LOCAL VARIETIES AND ECONOMIC ASPECTS OF INVESTMENT IN VINEYARD ESTABLISHMENT: THE CASE OF SERBIA

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ABSTRACT

Recently, entry into grapevine growing as initial step for wine production has become a wise business decision in Serbian agri-sector. Along promising possibilities for maintaining farm economic sustainability, many new or renewed vineyards have been established. It has become common that, within such vineyards, alongside commercially and internationally recognized grapevine varieties, certain local ones, such as Tamjanika Bela, are also planted. The main goal of the research was to develop the investment analysis towards vineyard establishment as a relevant tool in decision-making process (investment doesn't involve land acquisition). The applied methodological framework included selected dynamic methods for economic assessment of investment (Net Present Value – NPV, Internal Rate of Return – IRR and Dynamic Payback Period – DPP) supported by field data from one grape producer in Trstenik wine-growing subregion. The results, NPV of 2,418.87 EUR, IRR of 8.81%, and DPP of 9 years and 1.46 months, confirmed economic justification of vineyard enlargement.

Introduction

Observing all fruits grown worldwide, the grape (*Vitis vinifera L.)* is not among the most produced fruits as are bananas, citruses or apples (Lado et al., 2018; Scott, 2021),

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but it is surely ranked within the group of top ten fruits, or more closely, it represents globally the most popular fruit species (Mele et al., 2021). Above all, it belongs to the group of the most significant cultivated plant species n modern agriculture. In human consumption grapes could come as fresh or processed mainly as a wine, or other alcoholic beverage (grape spirits, brandy/wine spirits, tsipouro, etc.), as well as juice, jam and jelly, raisins, grape-seed oil, vinegar, etc. (Pappas et al., 2016; Cosme et al., 2017; Venkitasamy et al., 2019).

More than 55% of grapes production is turned to wine production (or in much smaller contents other alcoholic beverages), over the 35% are consumed as fresh (table grapes), while less than 10% are used in raisins production or similar types of processing (Agulheiro Santos et al., 2021). Grape and its by products are commonly used in food and beverage industry, cooking, conventional and alternative medicine, pharmacy, cosmetology and light chemistry industry, animal feeding and feed industry, etc. (Soto et al., 2015; Chowdhary et al., 2021; Sharafan et al., 2023; Quagliardi et al., 2024).

Grapes are mainly made of water, over 80%, carbohydrates, up to 20%, as well as around 1% of proteins, and negligible volume of fats. They are good resource of fiber, energy, certain vitamins (K, B1, B2, B6, C, or E), some macro and micro nutrients (K, Mn, or Cu). Besides, they possess different bioactive substances (phytochemicals), as are phenolic acids, flavonoids, anthocyanins and proanthocyanidins, or stilbenes (Nassiri Asl, Hosseinzadeh, 2009; Georgiev et al., 2014; Chavan, 2020; Tangolar et al., 2022; Chakka, Babu, 2022; Hatterman Valenti et al., 2024). In line to favorable chemical composition and antioxidative activity, grape and grape products consumption strongly benefits human health, preventing the cardiovascular diseases, cancer, diabetes, or dementia and decrease in cognitive functions, as well as it strengthens immune system, or skin and bones health, or it balances the cholesterol level, etc. (Vislocky, Fernandez, 2010; Yang, Xiao, 2013; Hohman, Weaver, 2015; Sabra et al., 2021).

Global trends related to overall production and areas under the vineyards could be observed in Table 1. There could be seen slight decrease in areas under the vineyards in last decade, while there come to stabilization of achieved volume of production, what is mainly the result of slight increase in achieved yields.

