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Investment Analysis of a Joint Forest and Game Management – A Case Study from Croatian Dinarides

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ABSTRACT

Wildlife-based tourism, including hunting, is attracting interest from governments, the tourism industry, and researchers. Capital investment in renewable resources, like forests, represents spatial and temporal management, which is significantly limited by the natural potential of a particular habitat (e.g., volume increment, the quantity of food for wildlife, etc.). Therefore, the return rate expected by the investor is quite fixed and the only tool by which the investor can increase it is by adding further business activities and/or expanding the existing value chain. In the Republic of Croatia, the only forests which can be purchased by individual or institutional investors, and in which it is possible to establish both active forest management and commercial hunting, are private forests. Based on these insights, we analysed characteristics of capital invested in a large-scale private forest, where game management is carried out in addition to extensive forest management. Of the 1,104 hunting grounds in Croatia, the one with the largest percentage of forest cover (92%) and privately owned (61%) was taken as the subject of this case study (name of the hunting ground: VIII/120 "Permani" (10,017 ha)). A theoretical approach was used in which the investor buys all private forests (predominantly consisting of common beech), conducts forest management activities, and makes a profit by selling timber (30-year period). Furthermore, the hunting segment consisting of game management for red deer, roe deer, wild boar and brown bear is evaluated. At the lowest cost of capital (5.41%), the results of the separate forest management revealed an Internal Rate of Return (IRR) of 5.10%, a negative Net Present Value (NPV) (-760,000 €) and a 30-year discount payback period. Joint forest and game management resulted in an IRR of 5.69%, a positive NPV (680,000 €), and the same length of a discount payback period.

Keywords: game management; capital budgeting; private forests; forest management planning; hunting tourism; Croatia

INTRODUCTION

Forestry is an economic branch and also a science that deals with the cultivation, care, protection and exploitation of forests (LzMK 2021a). Game management (hunting) is an economic branch and science and it includes the management, protection, hunting and use of game (LzMK 2021b). What is in common to these two branches is the land, i.e. land management. To be more precise, they overlap in their competence over forest land (since game management includes both forests, agricultural land, and other types of land use, like wetlands, rangelands, deserts, etc.). In other words, one particular activity cannot stand for itself due to the complexity of the natural forest ecosystem (processes and management approaches). While planning forest management activities, i.e., creating Forest Management Plans, the forest management attributes are partially incorporated into it, and vice-versa, when creating Game Management Plans. This interconnection is more informative and has almost no impact on the other one. This leads us to the idea that the overall insight would be essential for better understanding of the forests' potential. Since one of the major drivers for managing forests and game are the economic outcomes and benefits, the most significant impulse for this research is exactly the economic potential of joint management (forestry + game management).

A similar approach to that used in private forestry, which is based on sustainable and allowable cuts (more on this principle in Bettinger et al. (2008), Čavlović (2013) and Beljan et al. (2018a)), can be applied for game management. In fact, only a surplus above the optimal stock for each species should be bagged during a season (Hasenkamp 1995). To properly

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distinguish the term bagging (Pang 2017), it is necessary to say that there are regular, sanitary, and trophy bagging (shooting the game). With the latter, one tries to achieve the optimal and best possible ratio between natural and economic results. Each bagging is represented differently by the amount of game that is hunted and, of course, is variously valued from an economic point of view. Hunting can be described as a livelihood (subsistence), recreational, management, and commercial activity, where the last one is the most important from an economic point of view (Middleton 2014). Hunting is not just bagging but instead has multiple aspects of satisfaction (Pang 2017). This concept recognises factors such as enjoyment of nature, exploration of the outdoors, adventure and companionship (Hammitt et al. 1990). But the success in hunt and hunting the most precious trophies, regardless of wild meat (Gigliotti 2000, Naevdal et al. 2012, Sánchez-García et al. 2021), are the top-rated reasons for commercial hunting.

Game management is a source of both costs and benefits to the society (Gren et al. 2018). Costs occur from wildlife predation on livestock, damages in forest stands (browsing, bark striping, and frying) and in agriculture (crops), traffic collisions, and transmission of diseases to animals and humans. These negative interactions between game and land users should also be calculated as costs. Benefits accrue from hunting and recreational activities such as hunting tourism, food, and other ecosystem services (Middleton 2014, Arnett and Southwick 2015).

