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Technical, Allocative and Economic Efficiencies of Broiler Farms in Fars Province, Iran: A Data Envelopment Analysis (DEA) Approach

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Abstract: Broiler production has great potentials for increasing protein supply in Iran and plays a vital role in economic system of the country. In this study technical, allocative and economic efficiency of broiler production farms in Fars Province was estimated by using Data Envelopment Analysis approach (DEA) method. The results of the study reveal that under constant return to scale (CRS) and variable returns to scale (VRS) specification, on average, the farms technical, allocative and economic efficiencies were 82, 70, 57 per cent and 82, 73, 64% respectively. About 59 farms exhibited increasing returns to scale and 16 farms exhibit decreasing returns to scale. Evaluating factors associated with inefficiency suggests that education, age of farmer, training and being member of broiler producers cooperatives are statistically significant factors associated with technical, allocative and economic inefficiency.

Key words: Technical efficiency · Allocative efficiency · Economic efficiency · Broiler production farms

INTRODUCTION

Iran has been rated 1st producer and also 1st exporter of poultry meat in the Middle East region. Capital stock in poultry industry in Iran was 4000 Billions Rials (5 Billions $) in 2004 [1].

In the last four decades, large amounts of capital have been invested in poultry production in Iran and this sector plays a vital role in the country's economic system. Investment and employment levels and the role of this sector in the production of protein requirements of the nation have attained high proportions in the national economy. The poultry industry, with nearly 2.3 million tons of output ranked 8th in Asia and 18th in the world. The production of broilers in Iran has rose from 168,000 ton in 1979 to 727,000 ton in 2012. The per person consumption of poultry meat has also increased significantly. The greatest increase in per person consumption of poultry meat occurred since 1999 (From 4.2 kg to 10kg per capita) as the price of poultry meat was suitable compare to red meat and consumers became increasingly concerned about the level of cholesterol in their diet [2].

Poultry business is a profitable enterprise due to its short turnover rate and strong market demand. The growth of meat consumption is over 20 percent per year, so the poultry sector productivity growth needs to be fostered, through either technological development or an increase in production efficiency, in order to stand the demand pressure and self sufficiency of meat production

The current production is related to 70% of production units potential, so with regard to remained considerable potential, It is necessary to make of them in an optimum rate [1].

Measurement of the efficiency of agricultural production is an important issue in developing countries. If the farmers are inefficient in their practices, then it follows that output could be increased with less cost through extension and education. A measure of producer performance is often useful for policy purposes and the concept of economic efficiency provides a theoretical basis for such a measure [3].

Numerous researches have focused on measuring the relative level of technical and scale efficiency, by using the conventional DEA approach. Researches have been conducted by examining the performance of poultry sector in different countries [4].

Data Envelopment Analysis (DEA) is a widely non-parametric and powerful data analytic tool, which is commonly applied in the research and practitioner communities to determine the relative efficiencies of the decision-making units (DMU). Any entity that receives a

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set of inputs and produces a set of outputs could be designated as a DMU, thus, any group of such entities could be subjected to DEA. Consequently, this method has been applied to evaluate productivity and performance of DMU. One of the fundamental assumptions of DEA is that all DMUs in the sample are functionally similar in the sense that all DMUs receive the same number and the same type of inputs and outputs [4-6].

The objectives of this research are to evaluate whether the existing production systems in poultry sector in Fars Province are profitable and economically efficient. Therefore, the study aims at to measure efficiency in production systems in poultry sector in Fars Province finding out better use of existing human andcapital resources in the poultry production process and to locate reasons underlying inefficiency and suggest policy measures to enhance efficiency in poultry meat production.

MATERIALS AND METHODS

The study was carried out in Fars Province. Fars Province is in the south of Iran and its center is Shiraz. It has an area of 122,400 km^2. The state lies between Longitudes 4 30' and 6 60' East of Greenwich meridian and latitude 5 45' and 8 15' North of the Equator. In 2006, this Province had a population of 4.57 million people, of which 61.2% were registered as urban dwellers, 38.1% villagers and 0.7% nomad tribes. Fars Province has favorable agricultural potential and is one of the major agricultural producers in Iran. Based and on the intensity of poultry meat producers and the number of active farms,s ix of the 27 cities in Fars Province were chosen for the study.

Data were collected from a random sample of 100 out of438 broilers farms using a face-to-face questionnaire during January 2010.to February 2011. Secondary data were also collected from the Agriculture ministry of Iran.

