

Profitability Analysis of Sheep Farming in Turkey: a Case Study

Meral Uzunoç and Yasar Akçay

Department of Agricultural Economics, Faculty of Agriculture, Gaziosmanpaşa University, 60240,
Tokat, Turkey

Abstract: In this study, the data were obtained through personal interview with 46 sheep farmers of Tokat province for the year of 2006. In order to achieve the objectives, the values such as Net Present Value (NPV), Cost-Benefit Ratio (CBR) and Internal Rate of Return (IRR) were calculated. Three different discount rates (8, 5 and 3%) were used to get the NPV and CBR. The NPV were found to be positive (77.33 \$/head; 149.06 \$/head; 212.73 \$/head). In addition to that, the CBR were bigger than 1 (1.07; 1.12 and 1.15). The IRR was 12.92 percent. According to the results that achieved by the study, it was determined that the investment is economically feasible and profitable.

Key words: Sheep Farming, Investment Analysis, Net Present Value, Benefit Cost Ratio, Internal Rate of Return

INTRODUCTION

Livestock plays an indispensable role in the traditional agriculture and largely subsistence economy of Turkey. It is known that livestock production on a farm has many advantages. It permits the use of labor to some profit during parts of the year when it could not be used in producing crops. It permits the conversion of some marketable crops into other products, which can be disposed of to better advantage^[1]. Small ruminants in Turkey are well adapted to the rangelands and marginal/degraded lands of Anatolia and contribute to the livelihood of vulnerable and resource-poor farmers living under extremely difficult conditions in the semi-arid areas and highlands of the country. These species convert natural vegetation into valuable products such as meat, milk, wool, hair (mohair), skins, pelts and manure^[8].

Sheep farming requires low capital and not much specialized machinery compared with most of the other agricultural production alternatives^[11].

The biggest sheep population (155.73 million head) in the world is in China and England (35.50 million head) is in European Union (25). Turkey has an important place in the sheep population (25.20 million head) taking 8th rank in the world and 2th rank in the EU. The total livestock population in Turkey is estimated as 25.20, 10.07, 0.11, 6.61, 296.00, 3.90 and 0.80, 0.04 million sheep, cattle, buffaloes, goats, chickens, turkeys and ducks, pig respectively. The annual meat production in Turkey is about 1647035 metric ton, where as sheep meat contributes 272000 metric ton^[7].

Investment analysis is usually made to get financial aid from government agencies. The producer would like to know the results of his economic activity by working out a detailed cost-benefit analysis of the investment in the project^[1]. Quantitative studies related to the economics of sheep growing are limited in literature. The main objective of this study is to analyze the feasibility and profitability of investment in sheep farming.

MATERIAL AND METHODS

In this study, the data were obtained through personal interview with 46 sheep (Karayaka sheep growing commonly in the region) farmers of Tokat province in the mid Black Sea region of Turkey for the year of 2006. Simple Random Sampling Method was applied in selecting sheep farms^[16]. The farms were selected randomly. Sample size was calculated for 95% reliability and 5% permissible error.

Karayaka, a native sheep breed, is the most populous and dominant breed in the mid Black Sea region of Turkey, comprising approximately 3% of the Turkish sheep population. The Karayaka breed with coarse fleece traits is primarily raised to produce meat due to its high meat quality, although meat and offspring yields are low^[3].

The economic life of the activity is taken as 15 years, with 1 year of farm establishment, and 15 years of production. The annual production cost and income for each farm were obtained

In order to achieve the objectives, the values such as Net Present Value (NPV), Cost-Benefit Ratio (CBR) and Internal Rate of Return (IRR) were calculated.

The NPV is the total present value of future revenue and cost of an activity^[4].

The NPV was calculated by the formula $NPV = \sum_{t=1}^{\infty} V / (1 + i)^n$ where *FV* is the future value of

money, *i* is the interest or discount rate, and *n* is the number of years^[2].

Among the measures of investment returns over time, NPV offers the better measure of project worth^[13].