Hunting in the European Union approximately contributes to the management of over 65% of rural areas (Kupren and Hakuć-Błażowska 2021). It involves landowners, farmers, foresters, and other stakeholders and by that creates an extensive social network involved in nature and landscape management (Middleton 2014). According to Massei et al. (2015) and Sánchez-García et al. (2021), there are about 8–9 million hunters in Europe, which makes it the second-largest formally organised hunting population, after the one in the United States of America (Kupren and Hakuć-Błażowska 2021). In the EU hunting as a commercial branch is an important economic subject, approximately worth 16 billion € (Middleton 2014, Arnett and Southwick 2015). It should be emphasized that in all European countries there is a legal framework which regulates the harvest of wild natural resources, i.e. the game (Kupren and Hakuć-Błażowska 2021). The European Union's legal framework regarding hunting is rather complex. There are several legal documents which emerged as the result of international agreements that affect the internal law of each EU country (the so-called "Birds" and "Habitat" Directives).

Hunting tourism can be defined as a "special form of a selective tourist offer, based on sustainable tourism, while creating synergy between postulates of eco, rural and sport tourism, and it was developed thanks to hunters' passion for hunting outside of their own hunting grounds, for which they set aside significant funding" (Milojica et al. 2014). Except for the fact that hunting and hunting tourism has a long tradition, Croatia has excellent prerequisites for the development of hunting tourism (Kovačević and Kovačević 2006). Some of the prerequisites are relatively huge agricultural areas, a high stock of wild animals, geographical biodiversity (Sudarić et al. 2022), a preserved environment, and a pleasant climate (Milojica et al. 2014). Interest in hunting in Croatia is raising. According to the Croatian Bureau of Statistics, in 2020 in Croatia there were 64,394 registered hunters, representing an increase of 3.2% compared to 2019 (DZS 2021). The ratio between the inhabitants and hunters in Croatia is 1:65, which is the highest among the countries of Central and Eastern Europe (Deutscher Jagdverband 2021). Most Croatian hunters hunt quite intensively - according to a research conducted by Sudarić et al. (2022) in eastern Croatia, 78.6% of respondents go hunting once a week and 9.3% every day. These data indicate that many people are actively involved in hunting, which presents the potential for the development of hunting tourism. The potential of attracting foreign tourists should also be considered: out of approximately 7 million hunters in the European Union, about 1.5 million of them travel abroad once or twice a year to hunt, spending at the same time about 10 million € (Ružić et al. 2016). This group thus represents the strong potential for Croatian tourism, especially if one considers the high number of hunters in neighbouring countries such as Italy with 533,000 hunters, Austria with 118,000 hunters, and Hungary with 55,000 hunters (Deutscher Jagdverband 2021). The increased interest of foreign hunters in hunting in Croatia could also be seen from the fact that in the Osijek-Baranja County, in the period from 2008 to 2018, the average annual growth rate of permits issued to foreign hunters was 7.8% (Tolušić et al. 2020). When speaking about the economic effects of hunting tourism, it should also be taken into account that hunters are mainly people with higher purchasing power who spend up to three times more than regular tourists (Milojica et al. 2014).