Farms having up to 5000 birds were classified as small, those with 5000-15000birds as medium and those with over 15000 birds as large.

Model Specification: Efficiency, as defined by the pioneering work of Farrell (1957), is the ability to produce at a given level of output at the lowest cost and is expressed as a combination of technical and allocative efficiencies [7]. Technical efficiency is the ability of the farmer to produce the largest possible quantity of output from a given level of inputs while allocative efficiency measures the extent to which farmers equate the marginal value product of a factor of production to its price. Economic efficiency combines both allocative and technical efficiency. It is achieved when the producer combines resources in the least combination to generate maximum output (technical) as well as ensuring least cost to obtain maximum revenue (allocative). If the farm is technically and allocativelly efficient, then that firm is said to be cost effective [8]. It is possible for a firm to exhibit either technical or allocative efficiency without having economic efficiency [8]. Two efficiency measurement methods have been commonly used to estimate the best practice: one is the parametric Stochastic Frontier Analysis (SFA) and the other method is non-parametric method Data Envelopment Analysis (DEA). Stochastic Frontier Approach is based on the econometric estimation of the production cost, which requires the definition a priori of the functional form of the efficient frontier. Data envelopment analysis (DEA), the most representative method for efficiency evaluation, is a mathematical programming method for evaluating the relative efficiency of decision making units (DMUs) with multiple inputs and multiple outputs. The DEA advantage is that it permits the inclusion of multiple inputs and outputs in the best practice frontier. By the use of DEA, the best practice frontier formation does not require any predescribed functional relationship between the inputs and outputs. Also, the DEA model does not include a noise or random error term in the frontier estimation[10]. The method enables to find out the relative efficiency of a farm and to examine its position in relation to the optimal situation [5].

The Comprehensive reviews of the two approaches are provided by some researchers. In general, a large number of studies on efficiency measurements argue that a researcher can safely choose any of the methods since there are no significant differences between the estimated results [11].

- Input-oriented measures were chosen in this study

If there are k = 1,2,...,k DMUs, which in the context of our empirical application are poultry farmers, each DMU produces m = 1,2,...,k outputs using inputs that are both under and beyond a farmer control. There are data available on K inputs and M outputs for each of N exploitations. The K×N input matrix X and the K×N output matrix Y represent the data for all the firms. An intuitive way to introduce the DEA is via the ratio form. For each farm we would like to obtain a measure of the ratio of all

outputs overall inputs. According to Charnes *et al.* [12], the optimal weights are obtained by solving following mathematical programming problem [12]:

$$Max_{\mathbf{u},\mathbf{v}} (\mathbf{u}'\mathbf{y}_i / \mathbf{v}'\mathbf{x}_i)$$

Subject to $\mathbf{u}'\mathbf{y}_i / \mathbf{v}'\mathbf{x}_i \le 1,\ j = 1,2,\cdots,N$

$$\mathrm{u,v} \ge 0 \quad (1)$$

Where, u is a $M\times1$ vector of output weights and v is a $M\times1$ vector of input weights. The efficiency measure for the *i*-th DMU is maximized, subject to the constraints that all efficiency measures must be less than or equal to one. One problem with this particular ratio formulation is that it has an infinite number of solutions. To avoid this, Charnes *et al.* [10] proposed the use of a CRS (constant return to scale) equivalent Duality Linear Program which is defined as the following:

$$Min_{\theta,\lambda}\ \theta$$

Subject to $-\mathbf{y}_i + \mathbf{Y}\lambda \ge 0$

$$\theta\mathbf{x}_i - \mathbf{X}\lambda \ge 0$$

$$\lambda \ge 0 \quad (2)$$

Where θ is a scalar and λ is a vector of constants, x_i and y_i, are column vectors with the input and output data for the *i*-th farm. X is a *K* by *N* matrix and *Y* is a *M* by *N* matrix with respectively all input and output data for all *N* farms in the sample. The value θ is a score always lying between zero and one, with a value of one indicating that the farm lies on the frontier and is efficient. An implicit assumption of the model described above is that returns to scale are constant and thus farms are operating at an optimal scale. A BCC DEA model computes however for a Variable Returns to Scale (VRS) by adding the convexity constraint: $N1'\ \lambda = 1$, to the CCR model. Without this convexity constraint, the DEA model will describe a CRS situation.

