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Factors Influencing the Red Meat Production in Damietta Governorate of Egypt: Factor Analysis Approach

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Abstract: In Egypt, the increasing demand for red meat caused by the increasing population, feeding limitations, and increasing cost of production, has become an impetus for meat producers to change the system of production. This study is to find out the main factors that influence the red meat production sector in Egypt. A factor analysis method was mainly used to determine factors which are important in red meat production. The analysis was based on data obtained by means of a questionnaire applied to a random sample of 48 red meat producers in Damietta Governorate in late 2016. The final results showed that five key factors were successfully constructed using factor analysis which are a production factor, a financial factor, an administrative factor, a biological factor, and a technological factor. The production and financial factors are important in producing red meat. The most important variables influencing red meat production are the number of animal units, and the volume of concentrated feed. The success of livestock enterprise depends on a prior experience in the field of meat production. High feed prices and fear of diseases were key challenges for determining red meat production. The availability of livestock feed is the major challenge for the red meat sector. Policy implication focuses on the necessity to increase the domestic production of red meat through facilitating the procedures of animal loans and encouraging the producers to increase the number of meat animals. Also, it becomes a necessity to increase the production of fodder crops and the appropriate vaccines.

Keywords: Factor Analysis, Principal Components, Red Meat Production, Egypt

1. Introduction

Development of livestock production is considered one of the essential issues. Currently, the livestock production is one of the agricultural subsector in Egypt. Its share of agricultural GDP is about 35.30%. This is represented in red meat, poultry meat, fish, dairy, eggs, and others. The red meat subsector has a relatively direct minor role in the livestock production sector of Egypt, but nevertheless, domestic red meat production makes a valuable contribution to the national food supply, whereas the cash value for it is accounted for about 38.81% of the total value of livestock production on average during the period (2001-2014) (MALR).

In Egypt, the food problem is regarded as a major strategic issue that attracts intensive attention on all levels. The major sources of calories are plant-based products, representing over 92% of the total calories consumed per capita per day. Animal and fish products make up only 6.67% and 8.06% of the total calorie availability, respectively, indicating that animal and fish products are relatively expensive sources of calories (Dawoud, 2005). The domestic production of red meat is too insufficient to meet the growing domestic needs of red meat. Therefore, Egypt endeavors to follow a policy that will increase food level of animal protein. Due to the increasing demand for food and especially high value animal proteins caused by rapidly growing population and economic development. Greater emphasis is now being placed on the need to develop the red meat sector, which is considered as one of the essential animal protein resources. There are many factors to be considered in the animal production to develop the red meat sector.

This study is conducted to identify the actual situation of red meat production ,to investigate the key factors that

influence the red meat sector, and to identify the related production and marketing problems. This would be a valuable information providing policy, which may assist policy makers to develop the livestock production sector in Egypt.

2. Methodology and Data

The study employed descriptive statistics and factor analysis technique. Descriptive statistics used to summarize the information about the general trend in livestock sector and red meat production in Egypt. The study applied factor analysis model to determine the key factors that influence the red meat production in Damietta Governorate of Egypt.

2.1. Concepts of Factor Analysis

Basically, there are two factor analysis techniques: exploratory and confirmatory factor analysis. Both techniques of factor analysis are based on common factor model (Brynaf, J. M., 1994). The main objective of the exploratory factor analysis (EFA) is to determine the number of a common factors influencing a set of variables and to determine the strength of relationship between each factor and each observed variable. The Confirmatory Factor Analysis (CFA) is a tool that is used to test or confirm specific hypotheses about the factor structure for a set of variables. Exploratory factor analysis is simpler to be performed than confirmatory factor analysis, a larger sample size is required for the CFA than for the EFA; for these reasons, the exploratory factor analysis is one of the most commonly used technique for data analysis (Anderson, T.W. 2003).

Principal components analysis (PCA) and exploratory factor analysis (EFA) are most commonly used reduction techniques. These two techniques can be applied to a single set of variables to discover which sets of variables in the set form coherent subsets that are relatively independent of one other. Variables that are correlated with one another which are also largely independent of other subset of variables are combined into factors, factors which are generated are thought to be representatives of the underlying process that have created the correlations among variables (Tabachnick. B. Fidell. L. 1989). Factor loadings is the means of interpreting the role of each variable it plays in defining each factor. The loadings indicate the degree of correspondence between the variable and factor (Hair *et al.,*1998). Factor loadings are used to group variables with different factors.

In factor analysis, the VARIMAX procedure is the most common used method for factor rotation (Hair *et al.,*1998; Stewart,1981). This an orthogonal rotation to maximize the variance of the squared loadings of a factor (column) on all the variables (rows) in factor matrix which has the effect of differentiating the original variables by the extracted factor (Garson, G. D., 2008) VARIMAX procedure is to rotate the factor matrix to simplify the interpretation of the columns. Factors are rotated so that the loading are a very high or very low on a particular factor.

2.2. Model Specification

The model for factor analysis is represented as follows:

$$Y_1 = a_{11}X_1 + a_{12}X_2 + \ldots\ldots + a_{1j}X_j$$
$$Y_2 = a_{21}X_1 + a_{22}X_2 + \ldots\ldots + a_{2j}X_j$$
$$\ldots \quad \ldots \quad \ldots\ldots \quad \ldots$$
$$Y_i = a_{i1}X_1 + a_{i2}X_2 + \ldots\ldots + a_{ij}X_j$$

Where Yi represents the i the principal component, a_{ij} the loading coefficients and x_j the original variables (Anim and Lyne, 1994).

