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INTELLECTUAL CAPITAL AND FINANCIAL PERFORMANCE OF SERBIAN COMPANIES IN THE REAL SECTOR*

Intelektualni kapital i finansijske performanse srpskih preduzeća iz realnog sektora

Abstract

There is significant evidence that intellectual capital (IC) determines a company's potential for growth and generates the majority of its added value. Thus, research into measuring and analyzing IC and determining its impact on the financial and market performance of companies is gaining increasing interest. Different forms of IC such as knowledge, skills, talent, enthusiasm, patents, know-how, software, databases, close customer relations, brand, unique organizational design, and corporate culture can be categorized into human, structural, and relational capital. This paper explores the impact of IC, measured using the Value Added Intellectual Coefficient (VAIC™), on the financial performance of 100 Serbian companies in the real sector that achieved the highest net profits in 2010. We also analyze the impact of various individual IC components on financial performance. Scientific hypotheses are developed according to similar studies on IC and financial performance. Performance measures used in this research are net profit, operating revenues, operating profit, return on equity, and return on assets. Data is analyzed using statistical methods of correlation and regression (single and multiple). A simple regression model is used to indicate the relationship between VAIC, as an aggregate measure, and the financial performance of the selected companies, while multiple-regression models are employed to determine the relationship between individual components of VAIC and financial performance. Although the majority of similar studies so far show that IC has a significant impact on financial performance, this causality in the case of Serbian companies is small or irrelevant.

Key words: *IC, intangible assets, financial performance, Value Added Intellectual Capital (VAIC)*

Sažetak

Brojni su dokazi koji nedvosmisleno ukazuju na činjenicu da intelektualni kapital (engl. Intellectual Capital, IC) opredeljuje potencijal rasta preduzeća i generiše najveći deo uvećane vrednosti. Stoga sve više dobijaju na značaju i aktuelnosti istraživački naponi usmereni na merenje IC-a i njegovog uticaja na finansijske i tržišne performanse preduzeća. Različiti pojavi oblici IC-a kao što su znanje, obučenosť, talentovanost i entuzijazam zaposlenih, patenti, know-how, softveri, baze podataka, prisni odnosi sa kupcima, snaga brenda, unikatni organizacioni dizajn i poslovna kultura, mogu se kategorizirati na ljudski, strukturni i relacioni kapital. U radu se analizira međuzavisnost između IC-a, iskazanog pomoću koeficijenta dodate vrednosti IC-a (engl. Value Added Intellectual Coefficient, VAIC™), i finansijskih performansi 100 preduzeća iz realnog sektora Srbije koja su 2010. godine ostvarila najveću neto dobit. Pored ovoga, cilj istraživanja je i sagledavanje uticaja pojedinih komponenti IC-a na finansijske performanse. Hipoteze koje se testiraju razvijene su u skladu sa većim brojem sličnih studija u kojima je istraživani odnos IC-a i finansijskih performansi poslovanja. Merila performansi korišćena u okviru istraživanja su neto dobit, poslovni dobitak, poslovni prihodi, prinos na sopstveni kapital (engl. Return on Equity, ROE), prinos na ukupnu imovinu (engl. Return on Assets, ROA). Analiza prikupljenih podataka je izvršena primenom statističkih metoda korelacije i regresije (jednostruka i višestruka). Metod jednostruke regresije je korišćen da bi se sagledao uticaj VAIC™-a, kao agregatne veličine, na performanse izabranih preduzeća. Višestrukom regresijom je utvrđivana međuzavisnost između pojedinih komponenti koeficijenta VAIC™ i finansijskih performansi. Mada najveći broj do sada sprovedenih istraživanja ovog tipa u svetu ukazuje na značajan uticaj IC-a i njegovih komponenti na finansijske performanse, u slučaju srpskih preduzeća ova međuzavisnost je mala ili zanemarljiva.

Ključne reči: *intelektualni kapital, nematerijalna aktiva, finansijske performanse, koeficijent dodate vrednosti IC-a (VAIC™)*

* This edition is dedicated to the project financed by the Ministry of education and science titled "Strategic and tactical measures to overcome real sector competitiveness crisis in Serbia"(n. 179050, period 2011-2014)

Introduction

Unlike the industrial era, in the information era, resources that do not have a physical form are gaining increasing interest and are therefore becoming critical factors to success. Compared to visible and physical resources, which have financial bases (equipment, buildings, land, plants, materials, financial property, etc.), intangible resources such as disposable knowledge, information, skills, talents, close customer relations, corporate culture, reputation, information systems, and organizational practices are not explicitly visible. These non-material resources and the ability to exploit them accordingly form the essence of intellectual capital (IC). Value created by IC is greater than that created by the use of material assets.

Some companies recognize the importance of investing in IC in achieving competitive advantage. The most successful companies tend to have an IC that is 10 or 20 times the value of their material assets. Economic crises in particular highlight the importance of investing in IC; that is, these investments represent the best way of coping with today's economic climate.¹ However, despite its importance, determining the value and effects of IC remains highly challenging. For this reason, many researchers have focused on evaluating IC and establishing its effects on corporate performance. This is particularly important for the Serbian economy, since the current low competitiveness level of its real sector highlights the need for a strategy for its increase. In order to establish the main initiatives for such a strategy, it is vital to examine the practices of the best performers in this sector.

The present paper examines the relationship between IC and the financial performance of companies that achieved the greatest net profits in 2010 in the Serbian real sector. Empirical research was conducted using a sample of 100 companies from this sector that showed the highest net profits. Tested hypotheses were developed according to similar studies investigating the impact of IC on financial performance. The paper is presented in sections that focus on specifically defined research objectives. Empirical

research provides results for correlation analysis, and two regression models, generated from analyzing the data in financial reports. The efficiency of use of invested capital (both intellectual and physical) is quantified through the Value Added Intellectual Coefficient (VAIC). Financial performance measures used in the research are net profit, operating profit, operating revenue, return on equity (ROE), and return on assets (ROA). These measures are mostly used in analyzing and comparing performance of companies in Serbia.