However, based on the technical and allocative efficiency the economic efficiency can be determined as $EE = AE \times TE$. Allocative efficiency itself is calculated in two steps. First a cost minimizing vector of input quantities given the input prices is determined using:

$$Min_{\mathbf{x}_i^*,\lambda} w'x_l^*$$

Subject to $-\mathbf{y}_i + \mathbf{Y}\lambda > 0$

$$\lambda \ge 1 \quad (3)$$

Where *wi* is a vector of input prices for the *i*-th farm and *xi** (which is calculated by using linear programming) is the cost-minimizing vector of input quantities for the *i*-th farm, given the input prices *wi* and the output levels *yi*. The other symbols are defined the same as in eq. 1. The economic efficiency (*EE*) of the i-th farm is calculated as the ratio of the minimum cost to the observed cost (eq. 3)

$$EE = w'i\,xi^* / w'i\,xi$$

If there is a difference in the CRS and VRS technical efficiency scores for a particular farm, then this indicates that the farm has scale inefficiency, which equals the difference between the VRS and the CRS technical efficiency score. Thus, the input-oriented scale efficiency is defined as [3]:

$$Se = TE\ CRS / TE\ VRS$$

If the scale efficiency is less than 1, the DMU will be operating either at decreasing returns to scale (DRS) if a proportional increase of all input levels produces a less-than-proportional increase in output levels or increasing return to scale (IRS) at the converse case. This implies that resources may be transferred from DMUs operating at DRS to scale to those operating at IRS to increase average productivity at both sets of DMUs [13].

Description of Variables: Since the application of DEA require that their input and output of farms be kept at a reasonable level, in this study, five input variables and one output variable were considered for e?ciency measurement

Input variables include chicks, feed, fuel, labor and the other running inputs in broiler farms included the water and health care costs (medication, disinfection and vaccinations),etc.

- Chicks X1 represent the total number of chicks (in kilograms) per period;
- X2 represents the total quantity of feed (in kilograms) per period;
- X3represent the fuel and electricity cost per period
- X4 represent Labor (in person- day)

- X5 represent other running costs including water, health care costs (medication, disinfection and vaccinations),etc in Iranian Rial.

Output (Y) Represents a Weighted Output of Live Broilers Produced (In Kilograms) per Period

The Prices of Inputs Needed to Solve for the Cost Minimizing Dea Model Are Defined as Follows:

- W1 represents the price of chicks computed as the total chick expenses divided by X1 (in Rial/Kg).
- W2 represents the price of feed computed as the total of feed expenses divided by X2 (in Rial/Kg).
- W3 represents the fuel and electricity cost divided by X3
- W4 represent labor cost divided by X4
- W5 represent expenditures on other costs divided by X5

Identifying Factors of Efficiency: Side by side studies were done to identify the factors that influence the farm technical, allocative and scale efficiency using a Tobit analysis. Primary data were collected from farmers using a survey method involving a structured questionnaire The factors used in this study consist mainly of farm's human capital variables. Human capital variables include farmer's age, farmer's educational background or schooling (no. of years), farmers occupation that means whether poultry farming is considered as main or subsidiary occupation, experience, training received using bank long term loans, being member of farmers cooperatives, etc. The model is employed using DEA method to estimate the factors associated with efficiency with the help of LIMDEP statistical tool. The dependent variable in this model is the initial IEi calculated by DEA.

$$Iei = \alpha 0 + \alpha 1AG + \alpha 2ED + \alpha 3Ocu + \alpha 4Tr + \alpha 5Exp + \alpha 6me + \alpha 7LLT + \alpha 8Exp\ \varepsilon$$

Where,

- Iei is the technical, allocative and economic efficiency of poultry farms,
- AG is the age of the farmers in years,
- ED is formal education measured in years
- Ocu is the main occupation of the farmer dummy variables = 1 if poultry farming, otherwise,
- Tr is the training on poultry farming dummy variable = 1 if farmer received, = 0 otherwise.
- Exp is the experience of poultry farming, measured in years
- Me is if the farmer is a member of broilers cooperatives
- LLT is if the farmer have used long term loans dummy variable = 1 if farmer received, = 0 otherwise.
- ε is the error term.

RESULTS AND DISSCUTION

Recently, agriculture besides petroleum industries has had considerable effect on economic growth and its stability in Iran. Among various sectors in agriculture, poultry meat farming sub-sector has high potential for enhancing the industry, Furthermore, consumption of poultry meat is higher in comparison to other meat in Iran. Regarding this sub-sector, the newest strategy is to increase productivity of farms not only in order to reduce costs but also to enhance the product [4].

