JUSTIFICATION OF CAPITAL INVESTMENT IN SMALL-SCALE UNEVEN-AGED FOREST ESTATES

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ABSTRACT

This paper addresses the issue of justification of capital investment in small-scale uneven-aged forests (silver fir-common beech) in the Republic of Croatia. Investment is considered a purchase of a forest and its pertaining land. A case study was conducted on a real-life case of a forest estate that is currently for sale (area of 2.5 ha). Property purchase was hypothetical, while all incoming parameters such as property price, forest characteristics, increment, assortment structure and selling prices of wood assortments were real. Forest Management plans for private forest owners were used to estimate the cash flow. Cash flow and investment analysis were calculated using capital budgeting tools. Although the expected return on investment in forestry is in about 20 years, local currency inflation was taken into consideration. The results of the case study analyses would show whether the decision making was economically justified and if so, under what conditions to invest into a purchase of a small-scale forest property.
Key words: small-scale forestry, management plan, investment analysis, Croatia

1. Introduction

Capital budgeting is a decision-making process concerning long-term investment in real estate. It is a decision-making process on the so-called long-term projects that include forestry. The purpose of investment in forestry is in holding and generating specific yields (Klemperer 2003). In Croatia, the potential real estate market includes privately-owned forests, since in case when forests are owned by the state they are sold under special conditions. Consequently, this research was focused on the justification of capital investment into privately-owned forests (investor's forest purchase and forest management in the future). According to National Forest Inventory, privately-owned forests in the Republic of Croatia account for around 23 % of the total forest area which is 546,350 ha (Čavlović 2010). It is not possible to accurately establish the area covered by privately-owned forests due to incomplete land registration, as well as incomplete Management Plans for privately-owned forests (Berta et al. 2017). According to their characteristics, privately-owned forests located in Gorski Kotar region (Čavlović 2010) have the potential for production of high quality logs, although their owners do not recognise that (Posavec and Beljan 2012) and neither do the potential investors. Irrespective of the fact that Management Plans do not include business analysis elements (Posavec 2003), the fact that financial value of forests and investment potential has not been recognised is not surprising. A large number of authors has addressed the issue of characteristics of privately-owned forests in the Republic of Croatia (Kovačić 1987; Paladinić et al. 2008; Posavec et al. 2011; Posavec and Beljan 2012; Krajter et al. 2015; Berta et al. 2017), yet the authors have not tackled the issue of justification of capital investment or economic assessment of privately-owned forests. Consequently and also due to limited forest management potential, as well as due to the fact that individual forests are normally small-scale, privately-owned forests require a special approach.

One of the fundamental characteristics of the forest in terms of capital is long payback period (Posavec 2003; Beljan 2015). This investment characteristics is unacceptable when considered from private capital stance, since its objective is to achieve short payback period. Nevertheless, there certainly are investors for whom 20 years payback period is justified. Internal rate of return (IRR) for state-owned forests in Croatia ranges between 2% and 3 % (Figurić 1996), according to Partaš (1896) it stands at 3 %, whilst according to Nenadić (1930) at least 1 % to 2 %, according to Plavšić (1940) up to

2.5 %, according to Zelić (2006) it stands at 1.19%, according to Beuk (2012) 1.9 %, whereas according to Beljan (2015) it stands at 2.17%. It is obvious that the expected return on investment ranges between 1 % and 3 % which exceeds the interest rates currently offered by commercial banks. This capital is considered a low-risk investment that results in low internal rate of return (IRR), as well as low discount rates (Beljan 2015). Its minimum acceptable rate of return (MAR) that needs to be met by the investment is highly important for investors (Klemperer 2003). Each investor has an individual MAR according to which they make their investment decisions. The results presented in this text include internal rates of return for different investment scenarios in small-scale uneven-aged forest estates in Croatia according to which it is possible to define their relation with the investor's MAR. It can be assumed that investment that covers the inflation rate will be identified by investors as propitious.

