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Research Article

Economic Evaluation in Traditional and Industrial Livestock with Different Levels of Milk Production in Ardebil Province with Emphasis on Risk Criteria

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Abstract

The main objective of the livestock industry, as an economic production system, is to increase production efficiency through changes in performance and to increase economic productivity. Therefore, in designing genetic improvement programs for domestic animals, it is necessary to pay attention to recognizing the system of production and the factors affecting its performance and the profitability of systems, that is, revenues and costs. For estimation of market liquidity flow and economic returns, using a bio economic model, data on the revenues and costs was used of traditional and industrial cattle in Ardebil province during the years 2012-2016. The nourishment method based on the type of management was divided into two methods: traditional nourishment (in pasture) and industrial nourishment. The results of this study showed that the highest share of revenue and costs of nourishment units was related to milk sales and nutritional costs in both systems respectively. The investment risk level for industrial systems with different levels of milk production (high production, average production and low production) and the traditional system were estimated to be 0.032, 0.078, 0.030 and 0.013, respectively using standard deviation that these numbers represent the degree of deviation of the real result from the average result with medium returns which shows the high risk of investment in industrial dairy cattle compared to traditional dairy cattle. In both systems, the highest estimated relative significance was related to production traits, followed by survival and growth traits, respectively and the least value was related to reproductive traits.

Keywords: *Bio-economic model, Economic value, Risk, Traditional and industrial system*

Erdebil Bölgesinde Farklı Ölçeklerde Süt Üretimi Olan Geleneksel ve Endüstriyel Hayvancılık İşletmelirindeki Risk Faktörlerinin Ekonomik Değerlendirmesi

Öz

Hayvancılık endüstrisinin temel amacı, ekonomik bir üretim sistemi olarak, performanstaki değişimler vasıtasıyla üretim verimliliğini artırmak ve ekonomik verimliliği geliştirmektir. Bu nedenle, evcil hayvanlar için genetik iyileştirme programlarının tasarlanmasında, üretim sisteminin ve performansını etkileyen faktörlerin ve sistemlerin karlılığının, yani gelirlerin ve maliyetlerin tanınmasına dikkat edilmesi gerekmektedir. Piyasa likidite akışı ve ekonomik getirilerin tahmininde, biyoekonomik bir model kullanılarak, 2012-2016 yılları arasında Ardebil ilindeki geleneksel ve endüstriyel sığırların gelir ve maliyet verileri kullanılmıştır. Yönetim tipine göre beslenme metodu iki yönteme ayrıldı: geleneksel besleme (otlakta) ve endüstriyel besleme. Çalışmanın sonuçları, her iki sistemde de en yüksek gelir ve beslenme birim maliyetlerinin sırasıyla süt satışları ve beslenme maliyetleri ile ilişkili olduğunu göstermiştir. Farklı seviyelerde süt üretimi (yüksek üretim, ortalama üretim ve düşük üretim) ve geleneksel sisteme sahip endüstriyel sistemler için yatırım riski seviyesi standart sapma kullanılarak sırasıyla 0.032, 0.078, 0.030 ve 0.013 olarak tahmin edilmiştir. Bu rakamlar, geleneksel süt sığırcılığına kıyasla endüstriyel süt sığırlarında yüksek yatırım riskini gösteren orta getirilerle elde edilen ortalama sonuçlardan gerçek sonuçların sapma derecesini temsil etmektedir. Her iki sistemde de, en yüksek tahmini kısmi önem, üretim özellikleri ile ilişkiliydi, bunu sırasıyla hayatta kalma ve büyüme özellikleri takip ediyordu ve en düşük değer, üreme özellikleriyle ilişkiliydi.

Anahtar sözcükler: *Biyoekonomik model, Ekonomik değer, Risk, Geleneksel ve endüstriyel sistem*

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INTRODUCTION

Livestock has a special status as the development axis in the country's development programs. The capacity in this section as one of the important sub-sectors of the agricultural industry in the country requires more planning and more appropriate use of these capacities [1]. Nowadays, breeding science has been considered along with other sciences related to livestock industry as one of the important tools to provide a part of deficiencies and increase the quality of livestock production. The first step in the formulation and implementation of management and breeding programs to improve the performance of the traits and the profitability of breeding each breed is to determine the breeding goals and the relative importance of each trait in profitability that should be commensurate with the conditions of local breeding and also should have the sustainability of production [2,3]. One of the most important goals of dairy cattle is to increase profitability through raising revenues and reducing production costs [4]. The economic value of a trait is defined as the variation in profit for a unit of variation in the average of that trait while the other traits remain within the average range [5]. The economic value is influenced by the price of products and production inputs. So that the improvement level of a trait will affect future prices. Therefore, determination of economic values requires knowledge of the level of genetic enhancement in the future and their effect on prices [6]. Using the bio economic modelsis one of the important tools in calculating the economic value and profits of the production system. The bio economic model has three basic components: the design of the herd structure, the calculation of the profit function details for the defined production systems (inputs and outputs) and mathematical description of the processes existing in each production system. Using such models, costs and revenues are obtained based on the actual phenotype function, which depends not only on the potential genetic function, but also on the availability of food sources and feed intake capacity [7,8]. Any kind of investment in livestock faces uncertainties that make risky the return on investment in the future. Since production of livestock products are always exposed to unpredictable competitive markets for inputs and outputs, the risk of pricing may increase over time [9]. Kulak et al.[10] defined the risk as standard deviation or profit variance which can create great differences in the economic values of traits. But its impact on relative economic values, the amount and direction of genetic variation may be small [10]. Economists have defined the risk of investment as a possible deviation from the average return. They also define the risk of investing in conditions of uncertainty as potential losses. So, they have reported in their studies that investors should measure the risk only on the basis of the probability of losses [11].