Since the majority of the forests, globally looking, are owned by governments and are not profit-oriented (Palo and Lehto 2012), the only possible area for investment and economic analyses are private forests. Private forestland can generate an income for its owner from two basic inputs: forestry and game management. In the ideal case, sustainable development motives will come first, i.e., allowable cut is defined and equals the increment, and the economic motives will come second, exclusively as a result of the utilization of the allowable cut. The investment potential of privately owned forests has been analysed in many previous studies, such on a local scale (Krajter et al. 2015, Posavec et al. 2017, Beljan et al. 2018b, Beljan et al. 2020), in Croatia (Pukkala et al. 2003), Finland (Sharp et al. 2004), Australia (Schiberna et al. 2011), Hungary (Moss and Hedderick 2012), USA (Toscani and Secot 2015) and on a global scale (Beljan et al. 2022a). There is extensive literature on the market and non-market values in hunting demand using different methods and approaches, such as the Travel Cost Method (Knoche and Lupi 2007, Fagarazzi et al. 2021), Hedonic Pricing (Hussain et al. 2007, Martinez-Jauregui et al. 2015, Lozano et al. 2021), Contingent Valuation (Boman et al. 2011, Donnelly et al. 2019), Discrete Choice Models (Delibes-Mateos et al. 2014, Davis et al. 2022). However, game management, which is acknowledged to generate a large set of values in all sectors of the economy both through direct and indirect effects (Lindsey et al. 2007, Samuelsson and Stage 2007, Munn et al. 2010, Middleton 2014, Arnett and Southwick 2015, Kupren and Hakuć-Błażowska 2021), lacks its economics evaluation in the context of joint management with forestry. However, it is proper to say that we have found one study which incorporates forestry and

game management in economic terms. It is by Zhou (2007) who investigated two optimisation models (one for timber harvest, the other for reindeer harvest) in Sweden.

The above-elaborated issues regarding the lack of economic evaluation of the joint management brought us to the aim of this paper. From the potential investor's standpoint, an investment analysis on purchasing the private forest land, on which both forest and game management are maintained, will be conducted. By this concept, the forest's economic potential will be investigated closer to its Total Economic Value (Venkatachalam and Jayanthi 2016, Roy 2022).

MATERIALS AND METHODS

Research Area

For this research, the experiment area has been selected in the Croatian part of Dinarides. In the Republic of Croatia, there are 1,104 Hunting Grounds (HG) that are defined according to the property (state, county, and private). The boundaries of those areas are fixed. For this research, the experiment area has been selected in the Croatian part of the west Dinaric Alps – HG "Permani". The HG "Permani" has an area of 10,017 ha, where the most dominant land use category are forests (92.21%), and those are mostly privately-owned forests (61.18%). The amount of agricultural land is 6.04% (Table 1).

Since in Croatia the boundary of the HG does not correspond with Forest Management Units (FMU) or private forests, we had a case where five different FMUs, to a greater or lesser extent, are present in the experiment area. The first step was to collect all the data relevant for privately owned FMUs areas which spatially overlap with the HG "Permani" (HLS 2017). Here should be stressed that state-owned forests, apropos the FMUs of those, are not the subject of this research. The private FMUs in the HG have validity from 2018 to 2027 and take the surface shares as followers: "Mune" takes 43%, FMU "Brgud" 32%, FMU "Žejane" 24%, FMU "Kastavske šume" 1%, and FMU 0.4% "Lipa". The initial data is recalculated and now represents forest characteristics of all private forests in the HG (Table 2), which is a starting point for creating a new forest management plan unique for investigating joint forest and game management.

Private forests in this HG take a significant share of its surface (Table 1) and can be classified into five types (Table 2). High forests of beech are the most prevalent, followed by beech coppice and high forests of black pine with black hornbeam. The rest of the private forest types are represented in a minor share. It is important to emphasize that a larger forest surface does not necessarily mean larger economic potential, so characteristics such as silvicultural type (high forest or coppice), increment, and monetary value of cut, should be taken into account.

According to central hunting evidence (CHE 2022), four species of big game are present in the HG "Permani". Those are red deer *(Cervus elaphus* L.*)*, roe deer *(Capreolus capreolus* L.*)*, wild boar *(Sus scrofa* L.*)*, and brown bear *(Ursus arctos* L.*)*. The basic population quantities are stable from year to year since the harvesting is limited to the amount of yearly population increment (Table 3). Other big game species which are present in the HG, but are not managed actively, are brown bear, European badger, wild cat, rabbit, fox. Further, about twenty species of small game like birds, small rodents and small mammals can be found sporadically.

