

# Influence of Supporting Agrarian Policy Measures onto Increase of Cattle Production in Bosnia and Herzegovina

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## Summary

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Bosnia and Herzegovina has a deficit of most agricultural products, and that is why it is compelled to import significant quantities of food. In order to increase the degree of self-sufficiency, particularly for those products that have good potentials for production growth, creators of agrarian policy try to apply different agrarian policy measures for stimulation of agricultural production growth. One production with good potential is cattle production, i.e. production of milk and meat, for which Bosnia and Herzegovina has significant development potentials, and for whose advancement there have been provided different supporting measures. This paper presents the possible application of the cost-benefit analysis in evaluation of efficiency for some supporting agrarian policy measures adopted in order to improve the cattle production in Bosnia and Herzegovina. The cost-benefit analysis was completed for the six-year period, taking into account the productive period of bought heifer. The analysis includes economic and financial parameters (inflows and outflows), which annual amounts were discounted to the present values by utilization of the average social discount rate, in order to put all annual amounts at the same trend of calculation and to account for opportunity capital costs as well.

## Key words

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cattle production; supporting measures; cost-benefit analysis; sensitivity analysis; Bosnia and Herzegovina

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## Introduction

Cattle production in Bosnia and Herzegovina is characterized by small cattle farms with small numbers of milking cows and seasonal milk production. Among the farmers who had cattle in the period since 1992, 60% of them had only one cow, 30% had two cows, while less than 1% had five or more cows. Most of the cows were crossbred with common breeds represented by the local Busa bred, Grey Tyrol, Brown Swiss or Simmental bred. Productivity of milking cows is very low (Table 1) due to poor feeding (particularly in the winter time), late calf weanling as well as low rate of genetic improvement (only 32% of farmers used artificial insemination). Animals have been mostly kept in the stables during the whole year and they have been grazing fresh grass in the summer, while in the winter they have been fed by hay and silage.

However, beside mentioned limitations, economic analyses point at conclusion that cattle production on the small farms is never the less profitable anyhow and that milk production improves revenue of the family households.

Almost half of BiH livestock was lost in the period 1992-1995, while the facilities and equipment were hardly damaged. Renovation of the number of milking cows' mostly depends on preservation and situation of existing livestock as well as on possibility of heifer imports by private sector, as other supporting sources (e.g. donations or similar) are not sufficient to cover complete costs of the livestock number renovation. The forecast is that more than one decade is needed to renovate the livestock number situation from 1992. The agrarian policy measures directed toward an increase of cattle numbers must be designed in order to assure that the farmers have adequate support for the replacement of young heifers. There must be provision for enough financial resources and other possibilities for import of heifers-in calf free of taxes and without unnecessary bureaucratic procedures. The supporting measures should be directed first of all to those farmers who already have bigger livestock herds and market orientation.

In the period up to 1992 livestock production in Bosnia and Herzegovina was characterized by well developed formal and informal marketing systems, as well as by the vital private sector. The producers' selling posts were: weekly livestock markets in each commune, informal sales to the local restaurants, butcher shops and meat processors. Those markets had usual veterinary control. They functioned free according to the law of supply and demand. The general framework of such functioning has not been significantly changed so far, but the market volume of supply and demand has been decreased in the meantime.

Today the production of meat in Bosnia and Herzegovina to a great extent fulfills domestic needs, as result of drop in the meat demand. Although the meat processing industry

**Table 1.** Some indicators of cattle production results in EU and Bosnia and Herzegovina

Item	Unit	EU	BiH Small farms
Milk	lit/cow	5,500-8,500	1,440
Period between calving	months	13	18-24
Period of calf weanling	days	7-10	40-60

