
ECONOMIC FEASIBILITY OF FARM MACHINERY INVESTMENTS: A FARM-LEVEL INVESTMENT ANALYSIS

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ABSTRACT

Investments in agricultural machinery represent an important factor in the modernization and increase in the productivity of agricultural production. However, high initial investment costs and relatively slow returns on capital often limit the investment decisions of small and medium-sized farms, especially in transitional agrarian economies. The paper analyzes investment in agricultural machinery of a typical agricultural farm that cultivates 20 hectares of agricultural land. The analysis was conducted using investment analysis methods based on discounted cash flows, including net present value (NPV), internal rate of return (IRR), scenario analysis and sensitivity analysis. The results show that the investment without institutional support is not financially justified, while the inclusion of the subsidy significantly improves the economic indicators of the project. The findings contribute to a better understanding of investment decisions in agribusiness and indicate the importance of institutional incentives for the modernization of agricultural production.

Introduction

Investments in agricultural machinery represent an important factor in the modernization and increase in the productivity of agricultural production. However, high initial

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investment costs and relatively slow returns on capital often limit investment decisions at the level of small and medium-sized farms, especially in transitional agrarian economies. In the literature on agrarian economics, it is emphasized that institutional and financial factors, including subsidies and the availability of financial instruments, can significantly influence the investment activity of agricultural producers and accelerate the process of production modernization (Kay et al., 2016; FAO, 2022). At the same time, some studies indicate that the economic justification of investments in mechanization largely depends on the structural characteristics of farms, especially on the farm size and the intensity of production resources use (Wang, Chu, & Chen, 2020). However, despite the growing number of research on investment decisions in agribusiness, relatively few studies systematically analyze the economic viability of investments in agricultural machinery at the level of individual farms through the integration of operational, financial and institutional factors that influence the realization of investment projects. Although, Covid-19 pandemic did not have a negative impact on financial performance across all industry sectors (Funawer, 2022; Marković & Đokić, 2025; Shen, Fu, Pan, Yu & Chen, 2020), the economic climate and markets can be affected very quickly by changes in exchange rates, interest rates and commodity prices (Vapa Tankosić et al., 2024). Today, in light of the improved institutional framework, development of global trade and financial integration, structural transformations in the organization of production, the field of traditional trade credit support has developed significantly (Čavlin et al., 2022; Miljković & Arsić, 2025). Measuring financial efficiency in terms of company profitability provides valuable information about necessary modifications to reduce potential business risks (Zielińska-Chmielewska, Kaźmierczyk, & Jaźwiński, 2022; Pantić et al., 2026). The existing research often focuses on macroeconomic or sectoral analyses, while microeconomic analyzes of investment decisions at the household level are relatively less common. In this paper, the economic justification of investment in agricultural machinery is analyzed on the example of a typical agricultural farm in Serbia. Special attention is paid to the impact of institutional incentives, credit financing and changes in key operating parameters on the economic viability of the investment. In accordance with that goal, the following research questions were formulated: (RQ1) whether investment in agricultural machinery is economically justified in conditions without institutional support, (RQ2) to what extent subsidies and credit financing affect the financial feasibility of investment projects and (RQ3) how changes in operational and financial parameters affect the stability of the investment project. Based on the research questions, three research hypotheses were defined, which assume that the investment without institutional support is not financially justified, that subsidies and favorable financial conditions significantly improve the economic sustainability of the investment.

