ECONOMIC EFFICIENCY OF INVESTMENTS IN COW-CALF PRODUCTION IN THE REPUBLIC OF SERBIA[1]

Lana Nastić[2]

Abstract

Value of livestock production in the Republic of Serbia is rather low comparing to value of plant production. At the same time, cattle production is the most important concerning milk production, while level of beef production is low (production of pork is much important comparing to beef production). One of the ways to increase beef production in the Republic of Serbia is introduction of cow-calf production system. This production system has some advantages comparing to usual beef production system, such as low level of investments, use of available natural resources etc. To evaluate investments in cow-calf production, author used net present value, internal rate of return and payback period. Besides, level of profit was determined, depending on existence of state subsidies for this production. The results of the analysis indicated that economic efficiency of cow-calf production in Serbia significantly depends on level of state subsidies.

Key words: *cow-calf production system, investments, net present value, subsidies*

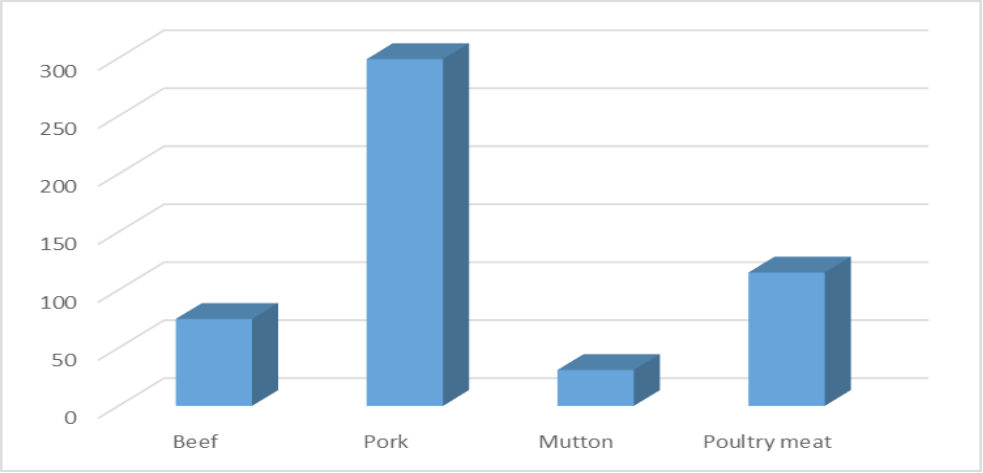
Introduction

In the structure of total agricultural output in the Republic of Serbia in 2019 participation of plant production was 68.5%, while participation of livestock production was only 29%. At the same time, agricultural service participated in total agricultural output by 2.5%. (RZS, 2020). Above presented data indicate strong need for improving the volume of livestock production in Serbia. Available statistical sources for 2020 show that beef production in Serbia is on a rather low level, comparing to pork (as dominant type of meat) or even poultry meat production (Figure 1).

1 This paper is a result of the research funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia based on the agreement between the Ministry and the Institute of Agricultural Economics, Belgrade (Contract No. 451-03-9/2021-14/200009), on the realization and financing of scientific research in 2021.

2 *Lana Nastić*, Ph.D., Research Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 69 72 852, E-mail: lana_n@iep.bg.ac.rs

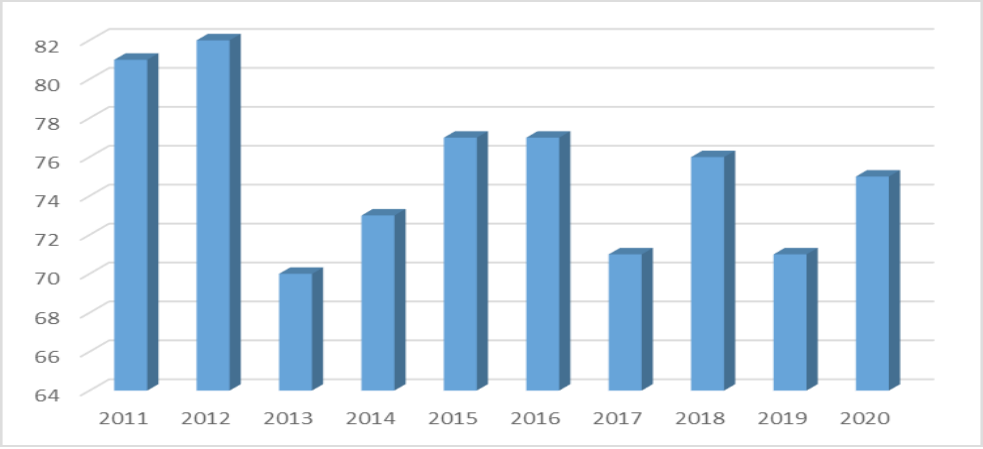
Figure 1. Meat production in the Republic of Serbia in 2020 (000 t).



