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COST-EFFECTIVENESS EVALUATION OF INVESTMENT IN INTEGRATED APPLE PRODUCTION

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Abstract

The authors present an economic evaluation and justification of the "expanding existing production of apples" on the example of integrated production family farm. As a starting point assumption was stated that the farm wants to expand the existing production of integrated production, and that the economy has its own cold storage and basic resources for organic and integrated production. The authors have presented calculations of static and dynamic evaluation of the project, along with economic performance indicators, based on which the owner of the farm can make a decision on the justification of the investment project. The planned production of apples is expected, alongside with growing the integrated production system in any way environmentally. Selected variety is Golden Delicious.

Key words: Integral apple production, investment project, economics, profitability, net present value.

Introduction

In this paper, the observed family farm wants to expand capacity of their production. The intention is to raise another orchard of apple tree in an area of 1 ha. Planned rising of new apple orchard involves an investment in the integrated production system. So that they could sell on the market during the later seasons at a higher selling price.

Farm intends apple kept under controlled conditions to place on the domestic market and foreign market. Given the existence of long-term cooperation with a number of major enterprises including buyers from the region and agribusiness, the farm will have no problems with sales of apples on the market.

Export of remaining portion produced apples will be achieved through foreign buyers. For apple exports to foreign markets, it is necessary to meet the required standards and quality for export. Given that the fruit production came just in order

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to achieve the highest standards of quality, the farm sees export of apples as a opportunity for development and a significant business challenge.

Production of apples, and the integrated production system does not present danger in any way to environment. This investment project is no change environmental conditions that degrade ecosystem. The activities of the holding will be done by the farm (the owner and four members of the family) with the help of three hired seasonal workers. Total safety measures that will be used in accordance with the regulations and are appropriate in this activity.

The result of this study will help the owner of the farm in the decision of the new investment, and help in making business decisions weather to start with a new investment. Calculations and economic calculations should be the basis and prerequisite of any investment. Nowadays it is unthinkable that the investments take place randomly, based on assumptions from previous experiences.

Methods and research description

The paper uses the method of written survey, where the individual interviews are conducted with agricultural producers. (Andrić et al., 2005) The resulting data were used as input data for the calculation method, the determination of the total cost, making the income statement, the determination of individual prices and services. (Cicea, et al., 2008) Also, data from the survey were used in the methodology of economic analysis, static and dynamic evaluation of investment projects, and evaluation of investment projects under uncertainty. (Andrić et al., 2005) All accounts and calculations are presented in euros (EUR).

Statistic evaluation of the investment project relates to the last, in this study, the fifth year of the project. Since static methods of evaluation of investment projects were used:

Productivity (PP= UP / Ubr) (1)

Economic efficiency (kE = Up / U) (2)

Accumulation of production (Cost-effectiveness) (sA = (D / UP) x 100) (3)

Cost-effectiveness investment (estimated investment value)
(SR = (D/lpy) x 100) (4)

The rate of return investment (T = lpv / D) (5)

Dynamic method of investment project assessment, net present value method and internal rate of return method (Elliot and Mumford, 2002). This method gets the score of their investment in investment and payback period of the investment.

The net present value of the investment project (NPV, net present value, NPV):

$$NSV = \frac{-I + \sum UB - UC}{(1+r)^t} \quad (6)$$

Internal rate of return, IRR economic rate of return, ERR:

$$ISR = i\min + (i\max - i\min) \times \frac{NSV(+)}{NSV(+) + NSV(-)} \quad (7)$$

Rating of investment projects under uncertainty is calculated gaining two basic indicators, namely: a turning point values and level of security. (Fairweather, 1999) Breakpoint profitability shows the critical and minimum values of production volume and sales revenue under the investment project which is no longer justified. (Cicea et al. 2008) A security level shows how much percentage (%) can fall sales volume (production) in terms of economic efficiency, without a loss.

