Productivity analysis of dairy cattle farms in Turkey: case study of Konya Province

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Abstract

One of the most important animal products for future generation nutrition is milk. To supply the need of increasing demand for dairy producers will be possible by increasing the productivity of dairy farms. The aim of this study is to increase the competitive capacity of the enterprises by conducting the productivity analysis of the milk enterprises in Konya province. Çumra, Karapınar and Ereğli districts constituted 15% of the number of bovine animals, were selected by using purpose sampling method. The number of dairy cattle in these enterprises constituted the main frame of the population the primary data collected from 125 dairy farm enterprises with questionnaire technique through stratified sampling method with 95% confidence interval and error margin of 5%. These enterprises were separated groups according to the number of animals as 0-50, 51-150, and 151-+ groups. It was studied with totally 125 sample farms; 72 in the first group, 38 in the second group and 15 in the third group. It was calculated that the average gross production value was 234,017.90 $, variable costs were 127,370.25 $, gross margin was106,647.65 $ and fixed costs were 52,820.19 $. Net agricultural income was calculated as 66,309.04 $ and 1 Kg raw milk cost is 0.27 $ at the surveyed. Generally, the productivity increases based on proportional enterprise scale. At these enterprises, labor productivity was156.97$, capital productivity was 0.28, variable inputs productivity 1.84 and cattle unit productivity was 2,827.47 $. The technical efficiency of the enterprises was calculated as 0.927, the scale efficiency was 0.973. As a result, it was determined that 44 enterprises were effective, 81 enterprises were ineffective within 125 dairy farming.

Keywords: Dairy enterprises. Productivity. Efficiency. Konya.

1. Introduction

The role of productivity is extremely important in increasing the national welfare. No matter if a country is developed or a developing one, the basic source of economic development is the productivity arch. One of the most important issues emphasized by economy, which is the science targeting the use of scarce resources in an efficient and intense manner, is the productivity.

The only way to use the existing resources in an efficient way and develop a society is increasing productivity. In this context, productivity may be defined as the relation between the outcomes produced by a production or service system and the inputs used to create these outcomes. In our present day, the developments in agricultural field are in the very heart of the social and economic welfare level of the developed countries.

Agriculture plays a great role in the industrialization of countries as a sector producing wealth. On the other hand, the fast increase in the world population constantly keeps hunger and poor nutrition issues in the agenda. It is estimated that the population of the world will exceed 9 billion by 2050s (Oguz and Bayramoglu, 2015). Today, many countries have to be concerned about how to feed their own populations. When considered in this respect, productivity is the driving force of development.

Developed countries ensure the stability in their countries with the help of agriculture and animal husbandry sectors, and have their places as exporters in the world arena. When some countries in the world are considered in terms of milk export rates, New Zealand alone covers 25% of the milk need of the world countries, Australia covers 13% of this need; and the USA produces 7% of the milk that is exported all over the world.

Today, one of the important criteria used in determining the development level of countries is the amount of animal products consumed per capita. In this respect, there is a cause-effect relation between animal protein consumption and development. When the consumption rates of the countries that are prominent in the world with their exports are analyzed, it is clearly seen that Australia ranks the first in the world in consuming milk per capita with a rate of annual 107 kg. The annual drinking milk consumption of the EU is 89 kg; and it is 83 kg in the USA.

The milk consumption is 26 kg per capita in Turkey. For this reason, improving animal husbandry is gaining more importance with each passing day (BAKA, 2011). In addition, it has been reported in several statistical studies that the annual red meat consumption per capita in developed countries is 100 kg. In our country, on the other hand, the annual red meat consumption per capita is 20 kg. It is necessary that animal production is

increased in order to cover the demand for food stuffs of animal origin. This is only possible by increasing the productivity per animal. It is inevitable to increase the productivity per animal by improving the animal husbandry and nutrition conditions. For this reason the aim of this study is to increase the competitive capacity of the enterprises by conducting the productivity analysis of the milk enterprises in Konya province.

2. Literature Review

There has been many different study about productivity, especially agricultural productivity and efficiency have become a popular topic among scholars. Liu et al., (2015) founded that all the major producing regions are relatively efficient and majority of years have witnessed high average efficiency scores range from 0.918 to 1.000.

Decomposition results of Malmquist index indicated that the average productivity (MALM) decreased over the entire period and the major source of decline was technical change.; Agriculture sector has great potential to increase its productivity through technical progress. Increasing expenditure on agricultural R&D and education upgrade the technology promotion system may help farmers to improve efficiency in agricultural production (Oguz and Yener, 2017; Canan and Ceyhan, 2016).

