Factors affecting development and profitability of buffalo husbandry: case of Turkey

Reception of originals: 07/19/2017
Release for publication: 03/19/2018

Metin Göksel Akpinar
PhD in Agriculture Economics
Institution: Akdeniz University
Address: Faculty of Agriculture, Department of Agricultural Economics, Akdeniz University, Antalya, Turkey.
E-mail: **mgoksel@akdeniz.edu.tr**

Mevlüt Gül
PhD in Agriculture Economics
Institution: Süleyman Demirel University
Address: Faculty of Agriculture, Department of Agricultural Economics, Süleyman Demirel University, 32260, Isparta, Turkey.
E-mail: **mevlutgul@sdu.edu.tr**

Yavuz Tascioğlu
PhD in Agriculture Economics
Institution: Akdeniz University
Address: Faculty of Agriculture, Department of Agricultural Economics, Akdeniz University, Antalya, Turkey.
E-mail: **ytascioglu@akdeniz.edu.tr**

Bahri Karli
PhD in Agriculture Economics
Institution: Süleyman Demirel University
Address: Faculty of Agriculture, Department of Agricultural Economics, Süleyman Demirel University, 32260, Isparta, Turkey.
E-mail: **bahrikarli@sdu.edu.tr**

Yalçın Bozkurt
PhD in Animal Science
Institution: Süleyman Demirel University
Address: Faculty of Agriculture, Department of Animal Science, Süleyman Demirel University, 32260, Isparta, Turkey.
E-mail: **yalcinbozkurt@sdu.edu.tr**

Abstract

With this study, it was aimed to define factors affecting buffalo husbandry and to determine the effects on breeder profitability. The data was retrieved from 462 buffalo breeders via face to face survey from Samsun, İstanbul, Diyarbakır, Muş, Tokat, Afyonkarahisar and Bitlis provinces of Turkey for 2014 production season, where buffalo husbandry is a prominent

agricultural activity. The analysis of profitability was made to evaluate technical efficiency of buffalo husbandry and direct field-based supporting schemes. The significant fields that policymakers should focus on were determined prior to determination of factors affecting producers' attitudes towards buffalo husbandry. These are producers' awareness and level of satisfaction, use of technology, supporting policies, marketing operations, producer organisations, local leadership, and income sustainability, the field of operation and level of technical knowledge. The positive and statistically significant relationship was determined between supporting policies factor reflecting producer attitudes and relative profitability. Accordingly, it was understood that appreciation in supports to the sector appeared to affect profitability positively. Another significant finding was the existing positive relationships between profitability and lactation period (months), amount of concentrated feed (kg/buffalo), productive information level of the breeder, existing buffalo stock and indebtedness situation of the breeder. The geographic variation of buffalo husbandry demonstrated that breeding and market conditions are essential and there are significant relationships between buffalo husbandry and producer organisations as well as development level of marketing organisations.

Keywords: Buffalo. Factor Analysis. Tobit Model. Relative profitability. Turkey

1. Introduction

One of the most critical problems of the world in the globalisation era is assurance of adequate and balanced nutrition. Rising per capita income that is being experienced by economic growth, lead to a demand shift from vegetative products to meat and milk products especially for developing countries (Behrman and Deolalikar, 1987; Popkin, 1993; Hansford, 2010). Due to the social fact that around 1 billion people on earth do live on the limit of hunger and 3 billion people experience hidden hunger because of limited access to adequate and balanced diet, nutrition is a common sensation for all countries (Young, 1996; Gopaldas, 2006; McMichael, 2009).

The main difference between food consumption model across developed and developing countries is related to animal-based products. Meat and milk products are indispensable and cannot be substituted with other food products for the nutrition of the society due to their biological significances. The most valuable food line for human nutrition is animal based on meat, milk, egg, honey and processed versions of these products (Wyness et al., 2011). No other food can replace animal-based proteins retrieved from these products. Eight amino acids that are important for brain development, as well as the healthy upbringing of humans only, exist sufficiently in animal-based proteins (Diener et al., 1980). Besides, a healthy person should consume 1 gram of proteins per his/her each kilogram of body weight per day, and at least 42 % of this protein level should be animal based (Anonymous, 2013).

One of the important criteria used to measure development level of countries is the amount of animal-based food consumed per capita. Animal husbandry sector, which is significantly essential for sufficient and balanced nutrition of people, is also effective in the generation of national income and employment. Accordingly, animal husbandry has not only economic but also social functions. In this direction, there observed rising interest and supported for animal husbandry sector on a micro level.

Buffalo husbandry has a special place among animal breeding activities due to its specific features. Buffalo, which is recognised as 'water buffalo' in the literature and was domesticated around 5.000 years ago, has been raised in around 40 countries with differing stocks (Sarıözkan, 2011). Buffalo husbandry has been maintained extensively in around 34 countries in the world. The rise between 1961 and 2001 has been recorded as 91 % (Bilal et al., 2006) and 128 millions of buffalos in 1982 had risen to 173 million in 2005 (Atasever and Erdem, 2008). Looking at the recent figures, it was recognised that number of water buffalos in the world has doubled from 97.3 million of the era between 1961 and 1970 to 195.1 million in 2014 due to FAO statistical data.

The biggest buffalo breeder country is India with its share of 56.38 % by the year 2014. Pakistan followed India with 17.73 % and China with 12.19 % respecting the FAO data. Buffalo husbandry has increased significantly in the countries that have been historically involved in the activity. Buffalo husbandry in Turkey, however, occupied 0.06 % of the world breeding statistics by 2015. A number of buffalos have risen from 97632 in 2011 to 142073 in 2016 and development of buffalo husbandry has been supported (Anonymous, 2017). Despite the rise in the presence of buffalos in the world, there observed periodic declinations in many producer countries as well as in Turkey.