Literature review

Investments in agricultural machinery increase productivity and contribute to modernizing of the agricultural production. Modern mechanization enables more efficient use of resources, increase in labor productivity and timely performance of agrotechnical operations, which can significantly affect yields and economic efficiency of production

(Pingali, 2007; FAO, 2022). Modern business environments are increasingly shaped by complex, interconnected risks stemming from environmental, social, technological and geopolitical disruptions (Vapa Tankosić et al., 2025). In addition to technological factors, the economic performance of agricultural enterprises is strongly influenced by the financial and organizational characteristics of production. Previous studies in the field of agribusiness economics emphasize that production efficiency, financial stability and market conditions together determine the sustainability of agricultural activities. Empirical research has shown that various operational and financial factors can significantly influence business performance in agricultural production systems. For example, research on beekeeping identified resource management, production organization and market conditions as important determinants of business performance in agricultural activities (Čavlin et al., 2023). Similarly, studies focused on the agri-food industry have shown that financial indicators such as liquidity and capital structure can significantly affect profitability and overall business performance in companies operating within the agricultural value chain (Čavlin et al., 2021). These findings highlight the importance of integrating production, financial and institutional perspectives when analyzing investment decisions in agriculture. In the context of making investment decisions at the farm level, the literature on the management of agricultural enterprises emphasizes the importance of applying standard methods of investment analysis. Methods based on discounted cash flows, such as net present value (NPV) and internal rate of return (IRR), are widely used in evaluating long-term investment projects in agribusiness. These methods enable the estimation of the economic value of an investment taking into account the time value of money and the expected future cash flows of the investment project (Gittinger, 1982; Kay, Edwards, & Duffy, 2016). In addition to operational and financial factors, investment decisions in agriculture are significantly conditioned by the agricultural policy instruments (Đurić et al., 2016; Tasić et al., 2026; Đurić et al., 2024). The banking sector is an important segment of the functioning of the state system, and as such is connected with the financing of social reproduction through loans and deposits (Bejatović, Vapa Tankosić, 2024). Public policies that include investment subsidies, direct payments and favorable credit lines can have a significant impact on the investment activity of agricultural producers. Empirical research shows that mechanization support programs can significantly increase investments in agricultural equipment and contribute to the modernization of production, especially in regions where mechanization is outdated or underdeveloped (FAO, 2022; Wang, Chu, & Chen, 2020). In the field of environmental policy, the findings have shown that there is no statistically significant relationship between attitudes toward environmental awareness (farm as business) and attitudes toward agri-environmental practices (Vapa-Tankosić et al., 2023). At the same time, investment decisions in agribusiness depend on market factors, such as the volatility of prices of agricultural products and the stability of farm incomes. Changes in market prices can significantly affect the financial viability of investment projects, while direct payments and other forms of institutional support can have a stabilizing effect on producers' incomes. In this sense, investment decisions in agriculture are often the

result of the interaction of operational, financial and institutional factors that together determine the economic viability of investment projects.

Materials and methods

The paper uses a case study approach combined with methods of investment analysis based on discounted cash flows (DCF), which enables the assessment of the economic justification of investment projects through the analysis of expected future cash flows and their present value. In assessing the economic justification of the investment, the basic indicators of the investment analysis were used: net present value (NPV) and internal rate of return (IRR). These indicators represent standard criteria for evaluating long-term investment projects because they enable the assessment of the profitability of the investment taking into account the time value of money (Gittinger, 1982; Kay, Edwards, & Duffy, 2016; Čavlin, Vojinović, & Vapa-Tankosić, 2024). The net present value of the investment project is calculated by discounting the expected future cash flows to the present value according to the following formula:

$$NPV = \sum_{t=0}^T \frac{CF_t}{(1+r)^t}$$

where CF_t represents the cash flow in year t , r discount rate, and T investment period of the project.

An investment project is considered economically justified if the net present value is positive and the internal rate of return exceeds the discount rate. In addition to the basic indicators of investment analysis, additional analytical tools were also applied in the work, including the profitability index, sensitivity analysis and scenario analysis of the investment project. Sensitivity analysis enables the assessment of the impact of changes in the key parameters of the investment on the economic value of the project, while the scenario analysis enables an overview of the possible economic outcomes of the investment project in different market and financial conditions (Boardman et al., 2018; Brealey, Myers, & Allen, 2020). The empirical analysis is based on the model of a typical agricultural farm engaged in arable production in the region of Vojvodina. The investment project refers to the purchase of a medium power tractor, and the analysis was carried out for an investment period of ten years. Using a case study allows for a more detailed analysis of investment decisions at the level of an individual farm and is a methodological approach that is often used in research on agrarian economics and farm management (Yin, 2018).

