

---

## Factors Hindering Investments in Forest Equipment in Bulgaria

Konstantin Kolev

University of Forestry – Sofia, Business Faculty  
Bulgaria  
[konstantinklv@yahoo.com](mailto:konstantinklv@yahoo.com)

**Abstract.** Wood-harvesting enterprises in Bulgarian forest sector are characterized with unqualified staff, low labour productivity and obsolete forest equipment. In connection with the last one should be mentioned that 80% to 90% from the wood extraction activities is realized by animal skidding [19], and nearly 90% of the specialized tractors are depreciated [8]. The lack of enough investments in Bulgarian forest sector imposes the goal of the survey and namely: to reveal the factors hindering investments in Bulgarian forest sector by means of appraisal of the financial efficiency of investment in timber harvesting equipment. Traditional methods for financial estimation of investment projects are used – Net Present Value (NPV) and Internal Rate of Return (IRR). The elaboration of project confirms the thesis that the entrepreneurs do not invest in forest equipment because of the following factors: firstly, the sector is characterized with low profitability; secondly, the entrepreneurs do not have security that for a long period of time concrete quantity of timber for harvesting will be guaranteed to them and they will be able to pay the interest rate to credit institutions as well as to achieve satisfactory internal rate of return; thirdly, the payment of the labour is low and due to this the investments in specialized equipment are missing; fourthly, some of the wood harvesting enterprises perform illegal actions, concerning timber harvesting, labour contracts, taxes, social securities and so on. This permits them to lower the price of the felled timber and to be more competitive on the market.

**Key Words:** asset investments, enabling investments, forest equipment, entrepreneurship.

### 1 Introduction

During the last 20 years the deficit of forest products on global market has stimulated the investments in forestry [12, 14]. They are performed mainly by institutional investors and small and medium-sized enterprises (SMEs). The institutional investors invest in forestlands, namely plantations in the South hemisphere and USA. They are attractive because are characterized with growing financial returns. In this connection should be mentioned that Internal Rate of Return (IRR) of timberland investments in some countries on average has the following values:

Argentina – 14.8%; Brazil – 21.6%; Uruguay – 18.0%; USA – 14.9%. IRR is considered from the point of view of investment's risk. It is lower than those of other assets with similar rate of return. The lower risk of timberland investments is consequence of the positive correlation of rate of return with inflation and lack of correlation of rate of return on plantation investments with returns on financial assets [3, 5, 17]. Because of the facts presented above the investments in forestlands are preferred by institutional investors in time of financial unsecurities to diversify and to decrease overall risks in an investment portfolio [3].

Investments of SMEs in the field of forestry can provide better access to goods, services, markets as well as higher level of employment in isolated communities [2, 9]. The importance of topic generates a lot of surveys [7, 9, 16, 17]. They introduce two new categories – asset investments and enabling investments. The goal of the first one is to create tangible assets by means of which to generate profits and to increase the nominal value of underlying capital of SMEs. The goal of enabling investments is to create framework for successful asset investments. The conditions, which enable investments should provide, are secure commercial forest use rights, proper management and sufficient cash flows to cover the investment costs in assets. The enabling investments are provided from NGOs, philanthropists or governments. The combination from asset and enabling investments must balance financial results with social justice for local people, who control the investible business, and environment [2, 9, 17]. Most of the asset investments in case studies in the articles cited above, contribute to sustainable forest management and generate profits for SMEs, who produce timber and non-timber products. In Bulgarian forest sector the situation is different. The institutional investors and enabling investments are missing. The investments of SME's are not enough and mainly in timber harvesting equipment as the main product from Bulgarian forest territories is roundwood. The timber felling enterprises are characterized with unqualified staff, low labour productivity and obsolete forest equipment. In connection with the last one should be mentioned that 80% to 90% from the wood extraction is realized by animal skidding [19], and nearly 90% of the specialized tractors are depreciated [8]. The lack of enough investments in Bulgarian forest sector imposes the goal of the survey: to reveal the factors hindering investments in Bulgarian forest sector by means of appraisal of the financial efficiency of investment in timber harvesting equipment. Through it is pursued another goal – the current article to serve as a handbook to entrepreneurs who are in logging business to calculate strictly their operating costs and revenues.

