VISIBLE INTANGIBLE ASSET EFFICIENCY AND TANGIBLE ASSETS EFFICIENCY: WHO CONTRIBUTES MORE TO THE BUSINESS PERFORMANCE OF AGRICULTURAL FIRMS?

Jasmina Ognjanović[1], Milena Podovac[2], Nemanja Pantić[3]

**Corresponding author E-mail: nemanja.pantic@kg,ac.rs*

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ABSTRACT

The realization of business activities is carried out by agricultural firms using available assets. Assets can be tangible and intangible. Theoretical and practical experiences show that these two types of assets affect firm value, create a competitive advantage, are a significant driver of productivity growth, and a key factor for the firm's survival in crisis. The paper aims to analyze the contribution of visible intangible assets efficiency and tangible assets efficiency to the business performance of agricultural firms, monitored through labor productivity, profitability, and firm growth. The sample consists of 42 agricultural firms that operated in 2023 in Serbia. A regression model was used to test the hypotheses. The results prove the contribution of visible intangible assets efficiency and tangible assets efficiency to the productivity of agricultural firms. At the same time, the influence of these variables on firm growth and profitability was absent.

Introduction

The agricultural sector contributes significantly to the overall Serbian economic activities (Ognjanović et al., 2023a) and therefore constitutes one of the most important sectors of the Serbian national economy (Dimitrijević et al., 2022; Milošev, 2023).

1 Jasmina Ognjanović, Assistant Professor, University of Kragujevac, Faculty of Hotel Management and Tourism in Vrnjačka Banja, Vojvođanska 5A, 36210 Vrnjačka Banja, Serbia., Phone: +38163608943, E-mail: jasmina.lukic@kg.ac.rs , ORCID ID (https://orcid.org/0000-0002-6036-5269)

2 Milena Podovac, Assistant Professor, University of Kragujevac, Faculty of Hotel Management and Tourism in Vrnjačka Banja, Vojvođanska 5A, 36210 Vrnjačka Banja, Serbia., Phone: +381641663882, E-mail: milena.podovac@kg.ac.rs , ORCID ID (https://orcid.org/0000-0002-0709-2927)

3 Nemanja Pantić, Assistant Professor, University of Kragujevac, Faculty of Hotel Management and Tourism in Vrnjačka Banja, Vojvođanska 5A, 36210 Vrnjačka Banja, Serbia., Phone:+381612058758, E-mail: nemanja.pantic@kg.ac.rs ORCID ID (https://orcid.org/0000-0003-0030-6950)

By strengthening the agricultural sector, the domestic market reduces the demand for imports, contributes to the strengthening of GDP, and affects the growth of employment (Milošev, 2023). The agricultural sector of Serbia accounts for 6.3% of the total value of GDP, employs 13.1% of total employees, participates in exports 16.2%, and imports 9.1% (Report on the State of Agriculture in the Republic of Serbia in 2023, 2024:11-12). However, the agricultural production market in Serbia is undergoing rapid transformations as it adapts to world trends, especially to the dynamics of Internet technology (Mihailović et al., 2024). Perhaps this is the reason why the agricultural sector of Serbia records a decline in the value of most economic indicators in 2023 (Report on the State of Agriculture in the Republic of Serbia in 2023, 2024:11).

Agricultural firms create a business result by using available assets - tangible and intangible. It is common for intangible assets, such as industry knowledge and managerial expertise, to be viewed as a separate entity from tangible assets in terms of ownership, but in practice, one cannot function without the other (Ognjanović et al., 2023c). Comparing these two types of assets, some scholars (Qie et al., 2023) believe that tangible resources are essential for the firm's growth, while intangible resources are significant factors of sustainable competitive advantage. Before the advent of the knowledge era, tangible assets were the primary factor of production (Coulter, 2010). Later, intangible assets gained primacy in business. Research even shows that intangible assets are up to twice as productive as tangible assets (Castillo, Crespi, 2024). It should also be mentioned that the financial statements show only one, visible part of intangible assets (keeping in mind the framework of IAS 38), which will be the subject of research in the paper. The paper aims to analyze the contribution of visible intangible assets efficiency and tangible assets efficiency to the business performance of agricultural firms, monitored through labor productivity, profitability, and firm growth.