Literature review

Definition and the nature of IC

IC is defined in a variety of ways because it is not homogenous. It often describes different things from different perspectives (economics, strategic management, finance, accounting, human resources, marketing, and communication). In attempts to define and categorize IC, its potential benefits and its reliance on non-material resources tend to be stressed. Thus, "intellectual" refers to the fact that the source of this capital is the human mind and knowledge. Stewart² uses IC to mean "packaged useful knowledge," while he defines IC as knowledge, information, intellectual property, and expertise that may be used for value creation. Sullivan³ focuses on the importance of knowledge, which represents the most significant part of IC, and defines IC as knowledge that can be converted into value. Edvinsson and Malone⁴ view IC as being equal to human capital plus structural capital. They define structural capital as hardware, software, databases, organizational structure, patents, trademarks, and other organizational capabilities.

An often-used synonym for IC is intangible assets. Logically, this "hidden value" could be viewed from the standpoint of a balance sheet's assets and capital. The very meaning of "intangible" indicates something that is not

1 Lev, B., "Remarks on the measurement, valuation, and reporting of intangible assets", *FRBNY Economic Policy Review*, September (2003) 17-21

2 Stewart, T. A., *Intellectual Capital: The New Wealth of Organizations*, Nicolas Brealey Publishing, London, 1998, p. 67

3 Sullivan, P. H., *Value - Driven Intellectual Capital: How to Convert Intangible Corporate Assets into Market Value*, John Wiley & Sons, New York, 2000, p. 228

4 Edvinsson, L. and Malone, M., *Intellectual Capital: Realizing Your Company's True Value by Funding Its Hidden Brainpower*, Harper Business, New York, 1997, p. 10-14

possible to touch, something that is barely describable or measurable. International accounting standard (IAS) 38⁵ defines intangible assets as non-monetary assets with no identifiable physical form. In addition to “intangible assets,” further synonyms for IC include “non-material resources,” “intangible capital,” “intangible values,” and “intellectual property”.⁶

Unlike tangible assets, whose value decreases over time owing to exploitation, the value of IC increases when it is used appropriately. Material resources are easier to obtain and imitate, while the creation of competencies and competitive advantage based on intangibles is far more complex. Value created by IC is indirect, potential, and contextual. IC rarely affects financial results directly, and the effects of investing in IC are uncertain. Different components of IC should interact continually. It is therefore difficult to value IC since its value is created indirectly and its effects tend to be delayed and uncertain. The value created is contextual because it depends on its fit with the strategy used, since the modern business environment demands that strategy is positioned at the center of the management process. Consequently, for value to be created, IC has to be linked to strategy⁷, and different forms of IC must be interrelated and connected to the company's tangible assets. It is through these links that the value of IC can increase further.

According to Choong⁸ and Dess et al.⁹, the measure of IC is the difference between a company's market and book value. Companies that focus mainly on physical assets have a lower market-to-book ratio (M/B ratio), and vice versa. However, this measure of IC has certain disadvantages. Firstly, for companies not listed on a stock exchange, the value of IC cannot be determined. Secondly, since the

measure is aggregate by nature, it is impossible to assess the individual components of IC and their contribution to value creation. Thirdly, the difference in the equation may be the result of many external factors to IC. For example, undervalued or overvalued positions of tangible assets on the balance sheet may reflect the market value of stock and even market capitalization, directly affecting the value of IC determined in this way. Fourthly, the ongoing economic crisis and its impact on stock prices represent further limitations to this measure, because the economic crisis has in many successful companies induced a “meltdown” of IC measured in this way. However, research shows that the majority of S&P500 companies did not invest significantly in the field of research and development (new technologies, brand improvement, trademarks, etc.), while at the same time investments in tangible assets increased.¹⁰ Fifthly, the limitations of using the difference between market and book value as a measure of IC become particularly visible in newly established capital markets. For instance, over 8–11 August 2011 the BELEX15 index on the Serbian stock exchange dropped 17% in only three days of trading.

If a company has a high M/B ratio, there are high expectations for its future business performance as generated by IC potential. One empirical study¹¹ on the M/B ratios of 3500 U.S. companies found that in 1978 there was no difference between the two values, since book value was at the level of 95% of market value. Twenty years later, book value was only 28% of market value. In 1982, out of every \$100 invested in S&P500 companies' share purchase, approximately \$62.3 went to tangible assets. Ten years later (1992), only \$37.9 out of \$100 was spent on material resources, and in 1999 this amount had dropped to just \$16. Newer research¹² indicates that, today, IC makes up around 75–85% of a company's total market value (Figure 1). In addition, data on S&P500 companies from the mid

5 International Accounting Standards Committee, *International Accounting Standard No 38 - Intangible Assets*, 2004

6 Kaufmann, L. and Schneider, Y., “Intangibles – a synthesis of current research”, *Journal of Intellectual Capital*, 3 (2004) 366-388; Choong, K. K., “Intellectual Capital: definitions, categorization and reporting models”, *Journal of Intellectual Capital*, 4 (2008) 609-638

7 Kaplan, R. and Norton, D., *Strategy Maps: Converting Intangible Assets into Tangible Outcomes*, Harvard Business School Press, Boston, 2004, p. 11

8 Choong, K. K., “Intellectual Capital: definitions, categorization and reporting models”, *Journal of Intellectual Capital*, 4 (2008) 612

9 Dess, G. G., Lumpkin, G. T. and Eisner, A. B., *Strategic Management (Text & Cases)*, McGraw - Hill International Edition, Boston, 2006, p. 118

10 Lev, B., “Remarks on the measurement, valuation, and reporting of intangible assets”, *FRBNY Economic Policy Review*, September (2003) 17-21

11 Dess, G. G., Lumpkin, G. T. and Eisner, A. B., *Strategic Management (Text & Cases)*, McGraw - Hill International Edition, Boston, 2006, p. 118

12 Lev, B., *Intangibles: Management, Measurement, and Reporting*, Brookings Institution Press, Washington, D.C., 2001; Kaplan, R. and Norton, D., *Strategy Maps: Converting Intangible Assets into Tangible Outcomes*, Harvard Business School Press, Boston, 2004; Cardoza, K., “The power of intangible assets: an analysis of the S&P 500”, *Les Nouvelles*, March (2006) 37

