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THE IMPACT OF INTELLECTUAL CAPITAL ON COMPANIES' MARKET VALUE AND FINANCIAL PERFORMANCE*

Uticaj intelektualnog kapitala na tržišnu vrednost i finansijske performanse preduzeća

Abstract

Intellectual capital determines growth potential, affects above average returns, and is a source of competitive advantage for firms in an information economy. Thus, this study investigated the relationship between the intellectual capital and market and financial performance of companies listed on Belgrade Stock Exchange (BELEX) in Serbia. The research sample consisted of 42 enterprises that made *BELEXline* index. The period of the research covered five years (2010-2014). Two research hypotheses were tested and partially confirmed: the impact of the intellectual capital of Serbian listed firms on their market performance and on their financial performance. According to research results, human capital and physical capital positively affect market performance of companies. When analyzing financial performance, human capital significantly affects return on equity and return on assets, whereas structural capital affects neither market nor financial performance, except in the case of employee productivity. On the other hand, physical and financial capital of companies are less important for employee productivity, unlike the human and structural capital.

Key words: *intellectual capital, market performance, financial performance, Value Added Intellectual Coefficient, VAIC*

Sažetak

Intelektualni kapital određuje potencijal rasta, zaslužan je za stvaranje najvećeg dela dodate vrednosti preduzeća i predstavlja izvor konkurentske prednosti preduzeća informatičke privrede. Ovo je razlog zbog koga se ova studija bavi odnosom između intelektualnog kapitala i tržišnih i finansijskih performansi preduzeća listiranih na Beogradskoj berzi (BELEX) u Srbiji. Uzorak je činilo 42 preduzeća iz korpe indeksa *BELEXline*. Period za koji je rađena analiza je pet godina (2010-2014). U radu su testirane i delimično potvrđene dve istraživačke hipoteze i to o uticaju intelektualnog kapitala preduzeća u Srbiji na njihove tržišne performanse i finansijske performanse. Rezultati pokazuju da ljudski i fizički kapital pozitivno utiču na tržišne performanse preduzeća. Kada se analiziraju finansijske performanse, ljudski kapital značajno opredeljuje stopu prinosa na kapital i stopu prinosa na ukupnu aktivu, dok strukturni kapital ne utiče ni na tržišne ni na finansijske performanse, osim u slučaju produktivnosti zaposlenih. S druge strane, fizički i finansijski kapital imaju manji uticaj na produktivnost zaposlenih u odnosu na ljudski i strukturni kapital.

Ključne reči: *intelektualni kapital, tržišne performanse, finansijske performanse, koeficijent dodate vrednosti intelektualnog kapitala, VAIC*

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Introduction

Before the business model shifted towards gaining competitive advantage through adequate exploitation of intangible assets, the companies mainly focused on increasing their value and wealth by maximizing corporate performance through more efficient use of tangible resources. In the work of Adam Smith, *Wealth of Nations*, he glorified productivity and efficient use of physical assets. The productivity goals were mainly achieved through use of existing technology and division of labor. This approach to maximizing the productivity led theorists and practitioners of the 20th century to try to apply this in the field of scientific management and practice. The most famous examples were Frederick Taylor and Henry Ford. During this period, efficient, lean processes with cost-efficient overheads have become regarded as the quickest route to profits. In addition, the companies continue to pursue efficiency through lean and, therefore, they hope, productive, organizational structures. However, since the modern society is faced with scarcity of tangible resources, increased global competition, and more demanding customers, it is necessary to re-evaluate the principles introduced by Adam Smith and traditional economics. Even in the information era, the productivity still matters. It is just that our understanding of productivity, and how to achieve it, has changed and will change. Adam Smith realized that the factory model of business did not improve workers' knowledge and skills. On the other hand, the knowledge era gives people the opportunity to learn in exciting and unexpected ways. Physical labor is no longer as important as it used to be [16, p. 20-21]. Nowadays, enterprises tend to create value by focusing more on intangible aspects of their assets than simply applying the tangible resources. According to the data supplied by the World Bank [44], the global world wealth is constituted mainly of intangible resources, which account for 78% of this wealth. When viewing the intangible resources, World Bank defines these as the sum of raw labor, human capital, social capital, and other similar factors. The interesting point of the mentioned study is that the percentage of intangible capital ranges from 59% in low-income countries, to high-income OECD countries where intangibles account for 80% of national

wealth. The most developed market economies base their competitiveness on knowledge, business innovations, strategies, on sophistication of their business model, and far less on natural resources and cheap labor. It is estimated that investments in intellectual assets among five OECD countries (USA, UK, Japan, Netherlands, Finland) each make up between 7.5% and 11.7% of gross domestic product [9; 22; 37]. This is particularly important for the Serbian economy, where corporate performance depends less on the knowledge and skills of employees and more on physical assets [29].

In contrast to tangible resources, which are represented by a physical objects and whose value can be measured with a reasonable level of certainty, intangible resources differ in terms that they are not visible, and relate to employee knowledge and skills, relationships with customers and other stakeholders, and components referring to organizational culture, intellectual property and brand equity. Various types of intangible resources make up the substance of intellectual capital (IC), which is a primary value driver in today's knowledge-based economy. New theories of strategic management, such as the resource-based view of the firm (RBV), the competence and capabilities-based outlook, and the knowledge-based premise, have contributed significantly to improving our understanding of the nature and importance of IC as a strategic resource [29].

This paper analyzes the current state of IC-related issues in the Serbian economy, specifically addressing the impact of IC and its components on market and financial performance. The paper uses 42 enterprises that were the members of *BELEXline* index at the Belgrade Stock Exchange in July 2015. The data regarding the analysis of market and financial performance were drawn from the official financial reports of these enterprises. The period that the research covers is five consecutive years, ranging from 2010 to 2014. The paper consists of the following sections. The first section after the introductory notes, relates to the presentation of basic conceptual frameworks regarding the understanding of IC. This section includes concept definitions and assessment of various approaches in terms of IC categorizations. The following section will deal with the literature review

of earlier empirical evidence regarding the IC's impact on market and financial performance. Afterwards, the paper presents the research methodology (description of the sample, development of research hypotheses, and presentation of used research variables). After presenting the research results and appropriate discussion, the paper ends with concluding remarks.

Intellectual capital: The what, why, and how

Intellectual capital in the knowledge economy represents the kind of assets with most potential for value creation, with predominant impact on firm's market value. With this in mind, one can say that investment volume in IC can be viewed as the leading indicator of firm's vitality and competitive advantage [26]. The first move towards understanding the concept of IC is giving a valid definition of the term itself. The terms that are most commonly used to describe the invisible assets, which create extra value in companies are intellectual capital, intangible assets, immaterial capital, intangible resources, intellectual property, invisible assets, immaterial values, and so on. No matter what the term is used, they point to similar contents and essence of these intangible assets of companies. The term "immaterial values" was mostly used by the researchers and organizations outside accounting systems of USA and Great Britain are used (like Germany, Sweden or France), and the term was used to describe non-monetary values that have no physical embodiment. The notion of this reflects the terms "intellectual capital" and "intangible assets". The differences among these three terms are only based on the areas of use and thus they are often presented as synonyms.