The specific objective of this research is to determine the economic justification of purchase concerning a small-scale uneven-aged forest estate in Gorski Kotar region (Croatia). A hypothesis has been put forward that upon low discount rates the investment has a solid economic footing, since the expected discounted payback period exceeds 20 years.

2. material and methods

2.1 Research area

The research area includes privately-owned forests in the region of Gorski Kotar in the Republic of Croatia. The region is specific due to uneven-aged forests of common beech (*Fagus sylvatica* L.) and silver fir (*Abis alba* Mill.) covering an area of around 127,300 ha of which privately-owned forests account for 23.79 % (Čavlović 2010). The average area covered by forest land parcel stands at 0.34 ha, as opposed to forest estates covering an area of 1.28 ha (Berta et al. 2017). The region is included in the zone of continental karst, whilst the dominant forest communities are *Omphalodo-Fagetum* (Marinček et al. 1992). The altitude ranges between 350 m and 1,534 m a.s.l., whilst the average annual temperature stands at 7.3°C with annual precipitation of 2,275 mm (meteorological station of the city of Delnice). Privately-owned forests that can potentially be found on the market differ from state-owned forests. Wood volume is three times lower in privately-owned forests compared with state-owned forests (Čavlović 2010), whereas forest regeneration is more difficult in all the forests throughout Gorski Kotar, irrespective of ownership (Čavlović et al. 2006; Teslak et al. 2016). The selected case study is a privately-owned forest that covers an area of 2.5 ha, which is for sale and is located in the immediate vicinity of the town of Čabar (45°35'40"N 14°38'50"E). The forest comprises of a coherent land surface divided into three cadastral plots. The privately-owned forest is surrounded on all sides with other forests owned by private forest owners, and an asphalt road passes through it. Due to the ice break dating back to spring 2014 (Šimić-Milas et al. 2015; Delač 2016) and bark beetle (*Ips typographus* L.) attack, the previous forest management was marked by a large-scale salvage felling.

2.2 Data collection and forest management simulation

The basic characteristics of the forest in question were established in December 2016 through field measurement on 4 circular plots of a radius of 12.62 m (500 m^2 surface). The location of the plots (their position in the area) were selected in advance using the method of simple random sampling. All the trees were measured - silver fir (*Abis alba* Mill.), common beech (*Fagus sylvatica* L.), norway spruce (*Picea abies* Karst.) and scots pine (*Pinus sylvestris* L.) whose diameter breast height (DBH) exceeds 10 cm. Each tree species was determined, their DBH was measured and their height was estimated

according to Čavlović and Božić (2008). Height curves were constructed using Mihajlov function (Mihajlov 1966) based on the heights measured and the diameter of the trees. Moreover, wood volume was determined based on standing timber prices according to Schumacher and Hall (1933). The current financial value of the total wood mass was estimated using assortment tables and the corresponding price list of Main forest products (HŠ 2012).

A virtual forest stand was constructed based on the data provided through field measurement according to the methodology described in Beljan et al. (2016). The virtual forest stand represents digital version of the stand measured on the field and it is used to access forest stand growth simulators in order to analyse future forest management.

The future forest management was simulated using MOSES ver. 3.0. programme, a programme package for forest stand growth and increment simulation, which is based on statistical modelling in mixed and uneven-aged stands (Hasenauer et al. 2006). Virtual forest stand was entered into MOSES programme and hence a simulation of forest management was performed for the forthcoming 30 years. For that purpose the privately-owned forest covering an area of 2.5 ha was divided into 5 smaller forest stands each of which covered an area of 0.5 ha, so that the revenue generated from timber assortment would be duly distributed in time. Consequently, the simulation was performed separately for each of the 5 forest stands with the starting time difference of 1 year. The 5-year cutting-cycle was used during the simulation, whilst the harvested volume was determined according to Klepac (1953). The harvested volume and its assortment structure can be followed at any point of the simulation.