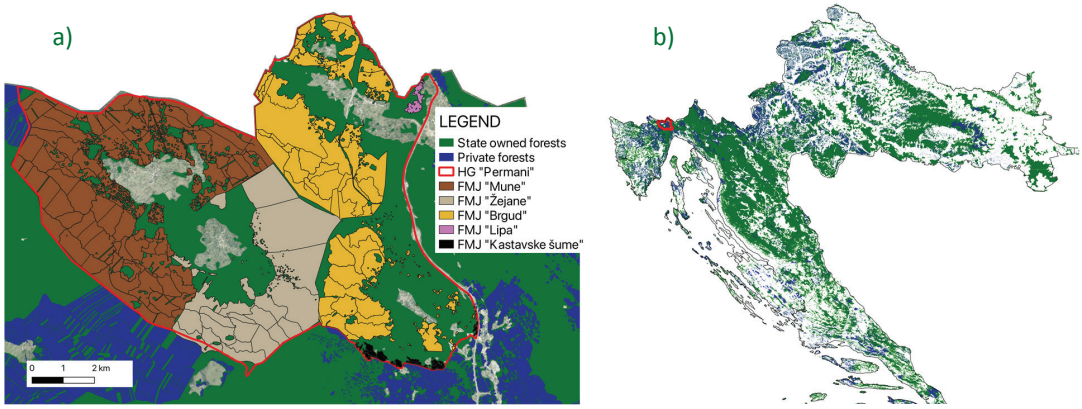

Figure 1. Research area defined by the boundaries of Hunting Ground "Permani" and belonging inner parts of privately possessed Forest Management Units (FMU) **(a)**. Total forest cover including state-owned and privately-owned forests at the national level **(b)**.

Table 1. Land use classes within the experiment area HG "Permani".

Land classification	Total forests	Private forests	State forests	Agricultural land	Other
Area (ha)	9,237	6,129	3,008	606	174
Share in total of 10,017 ha (%)	92.21	61.18	31.00	6.04	1.73

Notes: data source: HLS 2017

Table 2. Basic forest characteristics of private forests.

Forest type	Area (ha)	Average stock ($m^3 \cdot ha^{-1}$)	Annual increment ($m^3 \cdot ha^{-1}$)	Stock share per tree species (%)							
				Beech[1]	Oak[2]	Pine[3]	Hornbeam[4]	Maple[5]	Ash[6]	Spruce[7]	Other[8]
Beech high forest	3,313	175.49	4.15	71.9	13.2	1.0	5.8	2.7	0.3	4.8	0.1
Beech coppice	2,233	224.25	4.38	77.4	4.6	0.3	6.6	1.4	2.1	0.7	6.7
Black pine high forest	376	164.82	3.80	6.1	4.5	50.6	11.5	0.0	5.4	1.0	19.6
Turkey oak high forest	92	126.88	2.81	20.8	47.1	0.2	15.3	1.5	3.5	1.3	10.2
Shrub/bushes	115	-	-	-	-	-	-	-	-	-	-

Notes: table data recalculated from five different FMU so it can present unique forest area within the HG ; Tree species are as follows: [1] – *Fagus sylvatica* L. [2] – *Quercus petrea* (Matt.) Liebl. and *Quercus cerris* L.; [3] – *Pinus nigra* J.F.Arnold; [4] – *Carpinus betulus* L.; [5] – *Acer pseudoplatanus* L.; [6] – *Fraxinus ornus* L.; [7] – *Picea abies* (L.) H.Karst.; [8] – other broadleaved species.

Within the HG "Permani" there are 17 feeding stations for the big game, 50 salt stations, 32 watering holes and 18 high sits. Annual food intake is mostly constant and equals 18,000 kg of concentrate fodder (mostly corn), 6,000 kg of dry voluminous fodder, 5,000 kg of fruits and 1,000 kg of salt. Furthermore, annual game crops (1.5 ha), perennial game crops (0.5 ha) and grasslands (3.0 ha) are maintained as an additional source of food for game.

Simulation of Forest and Game Management

The following research phases from the perspective of potential investor were assumed: (1) purchase all private forest land (Table 2) at the average price of 0.26 €·m^{-2} (2 HRK·m^{-2} in local currency) and establishment of a limited liability company with only one employee, i.e. licensed forest officer (both for forestry and game management activities), who deals with the entire management of (2) forest management activities, (3) game management activities, (4) timber selling on forest site, and (5) commercial game hunting. A list of activities with belonging unit prices is given in Beljan et al. 2020, while the ones related to game management are presented here in Table 4. Here it is important to stress that forest management in the sense of this paper consists just of making trees for cutting and their selling as standing timber.