Since the study related the impact of various variables to the production of red meat in Egypt, variables identified to be included as variables in the analysis are expected to be correlated among themselves. This has further been indicated by the correlation matrix presented in the table 2. in the appendix. Factor analysis approach of data reduction has been applied by using software SPSS.

Factor analysis conducted on 21 variables that are supposed to have an impact on meat production. These variables included the basic variables that are directly related to the production of red meat and other variables related to basic variables.

Variable are as follows: Number of animals each season(x_1), Amount of production (in tons) (x_2), Feed cost (x_3), Cost of veterinary care (x_4), Value of the herd (x_5), Potential capacity (x_6), Current capacity (x_7), Labor cost (x_8), Other costs (x_9), Fixed costs(x_{10}), Farm size (x_{11}), Profitability (x_{12}), Net return per ton of meat (x_{13}), Cost per ton (x_{14}), Source of animal (x_{15}), Number of years of the farm operation (x_{16}), Livestock rearing experience (years) (x_{17}), Weight at the beginning of fattening (x_{18}), Number of sessions (x_{19}), Animal breed (x_{20}), Animal species (x_{21}).

2.3. Data Sources

The study was mainly based on the questionnaire survey applied to the livestock owners. The data was collected using a survey from which was distributed randomly to 48 livestock owners in the districts of Damietta Governorate in late 2016. The study applied the rapid appraisal technique to investigate the factors influencing livestock sector, due to the difficulty to obtain data on financial and non-financial data from farms. Also the data was collected from specialists and experts in the field of animal production.

In addition, the study used secondary data of livestock sector for the period (2000-2015). The sources of secondary data were the Ministry of Agriculture and Land Reclamation (MALR), and Administration of Agriculture in Damietta, Department of livestock. In addition to the relevant studies done on this subject. SPSS was used to perform statistical analysis of the data collected from the survey forms.

3. Results and Discussion

3.1. Actual Situation of Red Meat Production Sector

This section provides a summary of the situation of red

meat production sector in Egypt during (2000-2015). It is based on data from (MALR). Cow meat, buffalo meat, sheep meat, goats, and camel meat are considered the most important sources of red meat in Egypt. Table 1 presents mean and growth rate of the number of cows, buffalo, goats, sheep and camels in Egypt, 2000-2015. The total number of animal units is about 10084 thousand. This number is allocated to the cow, buffalo, goats, and sheep in the ratio 44.64%, 47.29%, 5.15%, and 2.72%, respectively. Thus buffalos and cows contribute together to about 91.93% of the total meat animal units in Egypt during the same period.

Table 1. *Mean and Growth Rate of the Number of Meat Animals in Egypt, 2000-2015.*

Item	Mean	%	Constant	B	R^2	F	Growth Rate
Cows	4501	44.64	3856.90	75.72	0.73	37.87**	1.68
Buffalo	4769	47.29	4370.37	46.94	0.66	26.98**	0.89
Goats	519	5.15	458.35	7.11	0.81	60.37**	1.37
Sheep	274	2.72	238.80	4.17	0.85	81.88**	1.52
Camels	106	1.05	101.77	0.49	0.05	0.78	0.46
Total	10084	100.00	8842.50	146.05	0.76	43.53**	1.44

Source: Calculated Based on Data from MALR, Various Issues.
** Indicates significant at one percent level of significance.

The table shows that buffaloes come the first meat animals due to the relative importance of their animal units to the total number of meat animal units in Egypt during (2000-2015), represents about 47.29% of the total units number. Then cows come second as the number of their animal meat units represents about 44.64% in the same period of time. This means cows and buffalos are the main sources of red meat product in Egypt, because they are suitable for the Egyptian consumers tastes and preference. This attracts investors and institutions concerned with animal product of buffalos and cows.

During the period (2000-2015), it is observed that the number of cows increased from 3530 in 2000 to 5023 animal units in 2013. A simple linear trend shows that the number of cows increased by a significant annual growth rate of 1.68%. The time trend variable is significant at the 0.01 probability level and it explains 73% of the variation in the number of cows. Buffalo slowly increased over the same period by a significant annual growth rate of 0.89%. The number of goat and sheep grew at a significant annual rate of 1.376% and 1.52%. While, camels showed a stagnant position during period (2000- 2015), resulting in stagnancy in red meat production from this source. During the same period, it is observed that the total number of meat animals increased from 8547.00 in 2000 to 11101 animal units in 2013. A simple linear trend analysis shows that the total number of meat animals units increased by 146.05 thousand animal unit/year, with an annual growth rate of 1.44%. The time trend variable is significant at the 0.01 probability level and it explains 76% of the variation in the change of the meat animals numbers.

Table 2. *The number of Cows, Buffalo, Goats and Sheep in Damietta, 2015(Figures in 000).*

District	Cows		Buffalo		Sheep		Goats		Total		%
	No.	Animal Unit	No.	Animal Unit	No.	Animal Unit	No.	Animal Unit	No.	Animal Unit	
Damietta	2125	2125	4198	5248	910	91	810	57	8832	7521	8.43
Fraskor	8283	8283	23163	28954	3633	363	1489	104	37717	37704	42.25
Kafr Saad	7458	7458	11555	14444	7323	732	2525	177	30011	22811	25.56
El zarka	5077	5077	4045	5056	4511	451	844	59	17848	10643	11.93
Kafr Elbattikh	2498	2498	6581	8226	3634	363	803	56	13854	11143	12.49
Governorat	26453	26453	47934	59918	23995	2400	6605	462	104996	89233	100.00
%		29.64		67.15		2.69		0.52		100.00	

Animal Unit Cow=1, Buffalo=1.25, Sheep=0.10, Goat=0.07, Camel=0.75.
Source: Administration of Agriculture in Damietta, Department of livestock, Statistical records 2015 (Arabic).