The modern management and accounting literature offers many different definitions and categorizations of intellectual capital. The following summarizations of various definitions and categorizations were given according to [14]. As is the case with terminology, there is vast array of different notions of IC and its nature. More or less every definition points towards the notion that IC represents non-monetary asset, which has no physical embodiment and possesses value and potential for generating benefits for the organization in the future. For example, Hall [21]

defined IC as the sum of contemporary value drivers that have the ability to transform company's resources into assets with extra tangible value. Edvinsson [15] stated that IC is represented through relationships with clients and employees. Authors Davenport and Prusak [12] explained IC in relation to technology, technological change, and management of information technology in a company. According to them, a company that successfully uses technology to manage and analyze the data is a company that knows how to manage IC. Bontis [2] claimed that IC possessed the characteristics, which may cause market value increase. Stewart [41] defined IC as "collective brainpower" of a company. Sullivan [42] defined IC as company's knowledge, which can be converted into profit. Lev [32] defined IC as sum of certain resources that will assure future benefits for a company. Daum [11] stated that IC possessed the attributes, which can quickly realize economic benefits. In addition, he pointed out that these intangible resources were mutually interlinked. Mouritsen, Bukh, and Marr [35] stressed out that IC utilizes its employees, managers, clients, information technology, and knowledge. In addition, the authors pointed out that IC only represents the mechanism that connects various resources into production process of a company and thus is not able to operate independently. Andreou, Green, and Stankosky [1] revealed that companies that operated in information age needed to be intelligent in order to absorb the knowledge from the environment and to adequately value and manage IC. Hsu and Fang [23] viewed IC as the sum of employee skills, knowledge, intellectual property, culture, processes, corporate strategy, and networks. According to Huang and Wu [24], IC cannot be seen as static intellect, but rather as demanding set of dynamic intellect-creating activities. All of the mentioned IC definitions have one thing in common, and that is that IC represents company asset that is the most potent in terms of future value creation.

Another critical issue in the field of IC theory and practice is determining the adequate categorization of IC. In order to manage IC properly, one must understand its key elements and their characteristics. Therefore, it is very important to categorize assets like skills, knowledge, talent, enthusiasm, trademarks, patents, expertise, experience,

software, databases, management processes, corporate strategy, business plans, relations with stakeholders, brand, unique organizational practices, corporate culture, and so on. These various elements of IC are interrelated and linked to the various physical assets of a company; therefore, the components of IC cannot be valued and observed independently. The categorizations of IC evolved as the IC discipline evolved and many different, but with the similar idea in mind, categorizations emerged. Hall [21] was among the first authors that systematically categorized IC. He categorized IC into IC that cannot be separated from human resources, and IC that is possible to separate from human resources. IC that cannot be separated from human resources is human capital and it is based on different types of knowledge. On the other hand, the IC that cannot be viewed separately from human resources are organizational capital (like business norms, rules of conduct, databases, organizational routines, corporate culture and so on), technological capital (like patents, trademarks, copyright, intellectual property), and relational capital (reputation, brand, customer loyalty, long-term relationships with stakeholders, distribution channels and so forth). Sullivan [42] used the three-element IC classification, but pointed out that it is essential to have certain business processes in order to transform IC into intellectual property, thus acknowledging that IC creates value indirectly and in relation to an organization's strategy. On the other hand, authors including Petty and Guthrie [38] adopted an IC classification consisting of two elements: organizational (structural) and human capital. The important classification is the one given within the Guidelines for managing and reporting on intangibles [34], which includes human capital, structural capital, and relational capital as main constitutive elements of IC. The central part of human capital is knowledge. Besides knowledge, human capital also includes skills, creativity, talent, learning capacity, responsibility, dedication, motivation, and employees' enthusiasm. Structural capital incorporates managerial processes, strategy, business plans, software, databases, structure of an organization, its patents and trademarks, and every other organizational capacity that helps improve productivity of employees. Relational capital involves external relationships with

various stakeholders and their image of company, like brand image or customer loyalty [27]. According to Inkinen [25], IC consists of several types of knowledge-based resources. In literature, there is a convergence towards three-dimensional categorization of IC, which includes human, organizational, and relation oriented resources. This categorization was established as an emergent standard and a starting point for building various IC measurement models. One of the categorizations of IC that come from the field of financial management was given by Damodaran [10, p. 407-456] and it is based on the IC's ability to generate cash flows. According to him, IC has three elements: IC that generates independent cash flows, IC that generates cash flows on the company level, and IC with potential for generating cash flows. The first category is made of trademarks, copyrights, licenses, and franchises. In cash flow sense, this type of IC is no different from tangible resources of a company. IC that generates cash flows on a company level consists of elements that cannot be separated from other company assets, but it is evident that they create increased value. This category consists of human capital elements (knowledge, skills, competencies, talent, enthusiasm, and the like), structural capital (organizational practices, management system, corporate culture), and relational capital (brand, relationships with stakeholders). The contribution of this type of IC is evident on the level of overall company results. IC with potential for creating cash flows is represented by those intangibles in a company that will eventually increase value. Examples of this IC category are patents and projects under development, natural reserves and so on.

Present study is one of the first to assess the IC of companies listed at the Belgrade Stock Exchange and one of the few empirical approaches to investigating the issue of IC in domestic literature. The results are original and valuable in at least three ways. Firstly, they validate the significant positive influence that human capital has on market and financial performance indicators of companies listed on Belgrade Stock Exchange. Secondly, it reveals that market performance is still more influenced by physical and financial capital, in comparison with IC. Thirdly, the research validates VAIC model's ability to assess the efficiency of IC's use by companies in Serbia.

Intellectual capital and performance; The review

The literature is quite rich with various empirical evidence on the relationship between IC and the financial and market performance of companies in different sectors of economy. The majority of these studies revealed a positive and strong impact of IC on financial and market performance of companies, but several of those, especially in developing economies did not reach the same conclusion. Bontis, Keow, and Richardson [3] investigated the relationship between IC and business performance in Malaysian industries and confirmed positive impact of IC within two industry sectors. On the other hand, Firer and Williams [18] found different relationship when investigated companies on stock exchange in Johannesburg. Their research revealed that the economy of South Africa was mainly relying on physical assets, and competitive advantage was achieved by adequately managing these resources. An interesting study conducted in Taiwan [5] found that IC contributed positively to market and financial performance. A study by Goh [20] investigated the level of IC efficiency in the banking sector of Malaysia. The results revealed that Malaysian banks were less efficient in using IC than foreign banks. In Egyptian software companies [39] human capital and selection of quality employees significantly influenced firm performance and export intensity. In a research conducted by Kujansivu and Lönnqvist [30] research sample included 20.000 entities and produced unsatisfactory results in terms of failing to validate IC's positive impact on performance in Finnish companies.