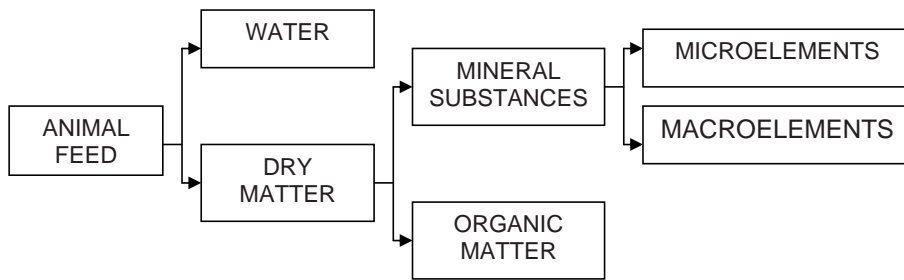
Source: CSO Sarajevo, BiH, International farm comparison network Agricultural researching center of Germany

has recovered since 1996, the improvements were minimal in the post-war period. For example, the present quantity of processed meat (an output was estimated to be 8,000 tons) amounts to only 30% of the production level achieved in 1991. Structure of domestic consumption has also changed, so demand had decreased for expensive beef, mutton and pork due to small revenues of population and decreased purchasing power on one side, as well as increased production of cheaper poultry meat on the other hand. In spite of mentioned changes, most small slaughterhouses have remained in production. Besides, new private firms for meat processing and production of the meat processed products are beginning to operate. On the other side, big social sector processing firms are collapsing because of low capacity utilization as well as lack of operating capital. This situation of processing capacities is characterized by significant percentages of unutilized capacities in the social sector together with an increase of investments in the private sector to erect and open additional processing capacities within mentioned branch.

## Production of the high-quality feed as condition for the heifers raising

Cattle represent heterotrophic organisms that are almost exclusively directed in their own nutrition toward consumption of matters made by autotrophic organisms. In an analysis of necessary substances for regular and high-quality nutrition of cattle, there have been unavoidably imposed some notions referring to the exchange of matters' process (Figure 1).

Standardized nutrition represents an important condition for regular cattle feeding. Its basic task is in as much satisfaction of cattle (and other livestock animals') needs in nutrients, minerals and vitamins as possible, by which there could be eliminated problems of the short supply or surplus nutrition. In that way it is strived, beside other influences acting in the same direction, to achieve maximal production abilities of cattle by as rational as possible fodder utilization, together with protection of normal



**Figure 1.**  
Exchange of matters in cattle feeding

health condition as well as reproduction. It is well-known that cattle nutrition norms include a part of fodder nutrients which satisfy maintenance needs for basic physiological functions of organisms as well as the productive part dependent on production level and structure of product. In addition, differences in norms are caused by physiological status of organism (e.g. growth, reproduction and pregnancy, breed and condition).

Former cattle fodder norms usually included data on necessary nutrient units, digestible proteins, calcium, phosphorus and carotene. Limitation of those data is result of need for their as simple as possible application in disseminated practice. The mentioned limitation has also resulted of insufficient knowledge of cattle needs for other nutrient and biologically active substances, particularly minerals. Today, cattle requirements are investigated to a certain level, so there appear more and more elaborated norms for cattle, particularly for individual cattle which are highly productive. Because of that it is necessary to carry out complete control of nutrition validity, as well as to evaluate the feed rations on the basis of data (concerning their nutrient and biological value) regarding content of: fibers, sugar, starch, proteins, macro and micro elements etc (Rozman. et al, 2002). It is necessary to stress that all norms, disregarding their basis and origin, should be considered only as judgemental data regarding cattle needs. However, some differences are certain to be present in their practical application. First of all, they are the result of unequal conditions between experimental application and practical application, then of individual deviations in the case of particular cattle categories etc. That is why it is necessary to have permanent observation of norms as well as correction of daily rations based on cattle performance (e.g. production level, health status, reproduction and condition).

When we are considering in-calf cows and heifers, adequate nutrition for these cattle categories have great importance – over-nutrition as well as poor nutrition could negatively influence embryo development, then parturition and calf vitality, milking ability, health and future reproduction of cow and heifer, milk production in next lactation as well as the animal condition. Fodder that constitutes ration structure of in-calf cows and heifers must have excellent quality both in the case of roughage (hay,

green matter) and concentrates which should have natural sources of protein.

Small farms dominate cattle production of Bosnia and Herzegovina, and they possess approximately 90% of total livestock. Around 485,000 hectares of meadows have been utilized as pastures and for hay production because of the need of winter fodder stocks for these farms. Besides an additional 860,000 hectares of natural pastures are being used for grazing in summer time. Most of the natural pastures are owned by the state, however with possibility to be used for grazing, given for utilization on the basis of local habits. The crops used as fodder (maize, alfalfa and clover) supplement nutrition of the grazing cattle.