In the latest years, there have been increasing attentions to measure production efficiency and to explore inefficiency determinants in dairy cattle farming like other agriculture products all over the World. In one hand, some researches have focused on the efficiency in milk production. In one study carried out in Slovakia by Dano and Gazikova (1993) and another in Colombia by Aldana-Vargas (1990), productivity and profitability in milk yield are focused on. In the study carried out by Kanechanacharoen (1993), in Thailand. Dano and Huba (1997), in their study in Slovakia, determined that the highest yield. Venkatesh and Sangeetha (2011), have put emphasis on the resource utilization efficiency in dairy cattle breeding enterprises study conducted in Madurai Province of Tamil Nadu State of India.

Alvarez et al., (2014) have conducted a study on efficiency analysis in dairy cattle breeding enterprises in Galicia in the north Spain. Tauer (2001) the activities of dairy enterprises in terms of efficiency and competitiveness, as the dairy farms' production costs per cow are higher than those of large enterprises in the so-called "Efficiency and Competitiveness of the Small New York Dairy Farm" study conducted by small dairy farms in New York tried to show whether or not he thought that he could not sustain it.

By using the stochastic Frontier function, the optimal production cost has been determined and the production costs of the enterprises are compared with this cost according to the number of animals and the competitiveness had been evaluated. Animal husbandry has an important place in Turkey, which is also the case in the whole world, in terms of adequate and balanced nutrition of the increasing population and in terms of being used as raw industrial material in many fields.

Aktürk et al., (2010), conducted in Biga District of Çanakkale Province, it has been aimed to examine the relations between the milk production and factors used in milk production. Keskin and Dellal (2011), have conducted a study for estimating the gross margin in dairy cattle breeding in the Thrace Region of Turkey. According to the results of the study, it has been determined that, in the farms there were 5.5 suckling cows and 10 Large Animal Unit (LAU) in the average. The milk production was 32 tons per farm and 5.8 tons per suckling cow during lactation period.

Because of this importance of productivity, there are many studies conducted on various fields to measure the productivity and profitability in dairy farming businesses. It is possible to list some of these studies as follows (Armağan, 1999; Skunmun and Chantalakhana, 2000; Günlü et al., 2001; Yılmaz et al., 2003; Pereira et al., 2005; Boussemart et al., 2006; Marco et al., 2008; Alverez et al., 2014; Oguz et al.,2015; Oguz and Canan, 2016; Oguz and Yener, 2017).

3. Material and Method

The main material of the study consists of the primary data obtained from the agricultural businesses where dairy farming is performed in the city of Konya. The results reported by previous studies that were conducted on the same subject, and the statistical data reported by relevant institutions were also made use of in the study. Çumra, Karapınar and Ereğli counties, which have 15% of the total cattle in Konya, were selected with purposeful sampling method. The number of the dairy cattle in these counties constituted the main framework of the study population. The layered sampling method was used in order to increase the reliability of the sampling and to ensure certain homogeneity in the farm size groups (Çiçek and Erkan, 1996). In determining the sampling volume, the Neyman method was made use of (Yamane, 1967). In the present study, the sampling volume was determined as 125 (Table 1).

$$n = \frac{[\sum(N_h S_h)]^2}{N^2 D^2 + \sum[N_h (S_h)^2]} \quad D = \frac{d}{t}$$

n = Sampling Volume

N = Number of Units in Population (Pcs)

d= Allowed Error Rate From the Main Mass Average Value

t= Standard Normal Distribution Value

N_h= h. Number of the Units in the Layer (Frequency)

S_h= h. Standard Deviation of the Layer

Table 1: Distribution of the businesses dealing with animal husbandry according to the number of animals (Sampling Volume).

Farm Size Groups (Per Animal)	Sampling Volume (Pcs)
0-50	72
51-150	38
151- +	15
Total	125

In distributing the sampling size to the counties, a proportional distribution was made by considering the share of the businesses given in the layers in the total amount. For the purpose of obtaining standardization of the processes applied in assessing the socio-economic characteristics, the family labor force potential was converted into man power unit (MPU), and the computations were made in this manner. By considering the natural conditions of the study area, it was presumed that a laborer could work for 280 days within a year in vegetation production; and 300 days in animal husbandry. Continuous disease, military service, education and similar periods in which the laborers could not work were excluded from the potential labor force values.

The numbers obtained were multiplied by the coefficients of each age group and gender (MPU) to obtain the Male Labor Force (MLF) (Ersöz, 1988; Peker, 1997). When converting the working days of the age groups into male working days, 0.50 coefficient was used for women and men between 7-14 years of age; 1.00 coefficient was used for men between 15-49; 0.75 for women; 0.75 for the men at and above the age of 50; and 0.50 for women (Oğuz and Bayramoğlu, 2015). Since the businesses were taken as a whole, the capital structures of them were examined by considering the classification of the capital according to functions (Açıl and Demirci, 1984; Inan, 1994).