## **2 Appraisal of financial efficiency of investment in timber harvesting equipment**

According to Snowdon and Patrice appraisal is “the systematic analysis of the different costs and benefits of a course of action, whether economic, social, environmental or financial” [24]. Key stages of appraisal are “to identify and set out a range of options; to identify the costs and benefits of the selected options; and to adjust costs and benefits for future changes in values and prices” [13, 24]. On this basis in the lines below are established average annual felling per timber harvesting company (range of options); investment costs, operating costs and revenues

(costs and benefits of the selected options) and future cash flows (adjust future costs and benefits).

Financial return model, presented in lines below, is elaborated for average size firm from Bulgarian forest sector. The model assumes that the firm operates under short run conditions, do not have market power and do not realize economies of a scale [10].

### **2.1 Average annual felling per timber harvesting company**

In Bulgarian forestry sector there are 3000 registered legal entities, whose main activities are connected with wood-harvesting. From them actively work nearly 1250 [19]. At the same time for the period 2011-2015 the average annual harvest from Bulgarian forest territories was around 6078 thousand m<sup>3</sup> [15], which means that the average annual felling per timber harvesting company is nearly 5000 m<sup>3</sup>. On the basis of this quantity in following lines is elaborated the project for investment in logging equipment.

### **2.2 Investment in timber harvesting equipment for logging of 5000 m<sup>3</sup>**

The structures of felled timber, the slope of the terrain and the scheme of logging, which requires the primary treatment of felled timber to be performed in forest on temporary technological sites [18], demand the investment in assets presented below. The total value of investment is 68 250 EUR.

#### **➤ Specialized forestry tractor**

The specialized forestry tractor is needed for transportation of construction timber to tractor road or temporary storage. Its technological equipment includes winch, arch for lifting the front end of the wood materials and a shield. The price of the most commonly used specialized tractor in Bulgarian forest territories is 36 000 EUR.

#### **➤ Truck with hydraulic crane and trailer**

For loading and transportation of felled timber to the consumers is needed a truck with hydraulic crane. The price of the most widely used truck in our practice is 19 000 EUR and the price of the hydraulic crane is 8500 EUR or the total price of the asset is 27 500 EUR. Towards the truck there is a trailer of 10 tones.

#### **➤ Chainsaws**

For three felling, pruning and cutting out the stems of assortments four chainsaws are foreseen. Their price is 2000 EUR.

#### **➤ Automobile Van**

The van is needed to transport workers from the clearing to the settlement where they should stay overnight. The price of the van is 2250 EUR.

#### **➤ Wagon for keepers and workers**

The wagon for guards and workers is on the temporary storage where the felled timber is stored and the machinery should be left after the end of the working day. The price of the wagon is 500 EUR.

### **2.3 Operating costs**

The operating costs are calculated at an average daily productivity of 25 m<sup>3</sup> and working week of 5 days. This productivity permits 5000 m<sup>3</sup> to be felled for 200 days. Since the logging process depends on climatic conditions the time for cutting down 5000 m<sup>3</sup> is expected to last 230 working days. During this additional 30 days when timber harvesting is not foreseen the workers will be engaged at the temporary storage with the following operations: sorting and cutting assortments, maintenance of felling equipment and road network. Wages, social and health insurances are expected to be paid for 12 months. Social and health insurances, which must be paid by employers is calculated for the third category labour at a rate of 17.96% from the insurance income.

The operating costs are systematized in four groups: costs for wages; social and health securities; costs for raw materials; costs for external services; depreciation costs.

All prices are without value added tax (VAT). All prices connected with timber are per solid cubic meter.

#### **➤ Costs for wages, social and health securities**

The necessary human resources for realization of project's activities are: forester (1 person); driver of the specialized forestry tractor (1 person); truck driver (1 person); chainsaw operators (3 persons); workers in the clearing (3 persons); workers on the temporary storage (3 persons); and two keepers. In the lines below are described the obligations of these category personnel and the monthly social security income for one person is pointed out: the forester should plan and organize timber harvesting – 500 EUR; the driver of the specialized tractor should transport the timber from clearing to the temporary storage – 440 EUR; the driver of the truck with a trailer should drive the felled timber from the temporary storage to the consumers – 440 EUR; the chainsaw operators cut down trees and perform the primary wood processing – 400 EUR; the workers in the clearing assist the chainsaw operators in their works, trim the stems, collect brushwood and arrange the timber into figures – 350 EUR; the workers on the temporary storage load the timber on the truck with the trailer and travel to the consumer to unload the truck – 350 EUR; two keepers guard the temporary storage – 230 EUR. The total costs per year for wages and social securities are 72 757.72 EUR. Labour costs for the process harvesting, primary treatment and extraction are 13.62 EUR/m<sup>3</sup>. Due to the low level of mechanization the labour costs for this process exceed significantly the costs for fuel and lubricating oil, which amount to 1.72 EUR/m<sup>3</sup>.