Separately for each forest type (except scrublands, see Table 2), the theoretical forest management plan has been created for the next 30 years. The idea behind that plan is to perform (1) uneven-aged management using the area control method with natural regeneration and (2) coppice management using the allowable cut principle (Čavlović 2013). The management plan was created specifically for a particular forest type where 10-year cutting cycles are assumed, and those plans are based on the forest type starting characteristics, as shown in Table 2. Both aim to direct the forest towards achieving a theoretically balanced structure in the long run, i.e., a normal forest. The primer outcome of the forest management simulation is the annual quantity and assortment quality of a cut timber which generates profit for the investor. The source of all input data on economic calculations (selling prices) is the price list of Croatian Forests Ltd. (HŠ 2022a), while the only fixed cost is the salary for one employee (2,000 €/month gross).

Game management simulation is actually an application (i.e. implementation) of a real hunting management plan for the HG "Permani" (HLS 2017). Costs are the result of yearly facility maintenance, food intake and plantation maintenance whose unit processes are collected on the free market (presented in Table 4). On the other hand, revenues are an outcome of commercial hunting. Big game hunting quantities regarding species, gender and age classes are presented in Table 3, for which all related summed revenues are assumed in Table 4.

Table 3. Data on big game quantities.

Game	Quantity	Game structure per age classes and related annual quantities for hunt				
		Calves	Young	Subadult	Adult	Total
Red deer	Basic population*	16	30	20	14	80
	For hunt	2	6	2	6	16
Roe deer	Basic population*	66	108	84	72	330
	For hunt	6	14	10	36	66
Wild boar	Basic population*	48	26	26	20	120
	For hunt	22	10	6	10	60

Note: data source: HLS 2017; Brown bear is not included in the table because of occasional hunting quotas; *Gender ratio (M:F) is 1:1.

Table 4. Costs and revenues of game management.

Hunting ground maintenance						Commercial hunting[1]	
Facility repairs	Costs (€·year^{-1})	Fodder	Costs (€·year^{-1})	Plantation	Costs (€·year^{-1})	Game species	Revenue (€·year^{-1})
Feeding stations	500	Concentrate	6,600	Annual	800	Red deer	18,000
Salt station	100	Dry voluminous	2,000	Perennial	2,000	Roe deer	33,000
Watering hole	1,000	Fruits	1,500	Pastures	3,000	Wild boar	33,000
Hunting hide	1,000	Salt	1,500	-	-	Other[2]	6,000
TOTAL			20,000				90,000

Notes: [1]- according to the price list of commercial hunt in Croatian forests Ltd. (HŠ 2022b) and meat prices as follows: 4.5 €·kg^{-1} for red deer, 5 €·kg^{-1} for roe deer and 3 €·kg^{-1} for wild boar; [2] - game which is commercially hunted sporadically. Only fixed cost is the salary for one employee (2,000 € /month gross).

Economics Valuation

Within the time frame of the next 30 years the comprehensive investment analysis has been conducted using the following tools according to Orsag and Dedi (2011): Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PP) and Discounted Payback Period (DPP). Corporate income tax in Croatian equals 18% and has been is used in this research accordingly. The cost of capital is set at minimum of 5.41% representing the investor with a well-diversified portfolio (Beljan et al. 2022b). Regarding the terminal value of the project at the end of the investment horizon conservative approach was taken. Terminal value is assumed to be equal to the initial purchase (i.e., current market) value of the estate.

RESULTS

As a result of land management, two separate scenarios have been conducted: a forest management scenario and an additional one that includes game management (i.e., joint management of forest and game). Forest management starts with all private forest land purchases which take into account 6,129 ha (Table 1) and the initial cost of about 17.5 Mil € (Table 5). Furthermore, separate forest management plans were created for a specific forest type and resulted in timber sold on the free market. The total annual cut differs from type to type and in the sum, it equals about 25,000 m^3 per year. The amount of annual cut is actually equal to the annual increment by which the sustainable forest management approach for a specific forest type is accomplished (varies from 2.81 m^3·ha^{-1} to 4.38 m^3·ha^{-1}). Annual income varies from 95 €·ha^{-1} to 181 €·ha^{-1} (Table 5) and it is constant for the entire project duration.