Table 1. Global grapes production and areas under vineyards (period 2013-2022, in ha, in t/ha, in t)

Element/year	2013	2014	2015	2016	2017	2018
Area	7,027,292	7,024,394	7,107,845	6,900,363	6,834,893	6,875,427
Yield	10.89	10.52	10.78	10.80	10.77	11.65
Production	76,507,662	73,906,174	76,593,826	74,517,216	73,600,630	80,096,667
Element/year	**2019**	**2020**	**2021**	**2022**	**Average**	
Area	6,909,210	6,918,656	6,881,764	6,730,179	6,921,002	
Yield	11.15	11.10	11.15	11.14	11.00	
Production	77,054,569	76,828,209	76,750,674	74,942,573	76,079,820	

Source: FAOSTAT, 2024.

Mentioned moves in production worldwide usually derive as the clearing or replacement of old vineyards with new one, that are functioning in line to principles of contemporary production systems, with presence of more productive grapevine varieties resilient to climate changes (primarily to water deficit or draught), or change in set production structure related to further purpose of grown grape (fresh consumption or processing), etc. (Alston, Sambucci, 2019; Santillan et al., 2019; Sgubin et al., 2023). In 2022, the largest areas under vineyards were in Spain (around 13%), France (around 11%) and China (around 11%), (commonly over 2.5 million ha). It is interesting, that those countries (including Italy), contrary to other top grape producers, have showed slight increase in areas under the vineyards. Currently, among the group of the largest grape producers are China, Italy, France, USA, Spain, Turkey, India, Chile, Australia, or Argentina (OIV, 2024).

Despite the mentioned limitations (decrease in areas under vineyards), simultaneously with the growth of agri-food products' prices, there has come to rise in the value of overall grapes production (mainly increase in grapes price at farm gate), (Table 2.).

Table 2. Global value of grapes market (period 2013-2022, in billion USD, in current prices)

Element/year	2013	2014	2015	2016	2017	2018
Value	68.26	71.75	64.46	64.51	69.10	73.66
Element/year	**2019**	**2020**	**2021**	**2022**	**Average**	
Value	75.20	83.33	86.02	85.13	74.14	

Source: FAOSTAT, 2024.

Besides, in last several years towards the climate and energy shocks, COVID 19 crisis, intensification of many local military conflicts, or general disturbance in global economy flows, etc., there has also been a significant increase in pricesof all agro-inputs, restricting the gained profitability in grape production. Nowadays, expectations are focused to further rise in agri-food prices (including grapes) and production costs, but still the huge market issue could be the influence on potential of (dis)similarity in their trends. Of course, it has to be underlined that both, grape prices and thecosts incurred in carrying out winegrowing activities can vary significantly across regions, due to local specificities in established production environment. Besides, it is not so rare that gained grape price is not only the reflection of circumstances at local market, but also represents the ability of grape-grower to properly expose its uniqueness (Nica, 2018; Ben Hassen, El Bilali, 2022; Accetturo, Alpino, 2023; Barakat et al., 2023; Belewu et al., 2024; Cavaliere et al., 2024).

Considering available climate and natural circumstances, Serbia is generally the suitable country for grape production. In this moment, there are roughly less than 20 thousand hectares of vineyards (SORS, 2025). Grape production is exercised in certain level at almost 14% of all farms, with domination of wine grape varieties (Jeločnik et al., 2024). In previous period, not only in Serbia is present the trend that during the renovation of old or establishment of new vineyards, there come to introduction of local varieties, as they have regional recognizability, or they could boost the country image, as well

as they have higher level of resistance to occurred pests, diseases and negative side of climate changes. Besides, they usually have stronghold in tradition, while they serve as guards of cultural heritage through the offer of local food products (based on domestic grapevine varieties), or development of wine tourism and entrepreneurial initiatives they include. Thus, a slow change in the structure of vineyards, with an increasing share of local varieties relative to international grapevine varieties, may help ensure the competitiveness and survival of the national viticulture sector (Popović, Živanović Miljković, 2012; Petrović et al., 2024; Tello et al., 2024).