Source: RZS (2021b).

While the volume of milk production is rather stabile, beef production during the period 2011-2020 significantly varied, and had decreasing tendencies (Figure 2). Therefore, beef production decreased by 7.4% in the last year comparing to the first year of the observed period.

Figure 2. Beef production in the Republic of Serbia during the period 2011-2020. (000 t).



Source: RZS, 2021b.

Volume of beef production also decreased in the EU countries in 2020. Although there are negative tendencies in the EU beef production quantities, there is an increase in number of cows involved in cow-calf production. The data show that in the EU during 2020 total number of cows engaged in cow-calf production increased by 0,4%, i.e., the number of heads increased by 48,000 (MPŠV, 2021).

Cow-calf system is an important way of increasing beef production because it is based on low level of investments, as well as on the use of cheap fodder sources. On the other hand, cow-calf production system has its drawbacks, such as low profitability and exposure to high level of risk (Ivanović, 2018). Perišić et al. (2009) discussed use of Simental breed for cow-calf production, and importance of regular fertility and low feeding costs for its economic feasibility. In cow-calf production system farmers primarily use low quality agricultural land, such as pastures and meadows. According to Farm structure survey (RZS, 2021a) (which was conducted in Serbia in 2018) total area of meadows and pastures in the Republic of Serbia is 676,724 ha, which is 13.1% of total available land (5,178,692 hectares). There are 246.774 farms in Serbia having meadows and pastures, which indicates great potential for the development of cow-calf production in Serbia. Cow-calf production system is not developed in Serbia, which resembles the situation in some neighboring countries, such as Croatia (Vinković et al., 2006).

According to Marohnić (2004) some of the most important preconditions for economically efficient cow-calf production are the use of pastures (preferably community pastures) and season of calving. Production in cow-calf system could be improved by applying rotation use of pastures, which is suggested by Štavalj et al., 2020. Besides, the quality of pastures itself influences the breed of cows that will be used in cow-calf production system (Ivanković et al., 2005). López-González et al. (2020) determined that intensification of production on pastures (by using cultivated pastures and irrigation systems) positively influences productivity of cow-calf system.

Turner et al. (2013) used system dynamics approach to discuss the influence of different cow sales scenarios (different cow culling rates) on some economic indices (net income and return on investments). Within this research, authors determined that an increase in cow cooling rate had a positive influence on the above mentioned indicators. Patalee and Tonsor (2021a) analyzed how changes of weather conditions influence cow – calf production, conclud-

ing that temperatures and precipitation influence not only level of production, but also location of production. Patalee and Tonsor (2021b) addressed a similar issue concluding "that weather impacts during the breeding season are substantially greater than seasonal weather impacts on cow-calf production".

Factors influencing cow-calf production, as well as indicators which could be applied to analyze efficiency of this production were also discussed by other authors (Ramsey et al., 2005; Ward et al., 2008), while some research addressed ecological aspects of cow-calf production system, discussing the influence of this production system on the environment (Morel et al., 2016; Angerer et al., 2021).

The goal of this research is to determine efficiency of investments in cow-calf production in Serbia, as well as profitability of this production type, primarily focusing on the level of state subsidies and its influence on the above mentioned indicators.

Material and method

To perform the analysis, the author established three models of family farms having 20 cows of Hereford breed, which is often used in cow-calf production in Serbia. The differences between models are based on the use of various subsidies available for such production. The models are formed on the basis of literature sources dealing with cow-calf production system (Knežević et al., 2005; Knežević et al., 2007; Ivanović, 2018). The basic assumption is that calves are sold on the market in autumn (at the weight of 210 kg), and that investment is observed for a period of 10 years.