The purpose of this study was to investigate the effect of risk on the trend of estimating liquidity flows in traditional and industrial livestock with different levels of milk production in Ardebil province.

MATERIAL and METHODS

In this research, data were used about revenues and costs of the years 2012-2016 on traditional and industrial dairy cattle of Ardabil province based on market conditions to estimate the liquidity flow of these units. Based on the type of management, the method of nourishment was divided into two methods: traditional and industrial nourishment. The industrial system was classified into three levels of low production (up to 25 kg), average production (up to 30 kg) and full production (35 kg and more) based on different levels of milk production.

The Traditional Method of Livestock Nourishment in Rangeland

In this method, native cattle are nourished and livestock is in grazing land over the year (except winter). And when using rangelands, they are fed with supplementary feed (including concentrates such as barley flour, wheat bran, and forage material such as straw). In the cold seasons, livestock is kept in the village in a closed position. In the closed position, the livestock is fed by a mixture of straw, bran, and concentrate.

Industrial Nourishment Method

In the Holstein cattle industry, cattle feeding are done entirely manually and in a closed position. In feeding these livestock, concentrates, straw, alfalfa and corn silage are used. Calves are taken from milk at three months old and are fed with hand feeds from two months old. In this research, the economic system of the cattle herd (in both production systems) was decomposed into revenue and cost components using the system analysis method, and each of these components was subdivided into other subsections. Then, simulation of a bio economic model was performed using a mathematical model and using MATLAB 8.0 programming language [12]. The revenue component included the sale of milk, the sale of surplus heifers, the sale of calves and eliminated cows and the costs included feeding, marketing, heifers nourishment and other costs (management costs) and fixed costs. Management costs included health, human power and reproductive costs, which were used as input parameters of the model. In this study, the annual profit for each breeder cattle was derived from the difference between revenues and costs and according to the following equation: P=R-C

In this equation, P is the annual profit, R is the annual revenue and C is the annual cost of each breeder cattle. The annual revenue per a cow was calculated according to the following formula:

$$R = R_{milk} + R_{(male\text{-}calves)} + R_{(culled\text{-}cows)} + R_{(culled\text{ - }heifers)}$$

In this equation, R_{milk} the revenue from the sale of milk, R_{calves} the revenue from sales of calves, $R_{culled\text{-}cows}$ the revenue from the sale of eliminated cows and $R_{culled\text{-}heifers}$ the revenue from the sale of surplus heifers. Each of the above parameters is expressed as follows [3,4]:

$$NCY = \frac{365}{CI}$$

$$PLTy = \frac{PLT}{365}$$

$$NmcCy = 0.5 \times NCY \times cr \times S24$$

$$R_{male-\ calves} = NmcCy \times Pc$$

$$NfcrCy = 0.5 \times NCY \times cr \times S24 \times SR \times PSR$$

$$NfcCy_{cull} = NfcrCy - \left(\frac{1}{PLTy}\right)$$

$$W_{heifer} = bw + (DG \times wa) + (PDG \times dwm)$$

$$R_{culled-\ heifers} = NfcCy_{cull} \times Wheifer \times P_{lw}$$

$$R_{culled-cows} = \frac{LW}{PLTy} \times p_{lw}$$

$$R_{milk} = (MY \times P_m) + \big(FY - (MY \times 0.035)\big) \times P_f$$

Respectively: NCY the number of calves per year, CI the calving interval (day), PLTy production lifetime (years), PLT production lifetime (day), NmcCy number of calves, cr calving rate (percent), S24 survival rate 24 h after birth (percentage), Pc price of calf (Rials), NfcrCy number of heifers, SR survival rates after ablactate (percentage), $NfcCy_{cull}$ number of surplus fattening heifers (percentage), W_{heifer} heifers weight (kg), bw weight of heifer at birth (kg), DG daily weight gain before ablactate (kg/day), PDG daily weight gain after ablactate (kg/day), wa days of birth to ablactate, dwm days of ablactate up to 18 months, P_{lw} the price per kilogram of live cow (Rials), LW live weight of eliminated cow (kg), MY and FY milk and fat production in a course (kg), P_m price of milk per kilogram with 3.5% fat (Rials), P_f price of fat per kilogram (Rials).

