Economic Horizons, May - August 2024, Volume 26, Number 2, 157 - 174
UDC: 33 ISSN: 1450-863 X

Original scientific paper
UDC: 657.421.3:005.9
doi:10.5937/ekonhor2402165D

THE EFFECT OF INTANGIBLE ASSETS ON CORPORATE FINANCIAL PERFORMANCE: THE EVIDENCE FROM SERBIA

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The paper examines how intangible assets, measured as the Value Added Intellectual Coefficient (VAIC), impact the margin and return ratios of the most profitable companies in Serbia. Previous research has demonstrated that intangible assets have a positive effect on the company's profitability across various contexts, including the European Union, the United Kingdom, and Serbia as well. This research study aims to determine whether intangible assets have a positive effect on the four ratios, namely the Net Profit Margin (NPM), the Earnings Before Interests, Taxes, Depreciation, and Amortization margin (EBITDAm), Return on Assets (ROA), and Return on Equity (ROE) or not. In the study, a sample consisting of the data collected from the official publication of the Serbian Business Registers Agency (SBRA) covering the period from 2017 to 2020 is used. The sample includes the 72 most profitable firms after excluding those not meeting the VAIC requirements. The findings of the study are indicative of the fact that intangible assets do have a positive impact on all the four ratios (NPM, EBITDAm, ROA, and ROE), which implies that companies in Serbia should prioritize investing in intangible assets so as to enhance their profitability and competitiveness.

Keywords: intangibles, intellectual capital, profitability, performance, VAIC

JEL Classification: O34

INTRODUCTION

The current context of the world economy is intensive in investments that cannot be seen or touched, the investments that are intangible assets according to the accounting rationale. In other words, intangible assets are perceived as a source of value creation in the modern economy (Chen, Cheng & Hwang, 2005; Dženopoljac, Kwiatek, Dženopoljac & Bontis, 2021). Unlike visible and tangible assets which have their physical or financial substance (equipment, buildings, land, plants, raw materials, financial

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assets, etc.), assets such as available knowledge, information, skills, training, close relationships with customers, good business culture, reputation, information systems, and organizational procedures are not visible. However, intangible assets are the main creator of value in businesses today (Janošević, 2009; Dženopoljac, Muhammed & Janošević, 2019). It is widely emphasized that the high-quality management of human resources and the development of patents affect the realization of a higher market value, investments in employees stimulate profitability, R&D investments positively correspond with the productivity of the firms and the disclosure of the information related to intangible assets causes market value to change (Guthrie, Petty & Johanson, 2001). The importance of firms' portfolio convergence in favor of intangibles is also referred to in the literature (Ciprian, Valentin, Mădălina & Lucia, 2012). *Esselte*, a company operating in the wood industry sector, expressed its concerns in 1979 about the digitization of paper records, also known as the "Paperless Office" concept. The company had been manufacturing paper products for over a hundred years and had also owned a subsidiary that printed Swedish law books. The printing process involved using computer presses, which allowed the company to maintain the database containing all of the Swedish legislation. As a result, *Esselte* launched an electronic search engine specifically designed for Swedish lawyers and attorneys, which was a significant technological advancement at that time (Sullivan & Sullivan, 2000). By converting the old business model into a new B2C model, *Esselte* consolidated intangible assets in digital form and reduced physical assets. The main symptom of the dramatic convergence in favor of intangible assets refers to the pandemic increase of the Market-to-Book Ratio of companies in today's world economy. In this sense in general, it is pointed out in the literature that intangible assets are all but fully recognized in a company's financial position statement, which means that the market value of a company is only partially recorded in the value of the net assets of that company (Janošević, 2009). It is possible to agree upon the fact that, to a certain extent, the explanatory power of the financial position statement has been impaired. However, the income statement has largely preserved its role, which is the reason why most evaluation approaches of firms are calculated according to the income statement. The reason is that information contained in the income statement is very important for the projection of future profits and cash flows a company will achieve (Skinner, 2008). The profit measure in the income statement is still very important. The accounting profit of the company is the generally accepted proof of the company's success (along with the satisfactory finance structure and liquidity) (Novićević & Antić, 2009). Since intangible assets are the key factor for achieving success in today's economy, financial performances mainly derived from the accounting profit are the main barometer for the high-quality management of intangible assets (Xu & Li, 2019). This research investigates the relationship between intangible assets and how they translate to financial performance. This research aims to test the impact of intangible assets on profit measures. The database was created based upon a hundred most profitable companies in Serbia selected by the Serbian Business Registers Agency (SBRA) for 2020. Due to the unusual impact of the COVID-19 pandemic on companies' financial performance, no data belonging to beyond 2020 were taken into consideration in the analysis carried out in this study. Some studies that analyzed the impact of intangible assets on companies' performance during the COVID-19 pandemic identified that the relationship had been negatively moderated by tangible capital (Ognjanović, Dženopoljac & Cavagnetto, 2023). Statistical multivariate regression analysis was used in this research study to test the hypotheses if the intangible assets of these companies impacted their profitability or not. In these hypotheses, intangible assets are proxied by VAIC. Profitability is presented through the margin ratios the Net Profit Margin (NPM), the Earnings Before Interests Taxes Depreciation, and Amortization margin (EBITDAm), and the Return on Assets (ROA) and Return on Equity (ROE) return ratios. The findings of the multivariate regression analysis highlight the importance of intangible assets and their subcomponents. Regarding the role of intangible assets in companies, managers need to involve intangible assets in the business strategy

and pay attention to and allocate resources towards them in order to achieve better financial performance. The terms "intangible assets" i.e. "intangibles" are dominantly used in this paper instead of the term "intellectual capital". Accounting science is more familiar with the term "intangible assets" (Gupta & Raman, 2020). However, authors use all these terms interchangeably in their studies without making a distinction (Pastor, Glova, Lipták, & Kováč, 2017).