To determine profitability of cow-calf production for the three observed models, the author used enterprise budgeting. Economic effectiveness of investments in this production is determined by applying net present value, internal rate of return and payback period (methodology described by Andrić et al., 2005; Gogić, 2014; Ivanović and Marković, 2018; Subić, 2010). Discount rate used for the investment evaluation was 3.15%. STIPS database is used as a source of market prices for products and materials in cow-calf production. Amount of subsidies and level of market prices are related to the year 2021.

Results and discussion

Three models of cow-calf production (all of them assuming 20 cows at the farm) were established. These models differ concerning the use of different state subsidies:

- Model A does not use state subsidies to support cow-calf production;
- Model B uses subsidies for cows in cow-calf system which are paid every year (amount of these subsidies is 40.000 RSD per head per year);
- Model C uses the same subsidies as model B, but also additional subsidies paid only once to support purchase of high quality breeding herd (cows in cow-calf system). Their amount equals 50% of breeding herd value.

Total investment in cow-calf production included not only the investment in breeding herd, but also the investment in buildings for their accommodation during winter months, investment in necessary equipment, as well as needed working assets (Table 1).

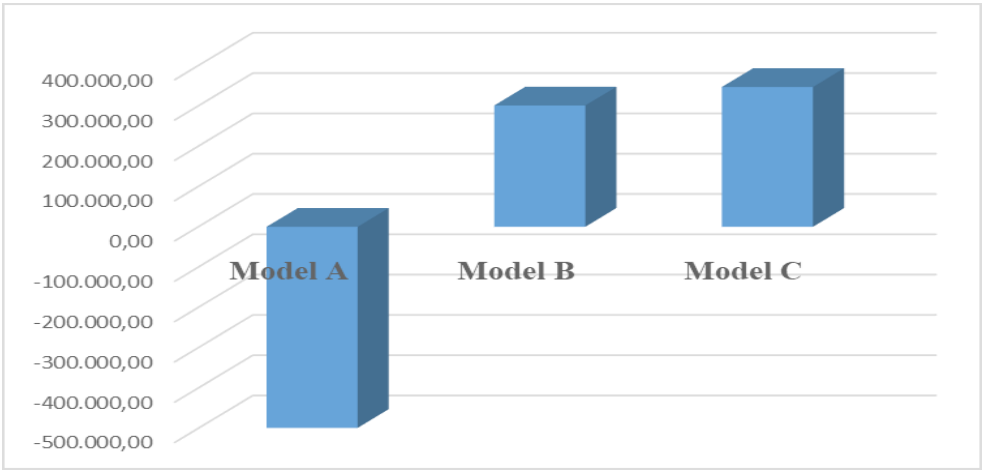
Table 1. Total investment in models A, B and C (RSD).

No.	Item	Total investment (Models A and B)	Participation in total investment (Models A and B) (%)	Total investment (Model C)	Participation in total investment (Model C) (%)
I.	**Fixed assets**	**5,942,000.00**	**83.33**	**4,187,000.00**	**83.33**
1.	Buildings	2,245,000.00	31.48	2,245,000.00	44.68
2.	Equipment	187,000.00	2.62	187,000.00	3.72
3.	Breeding herd	3,510,000.00	49.23	1,755,000.00	34.93
II.	**Working assets**	**1,188,400.00**	**16.67**	**837,400.00**	**16.67**
Total		**7,130,400.00**	**100.00**	**5,024,400.00**	**100.00**

Source: Author's calculation

While in the representative year (fifth year of the project) Model A is not profitable (Figure 3), Models B and C are profitable. The use of additional subsidies in model C increases profit by 15.26% comparing to Model B (from 301,005.05 RSD to 346,935.71 RSD).