Iran poultry industry has been developing very much over the past three decades. The numbers of intensive units have been increasing at a great rate, mainly due to the introduction of new hybrid birds, better management systems, vaccination against various diseases and other disease control interventions and the latest technical advances from other countries [14].

A major factor affecting the future structure of broiler production industry will be the relative efficiency of different producers. Producers who are inefficient will face pressures to reduce costs or to exit the industry. Whether or not the sector becomes more concentrated will depend upon whether inefficiency is due to economies of scale or production inefficiency.

Assessment of efficiency revealed considerable amount of technical, allocative and economic inefficiency among the sample of broiler farms in Fars Province and implied that the farms have considerable potential for enhancing profitability if they could operate at full technical, allocative and economic efficiency level.

The frequency distribution of the efficiency estimates obtained from the DEA frontier and their summary statistics are presented in Table 1 and Table 2.

The estimated mean values of technical, allocative and economic efficiency are 82, 70 and 57 per cent for constant returns to scale DEA frontier and those are 87, 73 and 64 per cent for variable returns to scale DEA frontier. Thus the results of DEA analysis reveal substantial inefficiencies in poultry production in the region.

Table 1:Frequency distribution of efficiency estimates from the DEA models

	Number of farms						
	CRS			VRS			
Efficiency index (%)	TE	AE	EE	TE	AE	EE	SE
0-10%	0	0	0	-	-	-	
10-20%	0	1	2	0	1	1	
20-30%	0	2	4	0	2	4	
30-40%	2	2	3	1	3	2	
40-50%	3	11	28	0	10	21	1
50-60%	8	9	22	4	9	20	1
60-70%	19	18	17	10	10	20	3
70-80%	13	23	7	10	24	10	3
80-90%	19	21	11	16	19	7	8
90-100%	46	13	6	59	22	16	84
Mean	0.827	0.700	0.572	0.878	0.732	0.640	0.940
Maximum	1	1	1	1	1	1	1
Minimum	0.396	0.152	0.142	0.366	0.167	0.159	0.487

Resource: the results of the study

Table 2: Frequency distribution of efficiency estimates from the DEA models based on farm size.

	Number of broiler	0-1000	1000-25000	25000-90000
Technical efficiency	14	4	9	1
Allocative efficiency	29	16	12	1
Economic efficiency	67	33	32	2

Resource: the results of the study

The estimated mean TE measure for the broiler farms under CRS and VRS DEA approaches were 82.7% and 87.8%. This result implies that the output of the farms potentially could be increased by 17.3% if the operation was technically efficient if CRS is assumed or by 12.2% if VRS is assumed.

The result of our study measured technical efficiency of poultry broiler production in Fars Province to be ranged between 0.396 to 1 with a mean of 0.827.These results indicate that technical efficiency of poultry broiler production in this region is relatively high but opportunities still exist for increasing productivity and incomes of broiler farmers in the study area.

Based on the CRS model, sixteen of the farms are fully efficient, but from the results of VRS model 30 farms were efficient, meaning they have an efficiency score of one.

The distribution of efficiency scores for the CRS DEA model shows that about 32% of the farms in the sample are operating at less than 70% efficiency, while 16% are fully efficient. Results from the VRS DEA model shows that 30% of the farms in the sample are operating at full efficiency.

Allocative efficiency ranged from 15.2% to 100%. The mean allocative (AE) and cost or economic (EE) efficiency measures estimated from the DEA frontier are 70% and 57.2%, respectively for CRS and 73.2% and 64% for VRS. These results indicates that the farms could use 30% less input to obtain the same level of outputs if CRS is assumed or could produce 27.8% more if VRS is assumed with the same given level of inputs used.

Alrwis and Francis [3] have studied technical, allocative and economic efficiencies of broiler farms in the central region of Saudi Arabia using a DEA approach. With the VRS model, the mean technical, allocative and economic efficiency were found to be 81, 77.9and 56.4%, respectively for CRS and 72,81 & 66.4% for VRS.

The mean TE estimated for small farms for the CRS and VRS DEA approaches were 82.1% and 87.2%. The mean allocative (AE) and economic (EE) efficiency measures estimated with the DEA model were 71% and 58.5%, respectively, for CRS and 74.5% and 65.3% for VRS in small farms in their study [3].