Table 2, presents the number of meat animals and animal units of buffalo, cattle, goats and in Damietta Governorate of Egypt in 2015. The total number of meat animal units is about 89233 thousand units. This livestock numbers is allocated to the Farskor, Kafr Saad, Kafr El-battikh, El zarka and Damietta district in the ratio of 42.25%, 25.56%, 12.49%, and 8.43%, respectively, the total meat animal units of Fraskor is the highest.

3.2. Evaluating the Appropriateness of Factor Analysis

Evaluating the appropriateness of factor analysis means assessing whether the variables are significantly and sufficiently correlated with each other so that their number can be reduced by applying the factor analysis. This can be done by a visual inspection of the correlation matrix. The correlation matrix provides an introspective view regarding the inter relationship among the variables (Carlos, M. *et al.* 2003). The First step in the analysis is an examination of the correlation matrix, presented in Table (2) in the appendix. The values in the table show that several variables are significantly correlated and strongly correlated. Therefore there is no way to demarcate the separate influence of the variables.

Further, there are certain diagnostic tests that affirm

multicollinearity. The Kaiser Meyer Olkin measure of sampling adequacy is used to examine the appropriateness of factor analysis. The Kaiser Meyer Olkin value is 0.734, which is greater than 0.5, hence KMO test confirms the correlation among variables and factor analysis of the variable is feasible (Table 3). Moreover, this result has further been vindicated by the Bartlett's Test of Sphericity. It provides the statistical probability that correlation matrix has significant correlations among at least some of variables (Hair *et al.*, 1998). This test has been applied to test the null hypothesis of spherical matrix. A chi-square test reject the null hypothesis of uncommon factor in favor of the alternative, that at least one common factor is presented, with a value of 1326.52 (with 210 degrees of freedom). It is suggested that if the Bartletts Test of Sphericity is significant, and if KMO exceeds 0.5, then factorability is assumed. Based on the results in the table 3, the data matrix has sufficient correlations and the factor analysis is appropriate to be applied to the set of study data.

Table 3. *Results of KMO and Bartlett's Test.*

Kaiser – Meyer- Olkin (KMO) Measure of sampling adequacy	0.734
Bartlett's Test of Sphericity Approx. Chi-Squared	1326.52
Degree of freedom	210
Degree of Statistical Significance	0.001

Source: Statistical analysis results based on sample data, using SPSS 17.

A principal components method was applied in the analysis after the rotation to varimax. Table 4 displays the total variance explained in five stages for factors that influence red meat production. Five factors were extracted because their eigenvalues are greater than one which are capable to explain about 79.134% of the variance among variables, of which around 41.70% is explained by factor one and 15.2% is explained by factor two.

The principal component analysis method provides the relationship between the extracted factors and variable included in the analysis. The second run gives the results of un-rotated component matrix as illustrated in table 5.

Table 4. *Factors Analysis for Meat Production: Explained Total Variance.*

Component	Initial Eigenvalue			Extraction Sum of Square Loading			Rotation Sum of Square Loading		
	Total	%Variance	Cumulative	Total	%Variance	Cumulative	Total	%Variance	Cumulative
1	8.950	42.618	42.618	8.950	42.618	42.618	8.760	41.715	41.715
2	3.192	15.198	57.816	3.192	15.198	57.816	3.199	15.235	56.950
3	1.962	9.343	67.159	1.962	9.343	67.159	1.833	8.730	65.680
4	1.331	6.337	73.495	1.331	6.337	73.495	1.463	6.965	72.645
5	1.184	5.639	79.134	1.184	5.639	79.134	1.363	6.489	79.134
6	1.022	4.882	84.016						
7	0.833	3.968	87.984						
8	0.771	3.671	91.655						
9	0.470	2.240	93.895						
10	0.423	2.014	95.909						
11	0.305	1.439	97.348						
12	0.251	1.197	98.544						
13	0.107	0.510	99.054						
14	0.069	0.328	99.382						
15	0.047	0.224	99.606						
16	0.043	0.204	99.810						
17	0.018	0.087	99.896						
18	0.014	0.066	99.962						
19	0.004	0.021	99.983						
20	0.003	0.012	99.995						
21	0.001	0.005	100.000						

Extraction Method: principal component analysis
Source: Statistical analysis results based on sample data, using SPSS 17.

Table 5. *Un rotated Component Matrix (Principle Component Analysis).*

No	Variable	Factors				
		1	2	3	4	5
1	Number of animals each season	0.986				
2	Amount of production (in tons)	0.960				
3	Feed cost	0.954				
4	Cost of veterinary care	0.950				
5	Value of the herd	0.937				
6	Potential capacity	0.920				
7	Current capacity	0.919				
8	Labor cost	0.915				
9	Other costs	0.902				
10	Fixed costs	0.620	-0.367			
11	Farm size	0.448				
12	Profitability		0.943			
13	Net return per ton of meat		0.929			

No	Variable	Factors				
		1	2	3	4	5
14	Cost per ton		-0.875			
15	Source of animal			0.728		
16	Number of years of the farm operation		0.426	0.614		-0.359
17	Livestock rearing experience (years)			0.573		-0.317
18	Weight at the beginning of fattening	-0.370			0.768	
19	Number of sessions		0.385	-0.428	0.699	
20	Animal breed					0.596
21	Animal species			0.465		0.552

Source: Statistical analysis results based on sample data, using SPSS 17.