LITERATURE REVIEW

Intangible assets

The importance of intangible assets was recorded relatively early by J. Westerman and L. R. Dicksee (Oppong, Pattanayak & Irfan, 2019). W. A. Patton (1922) was the first author to have contextualized the position of goodwill in accounting terms (Serenko & Bontis, 2013). However, intangible assets were more actively emphasized after the popularization of the resource-based view of the firm (RBV), which perceives the company as a collection of the resources available to management. In this sense, depending on their quality, the collection of resources affects the company's competitive advantage (Pike, Fernström & Roos, 2005) and their superior performance (Bhattu-Babajee & Seetanah, 2022). Intangible assets and knowledge as their major element have an impact on the shareholders' wealth and, according to M. Salehi, A. S. Gouji and M. L. Dashtbayaz (2020), they can improve the company's competitive advantage. Furthermore, tacit knowledge sharing represents a major element in the creation of companies' competitive advantage and strategy implementation. For example, it tends to play the key role in mergers and acquisitions during the negotiation phase (Dženopoljac, Abidi, Rauf & Bani, 2022).

The core structure of intangible assets is subject to multidisciplinary interpretation. In the common cross-section of the definitions highlighted by K. E. Sveiby (1997) and R. Petty and J. Guthrie (2000), the intangible asset structure is created by the company's human, structural, and external capital (Sveiby, 1997; Petty & Guthrie, 2000). According to N. Bontis and D. Nikitopoulos (2001), this structure is the closest to being the officially accepted structure in academic literature (Bontis & Nikitopoulos, 2001; Dženopoljac, Yaacoub, Elkanj & Bontis, 2017). Human capital represents the stock of knowledge in an organization that stems from employees (Bontis, Chua Chong Keow & Richardson, 2000). To build human capital in a company, it is crucial to focus on the factors such as employee satisfaction, employer branding, intrinsic motivation, and maintaining a healthy work-life balance (Slavković, Pavlović & Simić, 2018). The intellectual stimulation provided by the company's leaders improves the problem-solving skills in employees and contributes to the overall success of the company (Savović, 2017). Structural capital integrates all the knowledge of the current infrastructure of the company (López & Ramírez-Gómez, 2023). Structural capital refers to databases, algorithms and software, the organizational structure, documentation, and business processes (Bontis *et al*, 2000) and represents the nonhuman reserves of knowledge (Salehi *et al*, 2020). A significant determinant of structural capital in an enterprise is its organizational culture, which is often seen as the key element of the company's internal environment (Todorović, Erić & Stojanović, 2023). Organizational culture plays a significant role in the knowledge-based economy because it facilitates social communication and fosters collaboration among individuals and organizations. Organizational culture is an attribute closely linked to its members' values, beliefs, and assumptions. It is unique to each organization and helps shape each organization's identity (Pietruszka-Orty, 2021). Apart from the company's culture, the job structure and design also affect the engagement of its human capital (Bošković, 2021). As the third component of intangible assets, external capital is represented as relational capital which embodies the value of companies' relationships with their external stakeholders (Dženopoljac *et al*, 2017). According to L. Marinelli, S. Bartoloni, F. Pascucci, G. L. Gregori and M. F. Briamonte (2022), however, relational capital refers to the knowledge inherent in the relationships between an organization and its stakeholders, no matter whether they are

internal or external. This knowledge has a significant impact on the organization's ability to create value and thrive (Marinelli *et al*, 2022). One segment of companies' intangible assets that permeates all the identified elements of intellectual capital is the employer brand, which can be seen as an important intangible asset augmenting all the three components (Dženopoljac, Ognjanović, Dženopoljac & Kraus, 2023a).

The efforts made by management intended to make investments in intangible assets and their efficient usage must be measured. The literature on intellectual capital focused on the measurement issues with intangibles, but this occurred approximately ten years after the concept of intangibles had become a recognized research field (Dženopoljac, Senić, Labben, Arici & Koseoglu, 2023b). The measurement of intangible assets enhances the communication of real value to investors, as well as the implementation of management decisions intended to enhance the company's performance (Marr, Schiuma & Neely, 2004). G. Turner and C. Minonne (2010) pointed out the fact that the accounting profession should develop a tracking and management tool for investments in intangible assets and measure long-term returns on investments. It is important to establish a model that can distinguish companies in which the stock of intangible assets increases from those in which it is reduced (Turner & Minonne, 2010).

The Value Added Intellectual Coefficient (VAIC) that measures the efficiency of intangible assets in companies is the model that deserves to be treated highly significantly in the literature (Pulić, 1998). Indirectly, VAIC also indicates the amount of the stock of intangible assets in the company, given the fact that the companies that have a higher value of intangible assets tend to use them better (they tend to have higher VAIC efficiency coefficients). VAIC represents the methodology that consists of the three main efficiency coefficients, namely Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE), and Capital Employed Efficiency (CEE). CEE refers to the efficiency of the company's physical assets. The model is inspired by the logic that all of these three elements result in the creation of Value Added (VA) (Dženopoljac, 2014; Dženopoljac *et al*, 2017). According to A. Pulić (1998), VA is determined mathematically as follows (Pulić, 2000; Maji & Hussain, 2021):

$$VA = EBIT + D + A + EC \tag{1}$$

where EBIT is interpreted as Earnings Before Interest and Taxes, D as Depreciation, A as Amortization, and EC as Employee Costs (Maji & Hussain, 2021). A. Pulić (2000) stated that the calculation of the efficiency coefficients including HCE, SCE, and VAIC was covered by the following mathematical patterns (Dženopoljac *et al*, 2017; Maji & Hussain, 2021). HC corresponds with the company's employees' wages and salaries, whereas SC was calculated as the subtraction of HC from VA. According to A. Pulić (2000), the sum of HCE and SCE is expressed as the indicator of Intellectual Capital Efficiency (ICE) (Maji & Hussain, 2021).