2.3 Cash flow and economic analysis

Cash flow is a financial category that reflects the flow of cash: revenues and costs (Damodaran 2002). The forecast of cash flow for a specific project is the most difficult aspect of the process of economic analysis due to the fact that cash flow is the basis for the assessment of all the financial elements of the project (Damodaran 2002; Orsag and Dedi 2011). The option of purchase price of the forest in the local currency standing at HRK 1 to HRK 4 m^{-2} (Eur 1=HRK 7.42 on the date 30/03/2017) was considered. The costs concerning the purchase of forest estate were present on a one-time basis only nor did they at the commencement of the investment period. On the other hand and besides the costs, there were the revenues resulting from a 30-year period of forest management concerning the sales of standing timber (the investor sold standing timber assortment and did not own mechanisation, nor did they hire workers). The revenue generated through harvesting was presented for each year using the price list provided by Croatian Forests Ltd. for standing timber sales (standing timber) in combination with assortment tables.

Investment analysis was performed based on cash flow using the discounted payback period (Orsag and Dedi 2011), (NPV) nett present value (Klemperer 2003) and IRR-internal rate of return (Damodaran 2002). All the elements of analysis were observed within a 30-year period. Referential constant discount rate was used throughout the analysis, which in forestry of the Republic of Croatia according to Beljan (2015) stands at 2 %, yet the possibility to apply the rates ranging from 1 % to 6 % was also analysed.

3. RESULTS

The initial assortment structure of the privately-owned forest was determined following field measurement and data analysis (Table 1). The share of beech was the largest (133.43 $m^3 ha^{-1}$) and it was followed by silver fir, norway spruce and scots pine. It is important to highlight that standing dead timber accounts for almost one quarter of wood volume. The initial characteristics determined the future planning in relation to the forest in question which primarily concerns the harvesting of standing dead timber whose assortment structure, as well as its financial value, are not favourable for the investor. It was visible from the assortment structure (Table 1) that most wood volume was concentrated in one-

meter firewood and sawlog of 1st and sawlog of 2nd class, which was a direct consequence of a relatively small diameter. The share of the most valuable assortments - veneer and peeled veener – which account for only 5 m^3 ha^{-1}, cannot be considered as sufficient profit for the investor within a short period of time.

The excessive share of standing dead timber (Table 1), resulting exclusively from natural processes, determines the future planning. The forest needs to be channelled through forest management towards a higher wood volume that will in the future have the potential to lead towards higher quantities of uneven-aged forest harvesting and hence also towards production of assortment of higher financial value. From the initial assortment structure it was clear that all the timber assortments were present, yet their mutual ratio was unsatisfactory.

Table 1. Initial assortment structure of small-scale uneven-aged forest estate in year 2016

Timber assortments	Silver fir	Common beech	Norway spruce	Scots pine	Standing dead trees	TOTAL
	[m^3 ha^{-1}]	[m^3 ha^{-1}]	[m^3 ha^{-1}]	[m^3 ha^{-1}]	[m^3 ha^{-1}]	[m^3 ha^{-1}]
Veneer	0.11	1.65	0.11	0.55	-	2.42
Peeled veneer	-	2.74	-	0.28	-	3.02
Sawlog 1st	10.66	10.30	5.64	3.11	-	29.70
Sawlog 2nd	8.66	10.84	3.70	1.86	-	25.06
Sawlog 3rd	4.50	8.08	2.27	2.91	-	17.75
Thin roundwood	10.41	4.49	3.51	0.00	-	18.40
Long-meter firewood	0.00	17.45	0.00	0.82	-	18.27
One-meter firewood	27.43	62.33	9.06	2.53	-	101.36
Timber waste	13.68	15.56	5.27	2.47	95.60	132.58
TOTAL	75.45	133.43	29.56	14.52	95.60	348.56

3.1 Forest management simulation and cash flow

Simulation of the future management of a small-scale forest estate focuses on the increase of wood volume in the immediate future aiming to increase the production of more valuable assortments. Figure 5 provides the opportunity to observe the simulation on stand level and forest level (which actually shows the average for all the stands). During the first five years the focus was on the required harvesting of standing dead trees which resulted in wood volume decrease (Figure 5a). Subsequently and until the end of the observed period the wood volume increased (Figure 5a) and it can be assumed that its optimum will be achieved only in 60 years (starting from 2016). Uneven-aged forest harvesting that was simulated every 5 years (Figure 5a) resulted in revenues that can be observed through cash flow (Figure 5b).