No economic or social activity, nor any territorial unit (local community, region, or the country as a whole), can be established or operated without proper investment. Investments are initiators, levers, or simply the fuel of development, or even precondition for humans' survival (Singer, 1966; Spangenberg, 2001; Alsadat et al., 2017). In essence, investment considers putting certain amount of money into the established financial scheme or mechanism, or any physical property and service, expecting a certain level of profit gaining in close future (investment object exploitation will be based on its usefulness, while gained incomes over the costs may repay initially invested assets). So, they represent financing of any property, rights or interest that will provide income or increase in value of invested asset during the predefined period (Legum, 2006; Cheng, 2011).

In agriculture, they consider purchasing or establishment of capital assets and services such are facilities and plantations, land and livestock, mechanization and equipment, transfer to certain system of production, skip to new form of organization, etc. Investment does not consider momentarily economic consumption to investor (farm, enterprise or rural community), while they initiate accumulation of interests in upcoming period, based on production of different goods and services. They are important in creating the value added in agriculture and rural space, securing adequate life and business conditions at micro (farm or local community) or macro (national or regional) level (Hrytsaienko et al., 2019; Chulkova et al., 2019; Jeločnik, Subić, 2020).

Investments in sector of viticulture could target several things, such as the establishment of vineyard (land purchase, parcel clearing, leveling and reclamation, purchasing and setting the elements required for seedlings planting and further exploitation, as are pillars and wire, etc.), implementation of irrigation systems, including fertigation (irrigation combined with the application of fertilizers) and anti-frost systems, different mechanization, equipment and tools, various facilities (garage, warehouse for inputs, cooler for grapes, or cellar for final products, or processing facilities), various permits, or quality certificates, etc. (Cots Folch et al., 2006; Garcia Garcia et al., 2012; Overton, Murray, 2013; Seyoum Tegegn, Chan, 2013; Bulatović, Milić, 2014). The size of investment could vary due to many reasons, but primarily towards the comprehensiveness and novelty of producer's business idea.

There are no many scientific papers turned to analysis of investments in viticulture, partly caused by the lack of unique solutions, or more often due to general hiding

of essential elements of realized project ideas. Considering the grape production and processing as the sectors with significantly growing potential, while the demand for grapes and grape's products is growing intensively, there is assumed reasonable vitality of investments in underlined sector. Besides, investment in grape growing and processing is complex decision, pressed by many risks. Those in the position of investors are usually individual farmsand entrepreneurs, or enterprises and cooperatives. Financing modality could differ from investment of investor own financial assets in certain percent, to investment of assets gained from bank credits, some public incentives, international or national funds oriented to agriculture (IPARD, Wine Investment Fund, FAO, WB, and others), etc. (Cyr et al., 2010; Dutz et al., 2014; Kym, Jensen, 2016; Testa et al., 2018; Prodanović et al., 2020; Assenova et al., 2023).

As the main research goal has been set the reconsideration of results derived from assessment of investment in establishment (or enlargement) of vineyards under the local wine grape variety. It is expected from research to deepen current economic knowledge related to vineyards establishment.

Methods and Materials

In research were used the data gained from the farm oriented to grape production located in Tri Morave winegrowing region (precisely Trstenik wine-growing subregion). Data collection was performed through the in-depth interview with the farm owner. All used data, or made projections are referring to season 2023/24, i.e. all prices and costs within the observed period have been fixed to initial year. So, in order to simplify the investment analysis, it presumes occurrence of quite a similar production circumstances (primarily climate conditions), or after yields stabilization (full yieldingness) fixed volume of gained grapes. As was underlined, the value of all costs and prices (occurred in initial year of vineyard establishment and later during its running) are fixed, while they are in line to exercising good agriculture practice at the farm (used inputs match in the best way the specific requirements of planted grapevine variety), expectation of high yields, and overlapping with current prices of used inputs and obtained grapes at local market. Its assumed that observed farm has enough production capacities (labor, mechanization, facilities and equipment) to cultivate additional hectare of newly established vineyard (investment is turned to vineyard enlargement at farms' unused land that will induce better utilization of current farm's production capacities, i.e. investment does not involve land acquisition). Farm is willing to use the state financial support for vineyard establishment in amount of up to 50% of maximally allowed sum, while other part of investment value will be covered by own capital.