Factor analysis technique provides the facility of factor rotation to generate the orthogonal factors; accordingly, varimax technique of orthogonal with Kaiser Normalization has been used. The results are presented in the table 6. It clearly shows the orthogonal and the value of factor loadings clearly identifies each variable with factor. The variables with loadings greater than 0.40 were considered for interpretation purpose, as highly loaded. Factor loadings less than 0.40 are deleted from the table. Each factor is described based on these variables and assigned descriptive names. As shown in the table, the 21 variables are extracted into five factors.

Factor 1 consists of 11 items with factor loading ranging from 0.981 to 0.474, the items factor1 are number of livestock, value of the herd, amount of production (in tons), feed cost, labor cost, cost of veterinary, Actual production capacity, production capacity, other costs, fixed costs and farm size. The number of meat animal heads is more positive saturated variables on the first factor. The component 1 was the combination of all these 11 items and this component could be interpreted as (Production Factor). component 1 contributed to 41.717% variation (table 6) of red meat production of the Damietta Governorate.

The economic analysis of sample data showed that the cost of herd represents from 42% to 63% of the total costs. The feed cost represents from 25% to 48% of the total cost. While veterinary care cost represents from 0.30 to 1.70% of total cost. While labor represents from 2.5% to 8% followed by veterinary care cost (0.3% to 1.70%), other costs (0.2 to 1.30%). Fixed costs ranged from 1.oo to 7.00%% of the operating costs. The two main costs (herd and feed) represent respectively the 33% and the 21% of the total return.

Factor 2 consists of 3 items: profitability/LE., net return per ton and cost per ton of red meat and were significantly loaded with co-efficient values of 0.953, 0.940 and – 0.885 respectively. These formed the second component (Financial Factor) by explaining 14.48% of variation in the red meat production. For the second factor, the net return per unit of red meat showed strong positive loading, and cost per ton of meat showed strong negative loadings. There is an inverse relation between the factor and the cost of meat per ton indicating the lower cost of production which leads to higher net return. This encourages the producers to increase production quantity of red meat. The financial analysis of the sample data showed that the net return per animal unit was 7.53 thousand LE, 30% which is the highest among the producers of sample. The profitability was about 0.21 per pound.

The eigenvalue for the first component (Production) was notably greater than that of the second component (Financial) which showed the possibility of productivity improvement to a large extent.

Table 6. *Rotated Component Matrix (Varimax Method with Kaiser Normalization).*

No	Variable	Factors				
		1	2	3	4	5
1	Number of animals each season	0.981				
2	Value of the herd	0.966				
3	Amount of production (in tons)	0.955				
4	Feed cost	0.955				
5	Labor cost	0.924				
6	Cost of veterinary	0.923				
7	Actual production capacity	0.901				
8	Production capacity	0.901				
9	Other costs	0.873				
10	Fixed costs	0.637				
11	Farm size	0.474				
12	Profitability/LE.		0.963			
13	Net return per ton		0.938			
14	Cost per ton		-0.890			
15	Number of years of the farm operation			0.730		
16	Source of animal			0.672		
17	Past experience			0.648		
18	Number of sessions				0.824	
19	Weight at the beginning of fattening				0.756	
20	Animal breed					0.691
21	Type of product					0.579

No	Variable	Factors				
		1	2	3	4	5
Eigen value		8.950	3.192	1.962	1.331	1.184
Percentage of total variance		41.715	15.235	8.730	6.965	6.489

Source: Statistical analysis results based on sample data, using SPSS 17.

Table 7. *Component Score Matrix.*

No	Variable	Factors				
		1	2	3	4	5
1	Farm size	0.063	-0.074	0.150	0.058	-0.047
2	Production capacity	0.102	0.020	-0.039	0.144	-0.111
3	Actual production capacity	0.103	0.022	-0.052	0.146	-0.088
4	Past experience	-0.035	-0.041	0.368	-0.058	-0.138
5	Number of years of the farm operation	-0.021	0.118	0.421	0.036	-0.164
6	Type of product	0.021	-0.026	-0.175	0.031	0.471
7	Animal breed	0.030	0.070	0.042	-0.038	0.518
8	Source of animal	0.078	-0.021	0.349	0.112	0.222
9	Number of livestock	0.116	0.012	-0.024	0.014	0.050
10	Number of sessions	0.021	0.035	-0.025	0.566	-0.175
11	Fixed costs	0.070	-0.107	0.197	-0.058	-0.122
12	Weight at the beginning of fattening	0.040	-0.102	0.084	0.556	0.230
13	Value of the breed	0.128	-0.056	0.028	0.083	0.086
14	Feed cost	0.113	-0.001	0.005	-0.065	0.097
15	Cost of veterinary	0.094	-0.001	-0.067	-0.043	-0.078
16	Labor cost	0.109	-0.037	0.031	-0.082	0.081
17	Other costs	0.090	0.037	-0.078	-0.031	-0.031
18	Amount of production (in tons)	0.114	0.043	0.001	-0.027	0.118
19	Cost per ton	0.003	-0.285	0.096	0.029	-0.178
20	Net return per ton	-0.022	0.296	0.061	-0.024	-0.089
21	Profitability/LE.	-0.011	0.305	0.036	-0.045	-0.014

Source: Statistical analysis results based on sample data, using SPSS 17.

Factor 3. mainly illustrates the administrative items, hence, it called (Administrative Factor). Factor 3 comprised of 3 variables with factor loadings ranging from 0.730 to 0.648. The items in factor 3 are the number of years of the farm operation, source of animal and previous experience. The third factor accounted for 8.730% of the variations. This factor showed the importance of the number of years of farm operation, the source of animal and previous experience. The two items that load on factor 4 number of production sessions and the weight of animal at the beginning of fatting process. The number of production sessions associated with the weight of animal at the beginning of fatting. The high weight of animal leads to more production courses in a special time. This factor is a reasonable representation of the biological items. Therefore, it is called (Biological Factor).