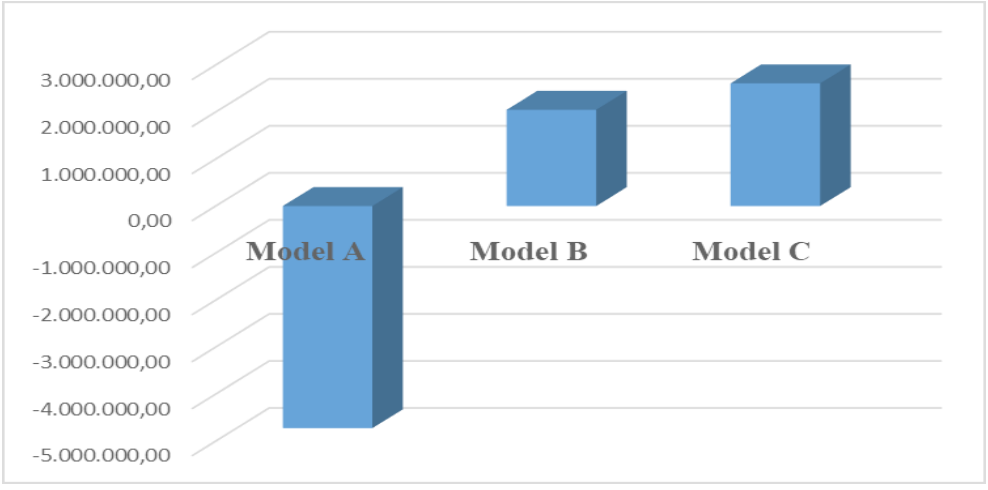
Figure 3. Profit in representative year for models A, B and C (RSD).



Source: Author's calculation

Net present value is negative for Model A (which does not use subsidies at all), indicating that such an investment is not economically efficient (Figure 4). Higher net present value is determined for Model C (2,609,426.83 RSD) comparing to Model B (2,047,849.06 RSD). The use of subsidies in model C led to an increase of net present value by 27.42% in comparison to model B. The results indicate that additional subsidies present in Model C have higher impact on economic efficiency of investments, comparing to their impact on profitability.

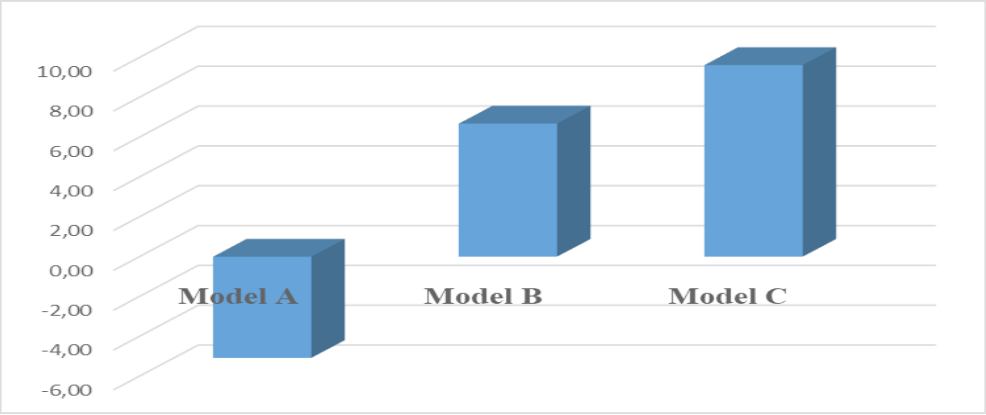
Figure 4. Net present value for models A, B and C (RSD).



Source: Author's calculation

Internal rate of return for Model B is 6.68% while it is somewhat higher for model C (9.62%). Both of them are higher than discount rate (which is 3.15%), so that investments in these two models are economically efficient. On the other hand, application of Model A leads to a negative internal rate of return (-5.08%) indicating that investment is not acceptable (Figure 5).

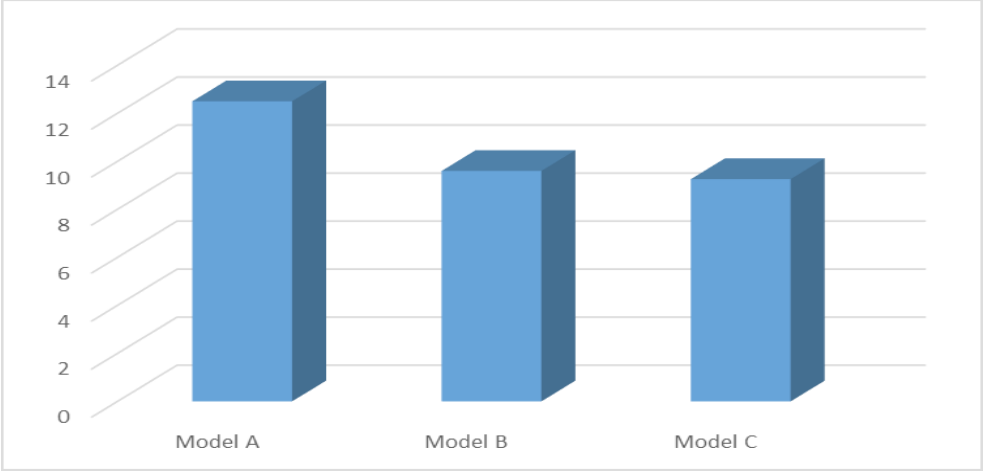
Figure 5. Internal rate of return for models A, B and C (%).