The most important yield property of water buffalo is its milk. Buffalo milk in Turkey is used in the production of cheese, yoghurt, ice cream and custard. In South Asian countries, 30-40 % of the milk produced is being consumed as raw milk, while the rest is processed (Burki et al., 2004). The most important feature of Mozzarella cheese, which is widely famous around the world as an Italian delicacy, is that it is produced out of Buffalo milk (Anonymous, 2012). Besides, fat ratio of Buffalo milk is higher than the other animals with 6,5-9 % (Hoffpauir, 1982; Burki et al., 2004). This high-fat ratio of the milk increases the value of processed products. Consumers in some countries prefer to pay more and consume buffalo milk rather than beef milk (Ligda, 1998). Buffalo leather as well is rather thick with 6-8 mm and cannot be easily curled. With this feature, it is a demanded input for the shoe (leather) and bag

production (Stoner et al., 2002). As there are special uses of buffalo products, development of buffalo husbandry has been supported. As acknowledged above, it is aimed to set forward the factors effective on development and profitability of buffalo husbandry with microdata for the sample of Turkey.

Therefore, the factors affecting Buffalo breeders in Samsun, Istanbul, Diyarbakir, Mus, Tokat, Afyonkarahisar and Bitlis provinces of Turkey were analysed for 2014 production season within this study with the utilisation of Factor Analysis.

2. Background

Two factors influence on farmers' choice of agricultural products. These are relative profitability and marketing convenience. Relative profitability varies depending on input prices, product sales price (Karlı et al., 1999). One of the economic criteria that measure the success of agricultural enterprises is relative profit. Relative profit shows the profitability of an enterprise according to another business or the production branch in one region compared to the production branch in the other region. Two factors affect the relative profitability. To increase the relative profitability either the production cost of the business must be reduced, or the gross production value must be increased. Therefore, it is possible to decide which operator or production line is more advantageous by examining the relative profit criterion. A relative profit means a proportional value. If it is above 1, it means that gross production value is obtained above the costs, and it shows that the farm is profitable.

Some researchers such as Işık and Gül (2016) found that the relative profitability of the buffalo farms in the Mus region was between 1.06 and 1.65. On the contrary, Günlü et al. (2010) determined buffalo farmers' financial and economic profitability be negative in the Afyonkarahisar.

3. Material and Methods

3.1. Determination of factors affecting the buffalo breeders

Factor analysis is one of the multivariable analysis methods applied to primary data retrieved from the field. With this analysis, it is aimed to question and inter-relate the factors with the main topic of the research with regards to determination of positive and negative impacts (Jowett, 1958). The factors concerned can be indicated as variables related with the

producer or breeder for this case (demographical, economical, sociological and psychological factors) and with the situations affecting the enterprise and its surroundings (geographical, technological, natural, and political factors). Accordingly, the results that are retrieved from the factor analysis are considered as important. Factor analysis is considered as beneficial in policy and strategy development for the target audiences and determination of common sensations.

Factor analysis, which is also known as data reduction methodology, encompasses of determination of some factors and evaluation of the pre-determined factors (Bartholomew, 1980). In this research, 'commonality' criterion is considered for testing applicability of factor analysis. Commonality, being one of the most important factors in the determination of the variables, refers to the representative power of the variables. When its value gets closer to 1, selection of the variable is considered as successful (Yurdakul, 1973). Appropriateness of concerned independent variables for the analysis is being tested via Kaiser-Meyer-Olkin (KMO) test statistic. KMO sample satisfaction measure is an index used in the comparison of observed correlation and partial correlation coefficients (Mulaik, 2010). As the KMO value reduces, the applicability feature of factor analysis methodology also reduces. Accordingly, having a KMO value below 0.50 is considered as 'unacceptable' (Kaiser, 1974). When the value is above 0.90, the analysis applicability is 'perfect', 'very good' for 0.80 and 0.90, 'good' for 0.70 and 0.80 (Field, 2009) and 'acceptable' for 0.50 and 0.70 (Hutcheson and Sofroniou, 1999). The criteria considered in deciding the number of factors are Eigenvalue, Scree test and common variance. The factors, with Eigenvalue higher than 1, are selected mostly in the implementation.

The factor analysis data matrix is demonstrated below. Columns refer to variables included in the factor analysis, while horizontal lines refer to observation values (Table 1).

Table 1: Factor analysis data matrix

	Variables					
Sample	X1	X2	X3	.	.	Xp
1	x_{11}	x_{12}	X_{13}	.	.	X_{1p}
2	x_{21}	x_{22}	X_{23}	.	.	X_{2p}
3	x_{31}	x_{32}	x_{33}	.	.	X_{3p}
				.	.	.
				.	.	.
n	x_{n1}	x_{n2}	x_{n3}	.	.	x_{np}

Reference: Ness, 2002

Mathematical model of factor analysis however, can be explained as below (Ness, 2002);

$x_1 = b_{11} f_1 + b_{12} f_2 + \ldots + b_{1k} f_k + u_1$
$x_2 = b_{21} f_1 + b_{22} f_2 + \ldots + b_{2k} f_k + u_2$
.
.
$x_p = b_{p1} f_1 + b_{p2} f_2 + \ldots + b_{pk} f_k + u_p$

Here:

f_k = general factors (factor weight or significance of k_{th} factor in measuring p_{th} variable)

b_{pk} = factor weights (correlation degree between p_{th} variable and k_{th} factor)

u_p = unique factor (a resource of all variance that cannot be explained by the factors)

3.2. Determination of effectiveness of socio-economic and demographic characteristics of producers on profitability

How much do the socio-economic and demographic characteristics and financial support affect profitability level was determined by multiple regression models and Tobit model.