The following research gaps have been observed in the literature. First, the paper analyzes only one part of intangible assets - the one that is disclosed in the balance sheet. Most studies are based on only one component of intangible assets - intellectual capital (Bhatia & Aggarwal, 2018), which is evaluated either by quantitative methods (most often by applying VAIC) or qualitative methods. By analyzing the visible intangible assets efficiency, the study aims to show the contribution of that part of intangible assets that are proven to exist in the firm, is owned by the firm, and meets the criteria of IAS 38. Second, regardless of the obvious impact of tangible assets on the business results of agricultural firms, research on this topic is rather modest. Supplementing the existing literature with such research is necessary, all the more so since intensive use of physical capital has been observed in the agricultural sector, while the use of intellectual capital is minimal (Ognjanović et al., 2023a). The research focus is in line with the recommendations of Okobo et al. (2022) that managers of agricultural firms must pay considerable attention to tangible asset efficiency to ensure a better contribution to the return on assets. Third, previous studies did not compare the strength of the impact of tangible and intangible assets on the business performance of agricultural firms, which will be analyzed in the paper. This is consistent with the suggestion of Sulaiman et al.

(2021) that agricultural firms must separately analyze tangible and intangible assets to total assets to ensure a better impact on business results.

The research questions that will be considered in the paper are:

- What is the contribution of visible intangible assets to the business performance of agricultural firms?
- What is the contribution of tangible assets to the business performance of agricultural firms?
- Which type of asset contributes more to the business performance of agricultural firms?

The study's contribution is that it is among the first to analyze the visible intangible assets efficiency and tangible assets efficiency. Previous studies have analyzed the impact of this type of property, but not through the efficiency coefficient. Second, the paper analyzes the value of the visible intangible asset that is owned by the firm and for which it is possible to estimate the future benefit and purchase value. Thirdly, the paper indicates which type of property has a stronger impact on the business performance of agricultural firms to ensure greater efficiency of use and a stronger impact on business performance.

Literature review

Assets of agricultural firms

The development of the agricultural sector largely depends on natural factors as well as state subsidies, agricultural policy, and regional characteristics (Milošev, 2023; Qie et al., 2023). As the results of the studies show, the agricultural sector is characterized by a low return on production as well as cyclical growth and decline in production (Ognjanović et al., 2023a). The industrialization of agriculture, the liberalization of the food market, the rise of food empires in the food supply chain (Cavicchi & Vagnoni, 2018; Ognjanović et al., 2023A), as well as technological trends that change the way agricultural products are produced and sold, are cited as possible explanations for such results (Mihailović et al., 2024). Such trends require a change in traditional methods of agricultural production and trade to comply with the requirements of a more interconnected and technologically driven marketplace (Mihailović et al., 2024). A significant role in this process of adaptation of agricultural firms, in addition to tangible assets, is also played by intangible assets, i.e. knowledge and know-how (Cavicchi & Vagnoni, 2018).

An agricultural firm's use of tangible and intangible assets. A competitive business market views tangible resources as necessary, while intangible resources can be used to gain and maintain a competitive advantage (Silver Coley et al., 2012). This trend is particularly pronounced with the emergence of the knowledge era, where intangible assets are seen as a significant resource that gradually replaces tangible ones (Qie et al., 2023). However, practice shows that these two types of assets are used simultaneously, complement each other, and add value to each other.

Tangible assets. According to the International Accounting Standard 16, tangible assets include property, plant, and equipment firms own for performing activities or leasing items to other entities that will use them for more than one year (Ognjanović et al., 2023c). The value of these assets is not complicated to show since tangible costs and benefits can be easily measured in money (Silver Coley et al., 2012). Due to its immeasurable importance in agriculture, Pezeshkian & Hamidi (2020) indicate the need for quality management of these assets throughout the firm's entire life cycle. Otherwise, high productivity, efficient distribution, and lower return on invested capital can occur (Okobo et al., 2022).