$$HCE = \frac{VA}{HC} \tag{2}$$

$$SCE = \frac{SC}{VA} \tag{3}$$

$$SC = VA - HC \tag{4}$$

$$CEE = \frac{VA}{CE} \tag{5}$$

If all these three coefficients are summed, the calculation of *VAIC* reads as follows:

$$VAIC = HCE + SCE + CEE \tag{6}$$

$$ICE = HCE + SCE \tag{7}$$

$$VAIC = ICE + CEE \tag{8}$$

The model has its limitations, too, e.g. the incomplete calculation of structural capital (research and development costs are not involved in the calculation of structural capital). The VAIC model does not involve the relational capital efficiency coefficient, either (Chen *et al*, 2005). VAIC model does not differentiate between assets and costs, nor does it make a difference between inventory and the inventory flow (changes). The VAIC model interprets the isolated contribution of the three types of capital, simultaneously neglecting their combined impact on added value (Marzo, 2022).

Intangible assets in the form of isolated reservoirs cannot contribute to financial performance. It is more than simply the sum of its three components (Mondal & Ghosh, 2012). The explanation of the reciprocal contribution of human and structural capital is intuitive and requires empirical evidence (Kai Wah Chu, Hang Chan & Wu, 2011). Some theorists attribute the incomplete coverage of structural capital (Morariu, 2014) and relational capital to the VAIC model. The VAIC model has a limitation where it only considers annual investments made in human capital, which can be confusing as it fails to account for the total value of employees resulting from the company's previous investments. Therefore, human capital is expressed inconsistently over time. The experience curve, which was introduced in the late 1960s, shows that there is a temporal difference in matching labor costs and generating future added value (Marzo, 2022). However, the intention in the VAIC model does not relate to the use of labor costs from an accounting perspective, but rather the intention is to encompass the incremental contribution that employees reflect on added value, which justifies the conclusion that employees' wages are investments because the company expects future benefits from such investments (Marzo, 2022). The VAIC model is also criticized for its inability to be applied to the companies whose profit is negative, which (according to the VAIC logic) have achieved negative value added (VA). In other words, the company spends more on inputs than on the output amount (Kai Wah Chu *et al*, 2011). P. Ståhle, S. Ståhle and S. Aho (2011) mentioned the problematic mathematical construction that relates human capital to its efficiency, which as such suggests that the lower human capital (labor costs), the higher its efficiency. This creates an issue when comparing intangible assets between the companies that have different wage structures as it can undermine the results (Ståhle *et al*, 2011). Despite the mentioned limitations, however, M. Holienka, A. Pilková and M. Kubišová (2016) indicate that this model is the best and most pragmatic solution to studying the impact of intangible assets on the creation of companies' value. The VAIC methodology is based upon available financial information and represents the most suitable system that can be used in empirical research (Holienka *et al*, 2016).

Intangible assets and profitability ratios

In 1959, E. Penrose introduced resource-based theory, which shifted the traditional view of companies as mere administrative entities. Instead, she proposed that companies were composed of various resources managers can utilize to gain a competitive advantage. This competitive advantage is achieved by owning unique and valuable resources that are difficult to replicate and with significant market value (Pike *et al*, 2005). H. Itami (1987) played a significant role in developing intangible assets theory, also known as "invisible assets." In his famous book entitled "Mobilizing Invisible Assets", H. Itami was one of the pioneers to explain that intangible assets such as technology, customer knowledge, and business culture were crucial resources for a company to gain a competitive edge (Kolaković, 2003; Pike *et al*, 2005). Knowledge and information are crucial for creating value in the digital economy, making a company's assets increasingly knowledge-intensive (Ghosh & Mondal, 2009), which means economic value is derived more from intangible assets than from physical ones (Kai Wah Chu *et al*, 2011). Intangible assets are also defined as "something that cannot be touched, yet slowly makes you rich," or as the "knowledge that can be converted into a profit" (Ghosh & Mondal, 2009, p. 370). The contemporary B2C business model implies departure from traditional dependence on physical assets for gaining a competitive edge.

Companies accumulate intangible assets through innovations, employees, and organization, according to G. G. Ciprian *et al*, 2012. Investing heavily in intangible assets may offer several advantages to companies, including scalability, non-depletion by use, and being difficult to imitate (Galbreath & Galvin, 2006). Scalability refers to the ability of intangible assets to be used in multiple places simultaneously, unlike physical, financial, and human assets that cannot be used for alternative simultaneous purposes (Haskel & Westlake, 2018). For instance, an airplane flying from San Francisco to London cannot be used simultaneously for a flight from San Francisco to Tokyo (Lev, 2001). In contrast, intangible assets can be used simultaneously without compromising each other's use. For example, while an airplane

and the crew can only serve one flight at a time, the reservation software application can serve multiple users simultaneously (Lev, 2001).