Finally, variables loaded for factor 5 are related to animal breed and type of animal, which were significantly loaded with co-efficient values of 0.691 and 0.579 respectively. This was labeled (Technological Factor) component 5 contributed to 6.489% variation of red meat production of Damietta Governorate.

This can be useful when planning to increase the production of red meat by selecting type and strain of animals with higher productivity. And at the same time, more effort should be exerted to raise the productivity of animal types using improved genetic techniques; introducing high yield genetics as means to increase red meat production.

Five new factors were successfully constructed using factor analysis and assigned as the factors influencing the red meat production. Table 8 shows the names of new factors and percentage of variance explains when it was extracted. When the first factor was extracted, then 41.715% of variance would be explained.

The results showed the importance of the technological factor. The source of the animal is correlated with production, administrative and technological factors. Also The correlation between technological factor and the weight at the beginning of fattening, and its correlation with biological factor. This indicates the saturation of animal breeding and type correlated with the source of the animal and the weight at the beginning of fatting. This indicates that farmers breed used foreign breeding animals with more productivity and to select the source of animal which has a high efficiency in meat production. Increasing the productivity of each animal is the most efficient way of producing more meat, through selecting the source of animal and breeding which achieve higher productivity.

Table 8. *Name of New Factors with Percentage of Variance.*

Factor	Name	% Variance
1	Production Factor	41.715
2	Financial Factor	15.235
3	Administrative Factor	8.730
4	Bio-Factor	6.965
5	Technological Factor	6.489

Source: Statistical analysis results based on sample data, using SPSS 17.

3.3. Challenges Facing Red Meat Producers in Damietta Governorate

There are many problems and challenges facing the producers of red meat in the study area such as productivity problems and marketing problems, which appeared during the field study. Productivity problems were high feed prices, high labor cost, lack of professional labor, the spread of foot and mouth disease, the high cost of veterinary medicines, high interest of loans for meat producers and feed shortage. Marketing problems, inequality prices, instability of sales, lack of market information, monopoly practices of some traders, seasonal changes of demand. This leads to deterioration in the red meat sector.

By using the variance analysis to identify the causes of productivity problems, there were statistically significant differences between causes of productivity problems at probability level of 0.01. Using the method of the least significant difference to arrange the causes of productivity problems, according to their relative importance, as shown in table 9 and 10, it appears that the high prices, high cost of labor, risk cost and high cost of animal breeding were among the first producers concerns, because there were no significant statistical differences among the causes. While poor quality of breed, the weakness of preventive and extension efforts, high cost of loan, shortages of feed, lack of skilled labor, were in the second order.

Lack of suitable diseases vaccine and nutrition problem are the most important because they require supplying of feed at reasonable prices.

Red meat producers generally use the available local feed resources, such as crop residues, grass, forage crops, and local feedstuffs (agro-industrial product). This requires an expansion in the cultivated area of fodder crops, the stability of prices for animals fatting, providing effective treatment and appropriate vaccines.

Using variance analysis to identify the causes of marketing problems, there was statistically significant differences between causes of marketing problems at probability level of 0.01. Using the method of the least significant difference to arrange the causes of marketing problems, according to their relative importance, as shown in table 11. Using the least significance difference, as shown in table 12, it appears that dumping and fear of diseases together came in the first order. While the fear of disease and lack of marketing organization and slaughtering young calves were in the second order, since there were no significant statistical differences. Finally, lack of marketing information, and seasonal changes in demand came in the fifth rank.

Achieving reasonable prices of production needs to increase the tariff imposed on red meat, ration of red meat, stability of sales, ban on slaughter young claves, increasing the sales and marketing outlets for red meat sector.

Table 9. *Variance Analysis for Productivity Problem Causes.*

Sources of variation	Freedom Degrees	Sum of Squares (SS)	Mean Sum of Squares (MS)	*F*-statistic
Between the reasons	9	944.980	104.988	27.748**
Within the reasons	440	1664.978	3.784	
Total	449	2609.958		

Source: Statistical analysis results based on Questionnaire sample survey in 2016.

Table 10. *The Ranks of Productivity Problem Causes, L. S. D at 0.01 and 0.05.*

No	Causes	Average	Rank	Group		
				1	2	3
X_1	High cost of labor	2.13	X_3	1.55		
X_2	Lack of professional labor	4.69	X_1	2.13		
X_3	High feed prices	1.55	X_{10}	2.20		
X_4	Feed shortage	4.58	X_5	2.40		
X_5	High value of animal breed	2.40	X_6		4.06	
X_6	Poor quality of animal breed	4.06	X_7		4.07	
X_7	Weakness extension effort	4.07	X_9		4.20	
X_8	High cost of veterinary medicines	6.45	X_4		4.58	
X_9	High Cost of loans	4.20	X_2		4.69	
X_{10}	Risk	2.20	X_8			6.45

L. S. D. value at 0.05=0.20, L. S. D. value at 0.01=0.26
Source: Statistical analysis results based on Questionnaire sample survey in 2016.

Table 11. *Variance Analysis Marketing Problem Causes.*

Sources of variation	Freedom Degrees	Sum of Squares (SS)	Mean Sum of Squares (MS)	*F*-statistic
Between the reasons	9	1391.636	154.626	66.66**
Within the reasons	440	1020.622	2.320	
Total	449	2412.258		

Source: Statistical analysis results based on Questionnaire sample survey in 2016.