Tobit model

The model, which was developed by Tobin in 1950s, is an extension of Probit model. It is a non-parametric alternative to the least squares regression model (Liao, 1994). Limitations issued on the dependent variable, mostly lead to data loss in economic researchers. As an instance, let's assume that we intend to estimate the amount of money spent by a customer based on his/her income and relevant economic variables. If the customer does not buy a house, it means that we do not have house purchasing expenditure data for this customer. These data are only available for purchaser customers. When information regarding the dependent variable exists only for some of the observations, this sample is called as a censored sample (Pindyck and Rubinfeld, 1998).

The dependent variable observed for Logit and Probit models (Gujarati, 2001):

$y_i = 1,\ \beta_1 + \beta_2 x_i + u_i > 0$

$y_i = 0, \beta_1 + \beta_2 x_i + u_i \leq 0$

On the other hand for Tobit model (Gujarati, 2001):

$y_i = 1, \beta_1 + \beta_2 x_i + u_i$ (If right side > 0)

$y_i = 0$ (If not)

When $\beta_1 + \beta_2 x_i + u_i \leq 0$; some observations receive value the of 0.

As negative and 0 value observations are neglected in the $y_i = 1,\ \beta_1 + \beta_2 x_i + u_i$ model, only observations are included in the model with the following characteristics and error terms cannot have zero mean value.

$$u_i > -\beta_1 + \beta_2 x_i$$

If the conditional expectation of error terms is 0 for:

$E(y_i/y_i > 0) = \beta_1 + \beta_2 x_i + E(u_i/y_i > 0)$; There appears no problem. However, if error terms are independent and are random variables with normal distribution, then the conditional expectation becomes:

$$E(u_i/y_i > 0) = E(u_i/u_i > -\beta_1 + \beta_2 x_i) > 0$$

If values of error terms are restricted to be higher than $-\beta_1 + \beta_2 x_i$, probability density function $f(u_i)$, neither gets collected around 0, nor has a symmetric distribution.

When the error terms are known to be normally distributed for Tobit models, Maximum Likelihood and other relevant likelihood based processes give estimators with asymptotic normal distribution. However, when the parametric structure of the likelihood function is determined in an improper manner, the estimators become inconsistent (Gujarati, 2001).

4. Findings and Discussion

Factor analysis has been widely used during the 1980s for researchers conducted in the fields of trade, personnel relations and determination of consumer preferences (Katz-Gerro and Talmud, 2005; Gorsuch, 1983; Paim, 1995). KMO value (commonality criterion) was used to test the applicability of factor analysis for this study.

Factor analysis is one of the multivariable analysis techniques, is being utilised to evaluate the relationships between many variables and to determine whether the information can be summarised with a fewer number of variables. The primary objective of the analysis is to find a way to summarise a definite number of variables containing original information into a new factor set with minimum possible data loss. Factor analysis is mainly directed to analysis of the relationship between some variables and to solve the problem of explaining these variables with their real dimensions (factors).

Factor analysis aims to evaluate relationships between dependent and measurable variables and to explain multi-dimensional system constructed with inter-related variables with a limited number of hypothetical variables (Child, 1972). The analysis involves putting inter-related variables together in a case with p variables and finding a limited number of variables that are not related to each other. While the analysis is called as data reduction technique, it encompasses determination of a number of factors and explanation of each factor.

KMO statistics comparing the relationship between correlation and partial correlation coefficients is calculated as 72.0 % for this study (Table 2). As this value is higher than 0.50 and as it is between 0.8 and 0.7, factor analysis is 'good' for the predetermined data set.

Table 2: Factor analysis Kaiser Meyer Olkin (KMO) test result

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.720
Bartlett's Test of Sphericity	Approx. Chi-Square	4925.796
	df	496
	Sig.	0.000

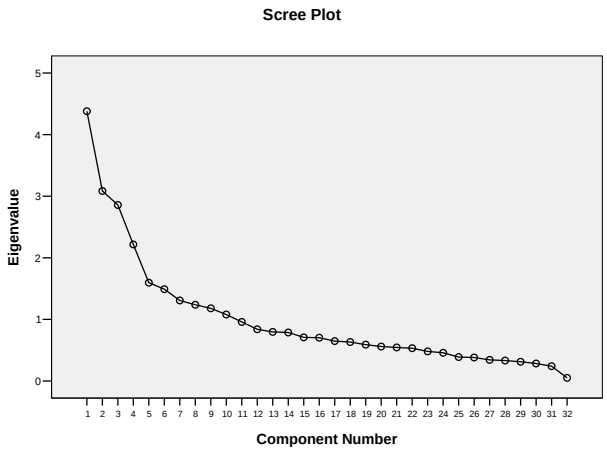


Figure 1: The factors affecting the development of water buffalo husbandry

Results of Eigenvalues, setting starting solution of factor analysis, and statistical findings regarding partial and cumulative variance criteria are provided in Table 3. 32 variables that affect buffalo husbandry either in positive or negative dimension were reduced into ten factors (Table 3).

Table 3: Statistical findings of starting solution of factor analysis

Factor	Definition of the factor	Eigen Value	Variance	Cumulative Variance
1	BREEDER AWARENESS	3.432	10.726	10.726
2	SATISFACTION LEVEL	2.625	8.203	18.929
3	USE OF TECHNOLOGY	2.509	7.841	26.769
4	SUPPORTING POLICY	2.347	7.335	34.104
5	MARKETING ORGANISATION	1.791	5.598	39.703
6	ORGANISATION	1.693	5.290	44.992
7	LOCAL LEADER	1.647	5.147	50.140
8	INCOME SUSTAINABILITY	1.633	5.103	55.242
9	REGION	1.386	4.331	59.573
10	LEVEL OF TECHNICAL INFORMATION	1.366	4.267	63.840

a) PRODUCER AWARENESS (F1)

Within the first factor, which explains 13.686 % of total variables, the importance of the information sources for buffalo husbandry and marketing for breeders were summarised. The statistical loads of television, radio and internet information, the involvement of universities, state organisations and cooperatives and the existence of exhibitions were found higher. Accordingly, the first factor was named as “BREEDER AWARENESS”. The printed and audio-visual information resources are essential in reaching breeders and improvement and direction of the breeding system.