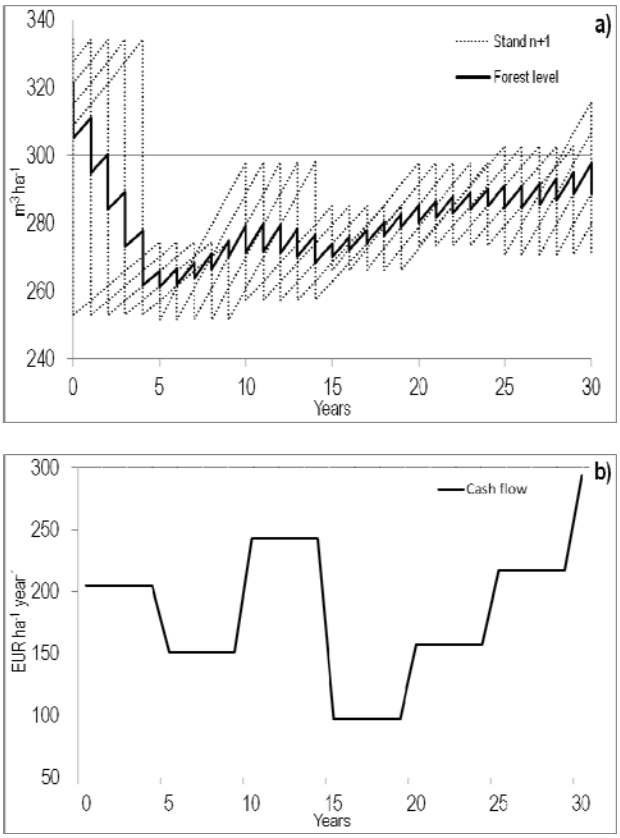

Figure 5. Management simulation on stand and forest level (a), cash flow (b)

Cash flow is the direct consequence of forest management simulation. It has been shown through average values per hectare (Figure 5b). Uneven-aged forest harvesting resulted in revenues every five years, yet, when observed at the level of the forest, the revenue was generated annually, albeit in another stand (in another part of the forest). Wood volume values (Figure 5a) and cash flow (Figure 5b) cannot fully match due to the quality of the harvested wood assortments, since during some years smaller volumes of wood were harvested and yet cash flow was high due to high unit price of wood assortments. At the commencement of the observed simulation period the revenue generated was relatively low, yet upon passage of time it showed an upwards trend (Figure 5b). The previously mentioned low revenue during the first years was necessary so that substantially higher revenue would be generated in the future.

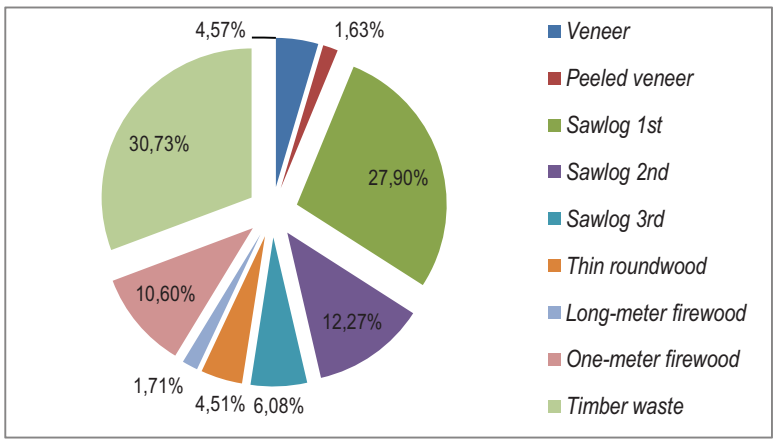

Figure 6. The share of produced wood assortments during 30-year simulation period