In a study to evaluate economic efficiency of poultry farms in Bangladesh Begun *et al.* [7] have estimated mean values of technical, allocative and economic efficiency as 88, 70 and 62 per cent for CRS DEA frontier and 89, 73 and 66% for VRS DEA frontier. In the farms that they studied, 68 farms were characterized by increasing return to scale, 19 farms had constant return to scale and 13 farms were characterized by decreasing return to scale. Also their results showed that education, size of poultry farm, training and experience were positively and significantly related to farm's technical and scale efficiency. Other factors such as farmer's age, number of family member and main occupation were insignificant to both CRS and VRS technical efficiency [7].

Heidari *et al.* [17] studied technical, pure technical and scale efficiencies of broiler farms in Yazd Province, Iran. The average values for 44 farmers involved in their study were found to be 0.9189, 0.9856 and 0.9324, respectively. Their results showed that based on CCR results only 9 farmers (out of 44) were relatively efficient. But from the results of BCC model 14 farmers (out of total 44) were efficient. The average values of PTE, TE and SE for all 44 farmers were found to be 0.9189, 0.9856 and 0.9324, respectively [17].

Esfahne and khazaie [16]estimated technical efficiency of broiler production farms in Iran under assumption of CRS ad VRS to be 0.91 and0.93,respectively [18].

Fotros and Solge [19] studied technical, allocative and economic efficiency of broiler farms in Hamedan Province, Iran ,and found their average to be 64.4,65.3 and 43.5, respectively [19].

Results of Ezeh *et al.* [20] study indicated that that the estimated farm level technical efficiency ranged from 08% and 97% with a mean of75%. The estimated stochastic frontier production function showed that stock-size, feed intake and labor input were critical variables that affected farmers output. Drugs and medication and depreciation cost were not significant nit price of input [20].

Adepoju [21] predicted the technical efficiencies of the poultry egg farm in Osun state of Nigeria between 0.24 and O. 93 with a mean technical Efficiency of 0.76.He indicated that production of egg was profitable in the study area and inputs were efficiently allocated and utilized [21].

Ike [22] calculated the mean technical efficiency of poultry production by small scale poultry farmers in Enugu State, Nigeria to be 62%, implying that there are yet about 38% of chances for improvement on the technical efficiency of production [22].

Heidari *et al.* [23] using DEA model, measured the energy consumption of broiler production farms in Yazd Province, Iran. The CCR and BCC models indicated 10 and16 farmers were efficient, respectively. The average values of TE, PTE and SE of farmers were found to be 0.90, 0.93 and 0.96, respectively [23]..

Chukwuji, *et al.* [8] carried a quantitative study to determine allocative efficiency of broiler production in Delta state of Nigeria. Results from their study estimated allocative efficiency for stock size, feed expenses, variable expenses and fixed capital inputs as 24.9, 24.8, - 4.6 and 11.9, respectively [8].

The scale efficiency index for the broiler farms in Fars Province ranged from 48.7% to 100%, with a mean of 94.0% that implies the observed farms could have further increased their output by about 6% if they had adopted an optimal scale. Twenty five farms are found to have unity scale efficiency score, which means they operate at most productive scale size.

More than 84% of the farms were over 90% scale efficient. In terms of scale efficiency, twenty five farms are exhibiting CRS scale. Among the scale inefficient farms, About 59% of farms exhibit increasing returns to scale, which implies that they have huge potential to increase efficiency by increasing farm size and sixteen farms exhibit decreasing returns to scale. Most of the large farms exhibit deceasing returns to scale and can increase efficiency by getting smaller.

The average scale efficiency in our study was 94.9%. This implies that studied farms could have further increased their output by about 5.1% if they had adopted an optimal scale. Fifty nine percent of the farms exhibit increasing returns to scale. This farms output levels are lower than optimal levels and they should be expanded to reach the optimal scale. Sixteen percent of the farms reveal decreasing to the scale. Results of our study suggest that scale inefficiency is mainly due to the farms operating under a suboptimal scale and these suboptimal-scale farms must have adjusted their output levels to a greater extent than the supra-optimal scale farms. Recent studies have focused on realities characterized by the presence of small-sized farms and have found similar results about diffusion of suboptimal-scale-efficient farms [7].

Alrwis and Francis [16] founded that more than 57% of the broiler farms in Central Saudi Arabia were over 90% scale efficient, indicating that a greater proportion of overall inefficiency in these farms was due to farms operating above the cost frontier than the farms being of an inefficient scale [16].