b) SATISFACTION LEVEL (F2)

The second factor referring to the satisfaction of breeders with their production activities explains 9.641 % of the variables. The relevant variables are satisfaction level of maintenance of animal breeding, interest on and satisfaction of buffalo husbandry activities, the tendency to continue buffalo husbandry. Accordingly, the factor was named as “SATISFACTION LEVEL”. The satisfaction level of breeders also provides information on the potential of continuity of the sector.

c) USE OF TECHNOLOGY (F3)

The frequency of computer and internet use and newspaper reading with higher loads refers to 8.929 % of the variables. Accordingly, the third factor was named as "USE OF TECHNOLOGY".

d) SUPPORTING POLICY (F4)

The fourth factor explaining 6.926 % of the variables had included an assessment of whether financial supports provided to animal breeding and specifically for buffalo husbandry were adequate or not. Therefore, the factor was named as "SUPPORTING POLICY".

e) MARKETING ORGANISATION (F5)

The "MARKETING ORGANISATION" factor had explained 4.987 % of variables included evaluations on the marketing system. The variables included were adequacy of the enterprise infrastructure and marketing organisation for buffalo husbandry and confirmation of respondents on inexistence of marketing problems.

f) ORGANISATION (F6)

The sixth factor was named as "ORGANISATION" and did represent 4.659 % of the total variables. The variables included in the factor were confirmation of the surveyed participants on the importance of organisation in animal breeding and marketing of buffalo products.

g) LOCAL LEADER (F7)

The seventh factor explained 4.086 % of the variables. The variables having comparatively higher loads were confirmation on the importance of organisation in Buffalo products, the effectiveness of leading village inhabitants as the reeves and cooperation with other breeders and neighbours. Accordingly, the factor was named as "LOCAL LEADER".

h) INCOME SUSTAINABILITY (F8)

The eighth factor represented 3.866 % of the variables and was called as "INCOME SUSTAINABILITY". The variables included in the factor was the improvements in animal breeding and buffalo husbandry in the last five years and frequency of following professional periodicals and papers related to production activities with higher loads.

i) REGION (F9)

The "REGION" factor representing 3.688 % of the variables did continue information regarding the provincial orientation of the buffalo breeding farms.

j) LEVEL OF TECHNICAL INFORMATION (F10)

The tenth factor explained 3.372 % of the variables. The factor, which was named as "LEVEL OF TECHNICAL KNOWLEDGE" involved information on the level of information on buffalo breeding and marketing of buffalo products. Additionally, the frequency of watching TV was also included in the factor.

Table 4: Rotation solution for factor analysis

Variables	FACTORS									
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Province	-0.03	0.14	-0.10	0.01	-0.02	0.05	0.06	-0.09	0.98	-0.01
s2_satisfaction on an.bred	-0.14	0.71	-0.05	0.12	-0.10	-0.03	0.10	-0.05	0.06	-0.06
s2_interest on buf.bred	0.03	0.75	0.02	-0.01	-0.08	0.08	0.07	0.01	-0.02	0.00
s2_satisfaction on bred.	-0.12	0.76	-0.03	-0.03	-0.01	0.02	0.00	0.01	0.03	-0.12
s2_ buf.bred information	0.22	0.40	0.08	-0.04	0.12	-0.09	-0.15	-0.16	0.02	-0.08
s2_ continue bred	-0.08	0.65	0.05	-0.03	0.08	0.06	0.18	-0.05	0.03	0.00
s3_computer frequency	-0.13	-0.03	0.00	0.96	-0.05	0.04	-0.06	0.10	0.01	0.11
s3_internet frequency	-0.12	-0.02	0.00	0.96	-0.04	0.03	-0.07	0.13	0.00	0.07
s3_newspaper frequency	-0.14	-0.04	-0.07	0.21	-0.01	0.00	-0.12	0.92	-0.06	0.21
s3_ periodical frequency	-0.24	0.03	-0.06	0.20	0.02	0.00	0.03	0.17	0.00	0.92
s3_TV frequency	-0.02	-0.17	0.01	0.09	-0.12	-0.10	-0.03	0.20	-0.12	-0.05
s7_3_inputs	0.01	-0.03	-0.39	-0.03	-0.17	0.16	0.36	-0.02	0.03	-0.01
s7_5_support on an.bred	0.23	0.04	0.81	0.01	0.16	-0.07	-0.02	-0.04	0.02	0.00
s7_6_ support on buf.bred	0.21	0.04	0.87	0.00	0.07	-0.01	0.01	-0.07	-0.04	-0.05
s7_10_infr. for bred	-0.05	0.00	0.10	-0.07	0.60	0.12	-0.12	0.00	0.00	-0.09
s7_11_infr. for mark.	0.04	0.03	0.04	0.01	0.75	-0.13	-0.18	-0.04	0.00	0.00
s7_12_problems of mark.	-0.07	-0.01	0.21	0.00	0.67	0.00	0.02	-0.04	-0.02	0.12