Game management includes all essential segments of HG maintenance: that involves costs for facility repairs, food intake and plantation maintenance (Table 4, left section), and income from commercial hunting (Table 4, right section). In total, all annual costs equal 20,000 €, while all annual incomes are about 90,000 €.

Results on cost and revenue structure (Figure 2) reveal segments that the potential investor should pay attention to. About 54% of all annual costs is the employee's gross salary (highest share in total cost structure), while the share of costs related to forest management is minimal. This is so because the fact that all the timber is sold as standing timber and natural regeneration is assumed. Also, forest management activities exclusively refer to the employee's domain (like marking trees that will be cut). On the other hand, game management-related costs take up all the rest of the cost structure (Figure 2). The revenue structure reveals a predominance of forest/timber related origin (about 90%) (Figure 2). The actual size of a certain forest type (ha) determines the share in revenue structure. Beech high forests, which are predominant by the surface, also prevail in the revenue structure followed by other forest types according to their surface significance (Figure 2). Revenues from commercial hunting result in a share lower than 10%.

Table 5. Investment cost and annual income of active forest management.

Forest type	Investment (€)	Total annual cut (m^3)	Annual income before taxes (€)	Average amount of cut (m^3·ha^{-1})		Average income before taxes (€·ha^{-1})	
Beech high forest	9,941,419	13,760	600,715	4.15		181.28	
Beech coppice	6,503,708	9,620	380,077	4.38		175.32	
Black pine high forest	750,322	1,420	60,550	3.80		161.40	
Turkey oak high forest	184,817	260	8,849	2.81		95.75	
Shrub/bushes	115,000	0	0	0		0	
TOTAL	17,495,268	25,000	1,050,190	4.12[1]	2.49[2]	172.18[1]	104.84[2]

Notes: [1]- average on total forest area (6,129 ha); [2] – average on total hunting ground area (10,017 ha).

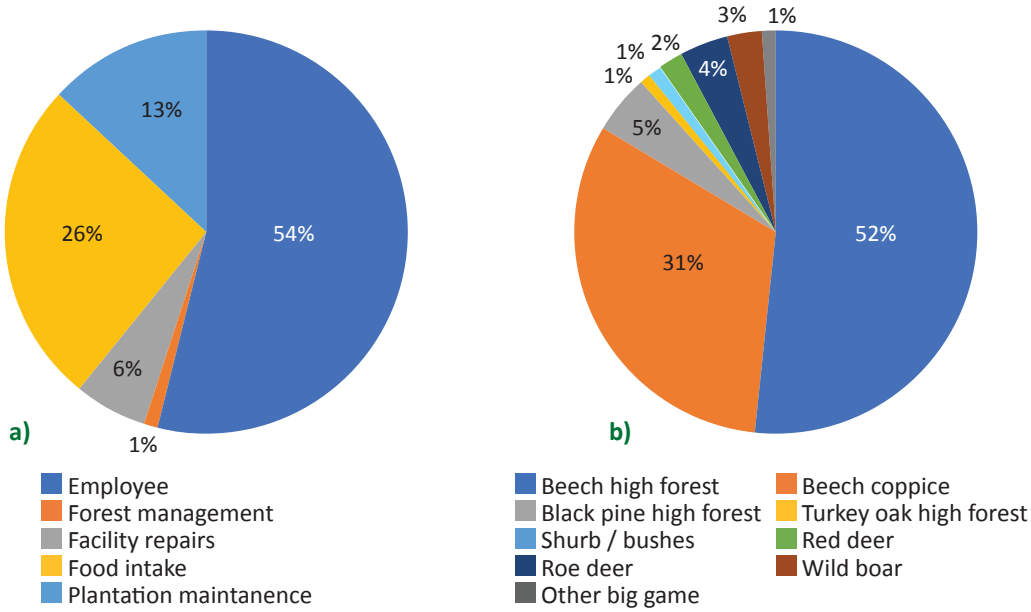

Figure 2. Structure of annual costs **(a)** and revenues **(b)** of the joint land management (both forest and game management).