Begun *et al.* [7] mentioned that large broiler farms were more allocative efficient than small farms due to economic advantages concerning the organization [7].

Keramidou *et al.* [10] studied efficiency analysis of the Greek poultry industry and suggests that small poultry size farms could be efficient because they managed to gain a competitive advantage in focused narrow market segments [10].

Analysis of various farms shows that farm size has positive and significant effects on technical efficiency levels. Farms operating at full economic efficiency levels

have lower production cost. This result is in line with those of Ezeh *et al* [20], Hajibagheri *etal* [24] and Adepoju [25].

Fotros and solge [19] found that middle size farms was more efficient in broiler producers in Hamedan, Iran [19].

Evaluating factors associated with inefficiency suggests that farmer's age, educational background, experience, training and being member of broiler producers cooperatives are statistically significant factors associated with technical, allocative and economic inefficiency but using long term loans, being poultry farmer as their main occupation were insignificant to both CRS and VRS technical efficiency in the models. This finding is consistent with the study of Esfahne and khazaie [18]. It is also in line with the findings of Begun *et al*. [7].

Younger farmers were technically more efficient than older farmers. This could be due to the fact that younger farmers adopt more efficient production methods and have more education in poultry production. This result aggress with Ezeh *et al*. [20], Ahmadu and Alufohai [26] and Esfahane and Khazae [18]. Yosef and Malmo [27] suggest that older farmers likely to be more conservative.

Yosef and Malmo [27] have studied the technical efficiency of poultry egg production farms in Ogun state in Nigeria. They have noted that years of experience and education had positive effect on technical efficiency while household size had a negative affect on it. They also found that farmers with large farm size were more efficient compare to smaller ones. They concluded that poultry egg production was profitable in the study area [27].

Alrwis and Fransis [16] and Omobolanle [28] suggested that older farmers were more technically efficient than younger ones. Their study indicated that farmers with more experience tended to be less technically efficient.

Farmers` with formal education have more ability to adopt new technology and innovation and use farm resources more efficiently especially in relation to feed mix and use medicine so it has a positive effect on efficiency.

This disagrees` with Ezeh *et al*. [20] and Ojo [25] whose result showed that education has a negative relationship with technical efficiency[20,25].Ojo [25] notes that the more educated and experienced the farmers, the less time they had for efficient supervision of their farms because of their involvement in other social activities Yosef and Malmo[27] noted that continuous practice of a occupation for a long period makes a person more experienced and more productive in practice so farmers with more years of experience and education are more efficient[27].

Al- Shadiadeh's[29] study results showed that the training needs in poultry keeping are higher than that for sheep and cattle[29].

Begun *et al*. [7] has noted that the more educated farmers are more likely to be efficient as compared to their less educated counterparts, perhaps as a result of their better skills, access to information and good farm planning.. They also noted that experienced farmers have more knowledge on their resource & practices, which enables them to resource utilization more efficiently [7].

Alabi and Aruna [30] suggested that higher level of education will enable farmers to access relevant information that will stimulate their production [30].

Khosravepour and Soleimanpour [31] and Shokri and Baghi [32] findings showed lack of proportion in current courses in agricultural scientific-applied educational system in Iran with job market and the weakness of this system in training [31, 32]. Onumah [33] has noted that formal education that enlightens farmers about the technical aspect is important to enhance efficiency [33]

Tijani *et al*. [9] found that farmers who have access to credit tend to exhibit higher levels of profit in efficiency and this might be as a result of credit received being misused or diverted to other uses [9]. Same results were reported by Featherstone *et al*. [15] and Idiong [34].

The findings of a number of studies on Iranian agricultural cooperatives indicate the failure of poultry growers cooperatives to achieve their constitutional mandates [35].

The Gender has been considered of one of the important factors in agriculture and poultry business [36]. We didn't involve it in our study because all of the farmers were men in the study area.

Farmers that have alternative sources of income do not pay proper attention to their farm. Maganga noted that farmers devote less time for their actual farm operations if they have other alternative work from which they can get immediate cash income while farm operations are becoming delayed [37].

The study observed that technical efficiency of broiler production farms varied due to the presence of technical inefficiency effects in broiler production in Fars Province, Iran. The variables of farmer's age, education, experience, training and being member of broiler producers cooperatives, experience and age of the poultry farmers increase the farmers technical efficiency.

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