Intangible assets have a nonphysical nature, the ability to produce future economic benefits (Bhatia, Aggarwal, 2018), determine the competence of the firm and provide support for the implementation of innovative activities (Intara & Suwansin, 2024). The development and efficient management of these assets enables the agricultural firm to generate high yields in the long term in the future (Rizaev & Kadirov, 2022). Due to its intangible nature, the presentation of the value of intangible assets in financial statements is not complete. That was the criterion for dividing intangible property into visible and invisible (Sveiby, 1997). Assets that can be seen on the balance sheet and that are quantified in monetary terms, such as goodwill, patents, licenses, and copyrights, are visible intangible assets (Bhatia, Aggarwal, 2018). Assets that are part of "under the surface" in the balance sheet are invisible intangible assets (Bhatia & Aggarwal, 2018). The paper will analyze the visible tangible asset (VTA) due to its monetary value, fulfillment of IAS 38 criteria, and proven ownership of the agricultural firm over this asset.

Considering the growing importance of intangible assets as well as the dominant role of tangible assets in agricultural production, it is useful to point out the differences between these two assets. First, intangible assets are characterized by a high degree of risk and uncertainty (Ognjanović et al., 2023a), which is not characteristic of tangible assets. As the main cause of high risk, Zhang (2003) cites the scarcity of public information on the value of intangible assets, which makes it difficult for investors to make assessments and projections. Second, intangible assets cannot be used as collateral for borrowing, unlike tangible assets (Grujić et al., 2024). This means that firms that borrow and own more tangible assets reduce their debt costs (Ognjanović et al., 2023c). Thirdly, the uncertainty in determining the specific benefit from the use of the asset as well as the duration of that benefit is more present in intangible assets compared to tangible assets (Zhang, 2003; Bhatia & Aggarwal, 2018; Ognjanović et al., 2023c). Fourth, since they do not have a physical form, intangible assets do not follow the same amortization pattern as tangible assets (Bhatia & Aggarwal, 2018). As a result, economic rents, growth opportunities, and other factors associated with intangible assets are not fully captured by accounting systems (Bhatia & Aggarwal, 2018).

The problem of intangible assets disclosure

Proper asset management involves accurately determining its value to identify future economic benefits (Intara & Suwansin, 2024). Management teams and reporting system aim to describe which combinations of tangible and intangible resources influence the creation of returns (Cavicchi & Vagnoni, 2018). The level of return on intangible assets is high (Rizaev & Kadyrov, 2022), which is supported by the difference between the market and book value of the firm (Bhatia & Aggarwal, 2018). However, intangible costs are difficult to assess in monetary terms (Silver et al., 2012) as well as the cash flow generated by these assets (Zhang, 2003). The problem arises that most intangible assets should be expensed at the time of creation and that only those that can be quantitatively identified can be capitalized in the balance sheet (Keong Choong, 2008).

Intangible assets disclosure is important, first of all, for firm management. It is also important for investors because a firm that provides greater expectations to use the existing technology, knowledge, and firm brand has a higher value (Bhatia & Aggarwal, 2018). Understanding the valuation of intangible resources should be of interest to both suppliers and customers who co-create value in business relationships (Silver Coley et al., 2012).

Tangible assets, intangible assets, and business performance

The analysis of the contribution of tangible and visible intangible assets to the business performance of agricultural firms is in line with the resource-based view, according to which firms gain a competitive advantage by using and developing internal resources (Barney, 1991; Milošev, 2023). To monitor the efficiency of using internal resources, Sveiby (1997) recommends that firm management use performance that emphasizes renewal, efficiency, and change and suggests the use of efficiency indicators, growth/renewal indicators, and stability indicators. Accordingly, the paper will analyze three performance groups: productivity, profitability, and firm growth. Productivity is an indicator of employee performance that depends on the efficiency of using available resources by employees (Ognjanović et al., 2023b). Profitability and firm growth are generally accepted indicators of the drivers of firm value that indicate the price market participants are willing to pay for the firm's capital (Calandro & Lane, 2007).