Table 12. *The Ranks of Marketing Problem Causes, L. S. D at 0.01 and 0.05.*

No	Causes	Average	Rank	Group				
				1	2	3	4	5
X_1	Inequality prices	4.80	X_2	1.80				
X_2	Dumping	1.80	X_7	2.11	2.11			
X_3	Instability of sales	5.22	X_6		2.69	2.69		
X_4	Slaughter young calves	2.71	X_4		2.71	2.71		
X_5	Lack of market information	6.44	X_8			3.04		
X_6	Lack of marketing organization	2.69	X_9				4.69	
X_7	Fear of diseases	2.11	X_1				4.80	
X_8	Monopoly of some traders	3.04	X_3				5.22	
X_9	Lack of adequate market	6.44	X_5					6.44
X_{10}	Seasonal changes of demand	7.11	X_{10}					7.11

L. S. D. value at 0.05=0.20, L. S. D. value at 0.01=0.26
Source: Statistical analysis results based on Questionnaire sample survey in 2016.

4. Conclusions and Recommendations

The results showed five new factors which were successfully constructed by using factor analysis and assigned as the factors influencing the meat production; which are production factor, financial factor, administrative factor, biological factor and technological factor. Factor analysis results indicated that effective factors production and financial factor are important in producing red meat. The most important factors influencing red meat production are the number of animal units, and the volume of concentrated feed. Feed cost is a significant component of the cost of producing red meat. As everyone knows, this indicates that number of meat animal heads plays an important role in increasing meat production. There is a potential of productivity improvement to a large extent. On large farm scale basis, the lower cost of production leads to higher net return, which encourages producers to increase production. Also, The success of livestock enterprise depends on a prior experience in the field of animal production, selecting animal and breeding type.

The nutrition problem is one of the most important production problems facing the red meat sector, while the high feed price is the most important cause that limits red meat production. As well as the marketing problem, the increase of imported red meat and fear of diseases were the key challenges for determining producer prices. The consequence of these reasons result in instability of sector production and deterioration in red meat sector.

Based on the results, the study recommends the following:

- There is a need to increase investments in the red meat sector in Egypt, besides facilitating the procedures of animal loans.
- Encouraging the producers to increase the number of red meat animals with high meat productivity. This can be achieved by funding the producers and facilitating the production system of livestock.
- Increasing fodder supply through extend the existing area of fodder crops and cultivation of high yielding varieties,
- Providing effective treatment and appropriate vaccines that are important items for increasing animal production.
- Application of advanced biotechnology and feed processing technology.
- Asserting not to slaughter young calves before they are fattened to the optimum weight at slaughter time.
- Policy maker should consider low cost loan to promote the production in a positive way.
- Increasing the investments in technology improvements in livestock production, encouraging the adoption of new bio-technologies in livestock production.

Appendix

Table A1. *Trends in the Number of of Cows, Buffalo, Goats, Sheep and Camels in Egypt, 2000-2015 (Figures in 000).*

Years	Cows		Buffalo		Sheep		Goats		Camels		Total	
	No.	Animal Unit	No.	Animal Unit	No.	Animal Unit	No.	Animal Unit	No.	Animal Unit	No.	Animal Unit
2000	3530	3530	3530	4224	4469	447	3425	240	142	107	14944	8547
2001	3801	3801	3378	4224	4469	447	3425	240	142	107	14944	8547
2002	4012	4012	3533	4416	4671	467	3491	244	134	101	15630	9029
2003	4369	4369	3777	4721	4939	494	3811	267	136	102	16890	9811
2004	4227	4227	3717	4646	5105	511	3582	251	127	95	16543	9515
2005	4485	4485	3845	4806	5043	504	3879	272	129	97	17265	10048
2006	4515	4515	3885	4856	5232	523	3803	266	142	107	17547	10237
2007	4680	4680	3897	4871	5289	529	3880	272	145	109	17726	10296
2008	5023	5023	3915	4894	5311	531	3920	274	159	119	17985	10499
2009	4524	4524	4052	5065	5498	550	4237	297	165	124	18975	11058

Years	Cows		Buffalo		Sheep		Goats		Camels		Total	
	No.	Animal Unit	No.	Animal Unit	No.	Animal Unit	No.	Animal Unit	No.	Animal Unit	No.	Animal Unit
2010	4728	4728	3838	4798	5591	559	4139	290	137	103	18229	10273
2011	4779	4779	3818	4773	5529	553	4174	292	110	83	18359	10428
2012	4946	4946	3983	4979	5365	537	4258	298	136	102	18521	10694
2013	4745	4745	4164	5205	5429	543	4306	301	141	106	18986	11101
2014	4762	4762	3915	4894	5564	556	4153	291	152	114	18529	10600
2015	4883	4883	3950	4938	5502	550	4180	293	158	119	18552	10661
Average		4501		4769		519		274		106		10084
%		45		47		5		3		1		100

Animal Unit Cow=1, Buffalo=1.25, Sheep=0.10, Goats=0.07, Camels=0.75.
Source: Central Agency for Public Mobilization and Statistics (CAPMAS), Statistics of Animal Wealth, different issues (in Arabic).