Overall, forest management alone, after 30 years, would end in negative figures (Table 6, left section). The payback period (which neglects the time preference of future incomes) equals a reasonable period of 20 years, i.e. a 5% annual payback (100/20=5%). However, the discounted payback period (the tool which better evaluates the project's characteristics) is 10 years longer (3.3% of linear annual payback). As previously shown in Table 6, the project's NPV is negative (-767,800 €). So, even when a minimal discount rate of 5.41% is applied, it is not advisable to invest in this project. Only an investor who, for some reason, would be ready to accept a lower cost of capital could consider investing. To be more precise, only costs of capital lower than 5.10% will result in a positive NPV (see IRR in Table 6, left part).

However, joint forest and game management will achieve positive economic results. The payback period is 2 years shorter; the discounted payback period is the same, NPV is higher for 1,450,300 € and IRR is higher for 0.59% (Table 6, right section). In the case study of this HG only joint management has its economic justification.

DISCUSSION

Metaphorically speaking, the game (wildlife for commercial hunting) can be considered as a by-product when managing land. A landowner or a company that manages both forest and agricultural land can also make a business from commercial hunting affairs. The accent is here put on the "can" since it is possible to manage the land without game management activities. If the landowner decides to get involved with commercial hunting but does not invest in the HG maintenance, the landowner can even then expect to have the game on their land. The characteristic of game management is such that the management can be done by nature (biotic) or humans (anthropogenic). In the case when human's presence is absent, natural mortalities will reduce a part of the game population (predators, diseases, starvation, etc.). The idea behind game management by humans is to anticipate natural processes and to monetise them, to commercialise the hunt itself. By that, the natural process is replaced by human interventions which are called commercial hunting. Furthermore, game management by

Table 6. Investment analysis.

Financial measure	Forest management scenario	Forest and game management scenario	Difference
Payback Period (years)	20	18	+2
Discounted Payback Period (years)	30	30	0
Net Present Value at 5,41% (€)	-767,800	682,500	+1,450,300
Internal Rate of Return (%)	5.10	5.69	+0.59

humans must in a shorter period and on a smaller surface result in a larger number of high-ranked and monetary appreciated hunting trophies. Because of all of this stated above, a landowner (or investor) can make a profit without investing in HG maintenance (Rasker et al. 1992). This is one of the important reasons why determining the price for commercial hunting based on a free-market principle can be questionable.

Furthermore, the "optimal stock" for a species of the game must be at least the survival size (due to the winter, predators, etc.). This means that the capital is natural, not economically based. Also, regarding the rate of reproduction apropos allowable commercialisation of a forest resource, Rasker et al. (1992) give rise to the concern about the usage of neoclassical economic theory when the economic valuation is used for natural resources. Utilisation, both for forest and belonging wildlife, is possible only above the level of "optimal stock" (i.e., utilisation of the increment), which means that only the utilised part can be found on the free market and be appraised by neoclassical/supply-demand theory.

Another issue that arises when it comes to the economics of game management is the pricing of commercial hunting. As it is well-known, in Croatia the majority of the forest land is state-owned and the State defines prices both for forests (Posavec and Beljan 2013, Beljan et al. 2022c) and game products. Since prices are set too low, a competitive market does not exist, the supply of forest and game products is artificially limited, and the space for a private investor who expects positive returns on his investment is rather small. It should be emphasised that long-year contracts for a lease over an HG (10-year period defined by Hunting Law, Official Gazette No. 99/2018) are almost regularly extended to the benefit of the former purchaser, leaving practically no chance for a "new" investor who is willing to bid at a higher price.