Previous researches provide different results about the contribution of intangible and tangible assets to the business performance of agricultural firms. Milošev (2023) concludes that internal factors are the key determinants of agricultural firms and that leverage is the most significant determinant of the profitability of these firms. Intara & Suwansin (2024) emphasize the importance of intangible assets stating that firms that invest more in these assets are more likely to experience positive benefits than those that do not invest enough. This is supported by the results of previous studies that empirically prove the impact of intangible assets on corporate sustainability growth in agricultural firms (Qie et al., 2023) and on the value of these firms (Sulaiman et al., 2021). In the literature, intangible asset was also observed through the VAIC method. Applying this method, Vetchagool (2022) concludes that intangible assets significantly

increase the profitability of agricultural firms. Analyzing the same method, Ognjanović et al., 2023a) come to the opposite conclusion that intangible assets do not affect the profitability of agricultural firms in Serbia. When it comes to the relationship between intangible assets and productivity, Castelli et al. (2024) prove that the long-term relationship of investment in the intangible assets of agricultural firms affects the growth of labor productivity. Hatane et al. (2021) state that productivity growth can occur by investing in intangible components such as education, training, certification programs, and internship activities. Further, research by Sim-im et al. (2019) shows that intangible assets have a positive relationship with the sustainable growth rate of agricultural firms. Also, the same authors concluded that agricultural firms in Thailand have the highest average sustainable growth rate. However, none of these studies analyze the visible intangible assets efficiency (VIAE) and its impact on the performance of agricultural firms. The following hypotheses were defined:

H_{1a}: VIAE positively contributes to the productivity of agricultural firms.

H_{2a}: VIAE positively contributes to the profitability of agricultural firms.

H_{3a}: VIAE positively contributes to the growth of agricultural firms.

Research shows that tangible assets are the most influential determinant of capital structure in the agricultural sector of Serbia (Grujić et al., 2024; Ognjanović et al., 2023A; Ivanović et al., 2021). Tangible assets contribute to the improvement of financial results (Varghese, 2023), short-term debt ratio, and leverage of agricultural firms (Grujić et al., 2024). Okobo et al. (2022) prove that tangible assets play a significant role in the ROA of food manufacturing firms in Nigeria. Some studies analyze the impact of tangible assets using the VAIC method through the capital employed efficiency coefficient (CEE). Ivanovic et al. (2021) conduct research in agricultural firms in western Balkans counties concluding that CEE is the most important element of IC. Ognjanović et al (2023a) prove the impact of CEE on the ROE of agricultural firms in Serbia. Similar results are reached by Vetchagool (2022), stating that a CEE affects the efficiency of agricultural firms. Other studies come to opposite conclusions. Yen et al. (2023) prove the negative impact of tangible assets on the performance of agricultural firms in Vietnam. As the tangible assets efficiency (TAE) in agricultural firms has not been sufficiently investigated, and as an asset that is significantly represented in the capital structure, it is necessary to determine how much its contribution is to the observed performance. That is why the following hypotheses were defined:

H_{1b}: TAE positively contributes to the productivity of agricultural firms.

H_{2b}: TAE positively contributes to the profitability of agricultural firms.

H_{3b}: TAE positively contributes to the growth of agricultural firms.

Materials and methods

Sample description

The sample includes agricultural firms that operated in Serbia during 2023. The sample includes firms with industrial classification codes 011; 012; 013; 014 and 015. Dependent and independent variables were calculated according to the value of the corresponding balance sheet positions. The financial reports for the observed firms were taken from the Serbian Business Registers Agency website. Out of a total of 200 analyzed firms, all necessary data for the calculation of variables were available for 42 agricultural firms. Data were collected in August and September 2024. The description of the sample according to three criteria (legal form, firm size, and number of working years) is given in Table 1.

Table 1. Sample descriptives

The legal form of the firms	**Number**	**%**
Agricultural cooperative	9	4.8
A limited liability company	30	71.4
Stock company	2	4.8
Limited partnership	1	2.4
Σ	**42**	**100**
Firms size	**Number**	**%**
Micro firms	10	23.8
Small firms	17	40.5
Medium firms	10	23.8
Large firms	5	11.9
Σ	**42**	**100**
Number of working years	**Number**	**%**
up to 10 years	4	9.3
11-20 years	11	26.6
21-30 years	15	35.5
31 years and more	12	28.6
Σ	42	**100**

Source: Author's calculation

Based on the results, it can be concluded that the sample is dominated by limited liability companies (71.4%), small agricultural firms (40.5%) as well as firms operating "from 21 to 30 years". (35.5%). The smallest participation in the sample is present in agricultural firms in the form of limited partnerships (2.4%), large firms (11.9%) and firms operating "less than 10 years" (9.3%).