Also, the annual cost per a cow was calculated by the following equation:

$$C = C_{(Feedh\text{-}birth\text{-}w)} + C_{(Feedh\text{-}w\text{-}ma)} + C_{(Feedh\text{-}ma\text{-}afc)} + C_{(Feed\text{-}\ cows)} + C_{(Healthh\text{-}birth\text{-}w)} + C_{(Healthh\text{-}w\text{-}ma)} + C_{(Healthh\text{-}ma\text{-}afc)} + C_{(Health\text{-}cows)} + C_{(Laborh\text{-}birth\text{-}w)} + C_{(Laborh\text{-}w\text{-}ma)} + C_{(Laborh\text{-}ma\text{-}afc)} + C_{(Labor\text{-}cows)} + C_{(Reproduction\text{-}heifers)} + C_{(Reproduction\text{-}cows)} + C_{Fix}$$

The variables used in the above relationships are defined as follows:

$C_{feedh\text{-}birth\text{-}w}$: The cost of feeding the heifers from birth to ablactate, $C_{feedh\text{-}w\text{-}ma}$: the cost of feeding heifers from ablactate to 18 months old, $C_{feedh\text{-}ma\text{-}afc}$: the cost of feeding heifers from 18 months old to the first childbirth, $C_{feed\text{-}cows}$: the cost of feeding the milchcows, $C_{healthh\text{-}birth\text{-}w}$: the health costs of the heifers from birth to ablactate, $C_{healthh\text{-}w\text{-}ma}$: health cost of the heifers from ablactate to 18 months old, $C_{healthh\text{-}ma\text{-}afc}$: health costs of the heifers from 18 months old to the first childbirth, $C_{health\text{-}cow}$: health costs for each cattle, $C_{laborh\text{-}birth\text{-}w}$: the cost of manpower from birth to ablactate, $C_{laborh\text{-}w\text{-}ma}$: the cost of man power from ablactate, $C_{laborh\text{-}ma\text{-}afc}$: man power costs from 18 months old to the first childbirth, $C_{labor\text{-}cows}$: the human cost per each cattle, $C_{Reproduction\text{-}heifers}$: the cost of reproduction of the heifers, $C_{Reproduction\text{-}cows}$: the cost of reproduction of the cattle, C_{Fix}: fixed costs.

In this research, for calculating the economic coefficients of traits, the average of the trait was increased by one unit and the difference of profit with the base state was considered as the economic coefficient of the trait, while other traits were within the average of the community. The economic coefficient of each trait was estimated using the following equation:

$$V_i = \frac{P_{\mu_i+\Delta} - P_{\mu_i}}{\Delta}$$

In this equation, V_i the economic coefficient, $P_{(\mu i+\Delta)}$ the average profit of each animal after one increase in the trait $P_{(\mu i)}$, the average profit of each animal before changing the average and Δ the average increase rate of the trait I [12,13].

$$RE = \frac{(EVi \times GSDi)}{\sum_{i=1}^{t}(EVi \times GSDi)} \times 100$$

In which: RE, EV, GSD respectively indicate the relative emphasis, absolute economic coefficient and standard genetic deviation for the i^{th} trait and t is the number of traits in the breeding goals.

Risk Measurement

One of the known methods for measuring risk is variance or standard deviation of expected returns. This statistical method measures the distribution of returns around their expected value. It is believed that the greater the dispersion of expected returns, the greater the uncertainty about the occurrence of these returns in the future.

The risk was calculated as [14]:

$$\sigma = \sqrt{\frac{\sum(r_i - \bar{r})^2}{n}}$$

In this equation, according to financial concepts, σ the deviation of actual returns or risk, r_i real returns, $\bar{r}$ average of returns, and n the number of courses. As the standard deviation is lower than the average, the risk will be less.

RESULTS

Analysis of Costs and Revenues of the Production System

The results of the revenues, costs, and profitability of this research for production systems by breeding methods for a period of 5 years (from 2012 to 2016) are shown

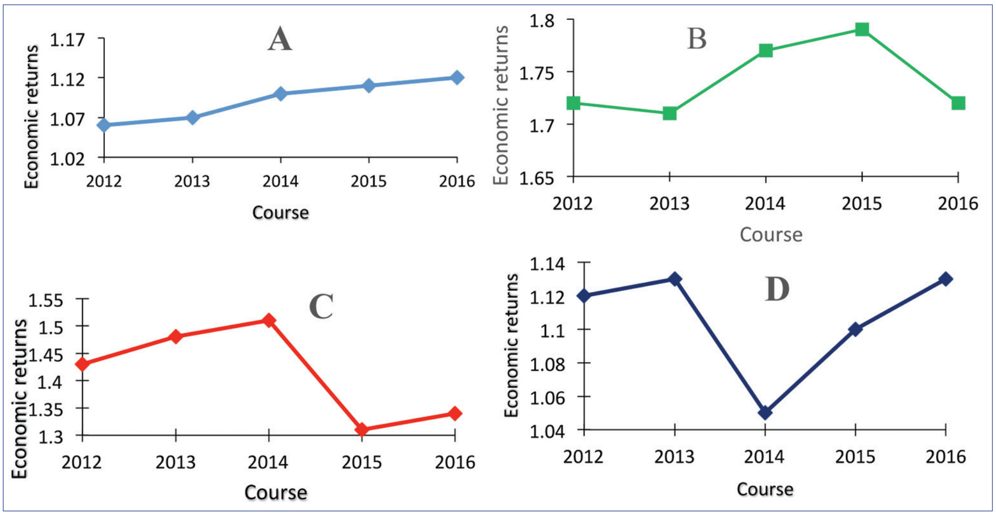

Fig 1. A: Economic returns of the traditional system, **B:** Full production in industrial system **C:** Medium production in industrial system, **D:** Low production in industrial system

Table 1. *Revenue, cost and primary profit from the weighted average of traits and system profit change after a unit increase in mean of traits for different levels of milk production in the industrial production system and in traditional breeding system*