For this purpose, the active assets that are the elements of the capital invested on the businesses by the entrepreneurs for the purpose of production; and the passive capital, which

showed the sources of the active ones, were determined. For the purpose of determining the number of the animals owned by the businesses in a homogenous manner, the "Large Animal Unit (LAU)" was used (Saner, 1993). The value of the fields that were used in a partnership as a rental field was shown in the active parts as well as in the passive parts of the balance sheets. In this way, the business was purified from rents and debts (Erkuş, 1979).

The gross profit method was used in analyzing the economic structures of the businesses. The gross profit was found by subtracting the variable costs from the gross production value. In computing the gross production value, the sales of milk, reformed cow sales, other animal sales (heifer, pregnant heifer, bullock, calf, etc.) and the sales of farm fertilizers, which are the main production values of dairy farming businesses, were considered.

Fixed costs consist of general administration costs, family labor force costs, permanent labor costs, building capital amortisement, building capital interest, building maintenance costs, animal amortisement, animal capital interest, equipment machinery amortisement. 3% of the variable costs were taken in computing the general administration costs.

Variable costs consist of concentrate feed, roughage, temporary labor force costs, veterinary and medication costs, electricity costs, artificial insemination, repair-maintenance, cleaning and other (salt, vitamin, chain, etc.) costs. Since the incomes of dairy businesses are computed on a daily basis, the interest rates of the variable costs were not computed in the study. In addition, the real interest rate 5% was used in computing the interest of the active capital (Kıral et al., 1999). The supports received by the producers from the state were not included in the agricultural income values.

The relative sales value method was used in computing the milk production costs. In this method, total costs made on the activity branch are distributed to each joint product, and the total of these is distributed to gross production value according to the contribution shares, and the share of the cost per product is divided by the amount of the obtained product to compute the unit costs (Kıral et al., 1999). In the present study, the gross profit was computed by subtracting the variable costs from the dairy farming gross production value (Açıl and Demirci, 1984; Bayramoğlu, 2003).

When computing the cost of 1 kilogram raw milk, roughage and concentrate feed costs, veterinary-medication costs, labor force costs, artificial insemination costs, salt, vitamin and feed additive costs, normal repair and maintenance costs of the stable, dairy farming equipment and machinery costs, transportation costs, opportunity costs, water and electricity

costs, fuel oil costs, and amortisements were considered. When computing the partial productivity, the gross production value was used as the outcome. In partial productivity computations, labor force (MPU), total active capital ($), variable inputs ($), and animal existence (CU) were considered. In measuring the activity of the businesses that were included in the study, the Data Envelopment Analysis was used. In Data Envelopment Analysis, the data are analyzed according to CRS (Constant Returns to Scale) and VRS (Variable Return to Scale) models. In these analyses, predictions were made according to both models.

Activity results were obtained for the input according to both model assumptions. In model approach for input, the target outcomes may be obtained by using minimum inputs. For this reason, there is an approach that has a tendency towards saving in using the resources. This approach in the Constant Income Assumption according to the scale intended for the input may be shown as follows (Färe and Grosskopf, 1994; Coelli et al., 2006);

$\min \theta,\lambda\ \theta,$

$st.\ -yi + Y\lambda \geq 0$

$\theta xi - X\lambda \geq 0$

$\lambda \geq 0$

Here, θ is a scaler and λ is an Nx1 constant vector. The θ value shows the activity level of the i^{th} production unit. According to the Farrel (1957) Definition, this value is between 0 and 1. The θ value's being equal to 1 means that the producer unit is over the active limit. The Linear Programming Problem was solved for each producer for N times, and the θ value, i.e. the Technical Activity Values is obtained for each unit (Coelli et al., 2006). Data Enveloping Analysis is a linear programming-based technique that aims to measure the relative performance of the decision units in case when inputs and outcomes that have different measurement units make it difficult to make comparisons. This analysis also ensures the measurement of relative performance of the decision units if they are measured with more than once and with different scales (Karkacıer, 2001). The variables that are taken into consideration in activity values are as follows:

Y: Milk Yield (Kg/LAU)

X1: Labor Force (Hour/LAU)

X2: Concentrate Feed (Kg/LAU)

X3: Roughage (Kg/LAUU)

X4: Large Animal Unit

X5: Innovation Index (%)

The data on the variables are based on Large Animal Unit (LAU), and the productivity per animal was taken as the dependent variable.

4. Results and Discussion

The gross production value in the businesses that were included in the study was found by adding the productive fixture value increases that occur in the vegetation and animal production to the value that is assessed with the farm yard prices of the products that are produced in the business organization (Erkuş, 1979; Oğuz and Bayramoğlu, 2015). The gross production value was computed separately for each production activity in the business. The vegetation production value of the business was taken as multi-year and annual, and the animal production value was taken as large animal unit (LAU) production value. The animal production values in the businesses included in the study are given in Table 2.

Table 2: Animal production values ($) and rates (%).