Erickson and Rothberg [17] investigated three US industries in the field of high technology for a period of eight years. The important conclusion was that IC, combined with proper knowledge management, is able to increase companies' market performance. Chiu, Chan, and Wu [6] investigated the companies listed at Hong Kong stock exchange and found positive impact of IC on profitability of businesses. In particular, structural capital played a notable part in enhancing corporate profitability, and showed increasing significance. However, empirical studies conducted in Serbia have somewhat different conclusions. Several distinct studies involved top hundred companies in regards with achieved net profit in 2010 and

2011, 300 top exporting companies, and 594 firms in ICT manufacturing industry [27; 29; 28]. The results of these research studies reveal that IC's impact on performance is either small or insignificant. Overall, these studies showed that physical capital was the main predictor of financial performance. It is interesting to note that a research study from Australia also concluded that financial performance of their companies were mostly affected by financial and physical capital, and less by IC [8]. Finally, research studies conducted in Spain and Greece failed to validate hypotheses that IC has positive and significant impact on financial performance [13; 33].

Presented research results involved the impact of IC on both financial and market performance of companies in various sectors and different economies in the world. It is evident that IC has stronger influence in more developed economies. In addition, this impact is even more significant in knowledge-intensive sectors (ICT, services, software, pharmaceuticals, and alike). However, there are only few studies covering developing economies. In addition, the studies that were implemented in Serbia did not cover the effects of IC on market performance of companies. This is why this paper has the main objective to determine whether market performance of Serbian listed companies is under significant influence of IC.

Data and methodology

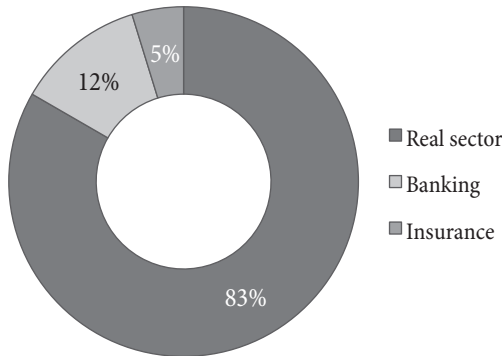
Sample description

The sample in our research included 42 enterprises, which were the part of the *BELEXline* market index on the date of revision made on July 24, 2015. The data about the market values and financial performance were downloaded on August 14, 2015. The data was gathered from the official financial statements of these enterprises during the period 2010–2014. The financial data can be found on the official website of the Belgrade stock exchange.¹The *BELEXline* index is used as the measure of market activity on the Belgrade stock exchange in Serbia. The companies that make up the *BELEXline* index are those whose shares have the highest rate of trade on the Belgrade stock exchange. The research sample is heterogeneous and it is comprised

1 <http://www.belex.rs/trgovanje/indeksi/belexline/korpa>

of companies from the real sector, banking sector, and insurance. The sample description is given in the Figure 1.

Figure 1: The research sample structure



As we can see from the Figure 1, the majority of the research sample is consisted of enterprises that operate within the real sector of Serbian economy, which is 83%. On the other hand, banking sector accounts for 12% of enterprises in research sample, while only 3% of analyzed companies belong to insurance sector. In this sense, the ratio between real sector companies and financial sector companies is 83% to 17%.

VAIC method

The present empirical study of IC's impact on financial and market performance among Serbian listed companies used the method firstly presented by Ante Pulic from Intellectual Capital Research Center in Austria. The method aimed at measuring a company's efficient use of all resources that exist at company's disposal. This way the management can assess whether its corporate performance relies more on tangible or intangible elements of their business operations. The measure of this efficiency is called Value Added Intellectual Coefficient (VAIC) (Pulic, 1998; 2004). The main idea behind the VAIC model is that knowledge assets and human potential positively affect business success. However, the method also separates the impact of physical and financial performance by introducing the capital employed efficiency coefficient. Beside this element, the VAIC coefficient includes measures of human capital and structural capital efficiencies. In the following paragraphs, the VAIC model will be described in more detail.

Model of VAIC starts by determining company's overall value added (VA) from business operations. This

measure is calculated by subtracting total expenses from sales revenues. The model omits human resources costs since they are seen as investment, not a cost and they are to be capitalized within the market value of a company. The method's primary objective is to assess individual contribution of each of the firm's resources (both tangible and intangible) to value creation. Thus, the VAIC calculation involves the following steps:

- (1) Value added = Sales revenues – Total expenses (except human capital costs)
- (2) Human capital efficiency (HCE) = Value added / Human capital costs
- (3) Structural capital efficiency (SCE) = Structural capital / Value added
- (4) Intellectual capital efficiency (ICE) = Human capital efficiency + Structural capital efficiency
- (5) Capital employed efficiency (CEE) = Value added / Capital employed
- (6) VAIC = Intellectual capital efficiency + Capital employed efficiency, or
- (7) VAIC = efficient use of IC + efficient use of physical and financial capital

According to Pulic, IC is consisted of only human and structural capital. The model does not have the ability to include the effects of relational capital. When assessing HCE, the model uses annual employee wages and salaries in order to obtain human capital costs (equation 2). The model depicts relative contribution of employees to creation of added value in a company. The structural capital component of VAIC is calculated as in equation (3). However, this equation does not point to the calculation of structural capital. The structural capital is calculated by subtracting human capital costs from value added. In other words, this element represents everything invested in gaining value added, except from human capital costs (salaries and wages). Equations (2) and (3) point to the conclusion that efficiency in using structural capital is reciprocal to human capital efficiency. IC efficiency sums up both structural and human capital efficiencies in the model (equation (4)). Physical and financial capital efficiencies are presented by the ratio between value added and net assets of a company, and their efficient use is labeled as capital employed efficiency (equation (5)). At the end, VAIC is

assessed as the sum of tangible and intangible capital of companies (equation (6)).

In its essence, the VAIC method expresses several important advantages for use. These advantages have been compiled according to [36]. First, the measurement method is easily comprehensible and easy to use in determining the contribution of IC to value creation in a company. By applying VAIC, various stakeholders are able to examine and assess overall resources and their value creation efficiency. Second, the data required in the model is easy to acquire since the main tool for this is using corporate financial reports. Third, VAIC is more objective and verifiable compared to other measurement models because the data used in its calculation had been previously audited [45]. Fourth, the VAIC method of assessing IC makes cross-organizational or cross-national comparison more feasible, unlike other measurement models, which require both financial and non-financial measures often including some subjective insights. These measures are naturally customized to individual organizations, and some of the measures especially non-financial measures are not always publicly available. This is why any comparative study on mentioned methods of measurement is not possible [43]. Finally, the enterprises can use this approach in terms of evaluating their own IC and organizational performance exclusive of the application of industry standards [31].