Intangible assets are assets difficult to replicate in the market. For instance, the iPhone design was not the unique feature of its intangible asset. *Apple* made investments in technology development, customer service (the Apple Store), brand development, market channels, and the innovative Just-in-Time (JIT) concept (Haskel & Westlake, 2018). By combining various forms of intangible and physical assets, favorable financial performance is achieved (Oppong *et al*, 2019). The combined value of these assets exceeds the sum of their values. In other words, the total value of the assets ($a_1 + a_2 + ...a_n$) is less than their combined synergistic value *a*, *i.e.* $a > \sum (a_1 + a_2 + ...a_n)$ (Ghalib, 2004). According to the above-mentioned, intangible assets represent a critically important collection of resources for creating a sustainable competitive advantage for a company (Ionita & Dinu, 2021). Competitive advantage correlates with companies' financial performance such as their revenue, corporate profitability margins, and better market indicators. The studies in which researchers analyze the impact of intangible assets on various financial performances are numerous. In the last 25 years, researchers have invested a considerable effort in elucidating the role of intangible assets in the condition of firms' profitability ratios. The VAIC model and the elementary components of the VAIC coefficient such as ICE and CEE (Radić, 2018; Rastić, Stevanović & Antić, 2021) or HCE, SCE, and CEE (Maditinos, Chatzoudes, Tsairidis & Theriou, 2011; Sardo & Serrasqueiro, 2017) are the most prominent accounting format for intangible assets used in studies (Bhattu-Babajee & Seetanah, 2022). For example, F. Sardo and Z. Serrasqueiro (2017) found a statistically significant positive relationship between HCE and ROA, on the one hand, and between CEE and ROA, on the other, in a longitudinal study conducted on a sample of 2,090 companies from 14 European Union member countries (Sardo & Serrasqueiro, 2017). D. Zéghal and A. Maaloul (2010) studied the impact of VAIC on companies' operating profit margin, ROA, and the market-to-book ratio (M/B ratio). The authors analyzed the high-tech, traditional, and service sectors on a sample of 300 companies in the United Kingdom for the year 2005 and came to the following conclusions: first, they identified a significant impact of the VAIC coefficient on the operating profit margin and ROA in all the three sectors, with but one exception referring to the high-tech sector, where no positive impact of CEE was found, which on its part implies that the high-tech sector was characterized by ROA being highly affected by intangible assets; second, in the case of the M/B ratio, a positive impact of the VAIC coefficient was only identified for the high-tech sector. In other words, investors perceive the companies that cultivate a higher level of intangible assets as more attractive; third, for the traditional and service sectors in the United Kingdom, investors still undervalue investments in intangible assets because no positive impact on M/B was found (Zéghal & Maaloul, 2010).

Using the financial statements of 96 Greek companies, D. Maditinos *et al* (2011) found in their study that HCE, SCE, and CEE had not been sufficiently stimulated to achieve their respective financial performances. More precisely, the findings are indicative of the fact that a significant positive relationship is only seen between HCE and ROE (from 2006 to 2008). No statistically positive impact on the M/B ratio, ROA, and sales growth was found, the conclusion being that the results for the Greek firms could be attributed to the insufficient exploitation of intangible assets and the fact that the Greek economy still created value from the exploitation of physical assets (Maditinos *et al*, 2011). M. Joshi, D. Cahill, J. Sidhu and M. Kansal (2013) tested the impact of intangible assets on ROA in the financial sector composed of 33 Austrian firms and found that HCE and SCE positively corresponded with ROA in banks, insurance companies, and investment funds (Joshi *et al*, 2013).

V. Dženopoljac *et al* (2017) tested the impact of the VAIC components on the three aspects of financial performance: first, profitability ratios (earnings before interest and taxes (EBIT), earnings before interest, taxes, depreciation, and amortization (EBITDA), ROE, ROA, the net profit margin, the EBITDA margin, and the gross profit Margin); second, the efficiency ratio ATO (Asset Turnover), and third, the M/B ratio, only to have come to the following findings: first, EBIT and

EBITDA correspond significantly with increases in SCE and CEE. These two components (SCE and CEE) also affect ROA, whereas ROE is only affected by CEE; second, the efficiency ratio (ATO) is affected by CEE, and third, M/B variability is only determined by the positive impact of HCE (Dženopoljac *et al*, 2017).

H. Pew Tan, D. Plowman and P. Hancock (2007) tested the impact of intangible assets in the firms operating in Singapore's economy. The 450 annual reports of 150 firms used in the study confirmed the four hypotheses for the period from 2000 to 2002. First, the VAIC model coefficients were proven to have positively correlated and to have been in a statistically significant positive relationship with ROE, earnings per share (EPS), and annual stock return (ASR). Second, the increase in HCE and SCE within the company affected future financial performances and the contribution of HCE and SCE was different for the sectors depending on the intensity of intangible assets within them. For example, they concluded that the variability of financial performances was largely explained by the impact of intangible assets in the service sector (Pew Tan *et al*, 2007).

R. Bhattu-Babajee and B. Seetanah (2022) found that VAIC positively impacted the financial performances found in a sample of 152 Mauritian firms. In the long- and short-term intervals, the VAIC coefficient had a positive and significant impact on ROA, ROE, and Tobin's Q. The influence of the VAIC coefficient on financial performance had weaker effects in the short term than in the long term. In other words, the authors noticed that the full effects of investments in intangible assets were time delayed. Reverse causality was also identified by the authors when the impact of financial performances on the VAIC coefficient was concerned, which is extremely important for stimulating employees' motivation because human capital is an integral component of the VAIC model (Bhattu-Babajee & Seetanah, 2022).

S. G. Maji and F. Hussain (2021) found a positive impact of ICE and technical efficiency on the financial performances of the banks in India for the period from 2005 to 2018, this impact, however, not being perceived in the lower performance quantiles that the banks had achieved, which suggests that ICE and technical efficiency represented the watershed of the successful and unsuccessful banks (Maji & Hussain, 2021).