The expected production of wood assortments has been shown in Figure 6. Timber waste had the highest share, accounting for 1/3 of all produced wood assortments. Timber waste, i.e. wood produced through standing dead tree harvesting is the direct consequence of the existing state initially found on site (Table 1). Hence highly-valuable assortments both of veneer and peeled veneer jointly account for only 6 %. The revenue during the simulation period was primarily generated through sawlog of 1st and sawlog of 2nd class which jointly account for 40.17 %. The simulation of forest management (Figure 5) was intended to achieve optimum results, whilst the criteria for forest harvesting were primarily biological, rather than financial. Consequently, it is obvious that the most valuable assortments will be harvested during the period after 30 years.

3.2 Investment analysis

The analysis of capital investment justification was performed based on cash flow and the initial investment (Table 2, Table 3). Discounted payback period and NPV were analysed with various scenarios concerning the purchase price of the forest and discount rates ranging between 1 % and 6 %. The investment costs showed in the subsequent tables were expressed in HRK and Euro. Forest prices on the local Croatian market are linked with the domestic currency and they are most frequently round numbers (e.g. HRK 2, HRK 3, or HRK 4 per m^2), whilst in rare cases the price is expressed in Euro. Hence, the prices expressed in Euro are not round numbers. Table 2 and Table 3 were both designed as crossword puzzles from which discounted payback period can be deducted and NPV if two entries, investment cost and discount rate, are given.

Table 2. Discounted payback period with different purchase prices of the forest and applying various discount rates

Investment cost [HRK ha^{-2}] / [Eur ha^{-2}]	Discount rate					
	1 %	2 %	3 %	4 %	5 %	6 %
10 000 / 1 347.70	4 yrs	7 yrs	8 yrs	8 yrs	8 yrs	9 yrs
20 000 / 2 695.41	14 yrs	16 yrs	19 yrs	22 yrs	26 yrs	30 yrs
30 000 / 4 043.12	26 yrs	29 yrs	>30 yrs	>30 yrs	>30 yrs	>30 yrs
40 000 / 5 390.83	>30 yrs	>30 yrs	>30 yrs	>30 yrs	>30 yrs	>30 yrs

Discounted payback period changed along with the changes of investment costs and the applied discount rate (Table 2). As expected, upon higher discount rate the payback period was always longer and vice versa. Table 2 presented cases in which return on investment was expected also after 30 years.

Nett present value was also influenced by discount rate and investment costs and according to the identical principle as discounted payback period (Table 3). Upon investment cost of EUR 0.13 m^{-2} and EUR 0.27 m^{-2} NPV was positive at all discount rates. The second extreme was investment cost of EUR 0.53 m^{-2} where NPV was always negative. In Table 3 it is important to point out that high investment costs do not always suggest negative NPV. Combinations of investment cost and discount rate for which NPV is negative (Table 3) also have discounted payback period that exceeds 30 years (Table 2).

Table 3. NPV of a 30-year investment with different purchase prices of forest and applying various discount rates

Investment cost [HRK ha^{-2}] / [Eur ha^{-2}]	Discount rate					
	1 %	2 %	3 %	4 %	5 %	6 %
	NPV [Eur ha^{-2}]					
10 000 / 1 347.70	3 530.49	2 908.48	2 401.74	1 985.61	1 641.16	1 353.80
20 000 / 2 695.41	2 182.78	1 560.77	1 054.03	637.90	293.45	6.09
30 000 / 4 043.12	835.07	213.06	-293.67	-709.81	-1 054.26	-1 341.62
40 000 / 5 390.83	-512.64	-1.134.65	-1 641.38	-2 057.52	-2 401.97	-2 689.33

Internal rate of return showed the percentage of invested compound interest on the invested capital during a particular period of time (30 years). The period of time analysed upon investment of EUR 1 347.70 ha^{-2} showed internal rate of return of 16.1 %, for investment of EUR 2 695.41 ha^{-2} it was 6.025 %, the invested EUR 4 043.12 resulted in 2.39 %, whereas the highest investment of EUR 539.08 ha^{-2} showed IRR of 0.31 %.