1980s reveal a significant increase in the book value of IC compared to each company's total book and market value. From 1975 to 2005, the proportion of total assets comprising the book value of IC rose from 1.9% to 43.2%, while at the same time the IC book value proportion of the market capitalization of companies increased from 1.6% to 15.5% (every ten years this share doubled).¹³

Figure 1: Growth in IC proportion of the market value of S&P500 companies over 1975–2010

Source: Ocean Tomo, "Intangible asset market value," available at <http://www.oceantomo.com/productsandservices/investments/intangible-market-value> (accessed 4 October 2011)

Approaches to defining and categorizing IC vary. Sveiby¹⁴, whose classification is often used, states that IC is made up of employee competencies, internal structure, and external structure. Employee competencies are the abilities of employees in terms of their knowledge, skills, and education. Internal structure entails patents, concepts, processes, technologies under development, IT, administration systems, and corporate culture. External structure includes relations with customers and suppliers, brand, and company reputation. A similar concept is

¹³ Cardoza, K., "The power of intangible assets: an analysis of the S&P 500", *Les Nouvelles*, March (2006) 37

¹⁴ Sveiby, K. E., *The New Organizational Wealth: Managing and Measuring Knowledge-based Assets*, Barrett - Kohler, San Francisco, 1997

used when categorizing IC into human, structural, and relational capital.¹⁵

The most important part of human capital is knowledge. It also comprises skills, creativity, talent, ability to learn, as well as responsibility, dedication, enthusiasm, and level of motivation. Structural capital includes the management process, corporate strategy and plans, software, databases, organizational structure, patents, trademarks, and every other organizational capability that supports employee productivity. In short, structural capital represents everything that stays in the office when the employees go home. Relational capital is actually external capital, which involves numerous external relationships with various stakeholders (customers, suppliers, creditors, investors, etc.) and their perceptions of the company. Examples of relational capital include brand, reputation, customer relations, partnerships with suppliers, agreements, licenses, sales channels, capacities for negotiation, and networking. Table 1 lists the main components of human, structural, and relational capital.

Conventional financial accounting and related performance measures do not align with the nature of the contemporary business environment, in which the majority of the value is created by IC. The market looks to the future while financial statements look to the past. In other words, financial statements and business ratios based on these statements do not supply sufficient relevant and timely information for adequate understanding of

¹⁵ MERITUM, *MERITUM Guidelines for Managing and Reporting on Intangibles*, Measuring Intangibles to Understand and Improve Innovation Management - MERITUM, Madrid, 2002; Seetharaman, A., Teng Low, K. L. and Saravanan, A. S., "Comparative justification on intellectual capital", *Journal of Intellectual Capital*, 4 (2004) 523-524; Bontis, N., "Assessing knowledge assets: a review of the models used to measure intellectual capital", *International Journal of Management Reviews*, 3 (2001) 41-60.

Table 1: Components of IC

IC		
Human capital	Structural capital	Relational capital
- Knowledge and skills	- Corporate culture	- Brand
- Trainings	- Management process	- Market reputation
- Creativity	- ICT systems	- Customer relations
- Ability to learn	- Corporate strategy and plans	- Communication with existing and new customers
- Responsibility, individualism, dedication	- Internal databases	- Ability to appeal to new customers
- Enthusiasm and level of motivation	- Software	- Business networks
- Flexibility and adaptability	- Patents, licenses, authorship rights	- Sales channels
- Attitudes (toward life, family, career, etc.)	- Franchises	- License agreements

the impact of IC on future value creation. The nature and potential of IC demands a new set of performance measures. Accordingly, the measurement and valuation of IC and its disclosure within financial statements have become increasingly prominent, with the aim of improving understanding how IC contributes to the value creation process. IAS 38 requires the disclosure of intangible assets within financial statements when it is evident that the company exploiting them will benefit directly from these intangibles in the future. In addition, IC should appear in financial statements according to IAS 38 when the costs of obtaining these intangibles can be estimated reliably. The challenge faced by the accounting profession is to find a suitable model for embedding the IC elements into financial statements.¹⁶

IC measurement

Today, the measurement of IC and its influence on a company's financial and market performance are crucial topics. Many attempts have been made to find a useful model for measuring the size and impact of IC on overall company performance. One early attempt in this area can be seen in the work of Edvinsson¹⁷, who developed a model for measuring IC (known as Skandia Navigator) while employed by the Swedish insurance company Skandia. Methods for measuring IC can be categorized into four large groups¹⁸: direct IC methods, market capitalization methods, ROA methods, and scorecard methods. The most important direct techniques for measuring IC are Technology Broker, Citation-Weighted Patents, and Value Explorer. Of market capitalization methods, the most significant are Tobin's q, and Market-to-Book Value. The most recognizable ROA techniques are the Economic Value Added (EVA) method, Calculated Intangible Value, and VAIC. Widely known scorecard models include the

Skandia Navigator, Value Chain Scoreboard, Intangible Assets Monitor, and Balanced Scorecard.

Value added as an indicator of IC

The starting point of the model developed and implemented by Pulic¹⁹ is calculation of value added (VA), as an indicator of a company's efficient use of IC. The basic idea behind this approach lies in determining the contribution of all company resources (human, structural, and physical) to the creation of VA, which is calculated by:

$$VA = OUT - IN \quad (1)$$

Outputs (OUT) represent total sales realized on the market. Inputs (IN) entail all the costs of managing the company, except for those related to human resources, which are viewed in this model as an investment. Further steps involve calculating intellectual and physical capital efficiency coefficients.

A company's IC comprises human and structural capital. Calculation of human capital efficiency (HCE) starts with employee salaries and wages, which are not included as inputs in this model. HCE is therefore calculated as:

$$HCE = VA/HC \quad (2)$$

Here, HC denotes total salaries and wages during one fiscal year. In this manner, the model describes the relative contribution of human resources to the creation of VA. The next component of IC, structural capital, represents everything that stays in the office when employees go home. Structural capital comprises hardware, software, organizational structure, patents, trademarks, and all other factors that support or increase employee productivity (EP).²⁰ Structural capital efficiency (SCE) is calculated by:

$$SCE = SC/VA \quad (3)$$

Structural capital (SC) represents the second component of a company's IC. The above equation indicates that SCE is inversely related to HCE. IC efficiency (ICE) is obtained by summing the partial efficiencies of human and structural capital:

16 Chareonsuk, C. and Chansa-ngavej, C., "Intangible assets management framework for long-term financial performance", *Industrial Management & Data Systems*, 6 (2008) 812-828; Lev, B., "Remarks on the measurement, valuation, and reporting of intangible assets", *FRBNY Economic Policy Review*, September (2003) 17-21; Lev, B. And Zarowin, P., "The boundaries of financial reporting and how to extend them", *Journal of Accounting Research*, 2 (1999) 353-385.