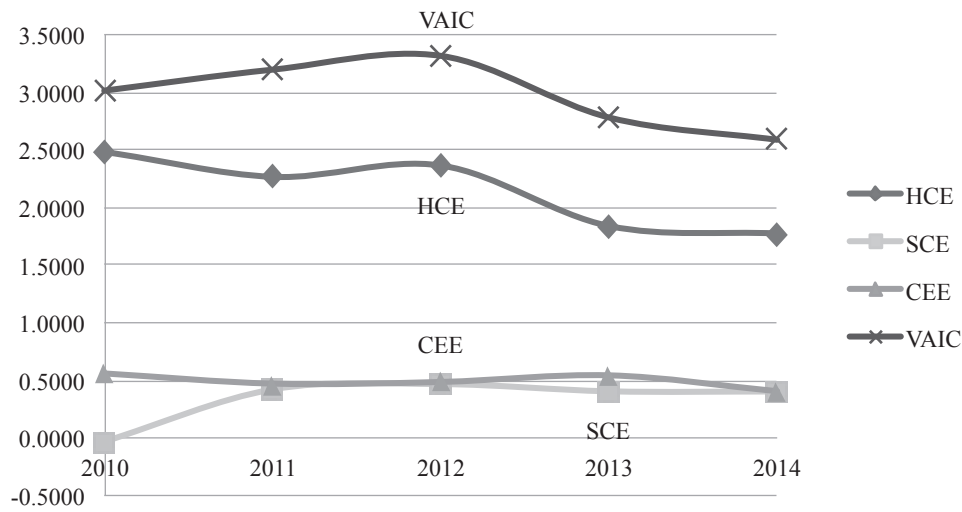
VAIC model suffers from several disadvantages. First, financial statements are used as the basis for its calculation. By doing so, the coefficient itself represents a measure of created value in the past, rather than company's future potential benefits. Besides this, VAIC model is unable to incorporate the synergy from combined exploitation of IC elements. Third, VAIC focuses on partial contribution to value creation done by its components. In practice, elements of IC interact among themselves so it is impossible to separate their individual contribution to corporate performance. Finally, the model fails to offer adequate analysis of the creation of added value for companies with negative equity and operating profit [6]. There are several important disadvantages when using VAIC. First, it is based on financial reports, which are indicators of past strategy. Second, VAIC does not take into account synergies that exist among the various components of

VAIC. Third, the model does not extensively analyze the innovation capacity and relational capital of a firm. Often cited critical view of VAIC model was assessed by Ståhle *et al.* [40]. The authors stressed out several important problematic issues. First, the authors mentioned that VAIC model measures only operational efficiency of a company and that there is no explicit link with IC. For example, in case of human capital, the model only takes into account annual salaries, neglecting their knowledge, skills, motivation, experience or training. It is similar when analyzing structural capital, while there is no relational capital in the model. Additional issue is treating IC and performance linearly. The second problem lies in model's calculation steps. In case of human capital, the higher the HC, the higher human capital is. However, when computing the human capital efficiency ($HCE = VA/HC$), lower value for HC implies better human capital efficiency. In addition, the application of value added (VA) is problematic. VA is obtained by the following equation $VA = OP + EC + A + D$, where A and D are independent from the created value. At the same time, structural capital represents VA minus human capital costs ($OP + A + D$) and in this manner, VAIC is linearly linked with structural capital and at the end it is not possible to fully compare the capital-intensive industries with others, due to the differences in human capital costs. The mentioned issue is also that model does not take into account the holistic nature of intellectual capital. Despite its disadvantages, VAIC had become widely accepted by the academic and professional community as the good indicator IC's productive use. Moreover, the fact that UK's Department for Business, Innovation and Skills use VAIC as the indicator of IC's use in companies significantly contributes its validity [46].

VAIC is well suited for assessing relative contribution of IC to creating extra value in developing countries because its usage enables the efficiency of IC to be compared with the efficiency of tangible assets. The objective of this empirical study was to determine the impact of IC and its components on companies' market and financial performance.

Figure 2 illustrates the values of various VAIC components over the analyzed period of five years. The human capital component makes up the majority of VAIC

Figure 2: The values of VAIC during the analyzed period



index. On the other hand, it shows the steady decrease in value during the five-year period. Structural capital element demonstrates the growth in the same period, while physical and financial capital maintains the stability. However, since HCE is the primary building block of aggregated VAIC coefficient, it is expected that its value predominantly determines the value of VAIC. Therefore, VAIC shows the steady decrease over time.

Research hypotheses and variables used

In order to assess the relationship between market and financial performance of listed companies on Belgrade Stock Exchange, the two main hypotheses are tested. The research hypotheses are developed in accordance to both theoretical concepts and previous empirical research in the field of intellectual capital. These hypotheses reflect the different approaches in terms of business operations of companies. The first approach attempts to assess the financial performance dependence on IC and its various components. On the other hand, the expected returns are also a determinant of company’s performance, especially

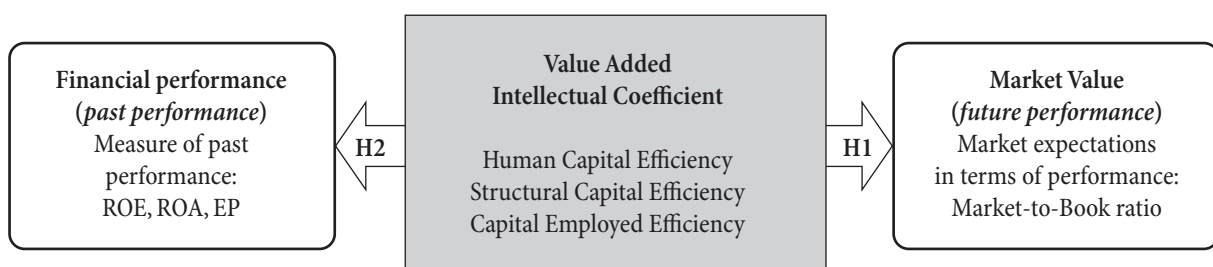
when analyzing the market performance. This is why the research tends to validate both sides, the past and future performance dependence on IC. When observing whether the IC mostly affects market or financial performance we can assess whether IC affects future expectations, existing performance or both. The approach is similar to the approach of Nimtrakoon [36]. As implemented by Figure 3 illustrates these assumed relationships that will be tested through the following research hypotheses.

