The agricultural area of Jiroft is more than 83000 hectares including 33,000 hectares gardens and 50000 hectare cultivation and rotation cultivation. About %28 of agricultural products of this city are garden fruits.

The number of farmers of Jiroft city is about 15000 families and 22000 agricultural workers and 6000 cattlemen and 2500 indirect jobs servicing the agricultural department. About 37000 persons occupied the city and as a result %64 of city population benefit directly or indirectly from agricultural department. At present more than 590,000 tones of citrus fruit are produced in different gardens of Jiroft city which are about %51 of total production of Kerman province and %11 of total production of the country as well.

From among garden products, we want to focus on orange. Any production ofthis product at Jiroft city is about 177884 tons in 6353 hectare of land. The average production of orange is about 28tones/hectare.

Estimation method of efficiency

In order to have a clear consideration of efficiency in producing units of orange, we selected about 24 producing units as the sample of our study. There are 7 inputs in these units (Variants): number of trees, consumption rate of chemical fertilizers in kg/hectare, water consumption in cubic meter /hectare, electrical conductivity of used water in micro mouse, permanent worker in persons, seasonal workers in person and under cultivation area in hectare as the main production inputs.

Other variants which are so much effective on production have not been used in this estimation such as trees distance from each other (number of trees in one hectare), age of young tree, age of farmer, literacy level of the farmer, side jobs of the farmer, family members of the farmer, benefiting from agricultural specialists. This is because any evaluation of effects of all mentioned items is not really a simple work and needs long-term studies and investigations.

In order to estimate technical-managerial and criterion efficiency of 24 producing units for a special output (orange) and 6 inputs (costs variant) we used Deep software and classified the results in tables 1, 2 , 3 and 4.

Table No. 1- Measuring of technical efficiency of 24 producing units
Through assumption a fixed output and based upon minimizing the production actors (in %)

Producing unit[1]	Technical efficiency	Producing unit	Technical efficiency	Producing unit	Technical efficiency
1	50	9	37.5	17	25
2	75	10	50	18	93.7
3	50	11	62.5	19	62.5
4	100	12	25	20	50
5	100	13	45	21	32.1
6	50	14	28.1	22	39.7
7	93.7	15	56.2	23	31.3
8	37.5	16	56.2	24	75
Total average of efficiency					55.3

Table No. 2- Measuring of technical- managerial and criteria efficiency of 24producing units in %

Agency	Technical efficiency	Managerial efficiency	Efficiency resulted from criterion	Type of criterion
1	50	100	50	Increasing
2	75	100	75	Increasing
3	50	100	50	Increasing
4	100	100	100	Fixed
5	100	100	100	Fixed
6	50	100	50	Increasing
7	93.7	100	93.7	Decreasing
8	37.5	100	37.5	Increasing
9	37.5	100	37.5	Increasing
10	50	100	50	Increasing
11	62.5	100	62.5	Increasing
12	25	100	25	Increasing
13	45	80	56.3	Increasing
14	28.1	50	56.2	Increasing
15	56.2	62.5	90	Increasing
16	56.2	100	56.2	Increasing
17	25	100	25	Increasing
18	93.7	100	93.7	Decreasing
19	62.5	100	62.5	Increasing
20	50	100	50	Increasing
21	32.1	57.1	56.3	Increasing

22	39.7	50	79.4	Increasing
23	31.3	50	62.5	Fixed
24	75	100	75	Fixed
Total average	55.3	89.6	62.3	

Table No. 3: Specifications of technical, managerial and criteria efficiency at 24 producing units (Garden) of Orange

Type of efficiency	Average	Maximum	Minimur	dance of gardens (Producing unit) Completely efficient	
				Number	Percentage
Technical efficiency	0.553	1	0.250	2	8.3
Managerial efficiency	0.896	1	0.500	18	75
Criteria efficiency	0.658	1	0.250	2	8.3

Table No. 4: Abundance of academic records among 25 selected farmers

Total number of farmers	Literacy level			
	3rd grade of middle school	High school diploma	Associate degree	Bachelor of science
24	6	10	1	7

DISCUSSION AND CONCLUSION

Table No. 1 which is based upon minimizing the production factor shows the average technical efficiency of %55.3 in 24 selected producing units of orange. Regarding the reflected estimations in this table only 2 producing units (Garden), means %8.3 are completely efficiency from technical point of view and about 14 units have a little efficiency than the average. It means that near %50 of units have an efficiency lower than %55.3.

DEA method based upon minimizing the production factors shows that only 22 units out of 24 ones are inefficient. It means that these units are not located on their own production territory.

Really these 22 units should make a revision in benefiting from their inputs with different rates (estimated efficiency -1). It means that for example unit No. 1 with a technical efficiency of %50 should reduce its production inputs up to %50 in order to reach to its efficiency scale without any need to reduce its production. The reduction of production inputs for unit No. 2 is equal to %25 in order to reach unit No. 2 to its efficiency scale. This policy should be applied for all units in which the efficiency level is lower than %100 in order to reach to their own efficiency level.