Breeding System	Initial values	MY	FY	SR	PSR	DG	PDG	LW	CI	PLT
Industrial System										
High production										
Revenue	145161612.72	145167522.72	145335612.72	145280764.59	145277117.08	145162550.76	145164895.87	145180862.72	145129732.98	145159217.34
Cost	83255829.06	83258409.15	83281333.92	83314198.98	83277691.61	83255858.99	83255930.27	83264856.94	83240028.07	83252525.31
Profit	61905783.66	61909113.57	62054278.80	61966565.61	61999425.47	61906691.77	61908965.60	61916005.78	61889704.91	61906692.03
Medium production										
Revenue	113481939.39	113487767.39	113641139.39	113591806.70	113588443.41	113482804.34	113484966.71	113499689.39	113452015.38	113479730.66
Cost	81045595.68	81048257.22	81074155.13	81109653.22	81070053.41	81045626.51	81045699.59	81055722.28	81028534.83	81041813.27
Profit	32436343.71	32439510.17	32566984.26	32482153.48	32518390	32437177.83	32439267.12	32443967.11	32423480.55	32437917.39
Low production										
Revenue	85665904.40	85671454.40	85823904.40	85768653.54	85765508.16	85666713.30	85668735.58	85682504.40	85637647.21	85663838.77
Cost	77494060.97	77496779.78	77524768.15	77561451.18	77520028	77494092.57	77494167.20	77504996.17	77476256.65	77489963.28
Profit	8171843.43	8174674.62	8299136.25	8207202.36	8245480.16	8172620.73	8174568.38	8177508.23	8161390.56	8173875.49
Traditional System										
Revenue	78577146.79	78582690.79	78722746.79	78668892.46	78666083.93	78577904.05	78579634.92	78591946.79	78551542.29	78575311.53
Cost	71845765.95	71848927.68	71876582.46	71908079.64	71868060.90	71845777.42	71845799.49	71856339.77	71829039.10	71841984.10
Profit	6731380.84	6733763.11	6846164.33	6760812.82	6798023.03	6732126.63	6733835.43	6735607.02	6722503.19	6733327.43

MY, milk yield; FY, fat yield; CI, calving interval; DG, preweaning daily gain; PDG, postweaning daily gain; LW, mature live weight; SR, preweaningsurvival rate; PSR, postweaning survival rate (to 18 months); PLT, productive lifetime

in *Table 1*. Also, the economic returns obtained from this research for the traditional system and the various levels of the industrial system are presented in *Fig. 1*. According to the results: Among the revenue sources in the traditional system the revenue from sales of milk 81.90%, revenue from sale of culled cow 11.30%, revenue from sale of surplus heifers 3.20%, revenue from sale of male calves 3.60% accounted for the most relative share. In the industrial system, the revenue from milk sales with 85.64% in full production, 85.16% in medium production and 84.37% in low production, the revenue from sales of culled cow with 9.42% in full production, 9.44% in medium production and 9.53% in low production, revenue from sales of male calves with 2.11% in full production, 2.66% in medium production and 2.83%in low production and the revenue from sales of surplus heifers with 2.83% in full production, 2.74% in medium production and 3.27% in low production accounted for the most relative share. By increasing the level of milk production, the relative share of milk sales revenue has increased in comparison with other sales of other sources of revenue. Cost sources are divided into two categories: constant and variable costs. In this research, the variable costs were 69475765.96 Rials of the traditional system costs and 78255829.06,

Table 2. *Economic values, economic weights and relative emphasis of traits in industrial production system with different levels of milk production and in traditional breeding system*

Breeding System	Milk Production	GSD	Economic Value (Rial)	Economic Weight (Rial)	Relative Emphasis (%)
Industrial system	**High production**				
	Milk yield	561.7	3329.91	1870410	27.12
	Fat yield	14.9	148495.14	2212578	32.08
	Calving interval	13.5	-16528.39	-223133	3.23
	Pre-weaning survival rate	13.1	60781.95	796243.6	11.54
	Post-weaning survival rate	16.2	96054.4	1556081	22.56
	Pre-weaning daily gain	26.15	908.12	23747.34	0.34
	Post-weaning daily gain	24.95	3181.94	79389.4	1.15
	Mature live weigh	13.32	10222.12	136158.6	1.97
	Productive lifetime	0.29	908.37	263.43	0.004
	Medium production				
	Milk yield	561.7	3166.47	1778606.2	29.52
	Fat yield	14.9	130640.55	1946544.2	32.31
	Calving interval	13.5	-12863.17	-173652.79	2.88
	Pre-weaning survival rate	13.1	45809.77	600107.99	9.96
	Post-weaning survival rate	16.2	82046.29	1329149.9	22.06
	Pre-weaning daily gain	26.15	834.11	21811.98	0.36
	Post-weaning daily gain	24.95	2923.4	72938.83	1.21
	Mature live weigh	13.32	7623.4	101543.69	1.69
	Productive lifetime	0.29	1573.69	456.37	0.008
	Low production				
	Milk yield	561.7	2831.20	1590285.04	29.19
	Fat yield	14.9	127292.82	1896663.02	34.81
	Calving interval	13.5	-10482.61	-141515.24	2.6
	Pre-weaning survival rate	13.1	35358.93	463201.98	8.5
	Post-weaning survival rate	16.2	73636.74	1192915.19	21.89
	Pre-weaning daily gain	26.15	777.31	20326.66	0.37
	Post-weaning daily gain	24.95	2724.95	67987.5	1.25
	Mature live weigh	13.32	5664.80	75455.14	1.38
	Productive lifetime	0.29	2032.06	589.3	0.01
Traditional system	Milk yield	561.7	2382.28	1338126.68	27.97
	Fat yield	14.9	114783.50	1710274.15	35.75
	Calving interval	13.5	8877.65-	119848.28-	2.5
	Pre-weaning survival rate	13.1	30471.11	399171.54	8.34
	Post-weaning survival rate	16.2	66642.19	1079603.48	22.56
	Pre-weaning daily gain	26.15	745.79	19502.41	0.41
	Post-weaning daily gain	24.95	2454.60	61242.27	1.28
	Mature live weigh	13.32	4226.18	56292.72	1.18
	Productive lifetime	0.29	1946.60	564.51	0.01