17 Edvinsson, L., "Developing intellectual capital at Skandia", *Long Range Planning*, 3 (1997) 366-373.

18 Roos, G., Pike, S. and Fernström, L., *Managing Intellectual Capital in Practice*, Butterworth-Heinemann, Oxford, 2005.

19 Pulic, A., "Measuring the performance of intellectual potential in knowledge economy", presented at the 2nd McMaster World Congress on Measuring and Managing Intellectual Capital by the Austrian Team for Intellectual Potential, 1998; Pulic, A., "Intellectual capital: does it create or destroy value?", *Measuring Business Excellence*, 1 (2004) 62-68.

20 Bontis, N., "Assessing knowledge assets: a review of the models used to measure intellectual capital", *International Journal of Management Reviews*, 3 (2001) 41-60.

$$\text{ICE} = \text{HCE} + \text{SCE} \quad (4)$$

Finally, the physical capital component, or capital-employed efficiency (CEE), is derived from the ratio of VA to a company's net assets:

$$\text{CEE} = \text{VA}/\text{CE} \quad (5)$$

Here, capital employed (CE) is the capital already invested in a company, that is, its net assets. In order to enable a comparison of overall value creation efficiency, the two indicators need to be added together as:

$$\text{VAIC} = \text{ICE} + \text{CEE}, \quad (6)$$

where VAIC is the value added intellectual coefficient. This aggregated indicator allows us to understand a company's overall efficiency and indicates its intellectual ability. Put simply, VAIC measures how much new value has been created per invested monetary unit. A higher value for this coefficient indicates higher value creation using the company's resources.

Despite criticism, chiefly put forward by Andriessen²¹, who suggests that the model's basic assumptions may lead to dissatisfying results, VAIC methodology is becoming increasingly accepted by researchers as a good indicator of a company's efficient use of IC. Moreover, the VAIC method was accepted by the former U.K. Department for Business, Enterprise, and Regulatory Reform and Department for Innovation, Universities and Skills as a measure of companies' IC, thus contributing greatly to the model's validity.²²

The most significant disadvantage of the VAIC model is that it is calculated using the financial statements of companies, which implies that the coefficient is a measure of value created in the past and not that of value creation potential. Another criticism (which also applies to other IC valuation models) entails the inability of the model to incorporate synergistic effects realized through interactions between different components of IC. VAIC methodology clearly depicts the contribution of each component of IC to value creation. However, in practice elements of IC interact, and therefore it is not possible to calculate accurately the contribution of each component to the creation of VA. For

example, advancements in IT (structural capital) may lead to increases in employee productivity (human capital). In addition, the model fails to offer adequate analysis of the creation of VA for those companies that have negative equity in terms of operating profit. In these cases, VA and all the elements of VAIC (HCE, SCE, and CEE) would be negative as well, which would lead to useless analysis.²³

IC and financial performance

A number of studies have dealt with the impact of IC on company financial performance. These studies mostly reveal a positive correlation between the value of IC components and corporate performance. A few studies stand out regarding similar research hypotheses and methodology to those used in the present study. For example, Firer and Williams²⁴ conducted research on a sample made up of 75 companies listed on the Johannesburg Stock Exchange. The companies were in industries expected to be characterized by high volumes of investments in IC and dependence on the efficient exploitation of IC. Their study is particularly interesting since the economy of South Africa was, at the time (2003), in the same stage of transition that the Serbian economy is experiencing today. Hypotheses presented in Firer and Williams' paper correspond to some extent to those developed in the present study. Further research, undertaken in Taiwan, aimed to provide insights into the relationship between IC (measured by VAIC) and market value and the financial performance of listed companies.²⁵ Another interesting study²⁶ presented the level of IC (also measured by VAIC) in domestic and foreign banks in Malaysian territory. Goh's research found that domestic banks were generally less efficient at IC exploitation. A similar study was conducted on Egyptian software companies to analyze how IC affected the organizational

21 Andriessen, D., *Making Sense of Intellectual Capital*, Butterworth-Heinemann, Burlington, 2004.

22 Zéghal, D. and Maaloul, A., "Analysing value added as an indicator of intellectual capital and its consequences on company performance", *Journal of Intellectual Capital*, 1 (2010) 39-60.

23 Chiu, S. K. W., Chan, K. H. and Wu, W. W. Y., "Charting intellectual capital performance of the gateway to China", *Journal of Intellectual Capital*, 2 (2011) 249-276.

24 Firer, S. and Williams, M., "Intellectual capital and traditional measures of corporate performance", *Journal of Intellectual Capital*, 3 (2003) 348-360.

25 Chen, M., Cheng, S. and Hwang, Y., "An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance", *Journal of Intellectual Capital*, 2 (2005) 159-176.

26 Goh, P. C., "Intellectual capital performance of commercial banks in Malaysia", *Journal of Intellectual Capital*, 3 (2005) 385-396.

performance of selected companies.²⁷ Another interesting study²⁸ involved Malaysia's entire financial sector, with the aim of determining the impact of IC on financial performance in the sector from 1999 to 2007, and VAIC was used as a measure of efficient IC use. Ting and Lean chose to analyze the financial sector after assuming its heavy dependency on IC performance.

Research objectives and hypotheses

The present research has two basic objectives. The first is to determine whether there is interdependence between the amount of IC (measured by VAIC) and the financial performance of selected companies from the real sector. The second basic objective is to analyze empirically the role of each component of IC on certain financial performance measures. Financial performance measures used here are net profit, operating revenue, operating profit, ROE, and ROA.