Hypothesis 1: Companies with higher values of VAIC tend to have better market performance.

This hypothesis shows the reliance of market-to-book ratio, as one of the mostly used market performance indicators of listed companies, on VAIC components. More specifically, by testing this relationship the results will shed the light on whether future, expected, performance is affected by human, structural, or physical component of VAIC.

Hypothesis 2: Companies with higher values of VAIC tend to have better financial performance.

Figure 3: Research framework [Adapted from 36]



The second research hypothesis will show the intensity and nature of relationship between three measures of financial performance (return on equity, return on assets, and employee productivity) and components of VAIC coefficient. This hypothesis, if confirmed, will prove that Serbian listed companies still do not rely on IC.

To test these hypotheses, the appropriate variables must be defined in the research, both dependent and independent. The dependent variables (measuring companies' market and financial performance) applied in the specific research are:

- Market-to-book ratio, MB (market capitalization to book value of assets)
- Return on equity, ROE (the ratio between net profit and average stockholder equity's book value)
- Return on assets, ROA (obtained as pre-tax income divided by total assets)
- Employee productivity, EP (pre-tax income divided by number of employees)

The independent variables in the research are elements of VAIC (efficiencies of using human, structural, and physical and financial capital), calculated as described in equations (1)–(7). Finally, the control variables in the

research model are firm size and leverage. As proxies for these control variables we use total assets and number of employees (for firm size), and ratio between total liabilities and total assets (for leverage).

Research results and discussion

Statistical analysis was implemented in causal and logical order and therefore enabled us to draw conclusions based on these results. Within Table 1, we can view values for descriptive statistics in regards to analyzed *BELEXline* companies. The data are given for each of the dependent and independent variable and entail values for minimum, maximum, mean, standard deviation, variance, kurtosis and skewness.

In case of research sample enterprises, there are significant variations in values, which are caused by variables' differences in calculation. In order to determine the appropriate correlation test for selected enterprises, we performed the tests that determine the type of data distribution in the sample (normality tests). The data in Table 2 shows the reliability of the research sample, in terms of valid input data. The basic normality tests used

Table 1: Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
		Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
EP	210	-770472,1	122404,3396	2247,583996	70952,1280694	-8,486	,168	84,653	,334
HCE	210	-1,9227	11,4337	2,146005	1,6678276	1,335	,168	4,570	,334
MB	210	,0000	3,6593	,667566	,6304153	2,033	,168	5,057	,334
CEE	210	-,1482	5,4324	,481658	,7335201	3,777	,168	17,288	,334
SCE	210	-19,9221	3,6829	,332589	1,5056989	-11,693	,168	158,414	,334
ROA	210	-,3626	,3533	,037454	,1046463	-,395	,168	2,533	,334
ROE	210	-8,1393	1,0139	-,014567	,6715863	-9,467	,168	106,822	,334
Valid N	210								

Table 2: Case Processing Summary

	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
	HCE	210	100,0%	0	0,0%	210
SCE	210	100,0%	0	0,0%	210	100,0%
CEE	210	100,0%	0	0,0%	210	100,0%
MB	210	100,0%	0	0,0%	210	100,0%
ROE	210	100,0%	0	0,0%	210	100,0%
ROA	210	100,0%	0	0,0%	210	100,0%
EP	210	100,0%	0	0,0%	210	100,0%

for the needs of this research are Shapiro-Wilk test and Kolmogorov-Smirnov test. The results of these normality tests are given in Table 3.

The results of presented tests point to conclusion that analyzed variables are not normally distributed. (Sig. <0,05). The values of aggregated VAIC coefficient have identical characteristics of distribution as its constitutive elements. Thus, the data in the research sample is not normally distributed, which implies the necessity to perform non-parametric correlation analysis (Spearman correlation test).

Table 4 reveals the results of Spearman’s correlation analysis. The results indicate that there is significant correlation between almost all of the VAIC components and selected measures of corporate performance. However, capital employed efficiency is an exception when analyzing its relationship with employee productivity. In addition, structural capital efficiency is significantly correlated with market performance, but this correlation only exists at the 0,05 level of significance. The following tables (5-8) present the results of the multiple regression analysis. We employed four different regression models in order to test if

Table 3: Normality tests

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
HCE	,154	210	,000	,894	210	,000
SCE	,324	210	,000	,263	210	,000
CEE	,232	210	,000	,579	210	,000
MB	,161	210	,000	,802	210	,000
ROE	,355	210	,000	,283	210	,000
ROA	,176	210	,000	,928	210	,000
EP	,342	210	,000	,311	210	,000

a. Lilliefors Significance Correction

Table 4: Correlation analysis

		MB	ROE	ROA	EP	HCE	SCE	CEE
<i>MB</i>	Correlation Coefficient	1,000	,467**	,503**	,412**	,277**	,175*	,370**
	Sig. (2-tailed)	.	,000	,000	,000	,000	,011	,000
	N	210	210	210	210	210	210	210
<i>ROE</i>	Correlation Coefficient	,467**	1,000	,949**	,795**	,500**	,308**	,436**
	Sig. (2-tailed)	,000	.	,000	,000	,000	,000	,000
	N	210	210	210	210	210	210	210
<i>ROA</i>	Correlation Coefficient	,503**	,949**	1,000	,822**	,494**	,306**	,378**
	Sig. (2-tailed)	,000	,000	.	,000	,000	,000	,000
	N	210	210	210	210	210	210	210
<i>EP</i>	Correlation Coefficient	,412**	,795**	,822**	1,000	,696**	,480**	,118
	Sig. (2-tailed)	,000	,000	,000	.	,000	,000	,089
	N	210	210	210	210	210	210	210
<i>HCE</i>	Correlation Coefficient	,277**	,500**	,494**	,696**	1,000	,780**	,215**
	Sig. (2-tailed)	,000	,000	,000	,000	.	,000	,002
	N	210	210	210	210	210	210	210
<i>SCE</i>	Correlation Coefficient	,175*	,308**	,306**	,480**	,780**	1,000	-,005
	Sig. (2-tailed)	,011	,000	,000	,000	,000	.	,948
	N	210	210	210	210	210	210	210
<i>CEE</i>	Correlation Coefficient	,370**	,436**	,378**	,118	,215**	-,005	1,000
	Sig. (2-tailed)	,000	,000	,000	,089	,002	,948	.
	N	210	210	210	210	210	210	210

** Correlation is significant at the 0,01 level (2-tailed)

* Correlation is significant at the 0,05 level (2-tailed)

and in what way human capital efficiency, structural capital efficiency, and capital-employed efficiency determined the past (financial) and future (market) performance. The multiple regression equation applied in all of the regression models is as follows:

$$Y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_p x_{ip} + \varepsilon_i,$$

for $i=1, 2, 3 \dots n$

In the presented model of multiple regression, Y_i is dependent variable, $\beta_0, \beta_1, \beta_2 \dots \beta_p$ are regression coefficients, $x_{i1}, x_{i2} \dots x_{ip}$ are independent variables, and ε_i represents the notation for the model deviations. The first regression model is presented in Table 5 and it sheds light on relationship between market-to-book ratio and relevant components of VAIC.