s7_15_ bred org. is imp.	0.02	0.03	0.54	-0.04	0.17	0.34	-0.21	0.07	-0.14	-0.02
s7_16_ mark. org. is imp.	-0.06	0.00	0.07	0.00	-0.27	0.17	0.53	-0.11	-0.01	0.03
s7_17_org. is imp. in mark.	-0.01	-0.04	-0.10	-0.11	-0.13	0.10	0.58	-0.09	0.01	0.04
s8_tv is imp.	0.40	0.10	-0.21	0.00	0.27	-0.01	0.66	0.22	0.15	-0.11
s8_radio is imp.	0.56	0.01	0.06	0.01	-0.13	0.05	0.08	0.11	-0.07	-0.07
s8_internet is imp.	0.83	-0.09	0.05	-0.23	0.01	-0.02	0.13	-0.09	-0.01	-0.05
s8_university is imp.	0.81	-0.03	0.15	-0.04	-0.08	0.05	-0.12	-0.10	0.01	-0.05
s8_supports to agriculture is imp.	0.59	0.01	0.08	-0.01	0.11	0.00	0.11	-0.07	0.04	0.02
s8_cooperatives are imp.	0.67	-0.02	-0.13	0.09	0.14	0.43	-0.11	-0.05	0.06	-0.08
s8_exhibitions are imp.	0.62	0.05	0.23	-0.15	-0.13	0.18	-0.11	-0.02	-0.03	-0.06
s9_eff. of reeves	0.19	0.05	-0.10	0.01	-0.04	0.77	0.11	-0.03	0.07	-0.02
s9_eff. of other leaders	0.12	-0.03	0.13	0.05	0.00	0.73	0.32	-0.02	-0.02	0.04
s2_improvement in an.bred in 5 years	0.06	0.45	0.09	0.01	0.00	-0.13	-0.17	0.02	0.09	0.10
s2_improvement in buf.bred in 5 years	-0.01	0.46	0.13	-0.04	0.03	-0.02	-0.07	0.06	0.03	0.07
s2_information buf.bred	0.12	0.53	-0.17	-0.01	0.03	0.07	-0.05	-0.07	-0.04	0.05

Familiar findings took place in various studies conducted by utilisation of Factor Analysis. Schrader et al. (2001) had searched for the reasoning behind the economic performance change in selected rural areas of the European Union in their study entitled 'The Dynamics of Rural Areas in Germany'. The selected rural areas from Scotland, Greece, Sweden and Germany were compared with regards to the significances of constructed ten factors. In the project entitled 'Economic Impacts on the Rural Areas of Rural Development Projects: Rural Development Project for Yozgat' Berk (2004) reduced 26 variables into six factors. In a study entitled 'Analysis of Socio-Economic Development levels of the provinces in Turkey with Multivariate Statistical Methods', Albayrak (2003) retrieved 130 variables prior to factor analysis related with socio-economic development and selected 48 variables to be converted into eight factors. Therefore, the socio-economic development data was summarised with eight factors.

Table 5: Dependency ratios between factors and variables (%)

Variables	FACTORS									
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Provinces									97.62	
s2_satisfaction on an.bred		70.92								
s2_interest on buf.bred		74.56								
s2_ satisfaction on buf.bred		75.99								
s2_ buf.bred information										
s2_ continue bred		65.36								

s3_computer frequency			96.00			
s3_internet frequency			96.40			
s3_newspaper frequency					92.09	
s3_ periodical frequency						92.40
s3_TV frequency						
s7_3_inputs						
s7_5_support on an.bred		81.49				
s7_6_ support on buf.bred		86.69				
s7_10_ infra.for bred			59.83			
s7_11_ infr. for mark.			75.45			
s7_12_problems of mark.			67.04			
s7_15_ bred org. is imp.		54.27				
s7_16_ mark. org. is imp.				53.24		
s7_17_org. is imp. in mark.				58.41		
s8_tv is imp.				66.28		
s8_radio is imp.	56.28					
s8_internet is imp.	82.56					
s8_university is imp.	80.89					
s8_supports to agriculture is imp.	59.43					
s8_cooperatives are imp.	66.94					
s8_exhibitions are imp.	61.88					
s9_eff. of reeves			76.93			
s9_ eff. of other leaders			72.99			
s2_improvement in an.bred in 5 years						
s2_ improvement in buf.bred in 5 years						
s2_information buf.bred	52.81					

Mutlu Çamoğlu and Saka (2012) reduced 16 relevant variables into five factors prior to cluster analysis. Askegaard and Madsen (1995) however, reduced 138 variables into 41 factors in their research.

Various econometric models were implemented to determine socioeconomic and demographic features of producers that affect their profitability. The data retrieved was analysed with SPSS statistical package.

The relative profitability (RV) retained from buffalo husbandry activities of the 462 surveyed producers was identified as the dependent variable.

Besides, the following factors affecting buffalo husbandry factors were included in the model as explanatory variables. These factors were incorporated in the model considering their values retrieved in the factor analysis. To remind, these factors are as following:

FAC1 : PRODUCER AWARENESS
FAC2 : SATISFACTION LEVEL

FAC3 : USE OF TECHNOLOGY
FAC4 : SUPPORTING POLICY
FAC5 : MARKETING ORGANISATION
FAC6 : ORGANISATION
FAC7 : LOCAL LEADER
FAC8 : INCOME SUSTAINABILITY
FAC9 : REGION
FAC10 : LEVEL OF TECHNICAL INFORMATION

The additional variables included in the model refer to socio-economic and demographic characteristics of the breeder and the enterprise. The variables included are as follows:

duration of buffalo milking – s30	:	Lactation period of the producer – (months)
amount of roughage – s42	:	Roughage used per day per buffalo (kg/buffalo head)
level of education – s2	:	Level of education of the producer – (years)
duration of buffalo folding – s45	:	The duration that buffalos were kept in the fold (months)
amount of concentrated feed – s43	:	The concentrated feed used per day (kg/buffalo head)
information on buffalo husbandry – s2	:	Producer's level of information (5 scales Likert)

After checking the significance level of the variables three main factors that contain aggregate data were included in the mode. These factors are FAC3, FAC4 and FAC8 respectively. The final form of the estimation equation is as follows:

RP = f(FAC3, FAC4, FAC8, duration of buffalo milking – s30, amount of roughage – s42, level of education – s2, duration of buffalo folding – s45, amount of concentrated feed – s43, information on buffalo husbandry – s2).