Hunting tourism can be an additional source of income for the investor. Resources necessary for hunting tourism are game species and their habitats (Tolušić et al. 2020). The analysis carried out at the HG "Permani" showed that this hunting ground has enough high populations of game species. This composition of the game may be interesting for hunters-tourists, considering that in 2020, according to the data of the Croatian Bureau of Statistics (DZS 2021), the most numerous animals shot for the big game were wild boar with 39,778 heads, roe deer with 17,789 heads and deer with 5,654 heads (the same species that can be found in the HG "Permani"). At a national level, compared to 2019, hunting bags for these game species increased: red deer by 8%, roe deer by 6.6% and wild boar by 0.2%, while at the same time, waterfowl decreased by 10%. HG "Permani" is located closer to the Adriatic part of Croatia, which is much more intensively engaged in tourism than continental Croatia. Hence, hunting tourism can enrich the tourist offer of this region and extend the tourist season, which mostly lasts from June to September, and in most part overlaps with the hunting season for red deer, roe deer and wild boar (all year long for wild boar). In this way, the number of tourist arrivals and overnight stays can be increased during autumn, winter, and early spring, when "usual" tourist activities in Adriatic Croatia are quite modest.

The incomes of hunting grounds could be increased by hunting tourism. Regardless of the excellent natural prerequisites necessary for the development of hunting tourism, at this moment, "Croatia lacks a richer and more diverse offer of hunting tourism facilities" (Milojica et al. 2014). Public authorities, such as the Ministry of Tourism and Sports and the Ministry of Agriculture, but also the local community and the hunting societies, are not sufficiently aware of the existing potential for the development of hunting tourism (including the meat preparation for the food market) (Kovačević and Kovačević 2006), and thus the promotion of hunting tourism is mainly based on the enthusiasm of individual hunting societies or county hunting associations. Therefore, more intensive cooperation of all stakeholders is necessary (Ružić et al. 2016), but also better education of both people from the hunting sector and potential tourism entrepreneurs (Milojica et al. 2014, Tolušić 2017).

Within this research, deviations in economic calculations can occur and affect results to some extent. Within the boundaries of this case study (the HG), there is also agricultural land whose costs and benefits in the context of game management are neglected. Agricultural land is owned by third persons who should receive annual payments regarding the fact that their land is used for game management (Gren et al. 2018). This specific segment in Croatia is regulated by the Hunting Law (Official Gazette No. 99/2018). Furthermore, input values regarding the price of commercial trophy hunting and the monetary value of wild meat are collected from a conditionally speaking "free market" whose veracity can be doubted because of widespread tax avoidance and other grey economy issues.

CONCLUSIONS

This analysis has shown that only joint management of forests and game has its economic justification. The forestry business alone (including the selling of standing timber) cannot fulfil the basic economic criteria of NPV at the minimal level of cost of capital. However, investors who can try to lower the cost of capital beyond the investigated minimum (5.41%) should use the cost of capital not higher than 5.10% (in nominal terms). However, joint management ensures a positive NPV and IRR of 5.69% which exceeds the cost of capital. This is supported by the cognition that game management if evaluated as a self-standing business activity, and a lucrative natural-based economic branch.

Profitability can be increased not by cutting costs but by increasing revenues instead. With better management, forests can produce highly valuable timber, and HG big game management can result in a higher share of valuable hunting trophies. Also, the land itself offers the possibility of non-wood forest products commercialisation (e.g., mushrooms, nuts, and berries).

On the basis of this analysis, it can be concluded that the forest management plan and the game management plan should be better interconnected. Therefore, administrative boundaries should overlap, a 10-year plan for both should start in the same year, and elements of both plans should be spatially and temporally connected.

The future management perspective should take into account this interconnection from the perspective of an added value chain that starts with the land and continues with all possible outcomes which can generate revenue for the investor. Here it is important to note that Croatian Hunting Law (Official Gazette No. 99/2018) allows private hunting grounds, but only in situations when the landowner possesses a minimum of 500 ha of land in one piece (all land parcels must lean each other continuously without gaps of land parcel of another landowner). Furthermore, according to the Croatian Forest Law (Official Gazette No. 145/2020), only privately owned forest properties which exceed 20 ha can have an autonomous management plan. In the end, we can conclude that the interconnection mentioned above is possible in properties with a size of 500 ha and more.

Author Contributions

KB conceived and designed the research, KB and MP carried out the data collection, KB and MP processed the data and performed the analysis, KB, HM and SB wrote the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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