The results of the first regression model reveal that the model has medium validity since it can explain 22,2% of changes in dependent variable. In addition, the results of this regression indicate that human capital together with physical and financial capital has significant and positive impact on market performance. According to the

results of the first regression model, the equation has the following elements:

$$\text{Market performance} = 0,597 + 0,085 x \text{HCE} + 0,29 x \text{CEE} + 0,04 x \text{Lev}$$

Figures 4 and 5 display the slope of estimated regression curves for the first regression model. The curves represent only the statistically significant relationships. The conclusion is that financial and physical capital are more crucial determinants of market performance than human capital efficiency.

The second regression model, focused on establishing the relationship between return on equity and components of VAIC, is shown in Table 6. The model has R square of 0,853, which means that the model can describe 85,3% of changes in dependent variable.

In addition, the model validates the hypothesis that business performance (presented by return on equity) of Serbian listed companies is significantly influenced by VAIC, specifically by human and physical capital

Table 5: Regression model with market-to-book ratio as dependent variable

Model Summary							
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson		
1	,316 ^a	,100	,087	,6024167			
2	,471 ^b	,222	,199	,5641076	1,625		
a. Predictors: (Constant), Leverage, Employees, Assets							
b. Predictors: (Constant), Leverage, Employees, Assets, SCE, HCE, CEE							
c. Dependent Variable: MB							
Coefficients							
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	,597	,050		11,975	,000	
	Employees	1,847E-005	,000	,040	,475	,635	,621
	Assets	-6,604E-011	,000	-,063	-,753	,452	,621
	Leverage	,040	,008	,314	4,737	,000	,993
2	(Constant)	,335	,072		4,666	,000	
	Employees	-1,296E-005	,000	-,028	-,334	,738	,547
	Assets	-4,748E-011	,000	-,045	-,522	,602	,506
	Leverage	,017	,010	,135	1,687	,093	,600
	HCE	,085	,025	,226	3,401	,001	,869
	SCE	,002	,026	,005	,075	,941	,967
	CEE	,290	,071	,337	4,095	,000	,564

Figure 4: The relationship between market performance and human capital

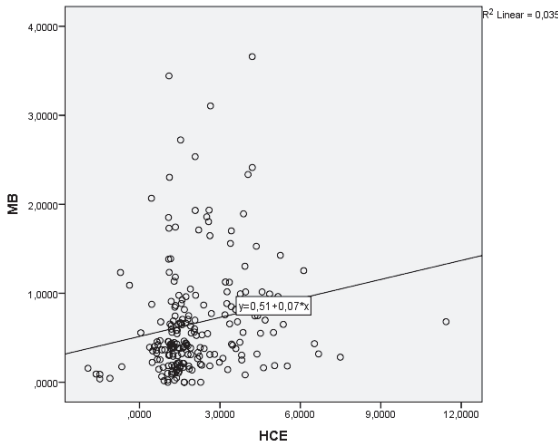
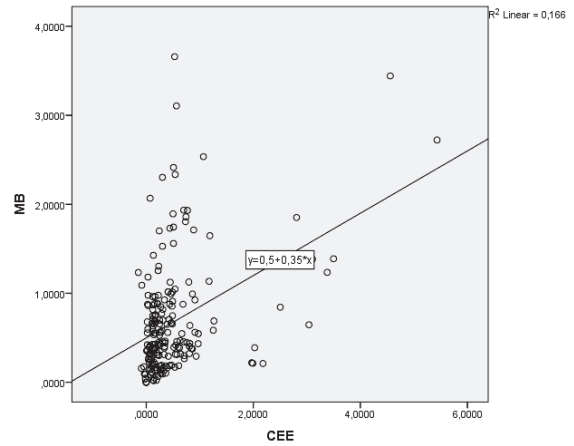


Figure 5: The relationship between market performance and capital employed



components. Therefore, we construct the second regression model as follows:

$$ROE = 0,153 + 0,024 \times HCE + 0,084 \times CEE + 0,0144 \times Assets - 0,125 \times Lev$$

Figures 6 and 7 present the slopes of estimated regression curves for individual independent variables in comparison to the dependent one. The conclusion is that financial and physical capital is slightly more important for return on equity than human capital efficiency, when observing separately.

Table 6: Regression model with ROE as dependent variable

Model Summary								
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson			
1	,919 ^a	,844	,842	,2672369				
2	,923 ^b	,853	,848	,2615952	1,984			
a. Predictors: (Constant), Leverage, Employees, Assets								
b. Predictors: (Constant), Leverage, Employees, Assets, SCE, HCE, CEE								
c. Dependent Variable: ROE								
Coefficients								
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics		
	B	Std. Error				Beta	Tolerance	VIF
1	(Constant)	,153	,022	6,921	,000			
	Employees	3,808E-005	,000	,077	2,210	,028	,621	1,609
	Assets	9,995E-011	,000	,090	2,572	,011	,621	1,610
	Leverage	-,125	,004	-,918	-33,261	,000	,993	1,007
2	(Constant)	,080	,033	2,415	,017			
	Employees	2,862E-005	,000	,058	1,592	,113	,547	1,827
	Assets	1,071E-010	,000	,096	2,541	,012	,506	1,977
	Leverage	-,132	,005	-,968	-27,827	,000	,600	1,667
	HCE	,024	,012	,061	2,094	,038	,869	1,150
	CEE	-,006	,012	-,015	-,530	,597	,967	1,034
	CEE	,084	,033	-,092	2,553	,011	,564	1,772