#### **➤ Costs for raw materials**

The costs for raw materials include: costs for acquiring rights of use of standing timber on root, costs for the specialized forest tractor, costs for the truck with the hydraulic crane, costs

for the chainsaws, costs for transportation of workers to the forest clearing, costs for personal protective equipment and special workwear.

The costs for acquiring rights of use of standing timber on root are 99 275.39 EUR. They are calculated on the basis of quantity of the felled coniferous (1712.5 m<sup>3</sup>) and deciduous timber (3287.5 m<sup>3</sup>) and their prices per solid cubic meter, received by the Executive Forest Agency as of 2017, which are respectively 12.34 EUR/m<sup>3</sup> and 23.77 EUR/m<sup>3</sup>. The costs for the specialized forest tractor, the costs for the truck with hydraulic crane and the van include fuel and lubricating costs as well as costs for tires changing. These expenditures amount to 3.04 EUR/m<sup>3</sup>. Concerning the costs for the chainsaws should be mentioned that their value is 1.34 EUR/m<sup>3</sup> and they include fuel costs, two-stroke chain oil costs, transmission chain lubricating oil costs, expenditures for change of chains and chainsaw guide bar.

Finally should be mentioned that the costs for personal protective equipment and special workwear are necessary from the point of view observation of legislation – the Labour Code, the Act for Healthy and Safety Conditions of Labour, Ordinance 5 on the order, manner and periodicity of risk estimation. On the basis of legislation and staff, that works on the temporary storage and clearing, are calculated the costs which amount is 506.8 EUR or 0.10 EUR/m<sup>3</sup>.

➤ **Costs for external services**

The costs for external services are comprised by costs for renting horses for hauling the felled timber and the costs for specialized tractor and truck insurances. In accordance with the terrain and structure of the timber it is foreseen 2500 m<sup>3</sup> to be hauled with horses from the clearing to the temporary storage. The price of this service is 6.00 EUR/m<sup>3</sup>. At the same time the total amount for insurances costs is 2700 EUR or 0.54 EUR/m<sup>3</sup>.

➤ **Depreciation costs**

The economic life of assets is the period of time during which the equipment can operate at an acceptable operating costs and productivity [20]. On this basis and in accordance with the categories of depreciable assets specified in the Corporate Income Tax Act depreciation costs are determined. They amount to 7125 EUR or 1.43 EUR/m<sup>3</sup>. For all amortizable assets a linear method of depreciation is applied.

On the basis of the presented above are calculated the total operating costs for timber harvesting and realization of 5000 m<sup>3</sup>. They amount to 218 396.75 EUR and may be presented by processes per solid cubic meter on figure 1. The total costs for timber harvesting, primary treatment and timber transport on the forest road amount to 14.80 EUR/m<sup>3</sup>. For comparison in a similar natural conditions in Germany and Austria due to the higher labour payment the costs for timber harvesting and transport are 26.82 EUR/m<sup>3</sup> while in Switzerland because of the steep slopes these costs amount to 47.15 EUR/m<sup>3</sup> [4].