These two objectives are tested with the following hypotheses:

1. Companies with higher VAIC tend to have higher net profit
 - 1a. Companies with higher HCE tend to have higher net profit
 - 1b. Companies with higher SCE tend to have higher net profit
 - 1c. Companies with higher CEE tend to have higher net profit
2. Companies with higher VAIC tend to have higher operating revenue
 - 2a. Companies with higher HCE tend to have higher operating revenue
 - 2b. Companies with higher SCE tend to have higher operating revenue
 - 2c. Companies with higher CEE tend to have higher operating revenue
3. Companies with higher VAIC tend to have higher operating profit

- 3a. Companies with higher HCE tend to have higher operating profit
- 3b. Companies with higher SCE tend to have higher operating profit
- 3c. Companies with higher CEE tend to have higher operating profit
4. Companies with higher VAIC tend to have higher ROE
 - 4a. Companies with higher HCE tend to have higher ROE
 - 4b. Companies with higher SCE tend to have higher ROE
 - 4c. Companies with higher CEE tend to have higher ROE
5. Companies with higher VAIC tend to have higher ROA
 - 5a. Companies with higher HCE tend to have higher ROA
 - 5b. Companies with higher SCE tend to have higher ROA
 - 5c. Companies with higher CEE tend to have higher ROA

Figure 2 shows the conceptual model used in determining the relationship between IC and financial performance.

Figure 2: Conceptual model of the research

Data sources and methods

The research used a sample of 100 Serbian companies from the real sector that had achieved the highest net profits in 2010 according to data in "Report on the functioning of the economy in Republic of Serbia in 2010", published by the Agency for Business Registers.²⁹ The study also used data drawn from the financial statements of each of these

27 Seleim, A., Ashour, A. and Bontis, N., "Human capital and organizational performance: a study of Egyptian software companies", *Management Decision*, 4 (2007) 789-801.

28 Ting, I. W. K. and Lean, H. H., "Intellectual capital performance of financial institutions in Malaysia", *Journal of Intellectual Capital*, 4 (2009) 588-599.

29 Agencija za privredne registre, *Saopštenje o poslovanju privrede u Republici Srbiji u 2010. godini - uporedni podaci iz finansijskih izveštaja za 2009. i 2010. godinu*, Beograd, 2011.

companies, gathered by the authors. Software SPSS 17.0 was used to analyze the data statistically.

Table 2 offers an insight into the companies' positions according to achieved net profit in 2010 and the level of efficiency in terms of VAIC. It was not possible to determine the level of VAIC for six of the analyzed companies, since their capital, salaries, and wages were at zero level in 2010. The data on VAIC rankings indicate that 45 companies were better positioned in terms of this criterion compared

to the net profit rankings. In other words, 45 companies from the real sector of Serbia use their capital (intellectual and physical) more efficiently than would be assumed simply by looking at the levels of net profit. The potential for value creation in these companies is undervalued when analyzing them solely on net profit. On the other hand, the companies whose positions were worse according to VAIC rankings (49 of them) are less efficient in terms of capital (particularly intellectual) exploitation.

Table 2: Company rankings according to net profit and VAIC in 2010

Company name	Net profit in 2010 (in 000 EUR)	Net profit ranking	VAIC in 2010	VAIC ranking	Rankings change according to VAIC comparing to net profit	
NIS	156,253	1	4.43	53	worse position	-52
Telekom Serbia	149,665	2	5.15	39	worse position	-37
PTT Serbia	43,906	3	2.00	87	worse position	-84
Tarkett	39,760	4	5.46	35	worse position	-31
Tigar Tires	31,384	5	4.04	60	worse position	-55
Lafarge BFC	24,196	6	7.12	21	worse position	-15
Coca-Cola HBC	21,929	7	3.71	65	worse position	-58
Telenor	20,121	8	7.51	19	worse position	-11
Yugorosgaz	18,862	9	8.31	16	worse position	-7
Airport "Nikola Tesla"	18,364	10	6.14	28	worse position	-18
Delta Maxi	17,852	11	4.30	55	worse position	-44
IM Matijević	17,619	12	4.94	44	worse position	-32
Philip Morris Operations	17,604	13	4.75	46	worse position	-33
Titan Kosjerić	17,122	14	5.92	32	worse position	-18
Elektroprivreda Srbije	16,935	15	7.86	17	worse position	-2
Delta City 67	16,693	16	2,006.97	1	better position	15
Holcim Serbia	15,905	17	5.96	31	worse position	-14
Henkel Merim	15,091	18	6.32	26	worse position	-8
Umka	14,068	19	3.56	68	worse position	-49
Victoria Logistic	11,117	20	12.59	10	better position	10
Imlek	10,953	21	4.61	48	worse position	-27
RTB Bor	10,062	22	n.a.	n.a.	n.a.	n.a.
Crvenka	10,044	23	4.48	52	worse position	-29
Napred	9,870	24	6.96	22	better position	2
Apatinska pivara	9,487	25	21.77	5	better position	20
Messer Tehnogas	9,403	26	4.32	54	worse position	-28
Amasis	8,821	27	-0.07	91	worse position	-64
Tetra Pak Production	8,682	28	11.58	11	better position	17
Pharmaswiss	8,529	29	5.02	41	worse position	-12
Budapest Energy Trading	8,370	30	1,461.39	2	better position	28
Srbijagas	8,352	31	4.95	43	worse position	-12
Rudnap Group	8,253	32	4.96	42	worse position	-10
Victoriaoil	7,667	33	12.67	9	better position	24
Elektro mreža Srbije	7,609	34	4.12	58	worse position	-24
Sojaprotein	7,507	35	7.18	20	better position	15
Direct Media	7,194	36	8.98	15	better position	21
Nelt Co.	7,037	37	1.89	88	worse position	-51
Mercator S	6,910	38	1.35	90	worse position	-52
Autoritas Investments	6,881	39	5.06	40	worse position	-1
Sheer Corporation	6,868	40	6.95	23	better position	17