Source: Author's calculation

The payback period for model A is longer than 10 years, which means that the investment in this model is not economically efficient. For other two models payback period is 9.60 years (model B) and 9.26 years (model C), so that these investments are feasible, because their payback periods are under 10 years (Figure 6).

Figure 6. Payback period for models A, B and C (years).



Source: Author's calculation

On the basis of above analysis performed for investments in cow-calf production system, it is determined that without subsidies this production is not profitable, while (considering all applied indicators) investments are not economically effective.

On the basis of Model B it is possible to determine net present value for various discount rates i.e., structures of investment financing (Table 2). It is also possible to calculate amount of subsidies which is necessary to achieve zero net present value for observed discount rates. Considering an initial discount rate (3.15%) it is acceptable to decrease existing level of subsidies (40,000 RSD/head/year) by 30.24%.

Table 2. Net present value for various discount rates (Model B).

Discount rate (%)	Net present value (RSD)	Level of subsidies leading to NPV=0	Decrease of initial subsidies leading to NPV=0
1	3,679,760.09	20,575.00	48.56%
2	2,877,992.62	23,980.00	40.05%
3	2,150,956.95	27,392.00	31.52%
3.15	**2,047,849.06**	**27,904.40**	**30.24%**
4	1,490,795.22	30,810.00	22.97%
5	890,553.11	34,233.00	14.42%
6	344,067.88	37,663.00	5.84%

Source: Author's calculation

The results indicated that level of discount rate significantly influence acceptable amount of subsidies (which are paid every year) for cow-calf production.

Conclusion

Beef production in Serbia is not developed enough, and has decreasing tendencies. Especially low level of development could be attributed to cow-calf production system in Serbia, although there are significant areas of agricultural land which can be used for this type of beef production. In order to facilitate development of cow-calf production system, Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia offers various subsidies for registered producers dealing with this beef production type.

Analysis revealed that the best economic effects are achieved if state support is used from the moment of the establishment of cow-calf enterprise (assuming that farmers use subsidies for the investments in purchasing high quality breeding herd). Such an approach has higher influence on economic efficiency of investments, comparing to profitability of cow-calf production. Having that in mind, it is necessary not only to work on directing farmers towards that type of production but also to educate producers concerning types and amount of subsidies available for such production.