C. Ionita and E. Dinu (2021) found no impact of intangible assets (recognized in the form of patents and R&D) on the sustainable growth rate (SGR) and the firm's value (FV) in Romanian companies. Their database contained a sample of the 78 companies listed on the Bucharest Stock Exchange (BSE) for the period from 2016 to 2019 (Ionita & Dinu, 2021). A. Rastić *et al* (2021), however, found a positive impact of ICE on SGR in the example of 67 Serbian companies for the period from 2015 to 2019 (Rastić *et al*, 2021). B. Komnenić and D. Pokrajčić (2012) identified a positive impact of HCE and CEE on ROE, ROA, and ATO, as well as a positive influence of SCE on ROE. On a sample of 31 multinational companies operating in Serbia, the authors confirmed the fact that the additional stimulation of structural capital was necessary (Komnenić & Pokrajčić, 2012).

In compliance with the findings of the foregoing studies, the following hypotheses were set:

H1: There is a positive impact of intangible assets on the net profit margin (NPM).

- H1a: Firms with a higher ICE coefficient tend to have a higher NPM.
- H1b: Firms with a higher CEE coefficient tend to have a higher NPM.

H2: There is a positive impact of intangible assets on the EBITDA margin (EBITDAm).

- H2a: Firms with a higher ICE coefficient tend to have a higher EBITDAm.
- H2b: Firms with a higher CEE coefficient tend to have higher EBITDAm.

H3: There is a positive impact of intangible assets on return on assets (ROA).

- H3a: Firms with a higher ICE coefficient tend to have higher ROA.
- H3b: Firms with a higher CEE coefficient tend to have higher ROA.

H4: There is a positive impact of intangible assets on return on equity (ROE).

H4a: Firms with a higher ICE coefficient tend to have higher ROE.

H4b: Firms with a higher CEE coefficient tend to have higher ROE.

In compliance with the hypotheses from 1a to 4b, the following figure was created (Figure 1).

RESEARCH METHODOLOGY

Data collection

To test the hypotheses 1a-4b, a sample of the companies based in Serbia was singled out from the official list published by the Serbian Business Registers Agency (SBRA) in November 2021 (SBRA, 2021), which involved the companies that had achieved the highest net profits in 2020. The data published after 2021 were not included in the list due to the significant impact COVID had had on the companies' performance. The data contain the financial statements of these companies for the period from 2017 to 2020. The firms that had not met the VAIC requirements were excluded from the sample (the companies that had had a negative operating profit in the given period). The definitive research sample contained the financial information of the following 72 firms (Table 1).

The definitive sample incorporates the data obtained from various industrial sectors, including the Manufacturing Sector (Pharmacy, Chemicals, Food and Drinks, Tobacco, Weapons, Wood, Packages, Furniture, and Textiles) comprising 46.48%, Transportation, Communications, Electric, Gas, and Mining making up 23.61%, Construction accounting for 13.89%, Trade and Consumer Services participating 9.73%, and Agriculture contributing 6.29%. After the data had been sorted out, a total of 288 observations were made, with four observations per year. A. Rastić, T. Stevanović and M. Staletović (2022) analyzed the same SBRA official list, but only the first ten companies. According to the authors, *Telenor* had the highest HCE and SCE coefficients, only to be followed by *Philip Morris Operations* and *VIP Mobile* (currently known as A1). The authors concluded that those highly profitable companies also had high VAIC coefficients, which suggests that the VAIC coefficients may correspond with the profit measures in Serbian companies. However, further analysis is required to confirm this conclusion (Rastić *et al*, 2022).

Regression models

To test the hypotheses 1a-4b, it is necessary to create regression models. Regression models contain a