Company name	Net profit in 2010 (in 000 EUR)	Net profit ranking	VAIC in 2010	VAICranking	Rankings change according to VAIC comparing to net profit	
Mercata	6,748	41	3.92	62	worse position	-21
Ball Packaging Europe	6,718	42	5.19	38	better position	4
C market	6,495	43	2.94	75	worse position	-32
Victoria Group	6,363	44	-0.09	92	worse position	-48
Dinamika	6,268	45	9.76	13	better position	32
Beohemija	6,190	46	6.10	29	better position	17
Utva industrial zone	6,155	47	-2.82	94	worse position	-47
Energoprojekt holding	6,059	48	6.20	27	better position	21
Jugoimport SDPR	6,056	49	2.18	86	worse position	-37
Veletabak	5,957	50	3.83	64	worse position	-14
Rubin	5,878	51	4.57	49	better position	2
Galenika Fitofarmacija	5,836	52	5.43	36	better position	16
Concern Farmakom MB	5,677	53	9.01	14	better position	39
Eurolion	5,512	54	3.93	61	worse position	-7
Pionir	5,342	55	3.86	63	worse position	-8
Bambi-Banat	5,270	56	3.64	66	worse position	-10
Fiat Cars Serbia	5,266	57	1.59	89	worse position	-32
Battery Factory	5,196	58	4.05	59	worse position	-1
M Centar Land	5,145	59	n.a.	n.a.	n.a.	n.a.
Saga	5,062	60	4.23	57	better position	3
Fresenius Medical Care	5,037	61	3.36	72	worse position	-11
PTP Dis	5,033	62	4.49	50	better position	12
Airtraffic Services Agency	5,025	63	2.45	84	worse position	-21
Gorenje	5,011	64	4.25	56	better position	8
Štark	4,992	65	2.99	74	worse position	-9
Concern Farmakom-Zajača	4,959	66	5.65	33	better position	33
Promist	4,955	67	24.66	4	better position	63
Valy	4,908	68	2.86	77	worse position	-9
Metro Cash & Carry	4,820	69	2.28	85	worse position	-16
M Centar Sistem	4,698	70	n.a.	n.a.	n.a.	n.a.
Jedinstvo	4,632	71	2.91	76	worse position	-5
Nokia Siemens Networks	4,450	72	4.49	51	better position	21
Pekabeta	4,440	73	2.47	83	worse position	-10
Ce-Za-R	4,423	74	6.00	30	better position	44
AOFI	4,388	75	-0.47	93	worse position	-18
Gebi	4,335	76	15.14	6	better position	70
Alfa Plam	4,333	77	2.72	81	worse position	-4
Takovo	4,298	78	3.41	71	better position	7
Grand Prom	4,265	79	2.80	78	better position	1
Promo Media	4,256	80	n.a.	n.a.	n.a.	n.a.
Vital	4,193	81	6.59	24	better position	57
PORR BAU Gmbh	4,137	82	5.34	37	better position	45
BZ Top Corporation	4,096	83	n.a.	n.a.	n.a.	n.a.
Ringier Axel Springer	4,076	84	3.50	69	better position	15
Agromarket	3,996	85	6.46	25	better position	60
Ćirić & Son	3,975	86	66.95	3	better position	83
Agroglobe	3,968	87	10.09	12	better position	75
Asseco SEE	3,891	88	3.14	73	better position	15
TE Nikola Tesla	3,847	89	4.89	45	better position	44
Novkabel	3,792	90	n.a.	n.a.	n.a.	n.a.
Elektrosrbija	3,769	91	2.70	82	better position	9
Nectar	3,690	92	3.56	67	better position	25
Fertil	3,655	93	13.72	7	better position	86
Roaming Electronics	3,646	94	13.60	8	better position	86

Company name	Net profit in 2010 (in 000 EUR)	Net profit ranking	VAIC in 2010	VAIC ranking	Rankings change according to VAIC comparing to net profit	
Serbia Highway	3,602	95	3.47	70	better position	25
Beohemija – Inhem	3,475	96	7.76	18	better position	78
Swisslion-Takovo	3,466	97	2.78	79	better position	18
Enmon	3,408	98	5.63	34	better position	64
Ericsson	3,407	99	2.75	80	better position	19
Milk factory Šabac	3,405	100	4.62	47	better position	53

Source: Agency for Business Registers, 2011, and authors' calculation

The sample comprises companies of varying legal form and size. Companies with limited liability (Ltd.) and corporations make up 94% of the sample. Some 92% of the companies are large, 5% medium, and only 3% small enterprises. These 100 companies together realized 38% of total net profit of the Serbian economy. In terms of the whole economy, the 100 most profitable companies make up only 0.1% of all entities in Serbia. The majority of the companies in the sample are in the manufacturing (46%), wholesale and retail (21%), traffic and warehousing (6%), and construction (6%) sectors.

The research model employed involves dependent and independent variables. The independent variables are the components of VAIC, HCE, SCE, and CEE, and the steps used to calculate these variables are described in Section 2. Conversely, the dependent variables selected are net profit, operating revenue, operating profit, ROE, and ROA:

- ROE is calculated by dividing net profit by the book value of average stockholders' equity

- ROA is the ratio of pre-tax income to the company's total assets

Gathered data were analyzed by applying statistical methods of correlation and regression, and the research model used both single and multiple linear regressions. The first regression model is a simple regression equation aimed at answering the question: How does VAIC, as an aggregate measure, affect the described dependent variables? Since certain components of VAIC affect financial performance by different amounts and in different ways, multiple regression was used to answer the question: To what extent and in what way do components of VAIC (HCE, SCE, and CEE) influence selected indicators of corporate success?