Used methodological framework corresponds to some previous researches focused to establishment of perennial plantations (Subić et al., 2021; Jeločnik et al., 2022; Nastić et al., 2023; Nastić et al., 2024). Investment analysis was based on applying common dynamic methods performed for assessment of investment efficiency, as are Net Present Value (NPV), Internal Rate of Return (IRR), and Dynamic Payback Period (DPP). The investment analysis reconsiders just first 10 years of established vineyard exploitation,

as was expected that the investment will be returned within this period. Analysis have not considered appliance of static assessment methods (fixing the representative year), as in conventional grape production the expected effective investment (vineyard) utilization covers longer period (up to 30 years), while certain specificity of vine is that in initial years of vineyard exploitation there is no or quite a limited grape yield under the similar production costs (Carbone et al., 2019; Williams et al., 2020), which could contribute to making the wrong conclusion.

Derived research results are reliable enough for initial decision of grape producer towards to entering the vineyard enlargement process. All used data and obtained research results have been presented in adequate tables, while all values are expressed in EUR (used currency rate - 1 EUR = 117.5 RSD) and correspond to one hectare of production surface, what enables further comparation with results derived from similar researches or entrepreneurial initiatives.

Possible research limitations are underlined using the data just from one locality, as well as the stability in observed prices and costs, or gained incomes and derived costs during the period of vineyard exploitation. Additionally, the farm could or could not apply to certain level of state financial support. Besides, gained research results may variate due to difference in used technological approach, grapevine variety, production ambitions and goals of the farm, way of investment financing (used of own assets or loan of commercial bank), etc. So, as was previously mentioned, there are no unique (or similar) solutions and production preconditions in grape production.

Results and Discussion

Farm wants to enlarge existing vineyard (currently 3 ha) for one hectare. As the dominant wine variety in vineyard is Tamjanika Bela, this promising local variety (without delving in this paper into the issue of genetic origin whether it is truly a local, regional, or international grapevine variety) will be also planted at vineyard extension. Farm is located in Trstenik wine-growing subregion. Parcel that will be used for vineyard expansion has a regular shape and it is owned by the farm (1 ha), so vineyard enlargement does not include land acquisition, while it will be the extension of current vineyard at the holding. It relies to existing vineyard along its entire length (soil and climate preconditions are the same). The owned terrain intended for the vineyard expansion has a moderate slope. As was previously mentioned, farm owns all necessary mechanization and equipment used in grape production, that can be also applied for parcel preparing and further vine planting. Farm has already implemented irrigation (drip) system, while it possesses required facilities for storing inputs, machinery, and additional part of grape yield. The farm applies adequate grape production technology, guaranteeing maximal grape yields of very good quality. Produced grape will be sold locally. It is planned that for certain production operations, or during the production peaks, farm will hire external labor.

New investment covers (Table 3.) just costs of activities (used mechanization and labor) and necessary inputs for parcel (1 ha) preparing for the vineyard establishment,

planting of certified seedlings (Tamjanika Bela), and implementation of seedling stands (vineyard support), as well as the costs of Permanent Working Capital (PWC), (standardized at 10% of overall investment value).

Costs of parcel preparing for vineyard establishment involve costs of external labor (payment of 12 per diems, while daily wage accounts to 25 EUR) mainly engaged for parcel leveling, extermination and clearing from wooden plants, correction of deep plowing, manual support to transport and deposition of manure and mineral fertilizers, etc. Mentioned activity was supported by tractor aggregates (different power) with adequate equipment. Working day of mechanization (tractor) considers costs of spent energy (fuel) and part of wage of operator engaged in performing of certain activity at 1 ha. Besides, it also considers depreciation of used mechanization, and other costs linked to exploitation of tractor unit. Mechanization is used for terrain leveling and clearing, manure and mineral fertilizers transportation and spreading, heavy tillage, direct activities linked to land preparation for planting vines seedlings, etc. Costs of used inputs manly involves costs of applied volume of manure (50 t of mature cow manure) and mineral fertilizers (superphosphate, potassium salt and limestone). It has to be underlined again that maid investment does not involve land acquisition.