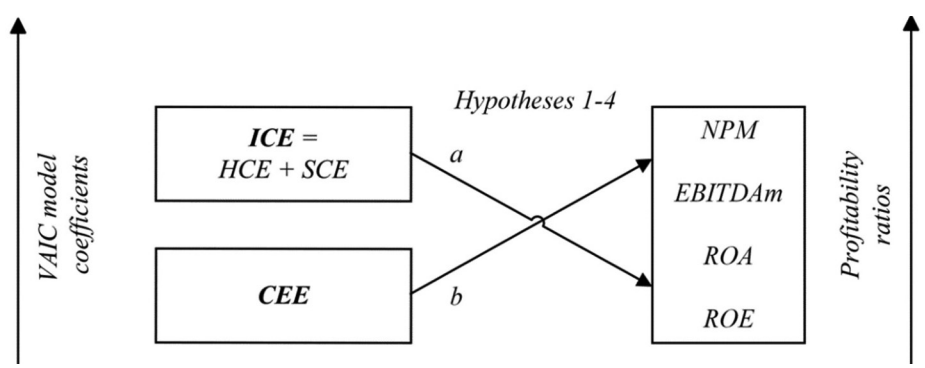

Figure 1 The illustrated view of the hypotheses H1a–H4b

Source: Authors

Table 1 The research sample: the most profitable firms in Serbia in 2020

JP Electric Power Industry of Serbia	Ball Packaging Europe Bel-grade	Gebi
Tigar Tyres Manufacturing Company	Pink International Company	Integral Engineering Branch
Telenor	Koteks Viscofan	My Supernova
Zijin Bor Copper	Lafarge Beočin Cement Facto-ry	Radun Inžinjering
Coca-Cola Hellenic Bottling Company - Serbia	Sinofarm Manufacturing and Trading Company	Galenika Phytopharmacy for Agricultural Chemicals Produc-tion
Telekom Serbia Telecommu-nications Company	Imlek Dairy and Dairy Prod-ucts Industry	Jysk
Philip Morris Operations	MOL Serbia Oil and Gas Trad-ing Company	Euro Road
Hemofarm	DM Invest Construction and Engineering Company	Flash
Delhaize Serbia	Banatski Dvor Underground Gas Storage	Polimark
Vip Mobile	Drenik ND Manufacturing Company	Nicefoods Restaurants
Farmina Pet Foods	Sport Time Trading and Media-tion Company	Teklas Automotive
Serbia Broadband – Serbian Cable Networks	PC Jugoimport-SDPR	Knez Petrol
PUC Belgrade Power Plants	Pharmaswiss	Valjevo Road Company
Tarkett Flooring Manufactur-ing Company	Phuket	Nelt
JP Srbijagas	Sport Vision Trading and Me-diation Company	Agromarket
CRH (Serbia)	Knjaz Miloš Mineral Water and Beverage Production Compa-ny	Mozzart
Grundfos Serbia	Heineken Serbia	Magna Pharmacia
Henkel Serbia	Forma Ideale Furniture Manu-facturing and Trading Compa-ny	RZD International
Tetra Pak Production	Planinka Company for Natural Spas, Tourism, Hospitality, and Production	Messer Technogas Company for Technical and Medical Gases Production and Trading and Ac-companying Equipment
Peštan	Sunoko Sugar Production and Trading Company	Titan Kosjerić Cement Plant
Karin Komerc	Matijević Meat Industry	Contitech Fluid Serbia
Johnson Electric	Strabag	Atlantic Grand
Almex	Phoenix Pharma	PC Post of Serbia
Japan Tobacco International	Inkop Construction Company	Bambi Confectionery Products Manufacturing and Trading Concern

Source: Serbian Business Registers Agency

specific constellation of the relationships between the dependent variable and the independent variables. In the case of the hypotheses 1a-4b, the dependent variables are the net profit margin (NPM), the EBITDA margin (EBITDAm), ROA, and ROE. The independent variables (explanatory variables) in the regression models are ICE and CEE. According to the hypotheses 1a-4b, the regression models are set in the following way:

$$NPM_{i,t} = \beta_0 + \beta_1 ICE_{i,t} + \beta_2 CEE_{i,t} + \varepsilon_{i,t} \quad (9)$$

$$EBITDAm_{i,t} = \beta_0 + \beta_1 ICE_{i,t} + \beta_2 CEE_{i,t} + \varepsilon_{i,t} \quad (10)$$

$$ROA_{i,t} = \beta_0 + \beta_1 ICE_{i,t} + \beta_2 CEE_{i,t} + \varepsilon_{i,t} \quad (11)$$

$$ROE_{i,t} = \beta_0 + \beta_1 ICE_{i,t} + \beta_2 CEE_{i,t} + \varepsilon_{i,t} \quad (12)$$

RESULTS AND DISCUSSION

Descriptive statistics and correlation analysis

The descriptive statistics (Table 2) contain the information about the independent and dependent variables. Based upon 288 observations, the means for the independent variables ICE and CEE are 4.318 and 0.774, respectively. The standard deviations for ICE and CEE are 2.67 and 0.77, respectively. The means for the dependent variables EBITDAm, NPM, ROA, and ROE are 21, 14.96, 15.67, and 32.96, respectively. The standard deviation for EBITDAm is 13.79, while for NPM it is 18.22, 16.73 for ROA, and 34.79 for ROE.

The Kolmogorov-Smirnov test ($p < 0.0005$) indicates the absence of normality in the distribution of the values of the variables (Table 3).

With the absence of normal distribution, it is necessary to implement correlation analysis with Spearman's correlation coefficient (r_s) (Table 4).

After correlation analysis had been conducted, the results showed the presence of weak correlation ($r < 0.5$), moderate correlation ($0.5 \leq r < 0.75$), and strong correlation ($r \geq 0.75$).

A weak positive and statistically significant correlation was identified between the ICE coefficient and RiOE, where $r_s = 0.243$ ($p < 0.05$).

A weak positive correlation between the CEE coefficient with NPM and EBITDAm was also identified.

A weak positive correlation was identified between the ICE coefficient and the dependent variables ROA and NPM, where $r_s = 0.300$ ($p < 0.05$) and $r_s = 0.393$ ($p < 0.05$), respectively.

A moderate positive correlation between the CEE coefficient and ROA was also identified.

Table 2 The descriptive statistics

	N	Mean	Std. Deviation	Min	Max
ICE	288	4.32	2.67	1.04	27.71
CEE	288	0.77	0.77	0.05	5.60
EBITDAm	288	21.01	13.80	0.24	70.95
NPM	288	14.97	18.22	0.12	247.86
ROA	288	15.67	16.73	0.08	123.09
ROE	288	32.96	34.79	0.23	305.89

Source: Authors

Table 3 The normality test results

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistics	df	Sig.	Statistic	df	Sig.
ICE	0.141	288	0.000	0.737	288	0.000
CEE	0.196	288	0.000	0.697	288	0.000
EBITDAm	0.122	288	0.000	0.932	288	0.000
NPM	0.208	288	0.000	0.469	288	0.000
ROA	0.177	288	0.000	0.693	288	0.000
ROE	0.190	288	0.000	0.697	288	0.000

Source: Authors

Table 4 The correlation analysis

			ICE	CEE	EBITDAm	NPM	ROA	ROE
Spearman's rho	ICE	Cor-rela-tion co-effi-cient	1.000	0.041	0.558**	0.393**	0.300**	0.243**
		Sig. (2-tailed)	-	0.492	0.000	0.000	0.000	0.000
		N	288	288	288	288	288	288
	CEE	Cor-rela-tion co-effi-cient	0.041	1.000	0.250**	0.061	0.366**	0.726**
		Sig. (2-tailed)	0.492	-	0.000	0.303	0.000	0.000
		N	288	288	288	288	288	288

**Correlation is significant at the 0.01 level (2-tailed).

Source: Authors

A moderate positive correlation was identified between the ICE coefficient and EBITDAm, where $r_s = 0.558$ ($p < 0.05$).