Table 1. Element of analysis by Method /Indicator

Element of analysis	Method / indicator	The purpose of the analysis
Assessment of the profitability of the investment	NPV, IRR	Assessment of the economic feasibility of the investment project
Relative efficiency of the investment	Profitability Index (PI), Cost Savings Ratio (CSR)	Assessment of the relationship between investment and economic benefits

Element of analysis	Method / indicator	The purpose of the analysis
Financial viability of the project	Debt Service Coverage Ratio (DSCR)	Assessment of ability to service credit obligations
Stability of results	Sensitivity analysis	Identification of key factors affecting NPV
Alternative investment outcomes	Scenario analysis	Evaluation of results in different market and financial conditions

Source: Authors' notes

Although the analysis is based on the model of a typical agricultural farm, this approach enables the identification of key economic determinants of investment decisions that are relevant to the wider segment of agricultural production.

Results

In order to illustrate the economic effects of investment decisions in agriculture, the paper uses a case study approach based on a typical agricultural farm model. The analysis focuses on the evaluation of the economic justification of the investment in agricultural machinery through the application of standard methods of investment analysis. The assumptions used in the analysis are based on the typical production and financial characteristics of agricultural farms in Vojvodina. The analysis is based on a typical agricultural farm, which cultivates 20 hectares of land and produces wheat, corn and sunflower. Data from the Census of Agriculture indicate that a significant part of the tractor fleet is older than two decades, which confirms the need to modernize agricultural machinery and increase investments in modern equipment (Republic Institute of Statistics, 2019). The farm is considering an investment in the purchase of a medium-power tractor in order to increase labor productivity and reduce the cost of using external machinery. Based on the estimated production results, the annual income amounts to approximately EUR 45,000, while the total production costs are approximately EUR 32,000.

Table 2. Basic financial indicators of the farm

Financial indicator	Amount (EUR)
Total assets	120,000
Own capital	90,000
Total liabilities	30,000
Annual income	45,000
Annual costs	32,000
Net profit	13,000

Source: Authors' calculations

Basic financial indicators are presented in the Table 2. Based on the estimated financial data, it is possible to calculate the basic indicators of the financial stability of the farm.

Current liquidity ratio

Assumed values: current assets: EUR 25,000 short-term liabilities: EUR 15,000

Liquidity ratio= $25.000/15.000=1.67$ (A coefficient value greater than 1 indicates that the farm has sufficient working capital to settle short-term obligations).

Debt-to-Asset ratio

Debt Ratio= $30.000/120.000=0.25$ (This indicator indicates that the farm has a relatively low level of indebtedness, which suggests a stable financial structure and the potential ability to finance new investment projects).

Basic assumptions of investment analysis

In order to assess the economic justification of the investment in agricultural machinery, an investment analysis based on the method of discounted cash flows (DCF) was conducted. This method enables the assessment of the value of the investment project by discounting the expected future cash flows to the present value. The analysis refers to the investment in the purchase of a tractor that is used in field production of a typical agricultural farm in the region of Vojvodina. The tractor is a key production resource in agricultural production because it enables the timely performance of agro technical operations, increasing work productivity and reducing the cost of using external machinery.

The initial value of the investment is EUR 60,000 and refers to the purchase of a medium-power tractor adapted to the needs of a farm with an area of approximately 20 hectares. The investment was analyzed over a ten-year investment period, which roughly corresponds to the economic life of agricultural mechanization in agricultural production (Table 3).

In the assessment of cash flows, it was assumed that the investment generates average annual operational savings in the amount of around EUR 8,000. These savings result primarily from a reduction in the cost of using external machinery, an increase in work efficiency and a more rational use of production resources.