76045595.68 and 72494060.97 of the industrial system costs with different levels of milk (full production, medium production and low production) respectively and what remains is the share of fixed costs. The reason for the greater share of variable costs in the traditional system is the low share of fixed costs in rural areas.

Among the variable costs, the highest relative contribution in both systems was related to feeding costs (40989063.44 Rialsin the traditional system and 46895611.97, 45885149.42 and 44063297.75 Rials respectively, in three levels of full production, medium production and low production) Production in the industrial system. After feeding, breeding heifers costs (13021199.10 in the traditional system and for the three full, medium and low levels of the industrial system were 12586634.15 and 12854163.32 and 12500080.28 Rials respectively), marketing (15373303.42 in the traditional system and for full production, medium

Table 3. *Estimated risk of the industrial system with different levels of milk production and traditional breeding system*

Breeding System	Period	r_i	$r_i - \bar{r}$	$\Sigma(r_i - \bar{r})^2$	σ
Industrial system	**High production**				
	2012	1.72	-0.022	0.000484	0.032
	2013	1.71	-0.032	0.001024	
	2014	1.77	0.028	0.000784	
	2015	1.79	0.048	0.002304	
	2016	1.72	-0.022	0.000484	
	Medium production				
	2012	1.43	0.016	0.000256	0.078
	2013	1.48	0.066	0.004356	
	2014	1.51	0.096	0.009216	
	2015	1.31	-0.104	0.010816	
	2016	1.34	-0.074	0.005476	
	Low production				
	2012	1.12	0.014	0.000196	0.030
	2013	1.13	0.024	0.000576	
	2014	1.05	-0.056	0.003136	
	2015	1.1	-0.006	0.000036	
	2016	1.13	0.024	0.000576	
Traditional system	2012	1.06	-0.032	0.001024	0.013
	2013	1.07	-0.022	0.000484	
	2014	1.1	0.008	0.000064	
	2015	1.11	0.018	0.000324	
	2016	1.12	0.028	0.000784	

production and low production levels in the industrial system were 18713382.94, 17232882.94 and 15850282.94 Rials respectively), and the share of other costs including medical, human power and reproductive costs in the traditional breeding system and industrial breeding system were reported equal to: 92200 Rials (for the traditional system), 60200 Rials (for full production), 73400 Rials (for the medium production) and 80400 Rials (for low production), respectively.

On the one hand, increasing milk production will increase milk sales and, on the other hand, will increase the energy needs for lactation, after that, food costs will increase. However, the outcome of these changes is that revenue will overcome the cost. But when milk production decreases, milk revenue and feed costs for lactation are reduced. In this case, lower revenue will be the dominant cost reduction. Simm [14] reported that in any growing system, more than half of the total cost is due to feeding costs that are consistent with the results of this study. This ratio has been reported 63.3% in Iran by [15]. In the study of milk and meat revenues were 90.3% and 9.7% of total revenues, respectively. Among the costs, the variable costs were 98.8% of the total costs, and feeding costs with 51.3% have the largest share in variable costs. After that, breeding heifers (26.5%), marketing (11.6%) and management costs (including cow health, labor and reproductive costs) accounted for 10.6% of total costs [15].

The ratio of revenue to cost (economic efficiency) [16] in the industrial system, with increasing milk production per a cattle over a period of 5 years (from 2012 to 2016) were estimated 1.72, 1.71, 1.77, 1.79, and 1.72 for full production cows, 1.43, 1.48, 1.51, 1.31, 1.34 for medium production cows and 1.12, 1.13, 1.05, 1.1 and 1.13 for low production cows *(Fig. 1)*. This means that the economic return of each cow (for example, in the medium- production industrial system) has decreased from 43% to 34% during 2012 to 2016, respectively. In other words, the economic return of traditional dairy farms has increased from 6% in 2012 to 12% in 2016.

Zahmatkesh and Amin Afshar [17] reported the total revenue, costs and total profits earned per a cow in a year for Holstein cows in Fars province with an average daily production of 24.5 kg of milk, 44314832 and 35370239 and 8944593 Rials, respectively that ratio of revenue to the cost is 1/25 and the economic efficiency is 25%. Using the numbers presented in the report of this researchers, founded that feeding costs accounted for 77% of the total cost and also sales of milk account for 62% of total revenues. In a study of [18] the average annual profit per a cow varied from 15206843 to 25921834 Rials and the revenue/cost ratio varied from 1.18 to 1.27% and all these parameters increased with increasing milk production. In general, sales of milk and feed costs accounted for the largest share of revenue and costs, and the share of both of these cases increased with an increase in milk production.