The CBR is the ratio obtained when the present worth of the benefit stream is divided by the present worth of the cost stream^[9], and can be obtained as follows^[6]:

$$CBR = \frac{\sum R_t / q^t}{\sum C_t / q^t}, \quad t = 0, \dots, n$$

where *R* is the total revenue, *C* is the total cost, *i* is interest rate, and *n* is the number of years and, $q^t = (1+i)^t$. The conventional management approach to selection of options is to conduct a cost-benefit analysis. Other things being equal one selects the option with the higher benefit to cost ratio, as long as it exceeds 1.0^[12].

The internal rate of return is a useful measure of project worth^[9]. IRR is discounted rate, which makes Net Cash Flows of the economic life of project zero^[14]. The IRR formula is as follows:

$$IRR = r_1 + \frac{(ND_1)}{(ND_1 + ND_2)} * (r_1 - r_2)$$

where *r*₁ is the last discount rate which makes NPV positive, *r*₂ is the first discount rate which makes NPV negative, *ND*₁ is the last positive NPV, *ND*₂ is the first negative absolute value of NPV. Sensitivity analysis is described as a technique for measuring the impact on project, while changing one or key input values about which there is uncertainty^[10]. In the sensitivity analysis, tree different NPV, CBR and IRR were found under the two different assumptions.

RESULTS AND DISCUSSION

The establishment costs of sheep growing are given in Table 1. With a percentage of 45.73,

construction and subsidiary items cost takes the most part of establishment cost. This is followed by sheep material (41.92%), and interest (4.62%).

The production cost was calculated as 85.89 \$/head in the year 1-4; 6-9; 11-14 and 15 and 180,85 \$/head in the year 5 and 10. The variable cost has the biggest share in the production cost and feed cost has the biggest share in the variable cost (Table 2).

The annual income of the producer is coming from the milk sales, meat and lamb sales, manure income, wool income and residual value. The residual value of the stock at the end of the production period is also considered as source of income (Table3).

The annual net profit (net cash flows) was calculated by subtracting the annual costs from annual income for a period of 15 years to be able to calculate NPV, CBR and IRR and is given in Table 4.

The establishment year is taken as a base and from the following year to the end of economic life was taken as production period. In such business that takes a long period, the present and future value of money invested in production needs to be counted. In the study, by using different discount rates (8, 5, 3 %), NPV of the period was calculated and given in Table 5. The NPV achieved for each discount rates are 77.33 \$/head; 149.06 \$/head and 212.73 \$/head, respectively (Table 5).

CBR is calculated by dividing the total discounted incomes by the total discounted costs. The CBR in all the three discount rates is greater than 1 (Table 5). This means that the producer has a positive return in the sheep growing.

As per table 5, IRR was found as 12.92 percent, which is greater than the interest rate of capital. This means that the farmers were making more than two times of capital interest.

In the sensitivity analysis, tree different NPV, CBR and IRR were found under the three different assumptions. If a 10 percent reduction of milk and meat price and 10 percent total cost overrun were assumed (Table 6), the IRR's for sheep growing decreased from 12.92 percent to 6.18, 9.94 and 11.16 percent, respectively. The results have shown that the IRR's for sheep farming are greater than the interest rate of capital.

The results indicate that sheep growing is a profitable mid and long term investment for small scale sheep farms. From this finding, it can be recommended that sheep farming is an alternative production activity in the rural area of the study region in Turkey.

Table 1: The Establishment Costs (\$/head)

Items	0. Year	
	(\$*/head)	%
Sheep material	83.85	41.92
Construction and subsidiary items cost	91.47	45.73
Materials-ammunition costs	0.91	0.45
Unexpected costs (5%) (a)	8.81	4.40
Total variable costs	185.04	92.50
Interest (5%) (b)	9.25	4.62
Building rent	0.20	0.10
Management cost (3%) (c)	5.55	2.78
Total fixed costs	15.00	7.50
TOTAL	200.04	100.00

* 1 US \$ equal to 1,390 YTL (New Turkish Liras) in 2006 (CBRT, 2006).

(a) The unexpected costs (transaction cost, transportation cost, labor and etc.) which occur during establishment period (Akçay et al., 2005).

(b) Interest rate is 5% of total variable cost (Uzunoz and Akçay, 2006).

(c) Management cost is taken as 3% of total variable cost.