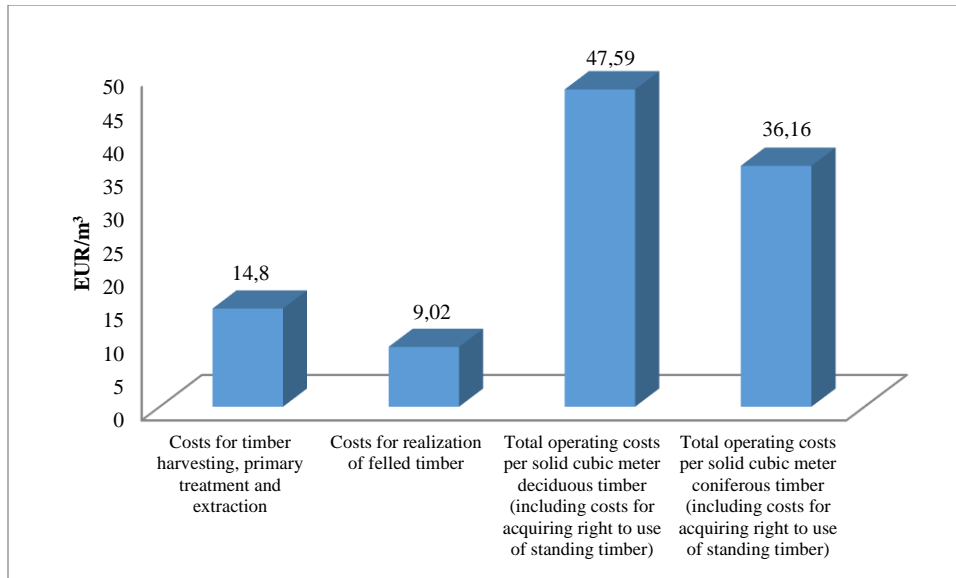


Figure 1: Operating costs by processes

## 2.4 Appraisal of net cash flows and financial efficiency of the project

Usually the large construction timber is not realized by forest owners and mostly state forestry enterprises as a standing timber on root, but as a felled timber from storage. Due to this the products, which logging enterprises most often can realize on national market are firewood from deciduous timber and technological timber from coniferous. On the basis of this assumption the amount of net cash flows is not overestimated and final financial result corresponds to economic realities in Bulgarian forest sector.

The average price of firewood for the consumer is 50 EUR/m<sup>3</sup> and the technological timber is realized on the price of 37.5 EUR/m<sup>3</sup>. The project is for 10 years. This is the period of the economic life of timber harvesting equipment. For every year from this period are done forecasts for the operating costs and revenues from timber realization. On this basis and by means of formula (1) [1, 11] are calculated net cash flows (see figure 2), generated by investment in timber harvesting equipment. Formula (1) is preferred because it gives opportunity for estimation of income, which will remain to the entrepreneur after covering all operating costs and payment of corporate income tax [11].

$$CF_t = (R_t - C_t - A_t) \cdot (1 - T_t) + A_t, \quad (1)$$

$CF_t$  – the net cash flow for year  $t$  from the economic life of the project, EUR;

$R_t$  – the net revenues from sales, EUR;

$C_t$  – the total costs (without costs for depreciation) for year  $t$  from the economic life of the project, EUR;

$A_t$  – the costs for depreciation for year  $t$  from the economic life of the project, EUR;

$T_t$  - the corporate rate income tax for year  $t$  from the economic life of the project, part of 1.0.