	Business Groups (Per Animal)							
	0-50		51-150		151-+		Businesses Average	
	$	%	$	%	$	%	$	%
Milk Production Value	49,871.80	80.61	203,892.22	85.68	624,908.27	86.68	165,698.39	85.20
PSV	7,328.83	11.85	24,701.63	10.38	61,132.64	8.48	19,066.62	9.80
Farm Fertilizer Value	4,670.81	7.55	9,389.04	3.95	34,858.59	4.84	9,727.69	5.00
Total	61,871.45	100	237,982.89	100	720,899.51	100	194,492.69	100
CU	2,017.99		2,419.32		2,457.48		2,349.91	

The animal production value per business was found as $194,492.69. In actual fact, 85.20% of this value comes from milk production, 9.80% comes from productive stock value (PSV), and 5.00% comes from fertilizers. A cow produces an average of 10 tons of fertilizer per year, and 1 ton of fertilizer is sold for $10.56 - $12.32 in average. A kilo of milk is sold at a price of $0.42 in average. The animal production value varies between the groups. The animal production value was determined as $61,871.45 in a business where there are 0-50 animals; as $237,982.89 in a business with 51-150 animals; and as $720,899.51 in a business with 150-+ animals. The GPV values in the businesses that were investigated in the study are given in Table 3.

Table 3: Gross production value (GPV) ($) and rates (%) in the businesses included in the study

	Business Groups (Per Animal)							
	0-50		51-150		151-+		Businesses Average	
	$	%	$	%	$	%	$	%
Vegetation Production Value	20,279.73	24.69	47,611.00	16.67	111,419.50	13.39	39,525.21	16.89
Animal Production Value	61,871.45	75.31	237,982.89	83.33	720,899.51	86.61	194,492.69	83.11
Total GPV	82,151.18	100	285,593.88	100	832,319.00	100	234,017.90	100
CU	2,679.43		2,903.33		2,837.30		2,827.47	
Decares	769.67		1,162.94		1,494.29		1,152.93	

About 83% of this value comes from animal production, and 16.89% comes from vegetation production. The GPV value per CU in a business was computed as $2,827.47. The majority of the income in the business is obtained from animal production. The fluctuations in the milk prices and productivity cause that there are also fluctuations in the incomes of the businesses which deal mainly with dairy farming (Table 3).

The management costs consist of two groups, which are the variable costs and the fixed costs. As it is clearly seen in Table 4, the animal production variable costs were determined as $104,235.23 as a result of the investigations in the study. The biggest share in the animal production variable costs belongs to concentrate feed cost with 62.41%. This is followed by roughage with 20.84%. The annual total variable costs were determined as $104,235.23 for the businesses included in the study.

Table 4: Variable costs ($) and rates (%) of animal production

	Business Groups (Per Animal)							
	0-50		51-150		151-+		Businesses Average	
	$	%	$	%	$	%	$	%
Concentrate Feed	23,923.44	62.51	79,541.87	62.26	225,733.79	62.48	65,048.69	62.41
Roughage	7,059.37	18.45	26,503.19	20.74	79,959.33	22.13	21,718.29	20.84
Veterinary Medicines	1,113.65	2.91	3,484.06	2.73	7,862.32	2.18	2,644.10	2.54
Artificial Insemination	4,788.73	12.51	9,032.62	7.07	26,267.61	7.27	8,656.34	8.30
Labor	0.00	0.00	6,456.63	5.05	17,556.34	4.86	4,069.58	3.90
Electricity	560.64	1.47	971.09	0.76	1,115.02	0.31	751.94	0.72
Water	667.60	1.74	1,308.85	1.02	1,444.08	0.40	955.71	0.92
Repair-Maintenance	110.04	0.29	259.04	0.20	645.58	0.18	219.60	0.21
Cleaning	24.45	0.06	131.58	0.10	516.43	0.14	116.06	0.11
Other	20.79	0.05	69.50	0.05	181.93	0.05	54.93	0.05
Total	38,268.71	100	127,758.42	100	361,282.43	100	104,235.23	100

Over 81% of this amount belongs to animal production variable costs and 18.16% belongs to vegetation production variable costs. the variable costs vary according to the business width groups. as the business width groups increase, so do the total variable costs.

Table 5: Total of the variables costs ($) and relevant rates (%)

	Business Groups (Per Animal)							
	0-50		51-150		151-+		Businesses Average	
	$	%	$	%	$	%	$	%
Animal Production Variables Costs	38,268.71	73.31	127,758.42	81.88	361,282.43	86.94	104,235.23	81.84
Vegetation Production Variables Costs	13,933.25	26.69	28,274.91	18.12	54,282.48	13.06	23,135.02	18.16
Total Variables Costs	52,201.96	100	156,033.33	100	415,564.90	100	127,370.25	100

Fixed costs, amortisement costs, family labor force payment, permanent labor force, building repair maintenance costs were not included in the computations (Table 6).