When evaluating the cash flows, the fact that the maintenance costs of agricultural machinery can increase over time due to wear and tear and the need for servicing was also taken into account. Therefore, it is assumed that the net annual savings may decrease slightly in the later years of the investment period.

The residual value of the tractor at the end of the investment period was also taken into account. It was assumed that the residual value after ten years is approximately 25% of the initial investment value of the tractor, and this value is included in the cash flow of the last year of the investment period.

A discount rate of 8% was used to discount cash flows, which represents an approximation of the opportunity cost of capital in agricultural investments. In the agribusiness investment analysis literature, discount rates between 6% and 10% are often used as a realistic estimate of the cost of capital (Gittinger, 1982; Kay et al., 2016).

Table 3. Basic assumptions of the investment analysis

Parameter	Value
The initial value of the investment	60,000 EUR
Investment period	10 years
Farm area	20 ha
Average annual savings	≈ 8,000 EUR
Residual value of the tractor	25% of the investment value
Discount rate	8%

Source: Authors' calculations

The annual operational benefits of the investment are estimated at approximately EUR 8,000 (Table 4). These benefits arise primarily from a reduction in the cost of mechanization services, an increase in work efficiency and a better timeliness of performing agro technical operations. In addition, investment in more modern machinery can contribute to the reduction of certain operational losses in production and increase the overall efficiency of the use of production resources.

Table 4. The structure of operational benefits of investment in a tractor

A source of savings	Estimated annual savings (EUR)
Reducing the cost of mechanization services	3,000
Reduction of labor costs	2,000
Greater work efficiency and timeliness of operations	1,500
Smaller operating losses in production	1,500
Total annual savings	8,000
A source of savings	Estimated annual savings (EUR)

Source: Authors' calculations

Economic justification of the investment

a) Investment assessment scenario without subsidy

The agricultural holding is considering an investment in the purchase of a new tractor whose market value is EUR 60,000. The investment project was analyzed based on the assumptions defined in the previous chapter: an investment period of ten years, average annual operational savings in the amount of EUR 8,000 and a discount rate of 8%. The cash flow projection is based on the assumption that the investment generates approximately EUR 8,000 in annual operating savings over a ten-year investment period. In the last year of the project, the cash flow includes the residual value of the tractor, which is approximately 25% of the initial investment value.

The investment payback period is approximately 7.5 years, which represents the ratio of initial investment to annual operating savings.

Based on the discounting of future cash flows, the following results of the investment analysis were obtained: NPV (8%) ≈ -6.320 EUR IRR ≈ 6,7%

The obtained results indicate that the investment without subsidies does not generate

sufficient economic value at a discount rate of 8%. A negative net present value and an internal rate of return lower than the discount rate suggest that the investment project in this scenario has limited financial viability.

b) Scenario of investment assessment with subsidy

In practice, investments in agricultural machinery are often supported by public subsidy programs. In this scenario, it is assumed that the farm can obtain a subsidy in the amount of 40% of the investment value.

The total value of the subsidy amounts to:

$$40\% \times 60,000 = 24,000 \text{ EUR}$$

The net investment financed by the farm amounts to:

$$60,000 - 24,000 = 36,000 \text{ EUR}$$

The investment payback period in this case is approximately 4.5 years, which is significantly shorter than in the no-subsidy scenario. The results of the investment analysis are as follows: NPV (8%) $\approx$ 17.680 EUR IRR $\approx$ 18-19%

The positive net present value and relatively high internal rate of return indicate that the investment becomes financially justified with the support of public incentives intended for the modernization of agricultural production. The results of the investment analysis are presented in a summarized form, while the projection of cash flows is based on constant annual operating savings during the investment period.

c) Additional indicators of the economic justification of the investment

In addition to the net present value and the internal rate of return, additional indicators of the economic efficiency of the investment project were used in the analysis.

The profitability index (PI) represents the ratio between the present value of future cash flows and the initial investment value.