Basic elements for calculating these two indicators are:

Total income: UP (8)

Variable costs: VT = Material costs + labour (9)

Fixed costs: FT = Non-material costs – labour (10)

Marginal result: MR = (8) - (9) (11)

Cost-efficiency break-even point: PTR = (10) / (11) x 100 (12)

Value break-even point: PTV = (8) x (12) / 100 (13)

Safety degree/rate: Ss = [(8) - (13)] / (8) x 100 (14)

Table 1. Total costs and trade balance (EUR)

	Descriptions	Project duration			
		I	II	III	IV
I	TOTAL INCOME	3.210,77	6.007,25	7.975,14	9.943,03
II	TOTAL EXPENDITURE	727,24	1.360,25	1.792,17	3.011,76
III	TOTAL COST (1+2+3)	1.088,77	1.721,78	2.153,70	2.993,01
IV	GROSS PROFIT (I-II)	2.483,53	4.647,00	6.182,98	6.931,27
V	INCOME TAX (10%)	248,35	464,7	618,3	693,13
VI	NET PROFIT (IV-V)	2.235,18	4.182,30	5.564,68	6.238,14

Source: Research findings

In support of this research, on the basis of surveys and research in the field, the cost of materials and services, fuel and raw materials. (Grgić, 2004) Certain total costs of production per year investment project, which is presented in table 1. It is

made income statement (Table 1), and economic and cash flow presented in tables 2 and 3.

Table 2. Cash Flow - Economic flow (EUR)

	Descriptions		Project duration			
			I	II	III	IV
I	TOTAL INCOME (1+ 2+3)	9.655,67	3.210,77	6.007,25	7.975,14	9.943,03
II	TOTAL EXPENDITURE (4+5+6+7)	9.480,19	975,59	1.824,95	2.410,46	8.289,17
III	NET INCOME (I-II)	175,48	2.235,18	4.182,30	5.564,68	1.653,86

Source: Research findings

Results

Research results justification of investment in a new production of apples using system of integrated production is presented through static and dynamic evaluation of investments. (Radinović and Grgić, 2008) Static assessment of the investment project following results was obtained:

Productivity (PP= UP / Ubr)

UP = 10.357,33

Ubr = 8,00

PP = 1.294,67 EUR

In accordance with the calculation, achieved sales revenue per employed worker is € 9,030.30. That is, the amount of € 9,030.30 represents the excess of the value (gross effect) per unit of labor expended from which the investor should cover interest and various other obligations, after which the remaining amount represents the amount of profit (net effect) per unit of labor expended, or by an engaged employee.

Economic efficiency (kE = Up / U)

Up = 10.357,33

UR =2.643,80

kE = 3,92

Economy coefficient is greater than 1, which confirms that the total revenues in excess of the total expenditure. Accordingly, it can be concluded that the investment project cost (cost-effective).

Accumulation of production (Cost-effectiveness) (sA = (D / UP) x 100)

D = 6.942,18

UP = 10.357,33

sA = 67,03%

The rate of accumulation is greater than 5.00% (assumed weighted cost of capital). Accordingly, we conclude that the investment project is accumulative, that is, when the exploitation of the project covered the price of financing sources, and above all represents the profit).

Cost-effectiveness investment (estimated investment value) (SR = (D / lpy x 100)

D = 6.942,18

IPV = 9.480,19

sRl = 73,23%

The rate of return is greater than 5.00% (assumed weighted cost of capital). Accordingly, we conclude that the investment project is profitable (which means that during the exploitation of the project covered by the price of financing sources, and above all it is a gain).

Return investment (T = lpv / D)

IPV = 9.480,19

D = 6.942,18

T = 1,37

Given the calculation, an investment project will be paid for 1.37 years. Thus, the payback period is one year and 4.44 months (0.37 x 12 months). Dynamic assessment of the investment project following results was obtained: The result marks the net present value of the investment project on the observed economy is presented in Table 3.