Table 6: Fixed cost ($) and relevant rates (%)

	Business Groups (Per Animal)							
	0-50		51-150		151-+		Businesses Average	
	$	%	$	%	$	%	$	%
Depreciation Expenses	8,807.84	40.38	32,098.97	46.05	80,790.20	50.84	24,526.23	46.43
Building Repair-Maintenance Expenses	1,802.00	8.26	5,171.79	7.42	10,551.94	6.64	3,876.41	7.34
Permanent Labor Force	1,226.52	5.62	23,748.70	34.07	61,704.23	38.83	15,330.59	29.02
Family Labor Force Price	9,973.41	45.73	8,678.26	12.45	5,867.37	3.69	9,086.96	17.20
Total	21,809.77	100	69,697.73	100	158,913.73	100	52,820.19	100

The total fixed costs in the businesses per company was determined as $52,820.19. In actual fact, 46.43% of this comes from amortisement costs; 29.02% comes from permanent labor force payment; 17.20% comes from family labor force payment; and 7.34% from building repair maintenance costs (Table 6). As the size of the businesses increase, the amount of the fixed costs decreases. Fixed costs do not depend on the production volume. Despite the expansion in the production field, the fixed costs will be decreased, and therefore, the costs per animal will also be reduced.

Table 7: Total agribusiness expenses ($) and relevant rates (%) in the research area

	Business Groups (Per Animal)

	0-50		51-150		151-+		Businesses Average	
	$	%	$	%	$	%	$	%
Variables Costs	52,201.96	70.53	156,033.33	69.12	415,564.90	72.34	127,370.25	70.69
Fixed Cost	21,809.77	29.47	69,697.73	30.88	158,913.73	27.66	52,820.19	29.31
Total Production Costs	74,011.73	100	225,731.06	100	574,478.64	100	180,190.44	100
Rate to Active Capital (%)	19.56		20.94		23.01		21.32	

The annual operational cost was $180,190.44 in the businesses that were included in the study. 70.69% of these costs consist of the variable costs; and 29.31% constitute the fixed costs. In addition, the average of CU for each business was computed as $2,177.11 (Table 7). 70.69% of the operational costs in the businesses are the variable costs; and 29.31% constitute the fixed costs.

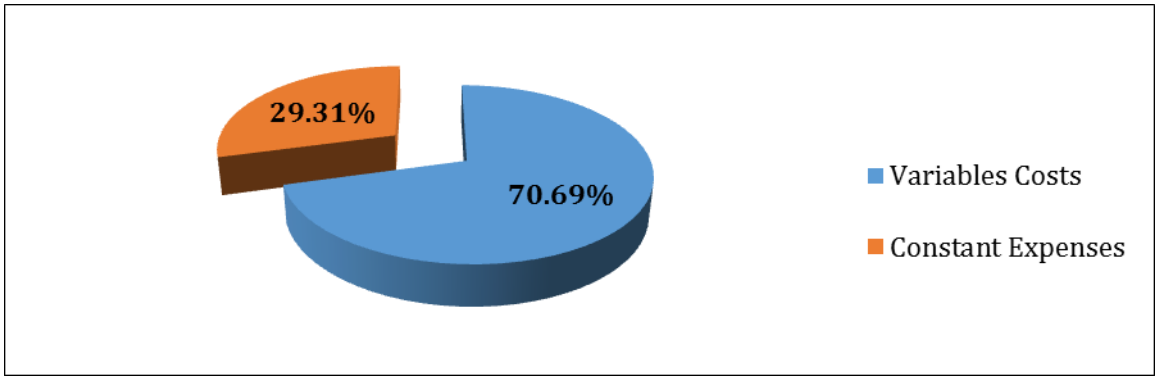

Figure 2: Rated distribution of the operational costs

The gross profit is computed by subtracting the total special variable costs made for the activity branches from the gross production value sum obtained for agricultural activity branches. In Table 8, the gross profit levels of the companies are given. in the companies that were included in the study, the gross profit per company was computed as $106.647,65. In this context, 54.43% of the GPV consists of total variable cost. 54.43% of the GPV consist of total variable costs and 45.47% consist of gross profit. In addition, gross profit increases as the business widths expand. The gross profit for each CU in businesses was computed as $1,288.55 and Gross profit per decare was computed as $525.42 (Table 8). Gross profit is an important criterion showing the success level of the business organization.

Table 8: Gross profit ($) and relevant rates (%).