There is evidence of poor utilization of accessible pastures and meadows in livestock nutrition. Besides, the hay harvest is done after maturity (for the sake of increased volume), and this causes decreased digestibility and lower protein content. Fertilizer has not been used at all or at low level for increase of pasture production. Water for livestock is mostly inadequate. Mountain pasture areas are frequently unreachable and unutilized. Also, the protein additives have not been correctly used, especially in the winter time and for the younger livestock. Beside mentioned constraints, other constraints include the following: late first calving (over 30 months) and long next calving intervals (18-24 months), late weaning of calves resulting in decrease of revenue made by milk sales, limited utilization of artificial insemination as well as limited use of improved bull breeds etc.

In order to stimulate fodder production across large areas, it is necessary to apply new technologies of fodder cropping. Beside maize, clover, alfalfa and a mixture of leguminous crops are growing on the farms in Bosnia and Herzegovina and these crops are increasingly planted, which can be interpreted as the positive phenomenon (Table 2). However, there are so many other things that could be done in order to increase yields and purpose of those crops in livestock husbandry, by promoting the new varieties. It is also necessary to increase the scope of crop types utilized as livestock feed, e.g. special kind of cow cabbage or root crops convenient for more intensive systems of cattle production in the lowlands (Repić and Rozman, 2002).

**Table 2.** Production of animal feed in Bosnia and Herzegovina

Crop	Harvested area (ha)		
	1995/96	1996/97	1997/98
Clover	102209	138306	121769
Alfalfa	69625	94222	94009
Grass/Leguminosae	19511	23191	22580
Cereals/Leguminosae	13964	3494	3303
Fodder maize	33909	33879	75959
Fodder sugar beet	16309	24354	44601
Vetch	1370	968	1327
Total	256854	318414	363548

Source: CSO, Sarajevo

### Results of the cost-benefit analysis in the case of the in-calf heifers number increase within the livestock number

The renovation and increase of livestock would, in turn, increase the meat and milk production that could satisfy a greater proportion of the expected increase in domestic demand caused by an increase of households' revenue in Bosnia and Herzegovina. In addition, any meat surplus could be exported and there would be realized additional positive effects, and finally through renovation and increase of livestock the utilization of domestic processing capacities could be increased.

The milking cows' population was estimated to be approximately 223,000 head. Average milk production per cow in Bosnia and Herzegovina amounts to 1,450 liters of milk annually, with potential annual total production of approximately 323,350,000 liters for the entire country. If we assume that average milk consumption per capita in Bosnia and Herzegovina amounts to 118 liters of milk annually, then it can be concluded that annual milk production at this level can only satisfy about 65% of total domestic needs. This raises the question how could necessary level of milk production be achieved so that domestic need of Bosnia and Herzegovina is satisfied? There are two possibilities for that: one possibility is to increase production of milk per cow (if it is possible by condition and genetic potential of the cows), and the second one is to increase the existing number of livestock by obtaining high-quality in-calf heifers. Taking into consideration the fact that the second variant could be implemented easier (under the assumption that there is at disposal necessary amount of financial resources for provision of heifers), then in future investigations there must be analysis of economic effects of the in-calf heifers increase using cost-benefit analysis (Čejvanović, 2003). In addition, utilization of subsidizing measures for purchase of in-calf heifers have been accounted for, as well as for bulls and for artificial insemination.

The anticipated subsidy amounts to 300 KM for each in-calf heifer bought by domestic farmer.

The cost-benefit analysis was completed for the six-year period, taking in account the productive period of bought heifer. The analysis includes economic and financial parameters (inflows and outflows) which annual amounts were discounted to the present values by utilization of the average social discount rate, in order to put all annual amounts at the same trend of calculation and to account for opportunity capital costs as well (Majković et al., 2005).

This analysis used existing levels of real prices, costs, tariffs and subsidies valid at the moment of analysis elaboration. Because of mentioned suppositions, the social discount rate used in financial cost-benefit analysis an effect of inflation was excluded. The calculations were made using a 9% discount rate (Pažek et al., 2006).