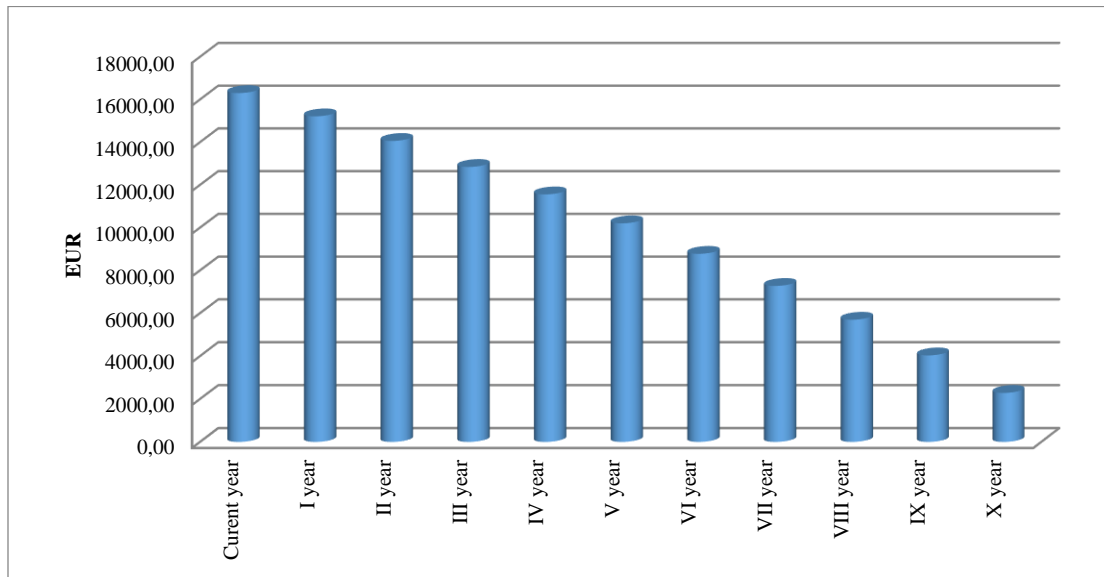


Figure 2: Net cash flows from investment in timber harvesting equipment

The financial efficiency of the project is estimated through the methods – Net Present Value (NPV) and Internal Rate of Return (IRR). These methods are selected due to their advantages. The priorities of the first one are: firstly, the method permits comparison between projects with different investment costs and economic life; secondly, the method permits to be established the total effect from several interconnected projects [1]. Theoretically IRR is inferior criterion than NPV, but it is widely used in the finance and forest economic literature and practice because it is easy to understand, explain and compare with other investment metrics [6]. NPV and IRR are calculated respectively by means of formula (2) and formula (3) [11]:

$$NPV = - \sum_{t=0}^m \frac{I_t}{(1+r)^t} + \sum_{t=m+1}^n \frac{CF_t}{(1+r)^t} + \frac{L_n}{(1+r)^n}, \quad (2)$$

where  $I_t$  is the investment cash flow in year  $t$ , EUR;

$L_n$  – future net income from eventual sale of the asset after the economic life of the project, EUR;

$n$  – number of years economic life of the project;

$m$  – number of the years during which and investment costs are accomplished;

$r$  – discount rate.

$$0 = - \sum_{t=0}^m \frac{I_t}{(1+IRR)^t} + \sum_{t=m+1}^n \frac{CF_t}{(1+IRR)^t} + \frac{L_n}{(1+IRR)^n} \quad (3)$$

The net present value is sensitive towards the discount rate. Because of that it should be carefully selected. According to Cubbage at al. discount rates used in forestry investments varied from as low as 6% in the northern hemisphere to 15% in the southern [6]. At the same time according to the conditions of the Republic of Bulgaria Rural Development Programme 2007-2013 the discount rate, which had to be used for estimation of investment projects financial efficiency, was 9% and according to the conditions of the Programme for the new period 2014-2020 the discount rate must be 6% [22, 23]. Following the conditions of the Programme for these two periods NPV is calculated for discount rate of 6% and 9%. In first case NPV is 649.10 EUR and in the second NPV is -5733.54 EUR. Concerning IRR should be mentioned that its value is 6.27% or nearly the lowest in the northern hemisphere according to the survey of Cubbage at al. [6].

### 3 Conclusions

On the grounds of the elaborated investment project in timber harvesting equipment the following conclusions can be done:

- The economic dimensions from project's realization have been reflected in the integral indicators of the methods for appraisal of investments projects. The Net Present Value (NPV) and Internal Rate of Return (IRR) confirm the financial inefficiency of the invested funds. For discount rate of 9% the NPV of the project is negative (-5733.54 EUR) and for 6% is 649.10 EUR while IRR is 6.27%. These indicators are not satisfactory enough and do not stimulate the entrepreneurs to invest in timber harvesting equipment. This confirms the statement of A. Niskanen at al. that entrepreneurs in forest harvesting follow the strategy of survival rather than seek profit due to the continuous low profitability [21].

- Through interviews, which were carried out during the elaboration of the investment project, with specialists and entrepreneurs from Bulgarian forestry sector is established that the last one do not invest in forest equipment because of the following factors: they do not have security that for a long period of time clearings in Bulgarian forest territories will be guaranteed to them and they will be able to pay interest rate to credit institutions as well as to achieve satisfactory internal rate of return; the payment of the labour is low and due to this the investments in specialized equipment are not enough; some of the wood harvesting enterprises perform illegal actions, concerning timber harvesting, labour contracts, taxes, social securities and so on. These permit them to lower the price of the felled timber and to be more



competitive on the market. In connection with the last one by means of enabling investments is necessary to be established conditions for overcoming the market failures and opportunistic behavior. This must forced enterprises to work through strict calculation of costs and revenues [25] and from here to be more self-sufficient and capable of performing asset investments [9].

#### 4 Acknowledgements

The author would like to thank the project 80-10-84/ 20.04.2017 from Sofia University St.Kl. Ohridski for the financial support.