Table 5. The analysis of the Profitability Index

Scenario	PI flows (EUR)	Investment (EUR)	PI
No subsidy	53,680	60,000	0.89
With subsidy	53,680	36,000	1.49

Source: Authors' calculations

A value of PI less than 1 in the Table 5 in the scenario without subsidy confirms that the investment is not economically justified, while a value of PI greater than 1 in the scenario with subsidy indicates a financially attractive investment project.

The cost savings ratio (CSR) as an additional indicator of investment efficiency represents the ratio between annual operating savings and the value of the investment.

Table 6. The analysis of the Cost Savings Ratio

Scenario	Annual savings	Investment (EUR)	CSR
No subsidy	8,000	60,000	13.3%
With subsidy	8,000	36,000	22.2%

Source: Authors' calculations

The results (Table 6) show that the inclusion of the subsidy significantly increases the relative efficiency of the investment, because a larger part of the investment value is compensated annually through operational savings.

Financial feasibility of the investment

Investments in agricultural machinery are often financed by a combination of own funds, state subsidies and bank loans. Therefore, the analysis additionally considered the scenario in which the agricultural holding finances the purchase of a tractor with the help of a long-term investment loan. In the analyzed scenario, it is assumed that the farm uses a state subsidy in the amount of 40% of the investment value, while the remaining part is financed by a bank loan.

The basic parameters of credit financing are as follows: investment value: EUR 60,000, subsidy: EUR 24,000, loan amount: EUR 36,000, repayment term: 7 years, interest rate: 5% per year. Based on the above assumptions, the annual installments of the loan amount to approx. 6.200 EUR.

Table 7. Projection of cash flow and ability to service debt

Year	Operating cash flow (EUR)	Loan installment (EUR)	Net flow (EUR)	DSCR
1	8,000	6,200	1,800	1.29
2	8,000	6,200	1,800	1.29
3	8,000	6,200	1,800	1.29
4	8,000	6,200	1,800	1.29
5	8,000	6,200	1,800	1.29
6	8,000	6,200	1,800	1.29
7	8,000	6,200	1,800	1.29
8–10	8,000	0	8,000	-

Source: Authors' calculations

In the Table 7 the results show that the investment remains financially viable even in the case of credit financing, although in the first years it generates a relatively modest positive cash flow due to the obligation to repay the loan. After the end of the loan repayment period, the farm's net cash flow increases significantly. The financial viability of the investment can be additionally assessed using the Debt Service Coverage Ratio (DSCR), which represents the relationship between operating cash flow and the annual loan installment. In the analyzed scenario, this ratio is approximately 1.29, which indicates that the farm generates sufficient cash flow to pay off the loan obligations. In practice, financial institutions, in addition to the DSCR indicator, often use the Loan Life Coverage Ratio (LLCR), which assesses

the ability of the investment project to generate enough cash flow to repay the total debt during the lending period.

This scenario indicates the importance of availability of favorable credit lines for financing investments in agriculture. The combination of subsidies and loans enables agricultural holdings to realize investment projects that would be much more difficult to achieve without institutional support.

Sensitivity analysis and scenario analysis of the investment project

In order to assess the stability of the investment project, a sensitivity analysis has been conducted.

a) Sensitivity to operational parameters

This analysis examines how changes in key operating parameters affect the economic feasibility of an investment project. The most important variables were the amount of annual operating savings, the size of the agricultural holding and the potential growth of the volume of production.

Sensitivity to the amount of annual savings

In the first step, the sensitivity of the net present value of the investment (NPV) to changes in annual savings resulting from the use of new machinery was analyzed.

Table 8. Sensitivity of NPV to changes in annual savings

Annual savings (EUR)	NPV without subsidy (EUR)	NPV with subsidy (EUR)
6,000	-19,740	4,260
8,000	-6,319	17,681
10,000	7.101	31.101

Source: Authors' calculations

The results in the Table 8 show that the investment project is relatively sensitive to changes in the amount of annual operating savings. While the investment without the subsidy becomes financially justified only at a higher level of savings, the inclusion of the subsidy significantly improves the economic viability of the project.