a. Dependent Variable: ROE

Figure 6: The relationship between ROE and human capital

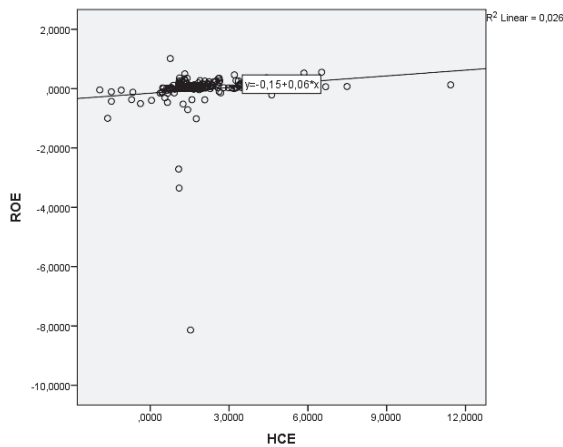


Figure 7: The relationship between ROE and capital employed

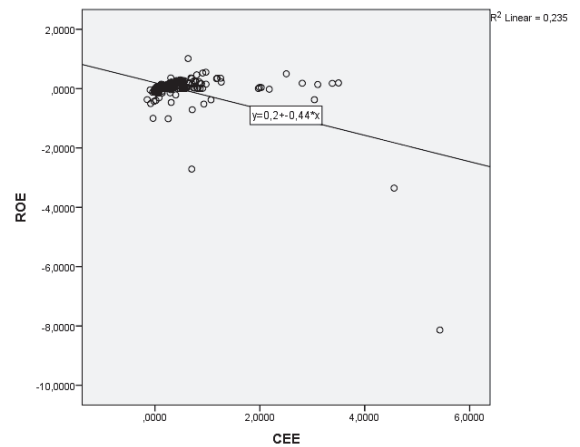


Table 7 depicts the results of the third regression model, which analyzes the impact of VAIC components on business performance presented by return on total assets of listed companies. Like the previous model, this regression model also shows that ROA is heavily influenced by human, physical, and financial components of VAIC.

However, the regression model has medium validity since it can explain 26,1% of changes in the value of ROA.

The construction of the third regression model looks as follows:

$$ROA = 0,041 + 0,022 \times HCE + 0,050 \times CEE - 0,005 \times Lev$$

Table 7: Regression model with ROA as dependent variable

Model Summary								
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson			
1	,244 ^a	,060	,046	,1022147				
2	,511 ^b	,261	,239	,0912620	1,780			
a. Predictors: (Constant), Leverage, Employees, Assets								
b. Predictors: (Constant), Leverage, Employees, Assets, SCE, HCE, CEE								
c. Dependent Variable: ROA								
Coefficients								
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics		
	B	Std. Error				Beta	Tolerance	VIF
1	(Constant)	,041	,008	4,904	,000			
	Employees	4,372E-006	,000	,663	,508	,621	1,609	
	Assets	6,096E-012	,000	,404	,687	,621	1,610	
	Leverage	-,005	,001	-,236	-,3487	,001	,993	1,007
2	(Constant)	-,020	,012	-1,710	,089			
	Employees	5,069E-007	,000	,081	,936	,547	1,827	
	Assets	1,282E-012	,000	,080	,936	,506	1,977	
	Leverage	-,009	,002	-,410	-5,271	,000	,600	1,667
	HCE	,022	,004	,356	5,497	,000	,869	1,150
	SCE	,000	,004	,002	,035	,972	,967	1,034
	CEE	,050	,011	,349	4,352	,000	,564	1,772
a. Dependent Variable: ROA								

Figure 8: Relationship between ROA and human capital

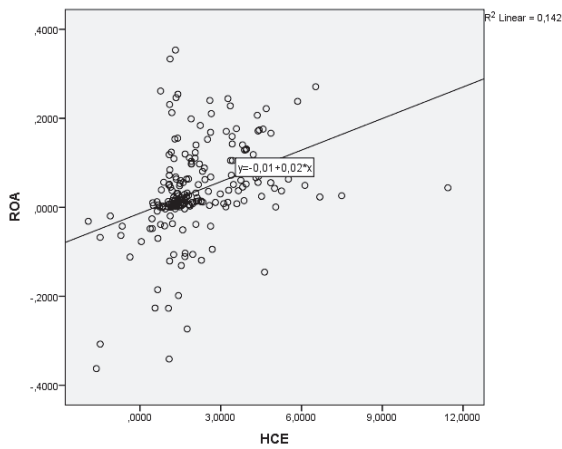
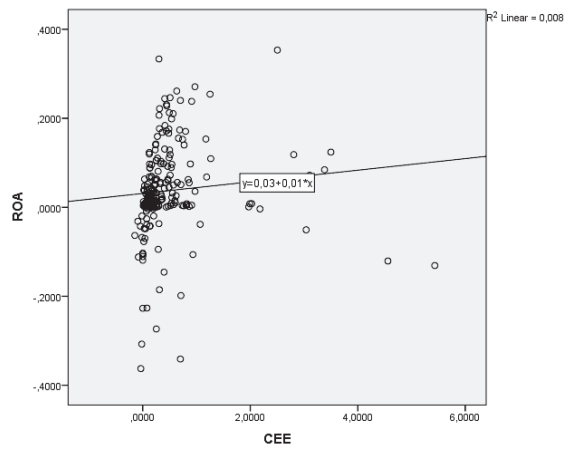


Figure 9: Relationship between ROA and capital employed



Figures 8 and 9 present the slopes of estimated regression curves for individual independent variables (HCE and CEE) in comparison to the dependent one (ROA). The conclusion is that financial and physical capital is far less important for return on assets than human capital efficiency.

The last regression model shows the nature of relationship between employee productivity and human, structural, and physical (with financial) performance (Table 8). The model manages to account for 23,6% of all the employee productivity alterations.

Table 8: Regression model with EP as dependent variable

Model Summary							
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson		
1	,161 ^a	,026	,012	70536,9790481			
2	,486 ^b	,236	,213	62925,6734007	2,067		
a. Predictors: (Constant), Leverage, Employees, Assets							
b. Predictors: (Constant), Leverage, Employees, Assets, SCE, HCE, CEE							
c. Dependent Variable: EP							
Coefficients							
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error				Beta	Tolerance
1	(Constant)	-1147,695	5838,449	-.197	,844		
	Employees	,717	4,548	,014	,158	,621	1,609
	Assets	1,755E-005	,000	,149	1,712	,621	1,610
	Leverage	-620,075	992,999	-,043	-,624	,993	1,007
2	(Constant)	-44151,817	7997,979	-5,520	,000		
	Employees	3,006	4,324	,058	,695	,547	1,827
	Assets	1,067E-006	,000	,009	,105	,506	1,977
	Leverage	-839,169	1139,903	-,058	-,736	,462	,600
	HCE	20115,048	2799,258	,473	7,186	,000	,869
	SCE	-6487,307	2940,085	-,138	-2,207	,028	,967
	CEE	8834,692	7898,056	,091	1,119	,265	,564
a. Dependent Variable: EP							