Results

Correlation analysis

Table 3 presents the results of correlation analysis. They indicate a moderate correlation between CEE and ROE

Table 3: Results of correlation analysis

		NP	OR	OP	ROE	ROA	HCE	SCE	CEE	VAIC
NP	Pearson Correlation	1	0.693**	0.939**	-0.051	0.005	-0.047	0.031	0.013	0.008
	Sig. (2-tailed) p-value		0.000	0.000	0.619	0.964	0.655	0.762	0.898	0.939
OR	Pearson Correlation	0.693**	1	0.795**	-0.113	-0.256*	-0.035	0.052	0.016	-0.072
	Sig. (2-tailed) p-value	0.000		0.000	0.270	0.010	0.735	0.611	0.875	0.488
OP	Pearson Correlation	0.939**	0.795**	1	-0.045	-0.079	-0.009	0.094	0.139	-0.025
	Sig. (2-tailed) p-value	0.000	0.000		0.659	0.433	0.932	0.358	0.176	0.808
ROE	Pearson Correlation	-0.051	-0.113	-0.045	1	0.042	0.175	-0.067	0.300**	0.037
	Sig. (2-tailed) p-value	0.619	0.270	0.659		0.681	0.096	0.521	0.003	0.722
ROA	Pearson Correlation	0.005	-0.256*	-0.079	0.042	1	0.091	-0.326**	-0.001	0.151
	Sig. (2-tailed) p-value	0.964	0.010	0.433	0.681		0.385	0.001	0.991	0.146
HCE	Pearson Correlation	-0.047	-0.035	-0.009	0.175	0.091	1	0.228*	0.024	0.972**
	Sig. (2-tailed) p-value	0.655	0.735	0.932	0.096	0.385		0.027	0.818	0.000
SCE	Pearson Correlation	0.031	0.052	0.094	-0.067	-0.326**	0.228*	1	0.057	0.119
	Sig. (2-tailed) p-value	0.762	0.611	0.358	0.521	0.001	0.027		0.588	0.253
CEE	Pearson Correlation	0.013	0.016	0.139	0.300**	-0.001	0.024	0.057	1	-0.030
	Sig. (2-tailed) p-value	0.898	0.875	0.176	0.003	0.991	0.818	0.588		0.777

*Significance level $\alpha=0.05$; ** Significance level $\alpha=0.01$; NP: net profit; OR: operating revenue; OP: operating profit

(Pearson coefficient 0.300) and between SCE and ROA, which in this case are inversely correlated (Pearson coefficient -0.326). Values for the correlation coefficient are interpreted according to Cohen.³⁰ In the case of CEE and ROE, there is a less than 0.3% probability that a correlation coefficient this large would have occurred by chance in a sample of 100 companies. On the other hand, the probability that the coefficient of correlation in the case of SCE and ROA would have occurred by chance in the same sample is less than 0.1%. Other performance measures (net profit, operating revenue, and operating profit) show no statistically significant correlation with independent variables.

Results of simple linear regression

Table 4 lists the findings from simple linear regression, where VAIC appears as an independent variable, and dependent variables are net profit, operating revenue, operating profit, ROE, and ROA.

Table 4: Results of simple linear regression (VAIC as independent variable)

Variable	R ²	β	T	Level of significance
Net profit	0.000	0.008	0.077	0.939
Operating revenue	0.005	-0.072	-0.696	0.488
Operating profit	0.001	-0.025	-0.243	0.808
ROE	0.001	0.037	0.356	0.722
ROA	0.023	0.151	1.465	0.146

No evidence can be found in these results of any statistically significant correlation between VAIC, as an aggregate measure of efficient capital exploitation, and the selected performance measures. This suggests that IC as measured by VAIC does not influence the corporate performance of the 100 investigated companies that recorded the greatest net profits in 2010.

Results of multiple linear regression analysis

Since it is possible to separate VAIC into components, particular analytical values utilize multiple linear regression to determine the impact of certain components on selected performance measures. The elements of IC used in this

research model are HCE and SCE. Tables 5, 6, 7, 8, and 9 present the results of this regression analysis.

Table 5: Results of linear multiple regression analysis (dependent variable net profit)

Variable	β	T	Level of significance	VIF
HCE	-0.057	-0.521	0.604	1.051
SCE	0.293	0.293	0.770	1.054
CEE	0.082	0.082	0.935	1.004

R² = 0.004 F = 0.104 Significance = 0.957

Table 5 shows that net profit does not significantly influence human, structural, or physical capital, viewed as a whole or individually. If we look at the value of R², we can conclude that there is little causality between net profit and HCE, SCE, and CEE coefficients, since only 0.4% of changes in net profit may be contributing to variations in these coefficients. As a test for multicollinearity, the variance inflation factor (VIF) was used. According to Myers³¹, VIF must be below ten in order for the statistical model to be relevant.

Table 6: Results of linear multiple regression analysis (dependent variable operating revenue)

Variable	β	T	Level of significance	VIF
HCE	-0.052	-0.475	0.636	1.051
SCE	0.060	0.552	0.582	1.054
CEE	0.004	0.037	0.971	1.004

R² = 0.005 F = 0.147 Significance = 0.931

Where the dependent variable is operating revenue, the conclusions are similar to those reached where the dependent variable is net profit. The model explains only 0.5% of total changes in operating revenue, while there is no significant correlation between operating revenue and HCE, SCE, and CEE (Table 6).

Table 7: Results of linear multiple regression analysis (dependent variable operating profit)

Variable	β	T	Level of significance	VIF
HCE	-0.035	-0.328	0.743	1.051
SCE	0.083	0.771	0.443	1.054
CEE	0.128	1.217	0.227	1.004

R² = 0.024 F = 0.736 Significance = 0.533

30 Cohen, J., *Statistical Power Analysis for the Behavioral Sciences*, (2nd ed.), Lawrence Erlbaum Associates, Hillsdale, NJ, 1988.

31 Myers, R., *Classical and Modern Regression with Applications*, 2nd edition, Duxbury, Boston, 1990, in: Field, A., *Discovering Statistics using SPSS*, 2nd edition, SAGE Publications, London, 2005, 175.

Table 7 presents the results of multiple linear regression when the dependent variable is operating profit. In this case, only 2.4% of changes in the value of operating profit may be the effect of changes in VAIC components ($R^2=0.024$). As in the case of net profit, there is no causality between IC components and the analyzed dependent variable.

Table 8: Results of linear multiple regression analysis (dependent variable ROE)

Variable	β	T	Level of significance	VIF
HCE	0.191	2.868	0.005	1.051
SCE	-0.160	-2.397	0.019	1.054
CEE	0.766	11.767	0.000	1.004

$R^2 = 0.628$ $F = 49.507$ Significance = 0.000

The data from Table 8 show the interdependence of ROE and components of VAIC. The R^2 value is 0.628, which indicates that changes in ROE value can be explained by changes in HCE, SCE, and CEE values in 62.8% of the cases. The statistically most significant relation is between ROE and CEE, and then between ROE and HCE, while the relationship between ROE and SCE is insignificant.