Sensitivity to farm size

In addition to the amount of annual cash flows, the size of the agricultural holding is also a significant factor of investment sustainability. In the literature on investment decisions in agribusiness, farm size is often identified as one of the key factors influencing the scale of investment and the efficiency of the use of production resources (Wang et al., 2020).

In the basic scenario, it was assumed that the farm cultivates 20 hectares of agricultural land and achieves annual savings of approximately EUR 8,000. However, larger farms can achieve a higher degree of mechanization utilization, which leads to increased operational savings.

Table 9. Sensitivity of the investment project to the size of the farm

Farm area	Annual savings (EUR)	NPV with subsidy (EUR)
20 ha	8,000	17,681
25 ha	9,500	27,000
30 ha	11,000	36,000

Source: Authors' calculations

The results in the Table 9 show that increasing the arable area significantly improves the economic justification of the investment, which confirms the importance of economies of scale in agricultural production.

Production growth scenario

In addition to direct savings in mechanization costs, investment in a new tractor can also contribute to an increase in the volume of production thanks to faster and more timely performance of agro technical operations.

In this scenario, an increase in household income of approximately 7% was assumed, which corresponds to an additional income of approximately EUR 3,150 per year. As the increase in production also implies an increase in variable costs, it was assumed that about 30% of additional income goes to production costs. In this way, the net additional cash flow amounts to approximately EUR 2,200 per year.

The total annual cash flow of the investment in this scenario is approximately EUR 10,200, which significantly improves the economic indicators of the investment project.

A rough estimate shows that in this case the net present value of the investment with the subsidy can reach approximately EUR 38,800, which represents a significant increase compared to the base scenario.

These results indicate that the effects of investment in agricultural machinery do not only result from cost reduction, but also from a potential increase in productivity and yield in agricultural production.

b) Sensitivity to financial parameters

In addition to the operational parameters of the investment project, the economic justification of the investment can significantly depend on the financial conditions. In this part, the sensitivity of the investment project to changes in the discount rate and credit financing conditions is analyzed.

Sensitivity to changes in the discount rate

The discount rate is an estimate of the cost of capital or the investor's expected rate of return. The changes in the discount rate can significantly affect the net present value of an investment project.

Table 10. Sensitivity of NPV to changes in the discount rate

Discount rate	NPV without subsidy (EUR)	NPV with subsidy (EUR)
6%	-1.119	22,881
8%	-6,319	17,681
10%	-10,843	13.157

Source: Authors' calculations

The results in Table 10 show that an increase in the discount rate reduces the economic value of the investment project. Nevertheless, even at higher discount rates, investments with subsidies retain a positive net present value, which confirms the importance of public incentives for the realization of investments in agricultural machinery.

Sensitivity to credit financing conditions

The financial viability of an investment project may also depend on the conditions of credit financing (Table 11), especially the interest rate and the structure of the loan. In order to assess the stability of the project, different lending scenarios were considered for a loan in the amount of EUR 36,000 with a repayment term of seven years.

Table 11. The sensitivity of the investment project to the conditions of credit financing

Lending scenario	Estimation of the interest rate	Annual loan installment (EUR)	Net annual flow (EUR)	DSCR
EUR loan - fixed interest rate	5%	≈ 6,200	≈ 1,800	1.29
EUR loan – variable interest	7%	≈ 6,700	≈ 1,300	1.19
RSD loan - fixed interest rate	8%	≈ 7,000	≈ 1,000	1.14

Source: Authors' calculations

Debt Service Coverage Ratio (DSCR), which represents the relationship between operating cash flow and the annual installment of the loan, was used to assess the farm's ability to service the loan.

The results show that the investment remains financially viable in all observed lending scenarios, although the increase in the interest rate reduces the available cash flow of the farm and increases the financial risk of the investment project.