Table 3. Investment in vineyard establishment (1 ha, in EUR)

Description	Value (in EUR)	Share (in %)
Costs of soil preparing for vineyard establishment (surface leveling and cleaning)	5,960.0	26.1
Costs of planting	7,075.0	31.0
Costs of seedlings stands implementing	7,700.0	33.8
PWC	2,073.5	9.1
Total	**22,808.5**	**100.0**

Source: IAE, 2024.

Costs of vine seedlings' planting (with hydro-drill) involve 17 per diems for external workers engaged in markers preparing, marking roads, paths, and rows, as well as places for planting vines, preparing seedlings for planting and their further planting with hydro-drill, etc. Used mechanization mainly involves tractor with trailer and water-tank. It was engaged for transportation of markers, seedlings, or water for planting, as well as for planting with hydro-drill, etc. Costs of inputs used for this segment of vineyard establishment considers the value of certified vine seedlings (variety Tamjanika Bela, planting density 4,000 seedlings/ha), etc.

Costs of setting seedlings stands involve 52 per diems paid for engaged external labor at activities of handling with stands, stakes, anchors and wire during their transportation, deployment and installation, etc. For that purposes (transport of inputs) were used tractor with trailer. Costs of inputs considers the price of external and inner stands (wooden), stakes (wooden), anchors (concrete), galvanized wire (5 mm, 3.1 mm, and 2.4 mm).

In grape production, full income or return on investment (full yielding of the vineyard) usually starts after fourth year, expecting that the farmers labor will be fully compensated at the market at that moment (Williams et al., 1994). For vineyard establishment and further grape production, farm is planned to apply for state support (Table 4.).

Table 4. Used subsidies for vineyard establishment and running (in EUR)

Description	Maximally allowed subsidies (in EUR per ha or seedlings)	Used subsidies (in EUR)
Direct payment (plant production)	acc. 150 EUR/ha	Fully used
Subsidies for soil preparing	acc. 4,250 EUR/ha	2,125
Subsidies for certified seedlings	acc. 1.1 EUR/seedling	2,000
Subsidies for stands	acc. 5,960 EUR/ha	2,980

Source: OGRS, 2023; IAE, 2024.

Expected incomes in first ten years of vineyard exploitation (after the moment of its establishment) are given in next table (Table 5.). Annual incomes differ due the achieved grape yields, obtained wholesale market price of grape and level of gained state support.

Table 5. Income forming in vineyard running (in EUR, for 1 ha, production year 2023/24)

Year	Yield (kg/ha)	Price (EUR/ kg)	Selling revenues (EUR)	Direct payments (EUR/ha)	Other subsidies (EUR)	Total incomes (EUR)
I	-	-	-	150	7,105	7,255
II	1,500	1	1,500	150	-	1,650
III	5,500	1	5,500	150	-	5,650
IV	9,000	1	9,000	150	-	9,150
V	10,000	1	10,000	150	-	10,150
VI	12,000	1	12,000	150	-	12,150
VII	12,000	1	12,000	150	-	12,150
VIII	12,000	1	12,000	150	-	12,150
IX	12,000	1	12,000	150	-	12,150
X	12,000	1	12,000	150	-	12,150

Source: IAE, 2024.

There should be underlined that the wholesale price for the fresh grapes of Tamjanika Bela, as rising star at national market in last several years, is much higher (for 50% to 100%) than the price of some commercial globally recognized white wine varieties. Price difference is also supported by the fact that mentioned variety has limited share within the overall vineyards' structure in Serbia, while it cannot fully respond to the growing market demand.