Table 2: Production Costs (\$/head)

COST ITEMS	Years					
	1-4	5	6-9	10	11-14	15
VARIABLE COST						
- Sheep material	---	83.85	---	75.54	---	---
- Labour	30.02	30.02	30.02	30.02	30.02	30.02
Feed						
Roughage feed	19.12	19.12	19.12	19.12	19.12	19.12
Compound feed	27.50	27.50	27.50	27.50	27.50	27.50
TOTAL	46.62	46.62	46.62	46.62	46.62	46.62
- Feed transportation	0.38	0.38	0.38	0.38	0.38	0.38
- Veterinary-Medicine	3.13	3.13	3.13	3.13	3.13	3.13
- Mate	0.32	0.32	0.32	0.32	0.32	0.32
- Transportation	0.04	0.04	0.04	0.04	0.04	0.04
- Lighting	0.45	0.45	0.45	0.45	0.45	0.45
- Water	0.41	0.41	0.41	0.41	0.41	0.41
- Disinfection	0.12	0.12	0.12	0.12	0.12	0.12
- Build., tools and mach.variable cost	0.15	0.15	0.15	0.15	0.15	0.15
- Working capital interest (5.25%)	4.29	8.69	4.29	8.69	4.29	4.29
TOTAL (A)	85.93	174.18	85.93	174.18	85.93	85.93
FIXED COSTS						
- Management cost (A*0,03)	2.58	5.23	2.58	5.23	2.58	2.58
- Building capital depreciation	0.85	0.85	0.85	0.85	0.85	0.85
- Building capital interest	0.24	0.24	0.24	0.24	0.24	0.24
- Building repairing and maintenance	0.29	0.29	0.29	0.29	0.29	0.29
- Tools-machinery capital depreciation	0.02	0.02	0.02	0.02	0.02	0.02
- Tools-machinery capital interest	0.02	0.02	0.02	0.02	0.02	0.02
- Tools-machinery repairing-maintenance	0.02	0.02	0.02	0.02	0.02	0.02
TOTAL (B)	4.02	6.67	4.02	6.67	4.02	4.02
PRODUCTION COST (A+B)	89.95	180.85	89.95	180.85	89.95	89.95

Table 3: Annual Income (\$/head)

Income Items	Years					
	1-4	5	6-9	10	11-14	15
Milk income	22.13	22.3	22.13	22.13	22.13	22.13
Meat income	32.91	32.91	32.91	32.91	32.91	32.91
Lamb income	46.15	46.15	46.15	46.15	46.15	46.15
Manure income	6.57	6.57	6.57	6.57	6.57	6.57
Woll income	4.82	4.82	4.82	4.82	4.82	4.82
Residual value	---	107.57	---	107.57	---	126.95
PVC*	2.85	2.85	2.85	2.85	2.85	2.85
TOTAL	115.46	223.00	115.46	223.00	115.46	242.38*

PVC: Productive Value Change

Table 4: Annual Income, Annual Cost and Net Profit (\$/head)

Years	Annual Income	Annual Cost	Net Profit
0	---	200.04	-200.04
1-4	115.46	89.95	25.51
5	223.00	180.85	42.15
6-9	115.46	89.95	25.51
10	223.00	180.85	42.15
11-14	115.46	89.95	25.51
15	242.38	89.95	152.43

Table 5: Net Present Value, Benefit Cost Ratio and Internal Rate of Return

	Years								Total	NPV	BCR	IRR
	0	1-4	5	6-9	10	11-14	15					
Annual Income	---	115.46	223.00	115.46	223.00	115.46	242.38					
Annual Costs	200.04	89.95	180.85	89.95	180.85	89.95	89.95					
Discount Rate (8%)	1.000	3.312	0.681	2.254	0.463	1.534	0.315					
Discounted Income	---	382.40	151.86	260.25	103.25	177.12	76.35	1151.23	77.33	1.07		
Discounted Costs	200.04	297.91	123.16	202.75	83.73	137.98	28.33	1073.90				
Discount Rate (5%)	1.000	3.546	0.784	2.778	0.614	2.177	0.481					12.92
Discounted Income	---	409.42	174.83	320.75	136.92	251.36	116.58	1409.86	149.06	1.12		
Discounted Costs	200.04	318.96	141.79	249.88	111.04	195.82	43.27	1260.80				
Discount Rate (3%)	1.000	3.717	0.863	3.206	0.744	2.766	0.642					
Discounted Income	---	429.17	192.45	370.16	165.91	319.36	155.61	1632.66	212.73	1.15		
Discounted Costs	200.04	334.34	156.07	288.38	134.55	248.80	57.75	1419.93				