Variables

Independent variables, visible intangible assets, and tangible assets are monitored through the efficiency coefficient. This coefficient assesses a firm's ability to use its assets and manage its liabilities to generate income in the short term with minimum costs (Alarussi & Gao, 2023). The calculation of this coefficient follows the VAIC model, analyzed by Pulić (2004), using value-added. Value added is an indicator of a

firm's ability to create value (Pulić, 2004). The calculation of the efficiency coefficient is measured as value added per value of the observed assets (Sveiby, 1997). Following the VAIC method (Pulić, 2004), value-added is calculated:

$$VA = OP+EC+D+A \quad (1)$$

VA = value-added; OP = Operating; EC = Employee costs; D = Depreciation; A = Amortization.

The paper analyzes only visible intangible assets that are shown in the financial statements. The analysis of disclosure of intangible assets has its advantages, primarily because financial information is still the predominant source of information based on which the sustainability of business activities is assessed (Ognjanović et al., 2023c). Accordingly, the VIAE coefficient is calculated:

$$\text{VIAE coefficient} = \frac{\text{Value added}}{\text{Value of visible intangible assets}}$$

Some authors examined the influence of tangible assets, calculating it as the ratio of the value of these assets and total assets (Xuezhou et al., 2020). The TAE coefficient in the paper is calculated: (Ognjanović et al. 2023c):

$$\text{TAE coefficient} = \frac{\text{Value added}}{\text{Value of tangible assets}}$$

The dependent variables analyzed in the paper are:

- Labor productivity shows how much each employee contributed to the creation of profit before tax and is calculated (Ognjanović et al., 2023b):

$$\text{Labor productivity} = \frac{\text{Profit before tax}}{\text{number of employees}}$$

- The profitability of agricultural firms is monitored through the Return on assets (ROA). ROA measures the overall efficiency of management in generating profits considering the level of assets at its disposal (Bhatia & Aggarwal, 2018). ROA is calculated (Lin & Li, 2024):

$$\text{ROA} = \frac{\text{Net income}}{\text{Total assets}}$$

- The growth of agricultural firms is monitored through the firm growth indicator, which shows whether there has been a change in operating income compared to the previous year. It is calculated (Lin & Li, 2024):

$$\text{Firm growth} = \frac{\text{Current year's operating income}}{\text{Previous year's operating income}}$$

Statistical methods

The analysis of dependent and independent variables will be performed using the program IBM SPSS. A confidence interval ά = 0.05 was used to determine statistical

significance. The set research hypotheses will be tested using regression analysis with descriptive statistics and correlation analysis.

Results

Descriptive statistics

The results of descriptive statistics show the mean values for the observed sample and the value of standard deviation, kurtosis, and skewness. The results of descriptive statistics for the observed sample are shown in Table 2.

Table 2. Descriptive statistics

Variables	Mean	St. Deviation	Kurtosis		Skewness	
			Statistics	St. Error	Statistics	St. Error
VIAE	1138.49	2658.88	4.24	0.365	21.43	0.717
TAE	2.10	7.94	4.97	0.365	26.09	0.717
Labor productivity	260.41	2345.96	0.906	0.365	4.779	0.717
ROA	-0.0029	0.11	1.30	0.365	10.50	0.717
FG	0.94	0.34	-0.10	0.365	2.72	0.717

Source: Author's calculation

Based on the results, it can be concluded that the mean is the highest in the case of the VIAE coefficient (mean=1138.49) and that in the case of this variable, the highest value of the standard deviation was identified (St. Dev = 2658.88). A significantly lower mean efficiency coefficient was identified for tangible assets, even 500 times lower than intangible assets. A possible explanation is the high value of tangible assets, which does not justify the creation of added value in agricultural firms. It is worrying that the companies in the observed sample have a negative mean value of ROA (-0.0029). On the other hand, the observed companies have a high growth compared to the previous year (2022), even almost 100%. Analyzing the kurtosis values, most of the observed variables, except firm growth, have positive values. This means that the distribution is more skewed than normal. On the other hand, the skewness values are also positive for all variables, which means that they are positioned left of the arithmetic mean, i.e. closer to lower values. Since the sample is less than 50, the Shapiro-Wilk test will be used to test the normality of the distribution. For all observed variables, the p-value is statistically significant, which means that the normality of the sample distribution is proven.