During the vineyard exploitation there comes to forming of certain expenses (Table 6.). Level of annual expenses mainly depends on volume of required inputs and services, and their market price. Farm has a practice to insure its production, while the costs of insurance of established production are 10% of the planed value of production. As was underlined, vineyard maintaining generates a certain level of costs, regardless of

whether any grape yields are obtained.of . Type of used inputs, applied services of mechanization, or activities done by engaged labor are generally the same in any year of vineyard exploitation. Their volume and intensity gradually increase from initial year along with the emergence and further growth of gained grape yields until they reach the maximum. After that moment they could be considered constant.

Table 6. Costs of vineyard running (in EUR, for 1 ha, production year 2023/24)

Year	Labor (EUR)	Mechanization (EUR)	Inputs (EUR)	Insurance (EUR)	Total costs (EUR)
I	800	500	1,230	-	2,530
II	1,050	800	930	150	2,930
III	1,100	800	1,092	550	3,542
IV	2,275	1,350	1,306	900	5,831
V	2,275	1,350	1,306	1,000	5,931
VI	2,275	1,350	1,306	1,200	6,131
VII	2,275	1,350	1,306	1,200	6,131
VIII	2,275	1,350	1,306	1,200	6,131
IX	2,275	1,350	1,306	1,200	6,131
X	2,275	1,350	1,306	1,200	6,131

Source: IAE, 2024.

So, in first three years, care of vineyard initiates expenses that are not followed by adequate incomes, i.e. grape yields, while in later stages of vineyard exploitation it shows its full economic potential. Production costs could be roughly grouped in three clusters, i.e. costs of used mechanization, required labor and applied inputs. For production activities there are mainly used tractors equipped by adequate side machines, trailer, water tank, or sprayer, etc. These group of costs are usually expressed for performed activity per hectare, while mechanized activities involve autumn or spring deep plowing (with vine (un)covering), corrective shallow plowing few times per vegetative season, transportation and spreading of mineral fertilizers, transportation of water and pesticides and spraying, land preparation for grassing, and grass sowing and mowing, transportation of grapes, green pruning, etc.

External labor is mainly seasonally engaged as support to farm members, for exercising specific labor-intensive activities in short period (season peaks). Engaged workers are usually locals, while their per diem represents sum usually paid for same or similar activities within the local community (generally 25 EUR/day). Workers are basically employed for activities such assoil cultivation in the row (after the seedlings planting, or seasonally as corrective measure to improve soil regime and facilitate plant growth), tying the shoots and trunks, shoots shortening, or redundant and barren shoots cutting, as well as preparing adequate solution and spraying the pesticides, manipulation under agro-chemicals, pruning (including green pruning) and disposal of pruned vine, substitution of weak or damaged seedlings, corrections after mechanized (un) covering of seedlings, maintenance of field roads and trails, broken stands repair, grape harvesting, manipulation under the fresh grapes, etc.

Considering applied inputs, they mainly involve used vine seedlings for annual substitution of weak or damaged seedlings (generally 5-10% of planted seedlings are changed in first two years), various pesticides, mineral fertilizers, banding, etc. Within the costs structure, in initial years costs of used inputs and engaged labor are at similar level but much higher than costs of mechanization, while in period of full vineyard exploitation costs of labor dominate (mainly affected by the level of costs of harvesting). In order to simplify the analysis, depreciation costs are not considered.

Observing the economic flow of investment (Table 7.), the investment generally does not generate positive cash flow in initial two years of vineyard exploitation, as in both years there is no, or there is so limited yield (income) that could cover the incurred production costs (a negative financial outcome in the first observed year was avoided as result of applied subsidies). Setting the economic flow of investment utilization (vineyard exploitation through the annual cycles in grape production) is a precondition for development of dynamic indicators used in assessing the investment economic effectiveness (Tables 8. and 9.). Indicators are calculated upon the discounted values of the net cash flow for all observed years.