A strong positive correlation between the CEE coefficient and ROE was also identified.

The analysis of the regression models

The multivariate linear regression of the first model (Table 5) indicates that the intangible assets in the model significantly affect the variability of NPM. The determination coefficient (R^2) shows that the coefficients ICE and CEE explain 2.4% of the variability of NPM. Although the explanatory power of the model is only 2.4% (R^2), the model is statistically significant ($p = 0.030$, $p < 0.05$). The standardized beta coefficient for ICE is $\beta = 0.155$ ($p < 0.05$), which confirms the hypothesis H1a. The higher the ICE coefficient, the higher NPM. The results show that the impact of CEE on NPM is negative but not statistically significant, so the hypothesis H1b is not confirmed ($p > 0.05$). According to the partial correlation coefficient (0.154), ICE explains uniquely 2.37% (based on the partial coefficient's squared value) of the NPM variability in the model.

The regression analysis results of the second model indicate that the intangible assets in the model significantly affect the variability of EBITDAm. The determination coefficient (R^2) shows that the ICE and CEE coefficients account for 27.4% of the variability of EBITDAm ($p < 0.05$). The independent variables (ICE, CEE) contribute statistically significantly to the variability of EBITDAm. The beta coefficient for ICE is $\beta = 0.477$ ($p < 0.05$) which explains that the hypothesis H2a is confirmed. The higher the ICE ratio, the higher EBITDAm. The impact of CEE on EBITDAm is positive and statistically significant $\beta = 0.188$ ($p < 0.05$), which explains why the hypothesis H2b is confirmed. Based upon the partial correlation coefficient (0.476), ICE explains uniquely 22.65% (the partial coefficient's squared value) of the variability of EBITDAm in the model. In comparison, the remaining part of the variability of NPM that is attributable to CEE amounts to 3.53% (Table 6).

Table 5 Multivariate linear regression for NPM

	R	R^2	Sig. (model)	Const.	Standardized coefficients Beta	Sig.	Unstandardized coefficients Beta	Correla-tions Part	Collinearity statistics	
									Tolerance	VIF
ICE	0.156	0.024	0.000	10.987	0.155	0.009	1.055	0.154	0.996	1.004
CEE	0.156	0.024	0.000	10.987	-0.032	0.591	-0.742	-0.031	0.996	1.004

Source: Authors

The analysis of the third regression model indicates that the intangible assets in the model significantly affect the variability of ROA. The determination coefficient (R^2) shows that the ICE and CEE coefficients explain 27.8% of the variability of ROA as a dependent variable ($p < 0.05$) (Table 7). The beta coefficient for ICE is $\beta = 0.229$ ($p < 0.05$), which confirms the hypothesis H3a. The higher the ICE coefficient, the higher ROA. The impact of CEE on ROA is positive and statistically significant, $\beta = 0.461$ ($p < 0.05$), which confirms the hypothesis H3b. Based on $Part^2$ (Part = 0.228), ICE explains 5.2% of ROA variability in the model, whereas the remaining part of ROA variability is attributable to CEE ($Part^2$=21.16%).

The analysis of the fourth regression model indicates that the intangible assets in the model significantly affect the variability of ROE. The determination coefficient (R^2) shows that the IiCE and CEE coefficients account for 68.5% of ROE variability ($p < 0.05$) (Table 8). The beta coefficient for ICE is $\beta = 0.131$ ($p < 0.05$), which confirms the hypothesis H4a. The higher the ICE coefficient, the higher ROE. The impact of CEE on ROE is positive and statistically significant, $\beta = 0.809$ ($p < 0.05$), which confirms the hypothesis H4b. ICE explains 1.69% and CEE explains 65.3% of ROE variability, respectively.

It can be concluded that the hypothesis 1 is partly confirmed, whereas the hypothesis 2, hypothesis 3, and hypothesis 4 are fully confirmed.

Table 6 Multivariate linear regression for EBITDAm

	R	R^2	Sig. (model)	Const.	Standardized coefficients Beta	Sig.	Un-standardized coefficients Beta	Correla-tions Part	Collinearity statistics	
									Toler-ance	VIF
ICE	0.523	0.274	0.000	7.767	0.477	0.000	2.464	0.476	0.996	1.004
CEE	0.523	0.274	0.000	7.767	0.188	0.000	3.354	0.188	0.996	1.004

Source: Authors

Table 7 Multivariate linear regression for ROA

	R	R^2	Sig. (model)	Const.	Standardized coefficients Beta	Sig.	Un-standardized coefficients Beta	Correla-tions Part	Collinearity statistics	
									Toler-ance	VIF
ICE	0.527	0.278	0.000	1.770	0.229	0.000	1.433	0.228	0.996	1.004
CEE	0.527	0.278	0.000	1.770	0.461	0.000	9.954	0.460	0.996	1.004

Source: Authors

Table 8 Multivariate linear regression for ROE

	R	R^2	Sig. (model)	Const.	Standardized coefficients Beta	Sig.	Un-standardized coefficients Beta	Correla-tions Part	Collinearity statistics	
									Toler-ance	VIF
ICE	0.828	0.685	0.000	2.550	0.131	0.000	1.701	0.130	0.996	1.004
CEE	0.828	0.685	0.000	2.550	0.809	0.000	36.365	0.808	0.996	1.004