	Business Groups (Per Animal)							
	0-50		51-150		151-+		Businesses Average	
	$	%	$	%	$	%	$	%
GPV	82,151.18	100	285,593.88	100	832,319.00	100	234,017.90	100
Total Variable Costs	52,201.96	63.54	156,033.33	54.63	415,564.90	49.93	127,370.25	54.43
Gross Profit	29,949.22	36.46	129,560.56	45.37	416,754.10	50.07	106,647.65	45.57
CU	976.82		1,317.10		1,420.68		1,288.55	
Decares	280.59		527.57		748.21		525.42	

Agricultural income is important in that it reveals the success of the entrepreneur in this field, and is obtained by subtracting the debit interests and the shares paid to the rent of the field from the gross revenue, and by adding the family labor force payment to the result (Erkuş, 1979). Agricultural is considered as the success criterion of an investor. It is also defined as "*some of the gross income that may be spent by the entrepreneur or his/her family to cover their needs for one year without any decreases in the gross capital value*". For this reason, the agricultural income obtained at the end of a period must not be lower than the amount of the financial assets necessary to cover the needs of the investor or his/her family. The agricultural income for each business was determined as $66,309.04. This value varies according to the business groups (Table 9).

Table 9: Agricultural Income ($)

	Business Groups (Per Animal)			
	0-50	51-150	151-+	Businesses Average
Gross Revenue	11,448.15	64,791.24	267,241.77	58,359.69
Debit Interests and Rental	1,262.52	1,024.72	824.04	1,137.61
Family Labor Cost	9,973.41	8,678.26	5,867.37	9,086.96
Agricultural Income	20,159.04	72,444.79	272,285.11	66,309.04

The production costs for dairy farming in the businesses investigated in the scope of the study are given in Table 10.

Table 10: Milk production costs ($) and rates (%).

	Business Groups (Per Animal)							
	0-50		51-150		151-+		Businesses Average	
	$	%	$	%	$	%	$	%
Concentrate Feed	23,923.44	40.12	79,541.87	46.17	225,733.79	46.69	65,048.69	44.94
Roughage	7,059.37	11.84	26,503.19	15.38	79,959.33	16.54	21,718.29	15.01

Veterinary and Medication Costs	1,113.65	1.87	3,484.06	2.02	7,862.32	1.63	2,644.10	1.83
Artificial Insemination	4,788.73	8.03	9,032.62	5.24	26,267.61	5.43	8,656.34	5.98
Labor	0.00	0.00	6,456.63	3.75	17,556.34	3.63	4,069.58	2.81
Electricity	560.64	0.94	971.09	0.56	1,115.02	0.23	751.94	0.52
Water	667.60	1.12	1,308.85	0.76	1,444.08	0.30	955.71	0.66
Repair-Maintenance	110.04	0.18	259.04	0.15	645.58	0.13	219.60	0.15
Cleaning	24.45	0.04	131.58	0.08	516.43	0.11	116.06	0.08
Other	20.79	0.03	69.50	0.04	181.93	0.04	54.93	0.04
A- Total Variable Costs	38,268.71	64.18	127,758.42	74.15	361,282.43	74.73	104,235.23	72.02
General Management Costs	1,288.07	2.16	3,832.75	2.22	10,838.47	2.24	3,207.70	2.22
Building Capital Amortisement	2,162.40	3.63	5,802.63	3.37	14,246.83	2.95	4,719.16	3.26
Building Capital Interest	1,802.00	3.02	4,835.52	2.81	11,872.36	2.46	3,932.63	2.72
Building Repair Maintenance	1,441.60	2.42	3,868.42	2.25	9,497.89	1.96	3,146.11	2.17
Family Labor Costs	9,973,41	16.73	5,157.14	2.99	5,867.37	1.21	8,016.54	5.54
Permanent Labor Cost	0.00	0.00	2,935.51	1.7	20,704.23	4.28	3,376.90	2.33
Cow Capital Amortisement	2,296.21	3.85	8,401.49	4.88	25,070.42	5.19	6,885.12	4.76
Cow Capital Interest	2,066.59	3.47	7,561.34	4.39	22,563.38	4.67	6,196.61	4.28
Equipment-Machinery Amortisement	185.12	0.31	1,220.01	0.71	855.88	0.18	580.22	0.40
Equipment-Machinery Capital Interest	138.84	0.23	915.01	0,53	641.91	0.13	435.17	0.30
B- Total Fixed Costs	21,354.23	35.82	44,529.82	25.85	122,158.74	25.27	40,496.15	27.98
Total Production Costs (A+B)	59,622.93	100	172,288.24	100	483,441.17	100	144,731.37	100

The production cost for each business was computed as $144,731.37 in actual fact, 72.02% of this amount consists of the variable costs; and 27.98% consist of the fixed costs. The highest share in the variable costs belongs to concentrate feed costs (44.94%); while, the highest share in the fixed costs belongs to family labor force (5.54%). Costs increase as the size of the businesses increase (Table 10). The production cost for the businesses that had between 0-50 animals was $59,622.93; and 64.18% of this value consist of the variable costs, and 35.82% of it consist of the fixed costs. The production costs for each business that had 51-150 animals was computed as $172,288.24; and 74.15% of this value consist of the variable costs; and 25.85% of it consist of the fixed costs. The production costs for each

business that had 151-+ animals was computed as $483,441.17 for each business; and 74.73% of this value consist of the variable costs; and 25.27% consist of the fixed costs. The annual gross production value of dairy farming was computed as $194,492.69. In actual fact, 85.20% of this amount consist of milk production; 9.80% consist of PSV; and 5.00% consist of farm fertilizers (Table 11).