Figure 10: The relationship between EP and human capital

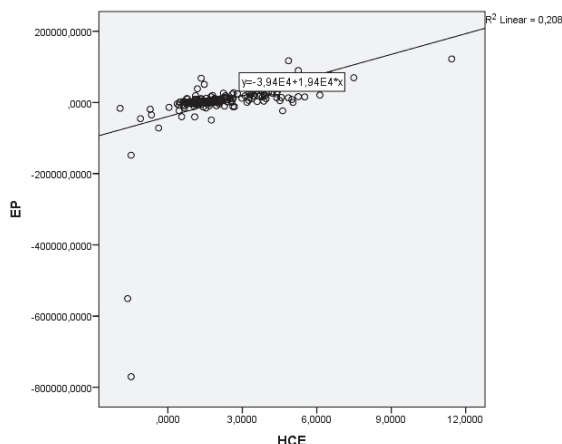
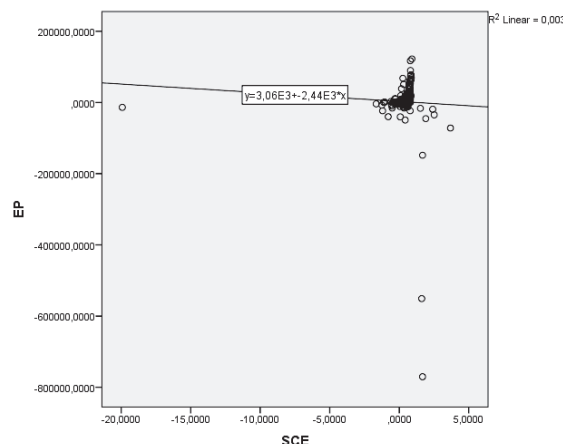


Figure 11: The relationship between EP and capital employed



Differently from the previous regression models, here the structural capital emerges as the determinant of employee productivity, together with human capital efficiency. Therefore, the employee productivity is affected by the investments in human capital. However, since the beta coefficient has negative value, the structural has significant but negative impact on productivity. This might mean that the listed companies do not invest properly in the elements of structural capital, or that these investments are not adequately capitalized. These conclusions lead to the following regression equation:

$$EP = -1147,695 + 20115,048 \times HCE - 6487,307 \times CEE$$

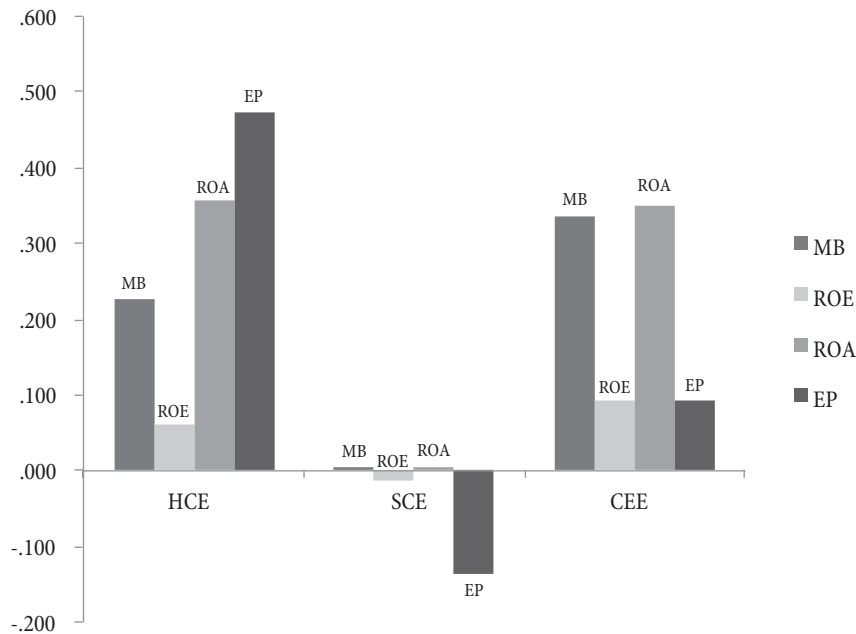
Figures 10 and 11 present the slopes of estimated regression curves for individual independent variables (HCE and SCE) in comparison to the dependent one (EP). The conclusion is that financial and physical capital is far less important for return on assets than human capital efficiency.

The results of the statistical analysis indicate that the research hypotheses are confirmed in all of the analyzed cases, except when it comes to the positive effect of structural capital on market performance. In addition, the structural capital component does not express any significant impact on financial performance as well, except when we analyze the employee productivity indicator.

Concluding remarks

In order to make adequate concluding remarks, we will make a brief comparison between research study undertaken among Serbian listed companies and similar studies worldwide. One such empirical study investigated the association between intellectual capital and corporate performance of companies listed on Malaysian stock exchange [19]. The study focused on discovering whether value creation efficiency, as measured by Value Added Intellectual Capital, could be explained by market valuation, profitability, and productivity. The findings revealed that these companies still depend very much on physical capital efficiency. The results also indicated that physical capital efficiency was the most significant variable related to profitability while human capital efficiency was of great importance in enhancing the productivity of the company. This study concluded that VAIC can explain profitability and productivity but fails to explain market valuation. Another study examined relationship between IC and organizational performance in firms in India [7]. The study revealed significant dependence of various organizational performance indicators on IC, especially on social capital (a form of structural capital), which includes knowledge tied up in relationships among employees, customers, suppliers, alliance partners and the like. This type of knowledge tends to lead to process and product innovations, better problem solving which tends to increase production and service delivery efficiencies as

Figure 12: The overview of VAIC impact on market and financial performance



well as customer satisfaction. Another study implemented by Calisir et al. [4] applied Value Added Intellectual Coefficient to compare listed companies on the Istanbul Stock Exchange (Turkey), in terms of intellectual capital efficiency and in terms of examining impact of VAIC and its components on company performance. The study revealed that as a whole, all of the companies in the sample had relatively higher human capital efficiency than structural and capital employed efficiencies. On the other side, the results of the study revealed that factors such as human capital efficiency, firm leverage, and firm size, predicted profitability well. Among them, human capital efficiency had the highest impact. In addition, capital employed efficiency was found to be a significant predictor of both productivity and return on equity, and the only determinant of market valuation was the firm size.

The results of the presented study implemented in Serbia, with the data from 42 companies listed on Belgrade Stock Exchange have several important conclusions. The information provided by Figure 12 illustrates these conclusions by addressing the market and financial performance dependence on various components of VAIC coefficient. The first obvious conclusion states that structural capital component represents the insignificant element of VAIC in terms of market performance and in terms of almost elements of financial performance.

However, the structural capital efficiency tends to be significant when it comes to employee productivity, but this relationship is inverse, leading to conclusion that structural capital still does not nurture and support the everyday productivity of employees. This conclusion is important since companies could realize that their investments in elements of structural capital (such as customer databases, organizational structure, functional organization, procedures, rules of conduct and the like) are not fully capitalized through market and financial performance. The second important conclusion is that market performance (objectified through market-to-book ratio) is much more affected by the companies' financial and physical capital (presented by capital employed efficiency) than by human capital efficiency. However, the human capital efficiency still determines the productivity of employees in Serbia's listed companies. When it comes to financial performance, both capital employed and human capital are the important influencers, with capital employed efficiency being more significant one in case of return on equity and return on assets.

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