Source: Authors

PRACTICAL IMPLICATIONS OF THE RESEARCH RESULTS

The results obtained from the regression analysis indicate a positive ICE impact on NPM, which is consistent with the previous studies (Xu & Li, 2019) and confirms the fact that resource allocation towards intangible assets is advantageous for Serbian companies. This could also influence investors', analysts', and stakeholders' perceptions. It is very important, however, to implement effective knowledge management in Serbian companies so as to enhance intellectual capital. The EBITDA margin is affected by ICE, which is consistent with the previous results (Zéghal & Maaloul, 2010). Over 22% of the EBITDA margin change was identified to be attributed to the ICE coefficient, which findings suggest that intangible assets improve the operational efficiency of the Serbian companies. The Serbian companies that efficiently use intellectual capital could also benefit from cost reduction or higher revenue generation. The company's ROA variability is also affected by ICE, which is consistent with the previous studies (Komnenić & Pokrajčić, 2012; Joshi *et al*, 2013; Sardo & Serrasqueiro, 2017; Radić, 2018). These results suggest that the Serbian companies efficiently use their intangibles (in the form of skilled workers and effective business culture, innovations, software, etc.) to generate returns from other assets. ICE is also responsible for ROE variability in the observed period, which is in line with the previous findings (Pew Tan *et al*, 2007; Maditinos *et al*, 2011; Dženopoljac *et al*, 2017). It means that intellectual capital significantly contributes to value creation for shareholders relative to the equity invested.

The Serbian companies should prioritize the initiatives that enhance and stimulate intangible assets to maximize financial performance. However, the other studies carried out in Serbia showed slightly different or contradictory effects of intangible assets. For example, when assessing the impact of intellectual capital on performance within the companies in Serbia's real sector, that impact was small or irrelevant (Janošević & Dženopoljac, 2011). Furthermore, a study on the most successful exporters in Serbia revealed no significant impact of intangibles on their performance (Janošević & Dženopoljac, 2012).

CEE's effect on NPM was negative and not statistically significant. CEE's impact on the EBITDA margin is relatively weak compared to the positive impact that ICE has on it, which could mean that there is an overinvestment in fixed assets, but more evidence is needed for such a conclusion to be made. If the Serbian companies' assets converge more towards fixed assets, the high depreciation costs incurred by the company will appear, which creates the impression that CEE does not affect the realization of corporate margins or has a negative effect. The results, however, suggest that the Serbian companies that are more intangible-intensive tend to create higher returns relative to their physical assets. Otherwise, V. Dženopoljac *et al* (2017) stated that the absence of a relationship between CEE and the company's corporate margins could also be attributed to the weaknesses of the VAIC model (Dženopoljac *et al*, 2017). ROA and ROE are relatively more affected by the CEE coefficient than by the ICE coefficient. CEE was found to be the strongest determinant to affect the variability of ROA and ROE.

The obtained results suggest that additional management refocusing is needed in the Serbian companies. The proven causality between ICE and the companies' profitability suggests that managers should make additional efforts to translate the utilization of intangible assets into financial performance. It is necessary to stimulate the activities of human and structural capital exploitation, which could be done through cherishing the organizational culture supportive of the development of talents and skills, creativity, and analytical tools in order to establish knowledge sharing. More investments are needed to foster innovation in terms of new products, processes, and technologies so as to enhance financial performance. The reactivation of decision-making towards intangible assets in the Serbian companies, however, necessitates the integration of intangible assets into a business strategy and the involvement of the intangible assets valuation models such as VAIC or, as M. Cosa, E. Pedro and B. Urban (2023) suggest, the intellectual capital key performance indicators (KPI).

CONCLUSION

The data from the year 2021 onwards were excluded in order to control the COVID-19 impact. The research examines the relationship between the intangible assets and profitability of the companies operating in Serbia officially listed as the most profitable ones in 2020. The study is based on the financial reports (financial position statements and income statements) of the most profitable Serbian companies in the period from 2017 to 2020. The study defines intangible assets as a combination of human and structural capital measured using the VAIC's ICE coefficient. Company profitability is measured using financial ratios, such as NPM, EBITDA margin, ROA, and ROE. The study reveals that the ICE coefficient has a significant influence on the profitability ratios. The research findings suggest the four main conclusions. Firstly, the ICE and CEE of the first model account for 2.4% of NPM variability. Secondly, the ICE and CEE coefficients explain 27.4% of the EBITDA margin variability, with the ICE coefficient alone accounting for more than 22% of the change in the EBITDA margin. Thirdly, the ICE and CEE coefficients explain 27.8% of ROA, with ICE explaining 5.1% of ROA on its own. Fourthly and finally, the ICE and CEE coefficients account for 68.5% of ROE. Based on these findings, the hypothesis 1 is partly confirmed, whereas the hypotheses 2, 3, and 4 are fully confirmed.

It is suggested that managers in the Serbian firms should additionally stimulate investments and the efficient use of intangible assets. Through the evident causality found in the study, the profitability of the Serbian business sector will be improved.

Despite the authors' honest intentions, the research study has some limitations. The authors decided not to use any data published after 2021 in their research due to the unprecedented impact of the COVID-19 pandemic on the companies' performance. As a result, the data sample used in the study is relatively small, only covering a narrow timeframe from 2017 to 2020, with the observations taken from the financial statements of those companies. The study does not involve control variables in the regression analysis. The limitations also correspond with the VAIC model. In spite of the limitations mentioned, the findings of the study still remain valid and reliable.

Future researchers are also suggested to analyze the effect of intangible assets on profitability to strengthen the management's perception according to which investments in intangible assets lead to an increase in the company's profitability. An extended timeseries framework and the adapted versions of the VAIC model are desirable in future research studies.

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Received on 11th January 2024,
after revision,
accepted for publication on 10th July 2024.
Published online on 29th August 2024.

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