4. Discussion and conclusion

The research findings show that capital investment in small-scale uneven-aged forest estates has economic justification. NPV is the principal criterion for acceptance or refusal of investment (Klemperer 2003; Orsag and Dedi 2011) and hence in Table 3 all the possible combinations of NPV can be determined. Consequently, investment cost or discount rate must not be observed separately, since e.g. a high investment cost at a low discount rate results in positive NPV. It is important to highlight the fact that in some cases the return on investment can be expected also after 30 years (Table 2). Upon the highest purchase price of the forest and application of the highest discount rate it is even possible that there will never be any return on investment. In other words, quantity and quality of wood assortments that can be produced from the forest would not be sufficient to settle the excessive investment costs. A conclusion can be reached that an investment is propitious only upon specific investment costs and discount rates, which was shown both in Table 2 and Table 3.

All the IRR opportunities presented are feasible in real investment upon purchase of small-scale uneven-aged forest estates, yet there is the issue of possible purchase price of the forest. It is highly unlikely that a potential investor will be provided the opportunity to invest in (in the purchase of) a forest at low prices that result in IRR of 16 %. In this specific case the investor would have to invest a maximum of EUR 4 043.12 ha^{-2} at the highest discount rate ranging between 2% and 3% (2.39%, to be more specific) so that NPV would be equal to zero, that is, each purchase price and discount rate lower than those previously mentioned would ensure a positive NPV (Table 3). Upon comparing IRR with average inflation rate of the local HRK currency during the period ranging between 2000-2016 that stood at 2.28 % (CBS 2017), a conclusion was reached that the purchase of the forest at the price of EUR 4 103.87 ha^{-2} covered the rate of inflation. In other words, the purchase of the forest at a lower price would ensure the increase of the invested capital for the investor, irrespective of inflation.

Concerning the MAR of the investor, a conclusion can be made that investment in this type of forests is unsatisfactory for those who expect high rates of return within a shorter period of time. Nevertheless, forestry needs to be considered from the aspect of investment in real estate which is extremely low risk (Klemperer et al. 1994) and one needs to strive towards the notion of unlimited annuity (of a normal forest) that will continuously produce both monetary and non-monetary values both for the common good and to the benefit of the investor. Forest management requires planning and management of large-scale areas and it is more acceptable for public capital where short payback period is not imperative (Beljan 2015). Natural forests, which have the largest share in the Republic of Croatia, are extremely low risk due to their stability, natural regeneration and stable wood assortment prices.

This research presented a scenario of optimal small-scale forest management. There certainly are more and less intensive forest management scenarios, yet the one presented in this paper is the one to provide the greatest long-term benefits both for the environment and for a "patient" investor. From the economic aspect, certainly the best option is to harvest the entire wood volume already during the first year and generate profit, yet this should not be considered as a desirable option by any investor.

Besides the presented cash flow (Figure 5b) which is the result of standing timber sales, revenue generated through hunting and harvesting of non-wood forest products, which can only exert a positive impact on the financial aspect of the investment, can also be considered. Moreover, a potential investor needs to consider the fact that the Republic of Croatia is currently preparing for the implementation of

Sub-Measures 8.5. (Subsidies for Investment in Increasing the Resilience and Environmental Value of Forest Ecosystems (NN 30/2015)) through which works in privately-owned forest estates can be financed by year 2020. Furthermore, it is important to point out the fact that the results of this research are based on one sample and it is possible that specific privately-owned forests in Gorski Kotar region can have favorable or untoward characteristics compared with the analysed sample.

Consequently, concerning all the previously presented information, the hypothesis that had been put forward was partially accepted. In fact, only the investors who deem the presented values of the economic analysis sufficiently satisfactory, are the ones who can certainly increase their capital levels through investment in privately-owned forests of Gorski Kotar region.

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