Table A2. *Presents the Correlation Matrix Ratios.*

Item	Farm Size	Production Capacity	Actual Production Capacity	Past Experience	Years of The Farm Operation	Type of Product	Animal Breed
Farm size	1	0.358	0.342	-0.026	-0.032	-0.109	-0.056
Production capacity	0.358	1	0.997	-0.278	-0.115	-0.25	-0.138
Actual production capacity	0.342	0.997	1	-0.281	-0.126	-0.223	-0.123
Past experience	-0.026	-0.278	-0.281	1	0.375	0.069	0.192
Number of years of the farm operation	-0.032	-0.115	-0.126	0.375	1	-0.053	0.165
Type of product	-0.109	-0.25	-0.223	0.069	-0.053	1	0.142
Animal breed	-0.056	-0.138	-0.123	0.192	0.165	0.142	1
Source of animal	0.291	0.108	0.099	0.119	0.291	-0.143	0.244
Number of livestock	0.389	0.917	0.921	-0.271	-0.097	-0.157	-0.082
Number of sessions	-0.091	0.274	0.277	-0.096	0.091	0.015	-0.11
Fixed costs	0.331	0.481	0.473	0.106	0.027	-0.041	-0.183
Weight at the beginning of fattening	-0.113	-0.303	-0.297	0.027	0.038	0.128	0.067
Value of the herd	0.43	0.831	0.835	-0.229	-0.132	-0.157	-0.095
Feed cost	0.351	0.823	0.822	-0.231	-0.05	-0.114	-0.047
Cost of veterinary	0.325	0.901	0.9	-0.338	-0.153	-0.21	-0.204
Labour cost	0.435	0.730	0.728	-0.231	-0.061	-0.167	-0.118
Other costs	0.455	0.854	0.855	-0.28	-0.169	-0.235	-0.101
Amount of production (in tons)	0.356	0.833	0.837	-0.247	-0.033	-0.122	-0.037
Cost per ton	0.137	-0.124	-0.136	0.153	-0.183	-0.022	-0.219
Net return per ton	-0.057	0.189	0.191	-0.127	0.411	-0.154	0.067
Profitability/LE.	-0.082	0.216	0.221	-0.142	0.393	-0.099	0.099
Sig. (1-tailed)							
Farm size	0.008		0	0.032	0.226	0.049	0.183
Production capacity	0.011	0		0.031	0.204	0.071	0.21
Actual production capacity	0.434	0.032	0.031		0.006	0.326	0.103
Past experience	0.418	0.226	0.204	0.006		0.366	0.139
Number of years of the farm operation	0.239	0.049	0.071	0.326	0.366		0.176
Type of product	0.358	0.183	0.21	0.103	0.139	0.176	
Animal breed	0.026	0.24	0.259	0.218	0.026	0.175	0.053
Source of animal	0.004	0	0	0.036	0.262	0.151	0.297
Number of livestock	0.276	0.034	0.033	0.265	0.277	0.461	0.236
Number of sessions	0.013	0	0.001	0.243	0.43	0.393	0.115
Fixed costs	0.23	0.021	0.024	0.431	0.403	0.201	0.331
Weight at the beginning of fattening	0.002	0	0	0.065	0.194	0.152	0.267
Value of the herd	0.009	0	0	0.063	0.373	0.228	0.381
Feed cost	0.015	0	0	0.012	0.157	0.083	0.09
Cost of veterinary	0.001	0	0	0.063	0.345	0.136	0.219
Labour cost	0.001	0	0	0.031	0.133	0.06	0.255
Other costs	0.008	0	0	0.051	0.414	0.213	0.404
Amount of production (in tons)	0.185	0.209	0.186	0.158	0.114	0.443	0.074
Cost per ton	0.355	0.106	0.104	0.204	0.003	0.156	0.33

Item	Farm Size	Production Capacity	Actual Production Capacity	Past Experience	Years of The Farm Operation	Type of Product	Animal Breed
Net return per ton	0.297	0.077	0.073	0.176	0.004	0.259	0.258
Profitability/LE.	1.000	0.358	0.342	-0.026	-0.032	-0.109	-0.056

Table A2. *Continue.*

Item	Source of Animal	Number of Livestock	Number of Sessions	Fixed Costs	Weight at The Beginning of Fattening	Value of The Herd	Feed Cost
Farm size	0.291	0.389	-0.091	0.331	-0.113	0.43	0.351
Production capacity	0.108	0.917	0.274	0.481	-0.303	0.831	0.823
Actual production capacity	0.099	0.921	0.277	0.473	-0.297	0.835	0.822
Past experience	0.119	-0.271	-0.096	0.106	0.027	-0.229	-0.231
Number of years of the farm operation	0.291	-0.097	0.091	0.027	0.038	-0.132	-0.05
Type of product	-0.143	-0.157	0.015	-0.041	0.128	-0.157	-0.114
Animal breed	0.244	-0.082	-0.11	-0.183	0.067	-0.095	-0.047
Source of animal	1	0.266	-0.19	0.327	0.166	0.357	0.33
Number of livestock	0.266	1	-0.016	0.562	-0.332	0.949	0.959
Number of sessions	-0.19	-0.016	1	-0.185	0.313	-0.086	-0.159
Fixed costs	0.327	0.562	-0.185	1	-0.253	0.621	0.612
Weight at the beginning of fattening	0.166	-0.332	0.313	-0.253	1	-0.146	-0.356
Value of the herd	0.357	0.949	-0.086	0.621	-0.146	1	0.92
Feed cost	0.33	0.959	-0.159	0.612	-0.356	0.920	1
Cost of veterinary	0.132	0.930	-0.014	0.589	-0.432	0.862	0.887
Labour cost	0.354	0.909	-0.28	0.597	-0.282	0.921	0.938
Other costs	0.1	0.875	0.021	0.46	-0.39	0.787	0.812
Amount of production (in tons)	0.341	0.963	-0.094	0.575	-0.298	0.918	0.961
Cost per ton	-0.028	-0.128	-0.235	0.29	0.096	0.062	-0.055
Net return per ton	0.061	0.125	0.231	-0.185	-0.134	-0.019	0.05
Profitability/LE.	0.09	0.185	0.208	-0.141	-0.155	0.023	0.135
Sig. (1-tailed)							
Farm size	0.24	0	0.034	0	0.021	0	0
Production capacity	0.259	0	0.033	0.001	0.024	0	0
Actual production capacity	0.218	0.036	0.265	0.243	0.431	0.065	0.063
Past experience	0.026	0.262	0.277	0.43	0.403	0.194	0.373
Number of years of the farm operation	0.175	0.151	0.461	0.393	0.201	0.152	0.228
Type of product	0.053	0.297	0.236	0.115	0.331	0.267	0.381
Animal breed		0.038	0.106	0.014	0.139	0.008	0.014
Source of animal	0.038		0.459	0	0.013	0	0
Number of livestock	0.106	0.459		0.112	0.018	0.287	0.149
Number of sessions	0.014	0	0.112		0.046	0	0
Fixed costs	0.139	0.013	0.018	0.046		0.169	0.008
Weight at the beginning of fattening	0.008	0	0.287	0	0.169		0
Value of the herd	0.014	0	0.149	0	0.008	0	
Feed cost	0.193	0	0.463	0	0.002	0	0
Cost of veterinary	0.009	0	0.031	0	0.03	0	0
labour cost	0.257	0	0.445	0.001	0.004	0	0
Other costs	0.011	0	0.271	0	0.024	0	0
Amount of production (in tons)	0.426	0.202	0.06	0.026	0.266	0.342	0.36
Cost per ton	0.345	0.206	0.063	0.112	0.19	0.45	0.372
Net return per ton	0.277	0.112	0.085	0.178	0.154	0.44	0.189
Profitability/LE.	0.291	0.389	-0.091	0.331	-0.113	0.43	0.351