Table 11: Dairy farming gross production value ($) and rates (%).

	Business Groups (Per Animal)							
	0-50		51-150		151-+		Businesses Average	
	$	%	$	%	$	%	$	%
Milk Gross Production Value	49,871.80	80.61	203,892.22	85.68	624,908.27	86.68	165,698.39	85.20
PSV	7,328.83	11.85	24,701.63	10.38	61,132.64	8.48	19,066.62	9.80
Farm Fertilizer Value	4,670.81	7.55	9,389.04	3.95	34,858.59	4.84	9,727.69	5.00
Total	61,871.45	100	237,982.89	100	720,899.51	100	194,492,69	100

The dairy farming production value in businesses that had 0-50 animals was computed as $61,871.45; and 80.61% of this amount consists of the milk production value; 11.85% of it consists of PSV; and 7.55% of it consists of farm fertilizer. The dairy farming production value for each business in businesses that had 51-150 animals was computed as $237,982.89; and 85.68% of this amount consists of the milk production value; 10.38% consists of PSV; and 3.95% consists of farm fertilizer. The dairy farming production value in businesses that had 151-+ animals was computed as $720,899.51; and 86.68% consist of milk production value; 8.48% consist of PSV; and 4.84% consist of farm fertilizer (Table 11).

Table 12: Distribution of the production costs according to products obtained ($) and rates (%)

	Business Groups (Per Animal)							
	0-50		51-150		151-+		Businesses Average	
	$	%	$	%	$	%	$	%
Milk Production Cost	48,059.38	80.61	147,608.23	85.68	419,068.65	86.68	123,304.14	85.20
PSV	7,062.49	11.85	17,882.80	10.38	40,996.05	8.48	14,188.39	9.80
Farm Fertilizer	4,501.07	7.55	6,797.21	3.95	23,376.46	4.84	7,238.84	5.00
Total	59,622.93	100	172,288.24	100	483,441.17	100	144,731.37	100

The unit milk cost was computed according to relative sales method. In this context, the share of each product that it receives from gross production value was computed. The

share of it, which was received from the production costs, was determined according to the rate of the product whose unit cost was computed in gross production value. The share of milk received from production costs was divided by the production value to compute the unit cost. The production cost was determined to be annual $144,731.37 in the businesses included in the study. According to the shares of the products received from the GPV, 85.20% of this value consist of milk production costs; 9.80% consist of PSV; and 5.00% consist of farm fertilizer (Table 12). The milk production cost was computed as $123,304.147 in average for each business. The unit milk cost was obtained by dividing the milk production costs to the milk production amounts. In this respect, the average unit milk cost was computed as $0.31. It was computed as $0.36 in businesses that had 0-50 animals; as $0.31 in businesses that had 51-150 animals; and as $0.30 in businesses that had 151-+ animals. As the business width groups increased in the study area, the unit milk cost decreased (Table 13).

Table 13: Unit milk cost ($/kg).

	Business Groups (Per Animal)			
	0-50	51-150	151-+	Businesses Average
Milk Production Costs ($)	48,059.38	147,608.23	419,068.65	123,304.14
Milk Production Amount (Kg)	47,667.06	167,795.29	494,506.45	137,806.77
Unit Milk Cost ($/Kg)	0.36	0.31	0.30	0.31
Milk Sales Price ($/Kg)	0.37	0.43	0.44	0.42
Variable Costs per Unit Production (The Variable Costs for 1 Kg Milk Production)	0.28	0.27	0.26	0.27

The gross profit for dairy farming in the businesses that were included in the study was computed by subtracting the variable costs spent on animal husbandry from the gross production value that was computed for animal husbandry activity (Table 14). The average gross profit was computed as $90.257,46 in the businesses included in the study.

Table 14: Gross profit ($)

	Business Groups (Per Animal)			
	0-50	51-150	151-+	Businesses Average
GPV	61,871.45	237,982.89	720,899.51	194,492.69
Variable Costs	38,268.71	127,758.42	361,282.43	104,235.23
Gross Profit	23,602.74	110,224.47	359,617.08	90,257.46

The gross profit was computed as $23,602.74 in businesses that had 0-50 animals; and as $110,224.47 in the businesses that had 51-150 animals; and as $359,617.08 in the businesses that had 151-+ animals.