According to the obtained results out of experimental analysis, it is obvious that a small number of considered gardens are completely efficient. In other words, they have %100 technical-managerial and criteria efficiency (Table No. 2).There are also other farmers with lower efficiency rate. As a result it is possible to increase the production and functions in current situation and by increasing technical knowledge of farmers and presenting agricultural special & distributing services.

The average of technical, managerial and criteria efficiency as mentioned in table No. III are respectively about 0.553, 0.896 and 0.658. It means that it is potentially possible to make an increase in production level up to %45 by increasing technical efficiency at fixed inputs level and in current condition.

The interesting point is the high level of managerial or net technical efficiency which is a sign of high level of skills of Jiroft farmers. Regarding the literacy level of the farmer and according to the following table all farmers have a very good literacy level.

Guidelines

- Electrical conductivity of agricultural water is higher than standard rate in a number of evaluated units with some difficulties in further access of these units to valuable agricultural water. Regarding the sensitivity of citrus trees to salty water, any reducing of these salts needs to make sweet the required water with further heavy investments. Prior to establishment of a garden it is necessary to evaluate any electrical conductivity of used water and also the relevant soil accordingly.
- Any consuming of chemical fertilizers should be applied after making required tests of water, leaves and soil in order to specify requirements as well. The farmers have little attention to this case.
- Although by dropping irrigation network, it is possible to prevent from water wastes, but benefiting from irrigation network is not yet optimized there. But it is necessary to change irrigation time for economy in water and prevention from evaporation. One of the most effective factors in suitable distribution of water throughout the gardens is modification of irrigation network (With regard to the land's gradient)
- Seasonal workers perform the cultivation with completely traditional methods. There is not any modern technology for taking of oranges and further packing and reducing of wastes. This may enable the farmers to have more economy in work force as well. Therefore it is necessary to have more attention to technical tools and supplementary of work in agriculture.
- Increasing the technical efficiency and/or increasing the production through omission of increasing of output and not omission of decreasing output as well.

Conclusion

By the use of land, capital and work force agriculture sector produces all required products of the society. In case of applying and allocation of these factors in an efficient way, it may find all its growth and economic development ideals. But in case of non-suitable applying of resources, not only it is impossible to have economic growth & development but also we will waste a great number of resources as well. As a result, there is always a question for agricultural section that how much and which level of efficiency is suitable for this section. Any reply to this question may enable all policy makers to write suitable foods programs and remove any obstacles against agricultural way with more economic growth and development as well.

Regarding the sample gardens of orange at Jiroft, the obtained results show that all farmers do not apply optimized inputs in way that they use more primary factors that w[illegible]herefore at this section it is necessary to upgrade their knowledge for optimized usage of resources. According to the field studies, it is obvious that there are some other effective factors in agricultural efficiency which are not used in this study. But we may name some of them as follows:
Personal interests in agriculture, Costs of other chances for performing other jobs, Access to the required credits and agricultural knowledge, Side jobs, Farmer age, Number of children.

REFERENCES

1. Akbari, N.V.M, Ranjkesh (2003). Productivity growth of total production factors in agricultural section of Iran through 1966-1996. Agricultural economy & Development magazine, 11th year (44&43), 117-142.
2. Emami Meybodi, Ali (2000), Measuring principles of efficiency & productivity, Commercial Researches & Studies Institute
3. Pirani Khosravi, Kazemi Hossein (2004), Measuring of technical efficiency at Iranian Insurance Companies, according to the random territory function estimation, Iranian Economic Researches Magazine, No. 18, pp 157-178
4. Hassan Pour, B (1997), Economic study of production and fig marketing at Fars Province, Master of Science Thesis, Shiraz University
5. Dehghanian, S. V. M. Ghorbani, (2003), Efficiency estimation of producers of apple, Khorasan province, Sciences & Agricultural Techniques & Natural Resources Magazine, 3rd edition
6. Rahmani, R (2001), Technical efficiency of Wheat cultivators and effective factors on it, Case study: Kohkiloyeh & Boyerahmad, Agricultural Economy & Development magazine, 33: 161-183
7. Faryadras, Chizari, A. H. Moradi, A (2002), Measuring & Comparing the efficiency of cotton farmers in Iran. Agricultural Economy & Development magazine, 40: 89-101
8. André Leclerc, et Mario Fortin Mars 2009, ÉCONOMIES D'ECHELLE ET DE GAMME DANS LES COOPERATIVES DE SERVICES FINANCIERS : UNE APPROCHE NON PARAMETRIQUE (DEA) Cahier derecherche / Working Paper 09-08, Département d'économique et GREDI, Université de Sherbrooke
9. Coelli, T., Prasada Rao, D. S. and Battese, G. E. (2002). An Introduction to Efficiency and Productivity Analysis. Kluwer Academic Publishers
10. Daniela Borodak , 2007 , Les outils d'analyse des performances productives utilisés en économie et gestion : la mesure de l'efficience technique et ses déterminants, Cahier de recherche © Groupe ESC Clermont, 2007 Cahier de Recherche.
11. Farrell, M.J. (1957). The measurement of productive efficiency. Journal of the Royal Statistical Society. Series A 120, 253– 281 .