The Effect of Traits on the Costs and Revenues of the Production System

The studied traits in this study can be divided into three groups in terms of the type of their effect on revenue sand costs. This classification is distinguished by the breeding system type and the different levels of milk production in *Table 1*. The first group includes a set of traits that, by increasing their average, increase the revenue and cost of the production system as well as the profits relative to the base state (Initial values). Milk production, milk fat content, the weight gain before and after ablactate, adult live weight, survival rate, pre and post ablactate traits were included in this group. The second group consisted of the longevity of the production which, by increasing its average, the revenue and cost of the production system decreased and the profit of the system increased. The third group included the trait of the interval between two births, which, by increasing its average, revenue and cost of the production system as well as the profit of the system reduced. The effect of increasing one unit in average of traits on revenues, costs and profitability of production systems is shown in *Table 1*. Also, the coefficients and economic weights along with the relative importance of the effective traits on profitability are presented in *Table 2*.

Results of Ranking of Traits

Improvement purposes in breeding cows under studied systems include production traits (milk and fat production), reproductive trait (calf interval), growth traits (the weight gain before and after ablactate, adult body weight) and survival traits (survival rate, before and after ablactate and production's lifetime). According to *Table 2*, in both systems, the highest relative importance of production traits (63.72%) in the traditional system and for full production, medium production and low production levels in the industrial system was 59.2 (full production), 61.83% (medium production) and 64% (low production), after that, the survival traits (30.91% in the traditional system and for full production, medium production and low production in the industrial system respectively were 34.1, 32.03, 30.4), growth traits (2.87% in the traditional method and 3.46%, 3.26% and 3% for full production, medium production, low production respectively in the industrial production system). The lowest amount was related to the reproductive trait (2.5% in the traditional system and for full production levels, medium production and low production of the industrial system 3.24, 2.88 and 2.6%, respectively).

DISCUSSION

The economic value of milk production was estimated for both systems positively. The positive economic value for milk shows that the genetic improvement of milk production trait has a positive effect on the profitability of the system. According to the results of this study, for each unit increase in milk production in the industrial breeding method, the amount of feed intake during breastfeeding increases due to increased energy needed for livestock breastfeeding. Increasing feeding costs and marketing costs are offset by an increase in milk sales revenue, which produces a positive coefficient for milk. In traditional breeding methods, for each unit increase in the average milk production, the amount of feed intake during lactation is higher than the price of manual feed and the cost of feeding calves increases. But in the industrial process, as milk production increases, calf feeding costs reduced, which is due to the fact that the calf's milk consumption is independently defined again the mother milk production. In general, any factor that reduces the cost of milk production will increase the economic efficiency of milk production. Some researchers have estimated the economic value of this trait as positive and some others have estimated it as negative [18-21].

The economic value of milk fat content was estimated for both production systems positively. Due to the fact that the same rewards are traits to surplus fat from the base level, the major factor that causes the difference in the economic value of this trait in different herds is the nutritional costs associated with the production of fat, which is influenced by the quality and composition of diet. As it is used in herds that use cheaper food, because of the lower costs of fat production, the economic value of this trait is larger. In general, an increase in the average production of fat leads to an increase in the price of milk and its sales revenue. Increasing one unit to the average of this trait leads to an increase in energy requirements and, consequently, an increase in the nutritional cost of lactating cows. Also, the cost of feeding male calves and heifers during infancy is increased due to the use of milk with higher fat percentages. But the total revenue from an increase in a kilogram of average fat production is much higher than the cost of it. Therefore, the economic value of this trait is positive and increases the profits of the production system. Some researchers have reported the economic value of milk fat positive, which is consistent with the results of this study Vatankhah and Faraji [22] have reported economic value of this trait negative.

The economic value of the interval between the two births was negative for both breeding methods. By increasing the average of interval of the two births trait, the annual milk sales revenue and male calves and surplus heifer reduced, consequently, annual revenue declined. Also, the nutritional costs of milk production for lactating cows declined due to the reduction in milk production, and the nutritional, health and reproductive costs, due to the reduction in the number of calves born per year, resulting in a decrease in total annual costs. It should be noted that by increasing average of this trait, the average annual revenue will be higher than the annual cost. The number of births and milk production per year is inversely proportional to the interval between births. Some researchers also found that the economic value of the interval between the two births was negative, and they explained increasing nurture costs the reason for it. Kahi and Nitter [4] also reported positive the economic value of this trait. Because annual reduced milk production was not considered by their model due to an increase in the interval between two births.