Table 6: Sensitivity Analysis

Assuming 10 percent higher total cost			
Discounted Rate (%)	8	5	3
NPV (\$)	-30.04	22.98	70.71
CBR	0.98	1.02	1.05
IRR (%)	6.18		
Assuming 10 percent lower price of milk			
Discounted Rate (%)	8	5	3
NPV (\$)	58.44	126.11	186.32
CBR	1.06	1.10	1.13
IRR (%)	9.94		
Assuming 10 percent lower price of meat			
Discounted Rate (%)	8	5	3
NPV (\$)	49.20	114.90	173.42
CBR	1.05	1.09	1.12
IRR (%)	11.16		

REFERENCES

- Akçay, Y., M. Uzunoğlu, T. Yanık, 2005. Investment Analysis on Rainbow Trout Farming. *The Indian Veterinary Journal*, 82(9): 972-976.
- Berkovitch, E., R. Israel, 2004. Why the NPV Criterion Does Not Maximize NPV. *The Review of Financial Studies*, 7(1): 239-255.
- Cam M.A., M. Oflaz, A.V. Garipoglu, 2007. Shearing Male Lambs in the cold Season Improves the Carcass Yield without Affecting Fattening Performance. *Animal Science Journal*, 78: 259-265.
- Castle E.N., H.M. Becker, A.G. Nelson, 1987. *Farm Business Management*. Third Edition, Macmillan Publishing Company, New-York, USA.
- CBRT, 2006. Statistical Data, Exchange Rates 2006. Central Bank of the Republic of Turkey, Available in <http://www.tcmb.gov.tr/yeni/eng>, Accessed 21 January 2007.
- Erkus, A., E. Rehber, 1998. Project Prepare Techniques, Ankara University Faculty of Agriculture Publications No: 1496 (451), Fourth Edition, Ankara. [In Turkish].
- FAO, 2006. Statistical Database/ Agriculture/ Production/Livestock, <http://www.fao.org>
- Gursoy, O., 2006. Economics and Profitability of Sheep and Goat Production in Turkey under New Support Regimes and Market Conditions. *Small Ruminant Research*, 62: 181-191.
- Gittinger, C.P., 1982. *Economic Analysis of Agricultural Projects*. Second Edition, Completely Revised and Expanded, The Johns Hopkins University Press, Maryland, USA.
- Marshall, E.H., 1999. *Technology Management Handbook*, Chap. 8-12, 8/ 59-63.
- Sahin, A., I. Yildirim, 2002. Economic Analysis of Sheep Farms in Center District of Van Province. *J. Agric Sci. of Yuzuncuyil University Faculty of Agriculture*, 12(2): 47-52, [In Turkish].
- Solomon, D.J., G.W. Mawle, W. Duncan, 2003. An Integrated Approach to Salmonid Management. *Fisheries Research*, 62: 229-234.
- Swinton, S.M., S.A. Brempong, G.R. Van Ee, 1997. Investment Analysis of Alternative Fruit Tree Sprayers in Michigan Orchards. Michigan State University, Dept. of Agricultural Economics, East Lansing, MI 48824, USA.
- Tauer, L.W., 2000. Investment Analysis in Agriculture, SP 2000-03, Dept. of Agric., Resource, and Managerial Economics, Cornell University, Ithaca, New York, 14853-7801, USA.
- Uzunoğlu, M., Y. Akçay, 2006. A Profitability Analysis of Investment of Peach and Apple Growing in Turkey. *Journal of Agriculture and Rural Development in the Tropics and Subtropics*, 107(1): 11-18.
- Yamane, T., 2001. *Basic Sampling Methods*. Translators: A. Esin, M. A. Bakır, C. Aydın and E. Gurbuzsel, Literatur Publishing, Istanbul, [In Turkish].