These results indicate that investment decisions in agriculture depend not only on the operational profitability of the investment project, but also on the financing conditions available to agricultural holdings.

c) Scenario analysis of the investment project

In addition to the standard sensitivity analysis, a scenario analysis of the investment project was carried out in order to assess the possible economic outcomes of the investment in different business conditions. Three basic scenarios were considered in the analysis: pessimistic, base and optimistic scenario. The pessimistic scenario assumes

a lower level of operational savings and less favorable financial conditions, while the optimistic scenario implies greater operational benefits from the investment and more favorable financial conditions. The base scenario corresponds to the assumptions used in the basic investment analysis.

Table 12. Scenario analysis of the investment project

Scenario	Annual savings (EUR)	Discount rate	NPV (EUR)
Pessimistic	6,000	10%	≈ -23,140
Basic	8,000	8%	≈ -6,319 (without subsidy) / 17,681 (with subsidy)
Optimistic	10,000	6%	≈ 13,601 (without subsidy) / 31,101 (with subsidy)

Source: Authors' calculations

The results of the scenario analysis in the Table 12 indicate that the economic justification of the investment project largely depends on the operational efficiency of the use of machinery and the cost of capital. In unfavorable conditions, the investment may remain financially unprofitable without institutional support, while more favorable operational and financial conditions significantly increase the economic value of the project. Such results confirm that public subsidies and stable financial conditions can play a key role in the realization of investment projects in agriculture.

Comparative analysis of scenarios

On the basis of previous analyses, a comparative analysis of different scenarios of the investment project was carried out. The goal of this analysis is to enable an overview of key economic indicators in different conditions of investment realization. In order to systematize the results of the investment analysis, a comparative scenario framework was constructed that enables an overview of the economic outcomes of the investment project in different operational and financial conditions.

Table 13. Comparative scenario framework for investment assessment

Investment scenario	Initial investment (EUR)	Annual cash flow (EUR)	NPV (EUR)	IRR
No subsidy	60,000	8,000	-6,319	6.7%
With subsidy	36,000	8,000	17,681	18-19%
Credit financing (subsidy + loan)	36,000	1,800 (first 7 years)	positive	>8%
Production growth (7%)	36,000	≈10,200	≈38,800	>20%
Larger farm (30 ha)	36,000	11,000	≈36,000	>20%

Source: Authors' calculations

The results of the comparative analysis in the Table 13 show that institutional factors, such as subsidies and the availability of credit financing, have a significant impact on the economic justification of investment projects in agriculture. While the basic scenario

without subsidies shows the limited financial viability of the investment, the inclusion of public incentives significantly improves the profitability indicators of the project.

In the scenario of credit financing, the net cash flow is reduced in the first years due to the obligation to repay the loan, while after the end of the loan repayment period it increases significantly. The scenario of a larger farm and the scenario of production growth indicate the importance of economies of scale and increased productivity for the long-term economic sustainability of investment projects in agribusiness. Comparative analysis of the scenarios shows that the economic sustainability of an investment project depends on the interaction of operational efficiency, financial conditions and institutional support. These results confirm the importance of public policies aimed at modernizing agricultural machinery and improving the productivity of agricultural farms.

Discussion

The results of the conducted investment analysis indicate several important aspects of making investment decisions in agricultural farms. First, the results of the basic scenario show that investment in agricultural machinery is not financially justified in conditions without institutional support. The negative net present value of the investment and the internal rate of return lower than the discount rate confirm hypothesis H1, according to which the investment in a tractor on a typical agricultural farm does not generate sufficient economic value without additional incentives. This result is consistent with the findings of numerous studies that indicate that investment in mechanization in small and medium farms is often limited by the amount of initial capital investment and relatively slow return on investment (Kay, Edwards, & Duffy, 2016). Second, the results of the scenario that includes the subsidy confirm the importance of institutional support for the implementation of investment projects in agriculture. The inclusion of a subsidy of 40% of the investment value significantly improves the economic indicators of the investment project, which is reflected in a positive net present value and a significantly higher internal rate of return. These results confirm hypothesis H2 and indicate the importance of public policies aimed at modernizing agricultural production, having in mind also ecological sustainability (Đurić et al, 2023). Similar conclusions are stated by FAO (2022), which points out that mechanization support programs can significantly increase productivity and investment activity in agriculture, especially in regions with outdated mechanization.