Table 9: Results of linear multiple regression analysis (dependent variable ROA)

Variable	β	T	Level of significance	VIF
HCE	0.268	2.838	0.006	1.051
SCE	-0.490	-5.190	0.000	1.054
CEE	-0.013	-0.143	0.887	1.004

$R^2 = 0.255$ $F = 10.050$ Significance = 0.000

Table 9 indicates the relationship between independent variables HCE, SCE, and CEE and the dependent variable ROA. The model explains 25.5% of changes in ROA, and a significant correlation can be seen between structural capital and ROA. Of least significance is the relation between human capital and ROA, while no correlation is observed between CEE and ROA. Table 10 summarizes the results of regression analysis.

Taking together all of the above findings, the following can be concluded:

- Correlation analysis failed to confirm hypotheses H1, H2, H3, H4, and H5.
- Results of multiple regression analysis confirmed hypotheses H4a, H4c, and H5b.

- The statistically most significant correlation is that between ROE and CEE (hypothesis H4c). The value of β is 0.766 with a significance level of 0.000.
- Multiple regression analysis confirmed hypotheses H1a, H1b, H1c, H2a, H2b, H2c, H3a, H3b, H3c, H4b, H5a, and H5c.

Conclusion, limitations, and avenues for future research

The importance and potential of IC as a factor in competitive advantage is undisputable. Developed market economies base their competitiveness on knowledge, information, commercial innovativeness, corporate strategies, and the sophistication of their business models, and far less on natural resources and cheap labor. The Lisbon Treaty represents efforts made by the European Union to strengthen their member states' competitiveness based on IC. A European Commission³² document entitled "Europe 2020 – European strategy for smart, sustainable, and inclusive growth" states that development based on knowledge and innovation must be a key pillar of future "smart" growth of European Union member states. Serbia is currently falling behind in the development of a knowledge- and innovation-based society. Since the competitiveness of the Serbian economy is low (according to the World Economic Forum's index of global competitiveness in 2011, Serbia is placed 95th), and as the Serbian real sector is currently in a state of crisis, the research results presented in this paper are logical and unsurprising. They indicate clearly that IC has a very small or insignificant impact on the financial performance of the 100 companies in the real sector with the highest net profits of 2010. Consequently, the level of IC is the limiting factor in growth in competitiveness. This is particularly relevant today, when investing in IC is the only real way of progressing business during times of economic crises.

The study failed to confirm hypotheses regarding the interdependence of net profit, operating revenue, operating profit, ROE, and ROA, and the independent variable VAIC (as an aggregate measure). The situation is

³² European Commission, *Europe 2020 – A European strategy for smart, sustainable and inclusive growth*, Brussels, 2010.

a little different when we analyze components of human, structural, and physical capital separately. The results of correlation analysis indicate a moderate positive correlation between CEE and ROE and a moderate negative correlation between SCE and ROA. In all other cases, there is no statistically significant relationship between dependent and independent variables of the proposed research model. Net profit does not depend on HCE, SCE, and CEE and is not therefore the consequence of the efficient use of IC. The situation is similar when we analyze operating revenue and operating profit and their relationship with VAIC components. However, the research reveals that HCE and CEE influence ROE, with CEE being more influential than HCE. On the other hand, ROA is mainly determined by the SCE coefficient.

The measurement and valuation of IC and its impact on companies' financial and market performance are crucial issues and should not be thought of as trivial tasks. Just as corporate performance cannot be analyzed using solely one measure, it is also impossible to assess IC from only one perspective. The VAIC coefficient is only one attempt of many to find a suitable model for estimating the level of IC and its contribution to corporate performance. Its basic advantage (simplicity of calculation and ease of use) is its main limitation. The main problem is in measuring the

contribution of something that is not physical and cannot be easily quantified. Even if IC could be clearly defined and presented, the key issue is that the value created by IC is indirect. The interaction between different forms of IC and with other forms of material assets should therefore be borne in mind, since the effects of IC tend to be delayed and unpredictable.

Another important limitation relates to the inability of the model to assess companies' future performance. Modern measures of performance start with cash flow rather than net profit. In other words, VAIC does not provide an adequate framework with which to integrate financial measures of performance with IC as a driver of future performance.

Apart from the abovementioned limitations of VAIC, the results of our empirical study undertaken in Serbia are a good basis for further research to improve understanding of the impact of IC on financial performance. One possibility is to include more variables such as different nonfinancial measures of performance. By doing this, the scope and validity of the research could be increased. Another route would be to conduct the research on a larger sample, which could have a different structure and be more representative. It may also be interesting to analyze the impact of IC on financial performance within and between particular

Table 10: Summary of research results found by regression analysis

Independent variable	Dependent variable	R ²	β	Level of significance	Hypothesis	Hypothesis confirmed
VAIC	Net profit	0.000	0.008	0.939	H1	No
	Operating revenue	0.001	-0.072	0.488	H2	No
	Operating profit	0.005	-0.025	0.808	H3	No
	ROE	0.001	0.037	0.722	H4	No
	ROA	0.023	0.151	0.146	H5	No
HCE	Net profit	0.004	-0.054	0.604	H1a	No
	Operating revenue	0.005	-0.052	0.636	H2a	No
	Operating profit	0.024	-0.035	0.743	H3a	No
	ROE	0.628	0.191	0.005	H4a	Yes
	ROA	0.255	0.268	0.006	H5a	No
SCE	Net profit	0.004	0.293	0.770	H1b	No
	Operating revenue	0.005	0.060	0.582	H2b	No
	Operating profit	0.024	0.083	0.443	H3b	No
	ROE	0.628	-0.160	0.019	H4b	No
	ROA	0.255	-0.490	0.000	H5b	Yes
CEE	Net profit	0.004	0.082	0.935	H1c	No
	Operating revenue	0.005	0.004	0.971	H2c	No
	Operating profit	0.024	0.128	0.227	H3c	No
	ROE	0.628	0.766	0.000	H4c	Yes
	ROA	0.255	-0.013	0.887	H5c	No

industries or between companies, for instance, of different sizes or legal forms or with different market positions or proportions of total revenues as export revenues.

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