The findings of the estimated linear econometric relationship of relative profitability and affecting socio-economic and demographic factors are provided in Table 6. Due to the findings, the goodness of fit of the model was found as 0.197, while it reduced to 0.182 after corrected. In other words, the explanatory variables had explained only around 20 % of the variation in relative profitability. However, the explanatory variables were found out to be significant due to the results of the t-test with higher values of the table t (2.04). Besides, the joint significance of the variables was confirmed with F test with (12.360 > 2.41). Therefore, the model was worth to be used for estimation and forecasting.

Table 6: Estimation results of the linear model

Variables	*Coefficient*	*Std. Error*	*t value*	*P*
Constant	0.771	0.447	1.723	0.086
FAC4	0.219	0.053	4.161	0.000
s30_ duration of buffalo milking	0.177	0.048	3.713	0.000
S43_ amount of roughage	-0.035	0.008	-4.378	0.000
s2_ level of education	-0.075	0.018	-4.179	0.000
FAC3	-0.215	0.056	-3.867	0.000
s45_ duration of buffalo folding	-0.070	0.026	-2.700	0.007
FAC8	0.112	0.051	2.190	0.029
s43_ amount of concentrated feed	0.044	0.019	2.391	0.017
s2_ information on buffalo husbandry	0.133	0.067	1.988	0.047

Table 6 provides information regarding the effects of socio-economic features of the buffalo breeders surveyed on their profitability. The variables with positive parameter estimates impact and that are statistically significant lead to an appreciation in the relative profitability. Vice versa, negative estimates lead to a depreciation in the profitability.

Also, there appeared a positive and significant relationship between the relative profitability and 'supporting policy' and 'income sustainability' factors representing the attitudes of the buffalo breeders. Accordingly, it can be said that the positive changes in these acknowledged factors are expected to contribute to the relative productivity of buffalo husbandry enterprises. However, a negative and statistically significant relationship was observed between relative productivity and the 'use of technology' factor. Therefore, a rise in the attitudes related to technology is expected to lead declination in the relative profitability.

Also, there is a positive and significant relationship between milking duration of the breeder (months), amount of concentrated feed used per day (kg/buffalo head) and informative awareness of the breeder scaled on 5 points Likert scale and the profitability. However, there are also variables that affect profitability negatively. These are the amount of roughage used per day (kg/buffalo head), breeder's education level (years), duration of buffalo folding (months). A rise in attitudes incorporated in these factors affects profitability negatively and in a significant manner.

Also, Tobit model was incorporated into the study to determine the socio-economic and demographic characteristics of the breeder that affect relative profitability.

Relative productivity (RP) retrieved from buffalo husbandry activities was considered as the dependent variable for the estimated model. The model was constructed as follows.

RP = f(FAC3, FAC4, FAC8, GROUP, s2_debt, s2_level of education, s2_ information on buffalo husbandry, s2_satisfaction of buffalo husbandry, s30_duration of buffalo milking S43_amount of roughage, s43_amount of concentrated feed, s45_duration of buffalo folding).

The factors included in the estimation were the same as the linear regression. These were FAC3 (use of technology), FAC4 (supporting policy) and FAC8 (sustainability of income) due to their weights calculated in the factor analysis. In addition to the factors chosen due to their significance, the socio-demographic variables included needs recall as well. In addition to the previously explained variables, two variables were included in the model. First one is GROUP variable in which the farms were classified due to a number of buffalos held representing the scale of buffalo farm. The 1st group refers to enterprises with 1 to 5 buffalos, the 2nd group refers to 6 to 15 buffalos, the 3rd group of farms have 16 to 35 buffalos, and the 4th group represents the largest scale with more than 36 buffalos. The second variable is a dummy variable referring to the indebtedness situation of the buffalo farm. If the breeder was indebted, the variable had taken the value of 1 and 2 for vice versa.

The findings of the estimation were provided in Table 7. The overall findings indicated that the model could be used for estimation and forecasting.

There found out a positive and statistically significant relationship between supporting policy and relative profitability. Accordingly, any positive change in the supporting policies followed was expected to lead appreciation of the relative profitability. However, use of technology again was expected to affect the profitability negatively.

Besides, the socio-demographic variables also affect the relative profitability. The milking duration regarding months, per head, concentrated feed use and information level of the breeder calculated based on the Likert scale (1-5), the size of the farm due to a number of buffalos held and breeders situation of not being indebted and the relative profitability have positive and significant relationships.

On the other hand, per head roughage used, education level of the breeder, folding period regarding months and relative profitability has negative but significant relationships.

Table 7: Tobit model estimation results

Variable	Coefficient	Std. Error	z-Statistic	Prob.
FAC4_1	0.205438	0.046443	4.423430	0.0000
FAC8_1	0.011226	0.045597	0.246209	0.8055

FAC3_1	-0.151641	0.047542	-3.189632	0.0014
GROUP	0.444420	0.040948	10.85324	0.0000
S2_Debt	0.275505	0.089108	3.091801	0.0020
S2_Education Level	-0.063299	0.015376	-4.116832	0.0000
S2_ information buf.bred	0.098906	0.058327	1.695729	0.0899
S2_ satisfaction on buf.bred	-0.123502	0.052229	-2.364628	0.0180
S30_ duration of buffalo milking	0.114644	0.033521	3.420039	0.0006
S43_ amount of roughage	-0.024240	0.007040	-3.443066	0.0006
S43_ amount of concentrated feed	0.031073	0.016389	1.896004	0.0580
S45_ duration of buffalo folding	-0.053800	0.021933	-2.452964	0.0142
SCALE: C(13)	0.946310	0.031131	30.39741	0.0000
Mean dependent var	1.538688	S.D. dependent var		1.189878
S.E. of regression	0.955129	Akaike info criterion		2.783783
Sum squared resid	409.6102	Schwarz criterion		2.900152
Log-likelihood	-630.0539	Hannan-Quinn criteria.		2.829599
Avg. log likelihood	-1.363753			

5. Conclusion

It is essential to compute unit profit retrieved from production activities both from vegetative and animal-based products to evaluate the development of the relevant activities. Accordingly, internal and external environmental conditions affecting the farmer and the farm and any change is these conditions affect the sustainability of production activities. Due to the specific character of agriculture and animal breeding sectors, supporting policies need to be considered. In fact, animal breeding has been supported through utilisation of different tools all around the world. Therefore, determination of correct supporting mix also depends on analysis evaluation of internal and external factors as emphasised above.