Based on the results obtained from the partial productivity computations, it may be claimed that, in general, as the scale of the business increases, so does the productivity. The average GPV per MPU in businesses is $156.97 which is the highest in 3rd group businesses. In this respect, it is possible to claim that 1st group businesses work in a labor-intensive manner. The capital productivity, which is computed by rating the GPV to total active capital is 0.28 in average for the businesses; and increases in a direct proportion with the size of the business organization. Relative profit was found by rating the GPV to total production costs. Relative productivity refers to the productivity of the capital invested in the production field by the businesses. Provided that relative productivity is over 1, the business is considered as profitable. The variable costs productivity, on the other hand, was determined as 1.84 in general. The animal productivity, which is the last computation item in partial productivity computations, was computed as $2,827.47 per CU (Table 15).

Table 15:Partial productivity of the businesses examined

Partial Productivity Criteria	0-50 Per Animal	51-150 Per Animal	151-+ Per Animal	Businesses Average (Per Animal)
GPV ($)	82,151.18	285,593.88	832,319.00	234,017.90
GPV/MPU	103.58	124.65	295.92	156.97
GPV/Active Capital	0.22	0.26	0.33	0.28
GPV/Variables Costs	1.57	1.83	2.00	1.84
Relative Productivity	1.37	1.67	1.72	1.62
GPV/CU	2,679.43	2,903.33	2,837.30	2,827.47

The activity values of each business to which the questionnaire was applied are given in Table 16. If the activity value of the business is 1, the business is considered as being active; and if the result is below 1, this shows that the business is not active.

Table 16: Activity values according to the size of the businesses

Layer Width	Number of Businesses	Technical Activity	Gross Technical Activity	Scale Activity	Active Businesses	Less Active Businesses	Inactive Businesses
0-50	72	0.901	0.933	0.966	18	17	37
51-150	38	0.956	0.975	0.981	16	11	11
151-+	15	0.982	0.993	0.989	10	4	1
Avg.	125	0.927	0.946	0.973	44	32	49

About 44 businesses out of a total of 125 had 100% activity level, while 81 businesses were not active. The Average Technical Activity of the businesses was computed as 0.927; and the Scale Activity was computed as 0.973. The Scale Activity reveals the losses that stem from not performing optimal-level production. If increasing or reducing the activity scale reduces the activity value, it may be concluded that the relevant production unit has "scale inefficiency". In this respect, it is possible to claim that 66.67% of the business organizations in the 3rd group worked in a more active manner. Meanwhile, it is also seen clearly that the total activity capital and variable inputs in the 3rd group were computed higher. The average innovation indices of the business organizations that were active in the study area was computed as 54.66%. The activities of the businesses were determined as 69.20% for the lowest level; and as 100% for the highest level, which makes an average of 92.70% (Table 17).

Table 17: Comparison of the activities of the organizations according to the VZA results

Inputs and Outcomes	Active Businesses	Inactive Businesses
Number of Businesses	44	81
Milk Yield (kg/animal/day)	22.95	22.68
Number of Animals (per animal)	80.11	47.37
Concentrate Feed Per Animal (kg/animal/day)	12.50	14.13
Roughage Per Animal (kg/animal/day)	22.91	21.79
MPU (hour/animal/day)	2.68	2.80
Innovation Index (%)	54.66	53.33

5. Conclusions and Recommendations

In general, companies must reduce the input use in order to increase the productivity and quality, and reduce the input amount by 7.3% in average in order to obtain the same amount of production. Especially the businesses that are not active must increase roughage production, and reduce the concentrate feed amount. Again, if the amount of the labor force is reduced in inactive businesses or the animal existence is increased in a way that will make use of the labor force, and is roughage production is performed in their facilities, this may increase the productivity of these businesses. If the inactive businesses in the study area increase the number of the animals that are milked over 50, this might help to increase their activities. However, when businesses are taking these steps, they must manage the balances in

and outside the organization in a perfect manner. In order to increase the activity in the businesses that were included in the study, the use of total active capital and especially the labor force must be reduced or the animal existence must be increased without making any changes in the existing inputs in 1st group businesses. Another option is to reduce the concentrate feed use per animal. In 2nd group businesses, on the other hand, although there is no need to make any changes, it would be beneficial to increase the technology use. It is an important result of the present study that the biggest difference between active and inactive businesses in all sectors is "*innovation*", and the businesses that use new technologies are in a more active status. In other words, it is important that business organizations follow new technologies and use them. The feed cost, which is the most important cost of animal husbandry sector, may be overcome by producing feed in the business organizations in a great deal by obeying certain rules; and thus, the related costs may be reduced, which is a proper step for businesses in this sector. Again, business organizations must increase their incomes coming from milk sales by focusing on organization, i.e. on being organized; and thus, reduce the input costs, which will increase their chances in today's competitive conditions.

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