According to gained indicators' values (Table 8. and Table 9.), establishment of vineyard under assumed natural, business, and administrative circumstances could be considered as economically justified business decision (in circumstances when investment does not involve land acquisition). More precisely, after 10 years of vineyard exploitation, generated NPV (2,418.87 EUR) gives strong assurance to grape producer that there could be expected significant cumulative profit over the entire lifespan of established vineyard (at least 25 to 30 years).

Table 7. Economic flow (in EUR)

No.	Element	Zero moment	Year									
			1	2	3	4	5	6	7	8	9	10
I	**Total revenue**	**0**	**7,255.0**	**1,650.0**	**5,650.0**	**9,150.0**	**10,150.0**	**12,150.0**	**12,150.0**	**12,150.0**	**12,150.0**	**12,150.0**
1.	Total income	0	7,255.0	1,650.0	5,650.0	9,150.0	10,150.0	12,150.0	12,150.0	12,150.0	12,150.0	12,150.0
II	**Total expenditures**	**22,808.5**	**3,002.5**	**2,930.0**	**3,752.8**	**6,162.9**	**6,352.9**	**6,732.9**	**6,732.9**	**6,732.9**	**6,732.9**	**6,732.9**
2.	Investment value	22,808.5	-	-	-	-	-	-	-	-	-	-
	2.1. Fixed assets	20,735.0	-	-	-	-	-	-	-	-	-	-
	2.2. PWC	2,073.5	-	-	-	-	-	-	-	-	-	-
3.	Costs without depreciation and interest	0	2,530.0	2,930.0	3,542.0	5,831.0	5,931.0	6,131.0	6,131.0	6,131.0	6,131.0	6,131.0
4.	Income tax	0	472.5	0.0	210.8	331.9	421.9	601.9	601.9	601.9	601.9	601.9
III	**Net cash flow**	**-22,808.5**	**4,252.5**	**-1,280.0**	**1,897.2**	**2,987.1**	**3,797.1**	**5,417.1**	**5,417.1**	**5,417.1**	**5,417.1**	**5,417.1**

Source: IAE, 2024.

Table 8. Derived values for Net Present Value and Internal Rate of Return (in EUR)

No.	Element	Zero moment	Year										Cumulative
			I	II	III	IV	V	VI	VII	VIII	IX	X	
0	1	2	3	4	5	6	7	8	9	10	11	12	13
1.	Net cash flow – economic flow (columns 3-12)	-22,808.5	4,252.5	-1,280.0	1,897.2	2,987.1	3,797.1	5,417.1	5,417.1	5,417.1	5,417.1	5,417.1	**38,739.4**
2.	Discount rate (%)	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	
3.	Discount factor $(1+i)^{-n}$ while i = discount rate, n = lifespan of investment	1.0000	0.93	0.87	0.82	0.76	0.71	0.67	0.62	0.58	0.54	0.51	
4.	Present value of net cash flow (column 3-12)	-22,808.5	3,974.3	-1,118.0	1,548.68	2,278.84	2,707.28	3,609.64	3,373.50	3,152.80	2,946.54	2,753.78	**25,227.37**
5.	**NPV (columns 2-12)**	**2,418.87**											
6.	**Relative NPV [(columns 2-12) / | column 2|] > i**	**0.11 (11%)**											
7.	**IRR > i**	**8.81%**											

Source: IAE, 2024.

In addition, gained value for IRR (8.81%) is above the applied, quite conservative discount rate (7%), (used discount rate represents the rate suggested by the National Bank of Serbia (NBS, 2019)). This represents strong argument that the increase in generated accumulation of farm assets through the grape production (exploitation of vineyard just in first ten years after its establishment) will be over the calculative price of external assets at the local capital market.

In line to supposed production circumstances, gained value for the Dynamic Payback Period (Table 9.) expects that the invested financial assets in vineyard establishment will be repaid to producer through the grape production in 9 years and 1.46 months. So, within the expected productive lifespan of vineyard (up to 30 years) less than 1/3 of observed period will be used for investment covering.