#### References

- [1] M. Alexandrova, *Financing and Efficiency of Investments in Real Assets*, UNWE, 2012 (in Bulgarian).
- [2] C. Antinori, *Community Forest Enterprises as Entrepreneurial Firms: Economic and Institutional Perspectives from Mexico*, Elsevier, *World Development*, 33, 9, 2005, 1529–1543.
- [3] L. Brotto, *Influence of Corporate Responsibility on Financial Return in Forest Plantation: Case Studies from South America, South East Asia and Africa*, 2015, PhD-thesis University of Padova, Italy.
- [4] P. Burgi, M. Thomas, B. Pauli, *Forest Enterprise Network in Switzerland. An Instrument for Measuring Economic Sustainability*, Federal Office for the Environment, Federal Statistical Office, Switzerland, 2015.
- [5] M. Campanale, *Exploring Characteristics of Existing Forestry Investment Vehicles*, *Forest Investment Review*, Forum for the Future, 2009.
- [6] F. Cubbage et al., *Global Timber Investments and Trends, 2005-2011*, *New Zealand Journal of Forestry Science* 44, 1, 2014, <https://doi.org/10.1186/1179-5395-44-S1-S7>
- [7] J. Davies, C. Ogali, P. Laban, G. Metternicht, *Homing in on the Range: Enabling Investments for Sustainable Land Management*, IUCN, CEM, 2015.
- [8] Dinev, D., K. Asparuhov, S. Kanev. *Logging and Thinning in Bulgaria – State and Outlooks*, Proceedings of 39<sup>th</sup> FORMEC International Symposium on Forestry Mechanization, Sofia, September 24-26, 2006.
- [9] D. Elson, *Guide to Investing in Locally Controlled Forestry, Growing Forest Partnerships in association with FAO, IIED, IUCN*, The Forests Dialogue and the World Bank, 2012.
- [10] L. Fortini, D. Carter, *The economic viability of smallholder timber production under expanding acai palm production in the Amazon Estuary*, *Journal of Forest Economics*, 20, 2014, 223–235.
- [11] I. Georgiev, Tz. Tzvetkov, D. Blagoev, *Management of Firm Innovations and Investments*, UNWE, 2013 (in Bulgarian).
- [12] R. Glauner, J. Rinehart, P. D’Anieri, *Can Timberland Investments in Emerging Markets Secure Forest Sustainability*, *European Tropical Forest Research Network News*, 54, 2012, 3-9.

- 
- [13] P. Harou, D. Rose, A. Lobianco, *Cost-Benefit Analysis of Forestry Instruments*, Proceedings from International Symposium ‘Socio-economic Analyses of Sustainable Forest Management’, Prague, May 15–17, 2013.
- [14] Indufor Oy, *Strategic Review on the Future of Forest Plantations*, Helsinki, 2012.
- [15] K. Kolev, *Current State of Wood Market in Bulgaria*, *Silva Balcanica*, 17, 1, 2016, 59–69.
- [16] D. Macqueen, *The Emergence of Investing in Locally Controlled Forestry*, *European Tropical Forest Research Network News*, 54, 2012, 53-59.
- [17] D. Macqueen, *Ringing the Changes with a New Approach to Forest Investment*, International Institute for Environment and Development, 2013, <http://pubs.iied.org/17144IIED>.
- [18] I. Markov, S. Glushkov, *Norms and Rates in Timber Harvesting*, Avangard Prima, 2008 (in Bulgarian).
- [19] Ministry Of Agriculture and Foods, *National Strategy for Development of Forestry Sector in Bulgaria 2013-2020*, 2013.
- [20] E. Miyata, *Determining Fixed and Operating Costs of Logging Equipment*, USDA Forest Service, 1980.
- [21] A. Niskanen, B. Slee, P. Ollonqvist, D. Pettenella, L. Bouriaud, E. Rametsteiner, *Entrepreneurship in the Forest Sector in Europe*, University of Joensuu, 2007.
- [22] *Republic of Bulgaria Rural Development Programme 2007-2013*.
- [23] *Republic of Bulgaria Rural Development Programme 2014-2020*.
- [24] P. Snowdon, H. Patrice, *Guide to Economic Appraisal of Forestry Investments and Programmes in Europe*, European Forest Institute, 2014.
- [25] I. Yovkov, K. Kolev, *Contradictions in the Models for Forestry Sector Management*, Avangard-Prima, 2009 (in Bulgarian).