Buffalo (water buffalo) husbandry has a stance among animal breeding activities because of its specific production conditions and the high value processed products retained from buffalos. Due to this features, buffalo husbandry is a specifically supported sector. In this process, it is essential to determine the factors effective for developing buffalo husbandry and analyse the profit level of the breeding activity. These findings are expected to help to evaluate the input use efficiency for buffalo husbandry and to find the correct path to support the activity.

Accordingly, a survey was conducted in representative provinces of Turkey (Samsun, İstanbul, Diyarbakır, Muş, Tokat, Afyonkarahisar and Bitlis for 2014 production season), and the factors and features' affecting of buffalo breeding was estimated. The factors were computed with a well-known data reduction methodology, factor analysis. Following this

computation, the factors, as well as, socio-economic and demographic characteristics of the farms and breeders were estimated to determine their effectiveness over the profitability of buffalo husbandry.

It is also worth to mention that, an extensive production model was observed which is dependent on grasslands. In the analysis of socio-demographic factors affecting relative profitability of buffalo breeding enterprises, there found a positive and statistically significant relationship between this relative profitability and supporting policies implemented that reflect attitudes of farmers. Accordingly, it can be said that an appreciation in supporting policies and implementation tools is expected to affect profitability level positively. Another significant finding is that lactation period (months), concentrated feed amount (kg/head), information level of the farmer, existing buffalo stock and indebtedness situation of the farmer affect profitability positively. These microfeatures can be considered as effective tools to stimulate profitability of buffalo husbandry.

Also, there appeared different significances in the formation of the factors that affect attitudes and behaviours of the buffalo breeder. These factors that can be used by policy developer and implementers are producers' awareness and level of satisfaction, use of technology, supporting policies, marketing operations, producer organisations, local leadership, and income sustainability, the field of operation and level of technical knowledge. Subsequently, due to the findings of the study reflecting the relative importance of production and marketing conditions in explaining the regional variation of buffalo breeding profitability, developing effective tools to improve the organisation of the sector and marketing policies are essential.

6. References

ALBAYRAK, A.S. Türkiye'de İllerin Sosyo-Ekonomik Gelişmişlik Düzeylerinin Çok Değişik Istatistik Yöntemlerle İncelenmesi" (Analysis of Socio-Economic Development of Provinces of Turkey with Different Statistical Methods). *PhD thesis*, Istanbul University Institute of Social Sciences, Department of Business Administration - Quantitative Methods, 369p., Istanbul, 2003.

ANONYMOUS, Ministry of Agriculture and Rural Affairs, Kocatepe Institute of Agricultural Research.

web:http://web.ttnet.com.tr/kocatepetae/Dunyada%20ve%20Turkiyede%20mandacilik, retrieved on: 10.12.2012, 2012.

ANONYMOUS, *Report on Animal Breeding Sector*. Ministry of Agriculture, General Directorate of Agricultural Enterprises. Web: http://tarim.kalkinma.gov.tr/wp-content/uploads/2014/10/2013-TIGEM-HAYVANCILIK-SEKTOR-RAPORU.pdf retrieved on: 02.03.2017, 2013.

ANONYMOUS, *Report on Animal Breeding*. Ministry of Agriculture, General Directorate of Animal Breeding. web: http://www.tarim.gov.tr/sgb/Belgeler/SagMenuVeriler/HAYGEM.pdf retrieved on: 01.06.2017, 2017.

ASKEGAARD, S.; MADSEN, T.K. *European food cultures: an exploratory analysis of food-related preferences and behaviour in European regions*. MAPP, 1995.

ATASEVER, S.; ERDEM, S.H. Manda Yetiştiriciliği ve Türkiye'deki Geleceği - (Buffalo Husbandry and Its Future in Turkey). *J. of Fac. of Agric., OMU*, 23(1):59-64, 2008.

BARTHOLOMEW, D. Factor Analysis for Categorical Data. *J. R. Statist. Soc. B* (1980), 42-3: 293-321, 1980.

BEHRMAN, J.R.; DEOLALIKAR, A.B. Will Developing Country Nutrition Improve with Income? A Case Study for Rural South India. *Journal of Political Economy*, Vol. 95, No. 3 (Jun. 1987), pp. 492-507, 1987.

BERK, A. Kırsal Kalkınma Projelerinin Kırsal Alan Üzerine Ekonomik Etkileri: Yozgat Kırsal Kalkınma Projesi Örneği"- (Economic Impacts of Rural Development Projects on Rural Areas: Example of Yozgat Province Rural Development Project). *Master of Science Thesis*, Çukurova University Institute of Science, Department of Agricultural Economics - pp. 161, Adana, 2004.

BILAL, M.Q.; SULEMAN, M.; RAZIQ, A. Buffalo: Black Gold of Pakistan. *Livestock Res. For Rural Development* 18(9):128, 2006.

BURKI, A.A.; MUSHTAQ, A.K.; BARI, F. The State of Pakistan's Dairy Sector: An Assessment. *The Pakistan Development Review*, Vol. 43, No. 2 (Summer 2004):149-174, 2004.

CHILD, J. Organization Structure and Strategies of Control: A Replication of the Aston Study. *Administrative science quarterly*, 163-177, 1972.

DIENER, P.; MOORE, K.; MUTAW, R. Meat, Markets, and Mechanical Materialism: The Great Protein Fiasco in Anthropology. *Dialectical Anthropology*, Vol. 5, No. 3 (November 1980), pp. 171-192, 1980.