Correlation analysis

Correlation analysis aims to determine the strength and direction of the relationship between the observed variables. The strength of the relationship is measured based on the value of the Pearson coefficient since the normality of the distribution has been proven. The results of the correlation analysis are shown in Table 3.

Table 3. Correlation analysis

Variables	VIAE	TAE	Labor productivity	ROA	FG
VIAE	1				
TAE	0.257	1			
Labor productivity	0.604**	0.543**	1		
ROA	-0.054	0.039	0.382*	1	
FG	-0.014	0.055	0.236	0.194	1
* *Correlation is statistically significant on the level of 0.050* ** *Correlation is statistically significant on the level of 0.000*					

Source: Author's research

The between the VIAE and TAE coefficients is not identified significant correlation (ρ=0.257, p=100). The VIAE coefficient achieves a significant and strong correlation only with labor productivity (ρ=0.604, p=0.000), which was also determined in the case of the TAE coefficient and labor productivity (ρ=0.543, p=0.000). By observing the correlation between business performance, a statistically significant and medium correlation was identified between labor productivity and ROA (ρ=0.382, p=0.013).

Regression analysis

The application of regression analysis requires the fulfillment of appropriate conditions: multicorrelation and autocorrelation. Multicollinearity is monitored through the VIF coefficient, which should not exceed 10 (Field, 2009). For the observed three regression models, the VIF value is in the limit values, which means that there is no high degree of correlation between the variables and the regression can be carried out. Autocorrelation is monitored through the Durbin-Watson coefficient, which should not be higher than 4. This coefficient does not exceed the limit values for the observed three regression models, which means that this condition for the application of regression analysis is also met.

Table 4. Model 1 – VIAE coefficient, TAE coefficient, and labor productivity

Independent variables		Standard regression model		
		β	**t-value**	**Sig.**
VIAE coefficient		0.654	**5.091**	**0.000**
TAE coefficient		0.194	**1.512**	**0.039**
Dependent variables: Labor productivity *Significant: ** p ≤ 0.01; * p ≤ 0.05* *DW =1.448* *R^2 = 0.400* *F = 12.982* *p = 0.000*				

Source: Author's calculation

Table 4 shows the results of regression model 1, based on which it can be concluded that hypotheses H_{1a} and H_{1b} are accepted. A positive and significant impact of the VIAE coefficient on the labor productivity of agricultural firms was identified (p=0.000). The value of the β coefficient shows that an increase in the VIAE coefficient by 1 unit of standard deviation leads to an increase in productivity by 0.654 units of standard deviation. Also, the TAE coefficient positively and significantly contributes to the labor productivity of agricultural firms (p=0.039). An increase in the TAE coefficient by 1 standard deviation unit leads to an increase in productivity by 0.194 standard deviation units. The coefficient of determination R^2 for the observed model is 0.400, which means that 40% of the productivity variability of agricultural firms is explained by the regression model, while the rest is influenced by other factors.

Table 5. Model 2 – VIAE coefficient, TAE coefficient, and ROA

Independent variables		**Standard regression model**		
		β	**t-value**	**Sig.**
VIAE coefficient		-0.069	**-0.416**	**0.679**
TAE coefficient		0.057	**0.346**	**0.732**
Dependent variables: ROA *Significant: ** p ≤ 0.01; * p ≤ 0.05* *DW =1.721* *R^2 = 0.006* *F = 0.117* *p = 0.890*				

Source: Author's calculation

Based on the results of regression model 2, it can be concluded that hypotheses H_{2a} and H_{2b} are rejected (Table 4). The VIAE coefficient does not contribute positively to the ROA of agricultural firms (p=0.679), nor does the TAE coefficient (p=0.732).