For our case, investment period of five years (years duration) would allow the investor a total increase in profit, calculated using a discount rate (s = 0.10) in the first moment of operation (n = 0), in the amount of 13 244, € 34.

Table 3. Search payback and net present value for the selected discount rate (EUR)

Project duration	Net income economic flow (present value of net proceeds)	Cumulative net income	Net income from economic flow	NSV 10%
"O"	0	-9.304,71	-9,30471	-9.304,71
I	2.031,98	-7.272,73	2,235.18	2,031.98
II	3.456,45	-3.816,28	4,182.30	3,456.45
III	4.180,82		5,564.68	4,180.82
IV	4.520,47		6,618.43	4,520.47
V	8.359,32		13,462.77	8,359.32
L			22,758.65	13,244.34

Source: Research findings

Considering that in the second year of the investment project the rest of the investment € 3,816.28, a net flow in the third year of € 4,180.82, the result indicates that for the rest of the settlement of long-term investments required = (3816.28: 4th 180.82) x 100 = 91.28% of cash flow from the third year. As a result, we have the following calculation payback period T = 2.91 years = 2 years and 10.92 months.

The internal rate of return (IRR), as an indicator of economic effectiveness of investment funds in the project, in relation to the placement of these funds on the money market at a certain discount rate (i = 10%) is obtained by reducing Σ NPV = 0, which in this particular case means:

In accordance with the methodology, internal rate of return should be at least equal to, or greater than the interest rate the creditor, (ie, weighted interest rate of all sources of financing). Thus, the investment is profitable because the internal rate of return exceeding the credit interest rate (43.30%> 5.00%), and the discount / weighted rate (43.30%> 10%).

Table 4. Low break-even point and cost efficiency (risk of falling produciton (EUR)

	Description	Project duration			
		I	II	III	IV
(1)	Total income (UP)	3.210,77	6.007,25	7.975,14	9.943,03
(2)	Variable costs (VT)	524,31	980,7	1.288,39	1.622,93
(3)	Fixed costs (FT)	564,46	741,08	865,31	1.370,09
(4)	Marginal result (MR)	2.686,47	5.026,55	6.686,75	8.320,11
(5)	Cost-efficiency break-even point	21,01	14,74	12,94	16,47
(6)	Value break-even point	674,63	885,66	1.032,03	1.637,34
(7)	Safety degree/rate	78,99	85,26	87,06	83,53

Source: Research findings

Breakpoint profitability shows the critical and minimum values of production volume and sales revenue under the investment project which is no longer justified. (Čejvanović et al., 2010) Accordingly, it can be concluded that the investment is the riskiest in the first year of the project when the volume of production should not fall below 21.01% (ie, income from the sale of not less than € 674.63).

A security level shows how much percentage (%) can fall sales volume (production) in terms of economic efficiency, without a loss. In this context, it can be concluded that the investment risk at least in the first / second year of the project when it is allowed to decrease the volume of production of 87.06% (which means that the revenue generated from the sale may be reduced by € 6,943.11).

Discussion

Investment as a concept and as a form of investment (Daugaard, 2020) is increasingly represented in agribusiness. Picking a good investment project is the basis for economic growth and survival in the market. In the future this will make a greater difference between successful and unsuccessful economy management.

In the modern fruit growing business methods for predicting financial results in terms of investment are increasingly used to predict success. Investments in agricultural production are increasingly professionalized from the standpoint of economic forecasting, techniques and production technology, selection of types and environmental requirements (Zhao et al., 2021). Nowadays, it is a reasonable business idea that takes into account the whole set of factors and risks, and less sporadic and spontaneous activity which meets certain needs of families for food and existence. Professional fruit production should first of all meet the economic criteria, meaning that it is to be economically viable, while at the same time monitor the market requirements in terms of environmental and production standards in fruit production (GLOBAL GAP, EURO GAP HACCP), select varieties, techniques and farming technology.