The economic value of daily weight gain pre-weaning was estimated positively. Weight in sales age and weight at birth is a function of daily weight gain pre-weaning and after ablactate. Since sales of male calves in the industrial system are constant at a constant age of alive cow and based on each kilogram, but the sale of surplus heifers is based on the numbers, as a result, for a unit increase in daily gain, the revenue from livestock sales increases and this increase is far greater than the increase in the cost of feeding heifers and male calves. Therefore, the economic value of this trait is positive in the industrial system. It should be noted that, as in a system, the selling price of bull calves and surplus heifers do not depend on the weight of the animal (sales are not based on numbers), the increase in the average of weight gain traits makes a decrease in profits, which is why the economic value of this trait in that system will be negative. Kahi and Nitter [4] have reported a positive economic value of daily weight gain pre-weaning but Sahragard Ahmadi [22] estimated the economic value of weight gain pre-weaning negatively. The economic value of the weight gain trait post-weaning was estimated positively for both systems. With the average increase of this trait, nutritional costs increase in the afterbirth period. However, due to the longer period of post-weaning by increasing the average of this trait, the sales weight will be increased and, as a result, total revenue increases to a greater extent than the total cost. Thus, by increasing one unit in the average of this trait, the annual profit of the production system also increases. Kahi and Nitter [4], Sahragard Ahmadi [22] reported the economic value of weight gain after ablactate positively, which is consistent with the results of this research.

The economic value of live mature cattle was estimated positively for both traditional and industrial nourishment methods. So that the cost of one kilogram to body weight is lower than the revenue earned. Increasing the cost of feeding cows by increasing the average adult body weight is compensated by increasing the revenue from the sale of eliminated cattle, which produces a positive factor for adult body weight. Kahi and Nitter [4] estimated the economic value of this trait positively. The reason for this is that in their research, the revenue from live weight heavier, covered more food costs of the heavier heifers and the maintenance of heavier lactating cows. Some scholars also estimated the economic value of this trait negatively.

Economic value of the survival trait was estimated for both nourishment methods positively. By increasing the survival rate, the number of calves and, consequently, their nourishment costs increases, which is compensated by increasing livestock sales. For this reason, the economic value of the survival rate was estimated pre-weaning and post-weaning positively. The economic value of survival post-weaning was greater than the economic value of survival pre-weaning. Because by increasing the survival rates pre-weaning will increase the feeding costs of calves during infancy. By increasing the survival rate pre-weaning, the number of male calves and surplus heifer for sales increased annually. This leads to an increase in annual revenue. On the other hand, an increase in the average survival rate trait leads to an increase in calves and heifers. Therefore, by increasing the average of this trait, total revenue increases to a greater extent than the total cost, and consequently the annual profit increases .Rogers et al.[23] reported that the use of survival trait in breeding programs due to an increase in the number of adult cattle in the flock, a reduction in the costs associated with buying alternative heifers and increasing the chance of optional removal of livestock in the herd, has led to an increase in the profitability of breeding cattle breeding units [24-27].

The economic value of the production life time was positive for both breeding methods. Due to increasing a unit of production life span, the revenue from the sale of surplus heifers are increased, because of the lower replacement rate. This also reduces the cost of heifer nourishment. Vatankhah and Faraji [21] have estimated economic value the life-time trait positively.

Risk of Examined Systems

In this study, the investment risk rate in traditional and industrial animal farms of Ardabil province was obtained based on standard deviation which it results are presented in *Table 3*, broken down by breeding methods and different levels of milk production. According to the following table, the standard deviation (risk) obtained for industrial production system with different levels of milk production (full production, medium production and low production), and the traditional breeding system of livestock in Ardebil province was estimated 0.032, 0.078, 0.03, 0.013, respectively. The standard deviation indicates the risk or deviation value of the actual result from the average with middle return. This means that although is expected that an average return be obtained, but with regard to the standard deviation, it is possible that the actual return (for example, in the traditional breeding system) be expected 0.013% greater or less than the average return. Obviously, the greater the scope of the aforesaid change, the more risk the investment will be. According to the results, the average economic return of industrial dairies in Ardebil province is higher than traditional dairy farms and along with this increase in returns; the risk of investment in these units is also higher.

The results showed that the ratio of revenue/cost and economic return in traditional livestock farms is increasing trend and in industrial livestock the trend is almost constant or decreasing. Also, the estimated investment risk in both production systems indicates the high risk of industrial livestock compared to traditional livestock farms. Because inthe investingrisk of traditional farms is only on the livestock. On the other hand, fixed costs in this sector are lower than industrial farms, because native cows need little space, facilities and equipment (due to the greater resistance of these races to environmental conditions). If in industrial farm animals, given that livestock is kept centrally and for a particular purpose, the vulnerability is higher and the incidence of each complication may cause serious damage.

REFERENCES

1. Albera A, Carnier P, Groen AF: Definition of a breeding goal for the Piemontese breed: Economic and biological values and their sensitivity to production circumstances. *Livest Prod Sci*, 89 (1): 66-77, 2004. DOI: 10.1016/j.livprodsci.2003.12.004

2. Ponzoni RW: The derivation of economic values combining income and expense indifferent ways: An example with Australian Merino Sheep. *J Anim Breed Genet,* 105 (1-6): 143-153, 1988. DOI: 10.1111/j.1439-0388.1988.tb00284.x

3. Groen AF: Cattle breeding goals and production circumstances. PhD Thesis Wageningen Agricultural University, Wageningen, Netherlands, 1989.