Table 9. Payback period of investment in vineyard establishment (in EUR)

Years	Present value of net cash flow	Cumulative net cash flow
0	-22,809	-22,809
I	3,974	-18,834
II	-1,118	-19,952
III	1,549	-18,404
IV	2,279	-16,125
V	2,707	-13,417
VI	3,610	-9,808
VII	3,373	-6,434
VIII	3,153	-3,281
IX	2,947	-335
X	2,754	2,419

Source: IAE, 2024.

Generally, there is no uniform solution in vineyard establishment, while it could come to certain deviations in required level of investments, or differences in profitability potential per established hectare of vineyard. Although, the investment object is vineyard of wine grape variety (local variety of Tamjanika Bela) that currently shows economic advantages over the commonly grown commercial wine grape varieties at local level, some previous researches focused to vineyards establishment (basically in different geographic context, or under unlike investment circumstances) have also showed that expected payback period could be around nine years (Szabo et al., 2022), or even less, i.e. around 8.2 years (Koprivlenski, 2016), or less than five years (Naveen et al., 2010). On other hand, under specific production circumstances (level of used subsidies, achieved yields and grape prices, used grape type (for fresh consumption or processing) and variety, occurred input prices, demand intensity, etc.) payback period could be prolonged up to 12 years (Eubanks et al., 2020).

Conclusion

Observed globally, there is a constant rise in market demand for grapes and grape products (mainly wine and dried grapes), with adequate response on production side.

General trends turned to slight expansion of existing vineyards, both in a way of their modernization (renewal) or enlargement, have been also occurred in Serbia. According to mentioned, grape producers, especially those involved in wine production, are facing the dilemma which way to go, to establish the vineyards under the commercial, globally recognized grape varieties, or under the local ones. Both ways have certain benefits and disadvantages, while final decision is very difficult, especially in accordance to the fact that vineyard establishment is long-lasting investment, which does not undergo significant changes after several years.

In economic sense, no matter to chosen vine variety, planned investment (vineyard exploitation) has to show long-term sustainability. As the value of overall investment in vineyard establishment is usually significant for the producer, he is forced to exercise detail market and supply analysis (both input and final products market), to consider whether he is able to handle planed enlargement of growing areas with existing production resources (e.g. mechanization, labor, or facilities), to perceive suitability of available natural conditions (e.g. water, soil, or climate elements), to analyze all investment scenarios due to model of financing, level of used subsidies, level of vineyard equipping and quality of implemented elements, etc.

It has to be underlined, that different state subsidies for supporting grape production sector are available to producers. As very sensitive sector of agriculture that could involve several suppliers and intermediaries, level of diversity and value of offered subsidies usually have one of major roles in process of defining expected direction and level of overall sector development. Although the part of support turned to vineyards and processing facilities establishment could be considered as satisfactory, segment that has to support annual grape production at the micro level, unfortunately sounds as relatively small. So, level of subsidies assumes to be certain reflection of official recognition of the viticulture sector, or verification of its strategic importance at national or even regional level.

In accordance to gained results of investment analysis (appliance of dynamic methods for assessment of economic effectiveness of investment), and under the assumed natural, administrative and production preconditions, grape producers would make economically right decision if they invest in enlargement of vineyard under white vine variety Tamjanika Bela (investment does not involve land acquisition). Derived values for NPV (2,418.87 EUR), IRR (8.81%), and DPP (9 years and 1.46 months) are convincing enough to justify further viability of grape production at observed farm.

Further research steps could imply sensitivity of investment in vineyard establishment due to the structure and level of used subsidies, or comparing effects of investment in vineyard establishment under commercial and local vine varieties, or enlarging the investment with land acquisition, or assessing the investment in entire process of wine making.

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Conflict of interests

The authors declare no conflict of interest.

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