If you want to invest in fruit production through borrowed capital by loans, no commercial bank would give money unless return on investment has been proved and a good business plan made. With this paper, we show an example of the introduction of new investment in the economy business (Garcés-Ayerbe et al., 2019). As a result of the research, we received the justification of investment in new apple production using integrated production in an area of one hectare (ha) of agricultural land. The results shown represent are suggestive the knowledge on justification of business investment, taking into account all economic indicators, both static and dynamic evaluation of the investment project. The authors of this study especially emphasize the dynamic evaluation of the investment project, although they do not diminish the importance of the structural analysis of profitability, efficiency and accumulation.

Unlike the static, dynamic indicators primarily present net value and internal rate of return give answers basic questions that are related to the start-up investment. Is the investment cost-effective in the long run? How long does it take for the return of investment to start? In what year is the risk greatest? How can sales or production decrease without it threatening the project?

If the owner of the farm has all of these economic indicators, he will be able to decide whether to invest or not. According to the authors, the purpose of agricultural economics is to help the management of farms in the process of making business decisions.

Conclusion

In this paper, the authors presented the economic evaluation of the investment project in raising new plantations of apples on specific observed farm that wants to increase its production area of apples by one hectare. The owner has the freezer as it provides a degree of autonomy with regard to the formation of the sales price, which leads to the conclusion that there will be no problems with sales of finished products. As a methodological basis for making business decisions, the static and dynamic economic indicators are used.

Given the static economic indicators, productivity output per worker is 9,030.30 euros and the economy coefficient is greater than one, which indicates the fact that the total income exceeds the total expenditure. The rate of accumulation is greater than 5.00% and leads to the conclusion that the investment project is accumulative. Also, the rate of return is greater than 5.00%, shows that the investment project is profitable. The investment project will pay off for 1.37 years. Thus, the return period is 1 year and 4.44 months (0.37 x 12 months).

Given the dynamic economic indicators, investment for a period of five years allows the owner an increase in profit, calculated in discount rate of 0.10%, in the amount of € 13,244.34. The total investment will be covered at the end of the second and beginning of the third year of the investment project. Given the economic efficiency of investment and internal rate of return of the observed investment project, which is higher than its credit interest rate (43.30%> 5%), or of the discount / weighted rate (43.30%> 10%) we can conclude the investment project profitable. The investment is the riskiest in the first year of the project when the volume of production cannot fall below 21.01% (i.e. income from the sales cannot be less than € 674.63). The degree of investment security is the least risky in the first / second year of the project when it is allowed for volume of production to decrease by 87.06% (which means that the revenue generated from the sales may be reduced by € 6,943.11). Based on the calculated economic indicators on the concrete example of the farm, the owner may make a decision on the justification of the investment project.

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OCJENA EKONOMISTIČNOSTI ULAGANJA U INTEGRIRANU PROIZVODNJU JABUKA

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Apstrakt

Autori daju ekonomsku ocjenu i opravdanost "proširivanja postojeće proizvodnje jabuka" na primjeru integrisane proizvodnje na porodičnim farmama. Kao polazište navedena je pretpostavka da se želi proširiti postojeću proizvodnju integrisane proizvodnje, te da farma ima vlastitu hladnjaču i osnovne resurse za ekološku i integrisanu proizvodnju. Autori su prikazali proračune statičke i dinamičke ocjene projekta, te ekonomske pokazatelje uspješnosti, na temelju kojih vlasnik farme može donijeti odluku o opravdanosti investicijskog projekta. Očekuje se planirana proizvodnja jabuka, uz uzgoj integrisanog sustava proizvodnje na bilo koji ekološki način. Odabrana sorta je Golden Delicious.

Ključne riječi: Integralna proizvodnja jabuka, investicijski projekt, ekonomika, rentabilnost, neto sadašnja vrijednost.

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