Table 6. Model 3 – VIAE coefficient, TAE coefficient, and Firm Growth

Independent variables		**Standard regression model**		
		β	**t-value**	**Sig.**
VIAE coefficient		-0.030	**-0.182**	**0.857**
TAE coefficient		0.063	**0.379**	**0.707**
Dependent variables: Firm growth *Significant: ** p ≤ 0.01; * p ≤ 0.05* *DW =2.046* *R^2 = 0.004* *F = 0.076* *p = 0.927*				

Source: Author's calculation

The results of regression model 3 are shown in Table 5. VIAE and TAE coefficients do not contribute to the firm growth of agricultural firms, which means that hypotheses H_{3a} and H_{3b} are rejected.

Discussions

The research provided answers to the research questions. First, visible intangible asset efficiency affects only the labor productivity of agricultural firms. Similar results were obtained by Castelli et al. (2024). The obtained results follow the resource-based view according to which investment in internal resources creates economic value and a sustainable competitive advantage (Ognjanović et al., 2023b). The growth of labor productivity of agricultural firms is the result of the effective application of intangible assets - technology and creative processes created by upgrading the knowledge and abilities of employees (Bai et al., 2024). Competencies of employees are crucial for agricultural firms aiming for agility and adaptability (Bešić et al., 2024). The paper did not prove the impact of visible intangible asset efficiency on the profitability and growth of agricultural firms. One of the causes of such results may be insufficient education of farmers (Hadelan et al., 2022) or insufficient investment in research and development (Castelli et al., 2024).

Second, tangible asset efficiency positively contributes to the labor productivity of agricultural firms, which is in line with the results of Castelli et al. (2024). In Serbian agricultural firms, the availability of tangible assets and their efficient use remains one of the key factors of high productivity (Ognjanović et al., 2023a). Managers of these firms should use agricultural subsidies to influence productivity growth through additional investment and more efficient use of tangible assets (Qie et al., 2023).

Thirdly, the results show that the visible intangible asset efficiency has a stronger influence on the labor productivity of agricultural firms than the tangible asset efficiency. The results of the correlation analysis confirm this conclusion. As a possible explanation for such results, the value of human capital is mentioned, which is a key component of intangible assets and which significantly affects tangible asset efficiency. In agricultural firms with superior human capital, employees creatively perform various tasks, show appropriate behavior at the workplace, dedication to business tasks, which ensures production efficiency (Ognjanović et al., 2023b).

Practical implications. Employees in agricultural firms use visible intangible assets and tangible assets with a minimum of costs and energy, which improves labor productivity. Managers of agricultural firms are recommended to increase the visibility of intangible assets and their more efficient use to ensure greater profitability and growth. This can be achieved by aligning investment expenditures in various components of intangible assets (R&D, technology, employee training, brand activities, customer relationship improvement) with the value created. Managers are recommended to invest additionally in intangible assets, first of all, modern food production technology as well as branding of these companies to strengthen their competitive position. It is also recommended that through agricultural subsidies and favorable loans, agricultural firms continue to invest in tangible assets.

Limitations of the research. The first limitation is the sample size. The observed sample consists of only 21% of the firms from the collected base of agricultural firms. This

result is a consequence of the limited disclosure of intangible assets in the financial statements, which was a condition for the firm's inclusion in the research. The second limitation is the analysis of only the visible part of intangible assets, which limits the precise determination of the impact of this variable. The nondisclosure part of the intangible assets did not meet the criteria of IAS 38 for the presentation of the value of this property. That is why the presented intangible assets do not influence operating performance enough (Intara & Suwansin, 2024) and the value of the VIAE coefficient is quite high compared to the TAE coefficient. However, the displayed value of the intangible asset meets certain standards (it is possible to determine the purchase value and future benefits), which confirms the presence and ownership of the company over this asset. Given the intangible nature of intangible assets, each of the applied methods for estimating its value had some limitations.

Future research may focus on more precisely determining the value of intangible assets. Also, researchers can analyze the impact of each of the components of intangible assets on the business performance of agricultural firms, as well as the impact of the components of tangible assets on this performance. It would be useful to make a comparison with the results from the agricultural sector of other, comparable countries.

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Conflict of interests

The authors declare no conflict of interest.

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