FIELD, A. *Discovering Statistics Using SPSS Third Edition*. Sage Publications, 2009.

GOPALDAS, T. Hidden Hunger: The Problem and Possible Interventions. *Economic and Political Weekly*, Vol. 41, No. 34 (Aug. 26 - Sep. 1, 2006), pp. 3671-3674, 2006.

GORSUCH, R.L. *Factor Analysis (2nd. Ed.).* Lawrence Erlbaum Associates, Inc., Publisher, New Jersey, 1983.

GUJARATI, D. *Temel Ekonometri (Basic Econometrics)*. Literatür Publishing, Istanbul, 2001.

GÜNLÜ, A.; ÇIÇEK, H.; Tandoğan, M. Socio-economic analysis of dairy buffalo enterprises in Afyonkarahisar province in Turkey. *Journal of Food, Agriculture & Environment*, Vol.8:689-691, 2010.

HANSFORD, F. The Nutrition Transition: A Gender Perspective With Reference to Brazil. *Gender and Development*, Vol. 18, No. 3, Food (November 2010), pp. 439-452, 2010.

HOFFPAUIR, R. The Water Buffalo: India's Other Bovine. *Anthropos, Bd.* 77, H. 1./2. (1982): 215-238, 1982.

HUTCHESON, G.D.; SOFRONIOU, N. *The Multivariate Social Scientist: Introductory Statistics Using Generalized Linear Models.* 288pp., SAGE Publications Ltd., 1999.

IŞIK, M.; GÜL, M. Economic and social structures of water buffalo farming in Muş province of Turkey. *Revista Brasileira de Zootecnia*, Vol.45(7): 400-408, 2016.

JOWETT, G.H. Factor Analysis. *Journal of the Royal Statistical Society. Series C* (Applied Statistics), 7/2 (Jun. 1958): 114-125, 1958.

KAISER, H.F. An index of factorial simplicity. *Psychometrika*, 39(1): 31-36, 1974.

KARLI, B.; ERKAN, O.; YURDAKUL O.; ÇELIK, Y. Factors Affecting the Crop Pattern in Irrigated Farms in Harran Plain and Precautions to be Taken in GAP Region. GAP I. Tarım Kongresi, 26-28 May 1999, Şanlıurfa, Turkey, 281-290, 1999.

KATZ-GERRO, T.; TALMUD, I. Structural Analysis of a Consumption-Based Stratification indicator: Relational Proximity of Household Expenditures. *Social Indicators Research,* Vol. 73/1 (Aug. 2005): 109-132, 2005.

LIAO, T.F. *Interpreting Probability Models: Logit, Probit and Other Generalized Linear Models.* 96p., Sage Publications Inc., 1994.

LIGDA, D. *Water Buffalo.* web: http://ww2.netnitco.net/, retrieved on: 10.12.2012, 1998.

MCMICHAEL, P. Interpreting the World Food Crisis of 2007-08. Review (Fernand Braudel Center), Vol. 32, No. 1, *Political Economic Perspectives on the World Food Crisis* (2009), pp. 1-8, 2009.

MULAIK, S.A. *Foundations of Factor Analysis, Second Edition*. CRC Press, Taylor & Francis Group, London, 2010.

MUTLU ÇAMOĞLU, S.; SAKA, G. *Türkiye Fındık İhracat Piyasasında Dış Ticareti Etkileyen Faktörlerin Analizi- (Analysis of Factors Affecting Foreign Trade in Turkey's Nut*

Exports Market). 3rd National Conference of Economics, Published paper. 1-3 November 2012, İzmir, 2012.

NESS, M. *Multivariate Techniques in Market Research.* The course of Agro-Food Marketing, 2001-2002, Zaragoza, Spain, 2002.

PAIM, L. A Consumption Model for Measuring Poverty: An Exploratory Exercise. *Social Indicators Research*, Vol. 35/2 (Jun. 1995): 129-153, 1995.

PINDYCK, R.S.; RUBINFELD, D.L. *Econometric Models and Econometric Forecasts. Fourth Edition*. Mc Graw Hill International Editions Economic Series, 1998.

POPKIN, B.M. Nutritional Patterns and Transitions. *Population and Development Review*, Vol. 19, No. 1 (Mar. 1993), pp. 138-157, 1993.

SARIÖZKAN, S. Türkiye'de Manda Yetiştiriciliğinin Önemi (Importance of Buffalo Husbandry in Turkey). *Kafkas University Journal of Veterinary Science Faculty,* 17 (1), 163-166, 2011.

SCHRADER, H.; KOCH, B.; HACHMOLLER, G.; MASUREK, L. *Dynamics of Rural Areas: National Report, Germany*. FAL, Braunschweig, August, 2001.

STONER, M.; LEMKE, B.; TAHTAM, B. *Water Buffalo Agriculture Notes.* State of Victoria, Dept. of Primary Industries. July 2002, AG0619,1-2, Farm Diversification Information Service, Bendigo, 2002.

WYNESS, L.; WEICHSELBAUM, E.; O'CONNOR, A.; WILLIAMS, E.B.; BENELAM, B.; RILEY, H.; STANNER, S. Red meat in the diet: an update. *Nutrition Bulletin,* Volume 36, Issue 1, March 2011: 34–77, 2011.

YOUNG, L. World Hunger: A Framework for Analysis. *Geography*, Vol. 81, No. 2 (April 1996), pp. 97-110, 1996.

YURDAKUL, O. Tarım İşletmelerinin Analizinde Yeni Bir Metod: Faktöriyel Analiz - (A New Method in Analysis of Agricultural Enterprises: Factor Analysis). *Ziraat Ekonomisi Dergisi - (Journal of Agricultural Economics):* 4 - 11, 1973.

Acknowledgement

This study was a part of our research project. We would like to thank TUBITAK (Project number: 113O309) for financial support for this project.