Subsidies for heifers amounting to 300 KM per head represent 15% of necessary amount for purchasing a Simmental in-calf heifer. This model there calculated as revenue items the production values obtained by an increase of milk production, as well as veal and sales of culled milking cows at the end of the six-year period. It was assumed that yields of milk as well as meat production, in the case of bought heifers, have increased in the course of analyzed period. The price of veal taken for the analysis was the actual price of live weight animal at the moment of calculation (4.5 KM/kg) reduced by the cost of import tariff and customs records. An important supposition was that the market price, both in the case of milk and meat, is equal to the sum of the threshold price (the price up to frontier plus tariffs) and transportation costs to the frontier.

Most costs associated with the subsidizing measures were concentrated in the first year of productive milking animals' life (Figure 2). It was also predicted that milk yields and veal production were increasing during the productive life of milking cows. Milk and meat were sold and at the end of the sixth year the milking cows were sold to the slaughterhouse as well.

Results of the cost-benefit analysis show that net present value for the period of six years is significantly positive (155,701 KM) and that the benefit-cost ratio is high and amounts to 1.93, i.e. present value of the total benefit is 93% higher than the present value of the costs. The cash flow for calculation of net present value is shown in the Figure 3.

The calculated internal rate of return was also very high and amounts to 39%. When we took into account benefits of additional employment as well, the positive results coming from purchase of new in-calf heifers were significantly improved (Table 3).

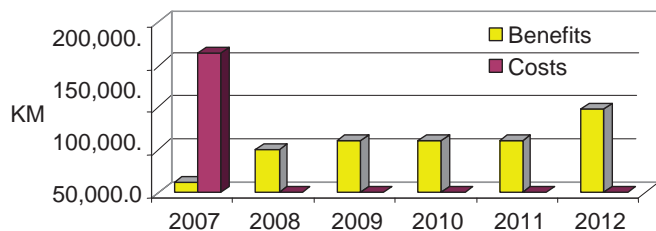


Figure 2. The cost and benefit ratio in the six-year period (2007-2012)

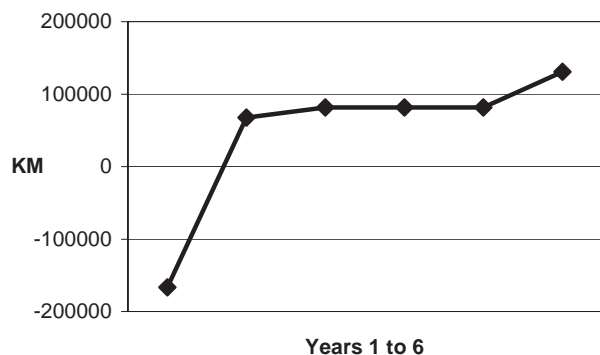


Figure 3. Cash flow for calculation of net present value

Beside the analysis of investment effectiveness/profitability, a sensitivity analysis of benefit-cost ratio was conducted such that some input parameters were changed (Table 4). The sensitivity analysis shows how the project profitability changes by changing values of treated variables such as production prices, subsidies etc. Sensitivity

Table 3. Results of the cost-benefit analysis in the case of in-calf heifers' purchase

Cost-benefit analysis – in-calf heifers	2007-2012
Net present value (NPV) of the project (r =9%, n=6)	155,701.2
NPV of the project + additional employment	319,175.3
Benefit-cost ratio of the project (r=9%, n=6)	1.93
Benefit-cost ratio of the project + additional employment	3.03
Internal rate of return of the project (IRR)	39%
IRR of the project + additional employment	69%

analysis, that includes calculating the project output by changing input variables, is frequently used as one method for forecasting the degree of risk as well as the uncertainty of the projected investments. Using the analyzed model, the sensitivity analysis must be carried out on the basis of proposed changes within the scope of +20% and -20% (but together with inclusion of the variant of zero change as well as +/-10%) for the most important parameters (domestic price and subsidy, stocks of accepted knowledge and costs of extension services, domestic price and change of tariff) (Vasiljević, 1998). The changes in parameters were checked by monitoring of the results of the net present value variables as well as the benefit-cost ratio.