Table A2. *Continue.*

Item	Cost of Veterinary	Labor Cost	Other Costs	Amount of Production (in tons)	Cost Per Ton	Net Return Per Ton	Profitability.
Farm size	0.325	0.435	0.455	0.356	0.137	-0.057	-0.082
Production capacity	0.901	0.730	0.854	0.833	-0.124	0.189	0.216

Actual production capacity	0.9	0.728	0.855	0.837	-0.136	0.191	0.221
Past experience	-0.338	-0.231	-0.28	-0.247	0.153	-0.127	-0.142
Number of years of the farm operation	-0.153	-0.061	-0.169	-0.033	-0.183	0.411	0.393
Type of product	-0.21	-0.167	-0.235	-0.122	-0.022	-0.154	-0.099
Animal breed	-0.204	-0.118	-0.101	-0.037	-0.219	0.067	0.099
Source of animal	0.132	0.354	0.1	0.341	-0.028	0.061	0.09
number of livestock	0.93	0.909	0.875	0.963	-0.128	0.125	0.185
Number of sessions	-0.014	-0.28	0.021	-0.094	-0.235	0.231	0.208
Fixed costs	0.589	0.597	0.46	0.575	0.29	-0.185	-0.141
Weight at the beginning of fattening	-0.432	-0.282	-0.39	-0.298	0.096	-0.134	-0.155
Value of the herd	0.862	0.921	0.787	0.918	0.062	-0.019	0.023
Feed cost	0.887	0.938	0.812	0.961	-0.055	0.05	0.135
Cost of veterinary	1	0.857	0.856	0.874	-0.028	0.073	0.119
Labour cost	0.857	1	0.759	0.916	0.026	-0.043	0.027
Other costs	0.856	0.759	1	0.851	-0.235	0.132	0.202
Amount of production (in tons)	0.874	0.916	0.851	1	-0.24	0.194	0.292
Cost per ton	-0.028	0.026	-0.235	-0.24	1	-0.745	-0.828
Net return per ton	0.073	-0.043	0.132	0.194	-0.745	1	0.974
Profitability/LE.	0.119	0.027	0.202	0.292	-0.828	0.974	1
Sig. (1-tailed)							
Farm size	0	0	0	0	0.209	0.106	0.077
Production capacity	0	0	0	0	0.186	0.104	0.073
Actual production capacity	0.012	0.063	0.031	0.051	0.158	0.204	0.176
Past experience	0.157	0.345	0.133	0.414	0.114	0.003	0.004
Number of years of the farm operation	0.083	0.136	0.06	0.213	0.443	0.156	0.259
Type of product	0.09	0.219	0.255	0.404	0.074	0.33	0.258
Animal breed	0.193	0.009	0.257	0.011	0.426	0.345	0.277
Source of animal	0	0	0	0	0.202	0.206	0.112
number of livestock	0.463	0.031	0.445	0.271	0.06	0.063	0.085
Number of sessions	0	0	0.001	0	0.026	0.112	0.178
Fixed costs	0.002	0.03	0.004	0.024	0.266	0.19	0.154
Weight at the beginning of fattening	0	0	0	0	0.342	0.45	0.44
Value of the herd	0	0	0	0	0.36	0.372	0.189
Feed cost		0	0	0	0.427	0.317	0.219
Cost of veterinary	0		0	0	0.432	0.389	0.43
Labor cost	0	0		0	0.06	0.195	0.091
Other costs	0	0	0		0.056	0.101	0.026
Amount of production (in tons)	0.427	0.432	0.06	0.056		0	0
Cost per ton	0.317	0.389	0.195	0.101	0		0
Net return per ton	0.219	0.43	0.091	0.026	0	0	
Profitability/LE.	0.325	0.435	0.455	0.356	0.137	-0.057	-0.082

Source: by researcher depending on sample data, using SPSS 17.
Determinant = 6.98E-02

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