4. Kahi AK, Nitter G: Developing breeding schemes for pasture based dairy production systems in Kenya I. Derivation of economic values using profit functions. *Livest Prod Sci*, 88 (1-2): 161-177, 2004. DOI: 10.1016/j.livprodsci.2003.10.008

5. Hazel LN, Lush JL: The efficiency of three methods selection. *J Hered,* 33 (11): 393-399, 1942. DOI: 10.1093/oxfordjournals.jhered.a105102

6. Groen AF, Steine T, Colleau JJ, Pederson J, Pribyl J, Reinsch N: Economic values in dairy cattle breeding with special reference to functional traits. Report of EAAP Working Group. *Livest Prod Sci*, 49 (1): 1-21, 1997. DOI: 10.1016/S0301-6226(97)00041-9

7. Cartwright TC: The use of system analysis in animal science whit emphasis on animal breeding. *J Anim Sci*, 49 (3): 817-825, 1979. DOI: 10.2527/jas1979.493817x

8. Dekkers JCM, Ten Hang JH, Weersink A: Economic aspects of persistency of lactation in dairy cattle. *Livest Prod Sci*, 53 (3): 237-252, 1998. DOI: 10.1016/S0301-6226(97)00124-3

9. Hirooka H, Sasaki Y: Derivation of economic weight for carcass traits in Japanese black cattle from field records. *J Anim Breed Genet*, 115 (1-6): 27-37, 1998. DOI: 10.1111/j.1439-0388.1998.tb00325.x

10. Kulak K, Wilton J, Fox G, Dekkers J: Comparisons of genetic value with and without risk for livestock trait improvement. *Livest Prod Sci*, 79 (2-3): 183-191, 2003. DOI: 10.1016/S0301-6226(02)00155-0

11. Levy H, Sarnat M: Portfolio and Investment Selection. xvii + 747 pp. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1984.

12. Demuth H, Beale M: Neural network toolbox user's guide. Matlab User's Guide, Natick, MA. The Math Works Inc. 2001.

13. Wolfova M, Wolf J, Kvapilik J, Kica J: Selection for profit in cattle: I. Economic weights for purebred dairy cattle in the Czech Republic. *J Dairy Sci*, 90 (5): 2442-2455, 2007. DOI: 10.3168/jds.2006-614

14. Simm G: Genetic improvement of cattle and sheep. Publisher: CABI, 1998. ISBN-13: 978-0851996424

15. Rafiei F, Mottaghi M, Shadparvar A, Najafi S: Investigating the effects of production system factors on economic productivity of Holstein herds using a simulation model. *J Agri Sci Iran*, 37 (5): 875-888, 2006.

16. Krupová Z, Motyčka J, Krupa E, Michaličková M: Economic importance of milk traits in Czech Holstein cattle under various milk payment systems. *Acta Agric Slov*, Supplement 5, 154-159, 2016.

17. Zahmatkesh R, Amin Afshar M: Designing a bioeconomic system for holstein milk cows in fars province. *J Anim Sci Res*, 5 (1): 91-99, 2009.

18. Vatankhah M, Nafchi MF: Cost-benefit analysis, economic and biological return in holstein cows in charmahal and bakhtiari province with different levels of milk production. *Anim Prod Res*, 2 (3): 1-9, 2013.

19. Gibson JP: Economic weights and index selection of milk production traits when multiple production quotas apply. *Anim Sci*, 49 (2): 171-181, 1989. DOI: 10.1017/S0003356100032293

20. Athari Mortazavi B, Shadparvar A: The effect of management, economical and biological factors of different traits in traditional and industrial methods of breeding bovine cows on the economic value. *J Rum Res*, 2 (2): 157-172, 2014.

21. Vatankhah M, Faraji Nafchi M: Determination of economic value of important traits in holstein cows in Charmahal and Bakhtiari province with different levels of milk production. *J Anim Sci*, 110 (1): 17-30, 2016.

22.Sahragard Ahmadi S: Estimation of the economic coefficients of milk production, fat percentage and Lifetime of mixed and Holstein herds in Lorestan province. *Msc Thesis,* University of Gilan, Iran, 2010.

23. Rogers PL, Gaskins CT, Johnson KA, MacNeil MD: Evaluating longevity of composite beef females using survival analysis techniques. *J Anim Sci,* 82 (3): 860-866, 2004. DOI: 10.2527/2004.823860x

24. Cardoso VL, Pereira Lima ML, Nogueira JR, de Carneiro RLR, Sesana RC, Oliveira EJ, El Faro L: Economic values for milk production and quality traits in south and southeast regions of Brazil. *R Bras Zootec*, 43 (12): 636-642, 2014. DOI: 10.1590/S1516-35982014001200002

25. van Arendonk JAM: Use of profit equations to determine relative economic value of dairy cattle herd life and production from field data. *J Dairy Sci,* 74 (3): 1101-1107, 1991. DOI: 10.3168/jds.S0022-0302(91)78261-1

26. Vargas B, Groen AF, Herrero M, Van Arendonk JAM: Economic values for production and functional traits in Holstein cattle of Costa Rica. *Livest Prod Sci*, 75 (2): 101-116, 2002. DOI: 10.1016/S0301-6226(01)00305-0

27. Seyedsharifi R, Esmailzadeh A, Hedayat Evrigh N, Savarsofla S, Seifdavati J: Determining the priority selection emphasis on characteristics in terms of optimized and non-optimized conditions of production system in dairy cows. *Kafkas Univ Vet Fak Derg,* 23 (6): 981-988, 2017. DOI: 10.9775/kvfd.2017.18097