Literature

1. Andrić, J., Vasiljević, Z., Sredojević, Z. (2005): *Investicije (Osnove planiranja i analize*). Univerzitet u Beogradu, Poljoprivredni fakultet Beograd.
2. Angerer, V., Sabia, E., von Borstel, U. K., Gauly, M. (2021). Environmental and biodiversity effects of different beef production systems. *Journal of Environmental Management*, *289*, 112523.
3. Gogić, P. (2014): *Teorija troškova sa kalkulacijama – u proizvodnji i preradi poljoprivrednih proizvoda*, Poljoprivredni fakultet, Beograd.
4. Ivanković, A., Caput, P., & Konjačić, M. (2005). Genotip kao osnovica rentabilne govedarske proizvodnje. *Stočarstvo: Časopis za unapređenje stočarstva*, *59*(6), 433-441.
5. Ivanović, L. (2018). Mogućnosti razvoja ekstenzivnih oblika stočarske proizvodnje u Srbiji. Doktorska disertacija, Poljoprivredni fakultet, Univerzitet u Novom Sadu, Srbija.
6. Ivanović, S. Marković, T. (2018). Upravljanja investicijama u agrobiznisu, Univerzitet u Beogradu, Poljoprivredni fakultet, Zemun.
7. Knežević, M., Perčulija, G., Bošnjak, K., Leto, J., Vranić, M. (2005). Tehnološko-tehničke osnove sustava krava tele, Stočarstvo 59:2005 (6), str. 443-450.
8. Knežević, M., Perčulija, G., Leto, J., Bošnjak, K., Vranić, Marina, Kutnjak, H., Grgić, Z. (2007). Studija izvodljivosti sustava „krava – tele" u Sisačko – moslavačkoj županiji, Sveučilište u Zagrebu, Agronomski fakultet, Centar za travnjaštvo.
9. López-González, F. A., Allende, R., de Lima, J. M. S., Canozzi, M. E. A., Sessim, A. G., & Barcellos, J. O. J. (2020). Intensification of cow-calf production: How does the system respond biologically to energy inputs in a long-term horizon?. *Livestock Science*, *237*, 104058.
10. Marohnić, I. (2004). Uzgoj mesnih goveda u Hrvatskoj u sustavu krava-tele. *Stočarstvo: Časopis za unapređenje stočarstva*, *58*(6), 471-478.
11. Morel, K., Farrié, J. P., Renon, J., Manneville, V., Agabriel, J., Devun, J. (2016). Environmental impacts of cow-calf beef systems with contrasted grassland management and animal production strategies in the Massif Central, France. *Agricultural Systems*, *144*, 133-143.
12. Patalee, B., & Tonsor, G. T. (2021b). Weather effects on US cow-calf production: A long-term panel analysis. *Agribusiness*, 838-857.

13. Patalee, M. B., & Tonsor, G. T. (2021a). Impact of weather on cow-calf industry locations and production in the United States. *Agricultural Systems*, *193*, 103212.

14. Perišić, P., Skalicki, Z., Petrović, M. M., Bogdanović, V., & Ružić-Muslić, D. (2009). Simmental cattle breed in different production systems. *Biotechnology in Animal Husbandry*, *25*(5-6-1), 315-326.

15. Ramsey, R., Doye, D., Ward, C., McGrann, J., Falconer, L., Bevers, S. (2005): Factors Affecting Beef Cow-Herd Costs, Production, and Profits, Journal of Agricultural and Applied Economics, Volume 37, Issue 1, pp. 91-99.

16. RZS (2020). Ekonomski računi poljoprivrede u Republici Srbiji, 2009–2019. Broj 114, Godina LVI.

17. RZS (2021a). Farm Structure Survey (FSS) 2018. Data base of the Statistical Office of the Republic of Serbia, Belgrade, Serbia, Available at: https://data.stat.gov.rs/?languageCode=sr-Cyrl

18. RZS (2021b). Livestock production. Data base of the Statistical Office of the Republic of Serbia, Belgrade, Serbia, Available at: https://data.stat.gov.rs/Home/Result/130202010401?languageCode=sr-Cyrl.

19. Subić, J. (2010). Specifičnosti procesa investiranja u poljoprivredi, IEP, Beograd.

20. Štavalj, J., Bobić, T., Gantner, R., & Mijić, P. (2020). Rotacijsko napasivanje u sustavu krava-tele. 55. hrvatski i 15. međunarodni simpozij agronoma, 16. - 21. veljače 2020. godine, Vodice, Hrvatska, pp. 479-483.

21. Turner, B. L., Rhoades, R. D., Tedeschi, L. O., Hanagriff, R. D., McCuistion, K. C., & Dunn, B. H. (2013). Analyzing ranch profitability from varying cow sales and heifer replacement rates for beef cow-calf production using system dynamics. *Agricultural Systems*, *114*, 6-14.

22. Vinković, B., Čač, Ž., Žurić, M., Rajković Janje, R., & Herak-Perković, V. (2006). Načela dobre farmske prakse u tovu teladi. *Krmiva: Časopis o hranidbi životinja, proizvodnji i tehnologiji krme*, *48*(5), 295-299.

23. Ward, C.E., Vestal, M.K., Doye, D.G., Lalman, D.L. (2008): Factors Affecting Adoption of Cow-Calf Production Practices in Oklahoma, Journal of Agricultural and Applied Economics,Volume 40, Issue 3, pp. 851–863.

24. MPŠV (2021). Izveštaj o stanju u poljoprivredi u Republici Srbiji u 2020. godini, Knjiga I.