The third important finding refers to the financial feasibility of the investment project in terms of credit financing. The analysis shows that the combination of subsidies and a bank loan can enable the realization of the investment even in situations where the farm does not have sufficient own capital. A positive debt service coverage ratio (DSCR) indicates that the farm's operating cash flow enables stable servicing of credit obligations. This finding is consistent with the literature that emphasizes the importance of the availability of financial instruments for the implementation of investment projects in agriculture (Gittinger, 1982). The sensitivity analysis additionally shows that operational factors can have a significant impact on the economic justification of the

investment project. The importance of annual operating savings and the size of the farm is particularly emphasized. The results show that the increase in arable land leads to a better use of mechanization and an increase in the operational benefits of the investment, which confirms the importance of economies of scale in agricultural production. This finding is consistent with empirical research that shows that larger farms invest more often in mechanization and realize greater benefits from technological investments (Wang, Chu, & Chen, 2020).

The results of the scenario analysis additionally confirm the importance of the interaction of operational and financial factors in the assessment of investment projects. In unfavorable conditions, characterized by lower operational savings and higher cost of capital, the investment may remain financially unprofitable without institutional support. Conversely, more favorable operating and financial conditions can significantly increase the economic value of an investment project. Such findings confirm the comparative analysis of the scenarios (Table 13) which shows that the economic viability of the investment project depends on the combination of operational efficiency, financial conditions and institutional support.

Conclusion

The aim of this work was to evaluate the economic justification of investment in agricultural machinery on the example of a typical agricultural farm in Serbia. The analysis was carried out using investment analysis methods based on discounted cash flows, including net present value (NPV), internal rate of return (IRR) and sensitivity analysis of the investment project.

The findings show that the investment in mechanization without institutional support is not financially justified, because the negative net present value and the internal rate of return lower than the discount rate indicate limited economic viability of the project. This finding confirms hypothesis H1 and indicates that high initial investment costs can represent a significant obstacle to the modernization of production on small and medium-sized farms.

At the same time, the analysis of the scenario with the investment subsidy shows a significant improvement in the project's economic indicators, which confirms hypothesis H2. A combination of subsidies and credit financing can enable the realization of investment projects even in situations of limited own capital. The results of the sensitivity analysis further confirm hypothesis H3 and show that operational factors, such as the amount of annual savings and the size of the farm, have a significant impact on the economic viability of the investment.

In order to strengthen local food system development, during the EU accession, local farmers with small farm size (well below the EU average farm size), with lack of financing, sales and marketing skills, administrative and trading cost burdens, need to have support from official bodies at regional and local level (Cvijanović et al, 2020). In

this context, public policies that combine investment subsidies and available financial instruments can significantly contribute to the modernization of agricultural production and increase the competitiveness of the agricultural sector. Research findings indicate that the effectiveness of the mechanization support program does not depend only on the amount of the subsidy, but also on the availability of financial instruments that enable agricultural holdings to implement investment projects.

The research findings indicate that investment decisions in agriculture should be analyzed through an integrated analytical framework. This approach enables a broader understanding of investment decisions at the level of agricultural holdings, which often operate under conditions of limited access to capital and pronounced market uncertainties. This paper contributes to the literature on investment decisions in agribusiness through the application of investment analysis methods at the farm level and indicates the importance of institutional and market factors for the economic sustainability of investments in agricultural machinery. Our research has certain limitations, as the analysis is based on a simulated model of a typical agricultural farm. Future research could include an empirical analysis of a larger number of farms and a more detailed consideration of the influence of market and institutional factors on investment decisions in agribusiness.

Conflict of interests

The authors declare no conflict of interest.

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