Sensitivity analysis (Table 4) for the purchase of in-calf heifers shows that the results of the cost-benefit analysis are significantly changing when the main parameters (pro-

Table 4. Sensitivity analysis of the benefit-cost ratio

		Sensitivity analysis – of the benefit-cost ratio					
		Percentage of the subsidy change					
		20%	10%	basis	-10%	-20%	
The price change in %	20%	2.15	2.15	2.14	2.14	2.14	
	10%	2.04	2.04	2.04	2.03	2.03	
	basis	1.93	1.93	1.93	1.93	1.92	
	-10%	1.83	1.83	1.83	1.83	1.82	
	-20%	1.75	1.75	1.75	1.75	1.74	

Table 5. Sensitivity analysis of the net present value change

		Sensitivity analysis – Net present value (in KM)				
		Percentage of the subsidy change				
		20%	10%	basis	-10%	-20%
The price change in %	20%	230,778	211,336	191,893	172,450	153,007
	10%	209,063	191,430	173,797	156,164	138,503
	basis	187,348	171,524	155,701	124,050	139,877
	-10%	168,046	153,830	139,615	125,400	111,185
	-20%	151,156	138,348	125,541	112,733	99,925

ducer's price and subsidy in this case) are changing too. For example, if the producer's price drops by 20% (i.e. the price of wheal at the farm drops from 4.5 KM to 3.75 KM per kilogram of live weight) and subsidy stays the same (300 KM per heifer), the ratio between benefits and costs also decreases from 1.93 to 1.75 (decrease of the cost efficiency by 18%). On the other hand, if the subsidy was reduced by 20% (i.e. from 300 KM to 240 KM per heifer), but with no change in producer's price, the ratio between benefits and costs stays almost the same.

However, when we analyze the net present value (Table 5), a decrease of subsidy by 20% resulted in decrease of net benefit (i.e. net present value has been decreased from 155,701 KM to 139,877 KM), while the drop of the producer's price by 20% resulted in a drop of the net present value as well. The ratio between benefits and costs shows the level of subsidy profitability, while analysis of the net present value takes in account total efficiency of the subsidy measure. The analysts could use sensitivity analysis for an estimate of alternative measures' influence, but also for an estimate of the cost efficiency and total efficiency of subsidy measure as well (Rozman, 2001). Finally, the sensitivity analysis has shown that net present value is more sensitive to price changes than to changes at the subsidy level.

## Conclusion

There are dominant small farms with small number of milking cows and seasonal milk production in cattle production in Bosnia and Herzegovina. They owned approximately 90% of total livestock. Around one half of total livestock fund in Bosnia and Herzegovina was lost in the period 1992-1995, while capacities and facilities were significantly damaged. Renovation of the milking cows, fund greatly depends on the possibility of private sector to import heifers, as other sources of support are not sufficient to cover full costs of the livestock fund renovation. Agrarian policy measures directed toward enlargement of cattle fund have to be designed in such a way to assure adequate supports for farmers to keep or purchase young heifers, as well as to provide sufficient financial resources and possibility for import of in-calf heifers without custom duties and without bureaucratic procedures. Supporting measures should be first of all directed toward those farmers who have bigger herds and market orientation.

Different kinds of constraints coming from the farms or out of them cause low level of production and profitability on the livestock farms in Bosnia and Herzegovina, particularly on the small farms. One of the most important constraints is inadequate livestock nutrition. Among other things, poor utilization of accessible pastures and meadows in livestock nutrition is evident. Fertilizer has been not used at all to increase of production in pastures,

while mountain pasture areas are frequently unreachable and under utilized. Also, the protein additives have not been used correctly, especially in the winter time and for the younger livestock categories.

Necessary levels of milk production which should completely satisfy the domestic needs of Bosnia and Herzegovina for milk can be achieved in two ways: by increased production of milk per cow (if it is allowed by condition and genetic potential of the cows) or by an increase of existing livestock by purchase of the high-quality in-calf heifers. Taking into consideration the fact that second variant could be implemented easier (under assumption that there is at disposal necessary amount of financial resources for provision of heifers), in this paper there is analysis of the economic effects of in-calf heifers provision by utilization of the cost-benefit analysis.

Results of the cost-benefit analysis show that net present value for the period of six years is significantly positive (155,701 KM) and that the benefit-cost ratio is high and amounts to 1.93, i.e. present value of the total benefit is 93% higher than the present value of the costs.

The calculated internal rate of return is also very high with amounts up to 39%.

In addition, the utilization of some agrarian policy measures has been accounted for (subsidies for purchase of in-calf heifers) and the applied economic effects have been analyzed. The results of analysis show high profitability of analyzed subsidizing measures.

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