Journal of Intellectual Capital

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Abstract
Purpose – The purpose of this paper is to examine whether intellectual capital (IC) creates value in the Serbian information communication technology (ICT) sector. More specifically, it examines the degree to which IC and its key components affect the financial performance of selected ICT companies compared to effects on physical and financial capital.
Design/methodology/approach – The analysis included 13,989 Serbian ICT companies during 2009-2013. Value-added intellectual coefficient (VAIC) was used to measure the level of IC contribution to value creation. Measures of financial performance used in the study were return on equity, return on assets, return on invested capital, profitability, and asset turnover.
Findings – Results indicate that, when using firm size and leverage as control variables, only capital-employed efficiency has significant effect on financial performance. Finally, the research confirms that there were no significant differences in financial performance among different ICT subsectors.
Research limitations/implications – Main research limitation is related to the disadvantages of VAIC as the measure of IC's contribution to value creation.
Practical implications – Owners and managers of Serbian ICT companies must recognize the importance of managing both the physical capital and the intangible resources embedded in their employees and processes.
Originality/value – This is the first paper to examine comprehensively the impact of IC on financial performance in the ICT sector in a transitional economy. This study differs from prior studies in that the authors analyzed every company that operated in Serbian ICT sector.
Keywords Serbia, Intellectual capital, Intangible assets, Corporate performance, ICT industry, Value-added intellectual coefficient
Paper type Research paper

1. Introduction – the nature and role of intellectual capital (IC)
In conventional management, tangible assets like land, factories, machinery, equipment, and raw materials were used as the basis for performance improvement. When these sources of corporate wealth became scarce or harder to obtain, managers took a U-turn toward finding ways of gaining competitive advantage even while having less physical capital at their disposal. In other words, managers had to do more with less, and had to focus on working smarter, not harder. Thus, the knowledge-based economy was born. The knowledge-based economy supports a business model that relies mainly on wealth creation through development, deployment, and utilization of companies' intangible assets or IC. The cornerstones of IC that drive enterprise performance include knowledge, competence, intellectual property, brands, reputation, and customer relationships (Janošević and Dženopoljac, 2014).

The interest in IC radically grew during the 1980s when a number of knowledge-intensive industries appeared, such as software development, biotechnology, consulting,

Journal of Intellectual Capital
Vol. 17 No. 2, 2016
pp. 373-396

1469-1930
DOI 10.1108/JIC-07-2015-0068

computer, and internet-based industries. The term came to be particularly widely accepted after it appeared in Thomas Stewart's (1991) cover article in *Fortune* magazine. The paper addressed IC in a very broad way, as the sum of knowledge, information, intellectual property, and experience held by everybody in a company, put to use to create a competitive edge, and ergo, the wealth of a company. Afterwards, many contributors attempted to refine, update, and further shed light on the IC of companies. Knowledge management and IC are considered among the youngest management disciplines to have gained acceptance in the scientific community.

Hall (1992) saw IC as a value driver, transforming production resources into assets with extra added value. Edvinsson and Malone (1997) asserted that IC, although invisible, possessed crucial importance for corporate performance. Stewart (1998) defined IC as collective brainpower reflected in different forms of knowledge, important information, company's intellectual property, and experience. A rather interesting and influential definition of IC was given by Sullivan (2000), who stated that IC represents knowledge that can be converted into profit. This definition hits the core of IC: it is potentially important for corporate performance, but it is up to managers whether they will realize this potential. Finally, Lev (2001) saw IC as a company's rights to future benefits, created by the effective and efficient use of IC. Marr and Schiuma (2001, cited in Marr, 2004) defined IC as the group of knowledge assets attributed to an organization that most significantly contribute to an improved competitive position of this organization by adding value to the defined key stakeholders. In a more recent work by Edvinsson (2002, p. 93), mentioned the systematic effect of multiplying the effects of human and structural capital (SC) when effectively combined and used. To be more precise, Edvinsson explained that SC served as the basis for multiplying employees' talents, thus increasing the IC value in a company. Hsu and Fang (2009) viewed IC as the sum of capabilities, knowledge, culture, strategy, process, intellectual property, and relational networks of a company. These resources create value or competitive advantages, and aid in achieving corporate goals.

The obvious and empirically proven importance of IC for companies and for economies as a whole are the main motives for implementing an analysis of the interrelation between IC and financial performance of enterprises operating in one knowledge-intensive industry, in this case the information communication technology (ICT) industry. Thus, the main goal of the paper is to reveal the existence and nature of relationship between IC and financial performance of enterprises in the ICT industry in Serbia. The undertaken research represents the first effort toward obtaining comprehensive view of the ICT sector in a transitional economy, such as Serbia. The empirical research was implemented through in-depth analysis of financial performance of 13,989 ICT companies in Serbia, and determined whether these companies rely heavily on IC, which is often assumed in the literature. Accordingly, the paper is divided into an introduction and five subsequent sections. Section 2 relates to the literature review in terms of different IC categorizations. Section 3 deals with the importance and role of IC in the value-creation process of firms in general, firms in knowledge-intensive industries, and firms in the ICT industry. In Section 4, focus shifts toward explaining the research methodology, which includes sample definition, development of research hypotheses, and identification of variables used in the empirical study. Section 5 presents the results and discussion of the applied empirical study in the ICT industry of Serbia. Section 6 contains concluding remarks.

2. Main components of IC

Efforts toward a sound categorization of the IC of a company are also efforts toward better management of this IC. One of the early categorizations of IC, made by

Karl-Erik Sveiby (1997) (cited in Sveiby, 2002) distinguished internal structure, external structure, and employee competencies. Internal structure consists of internal company systems, databases, business processes, and routines that are used as business supports. External structure entails relationships with external stakeholders and networks. Finally, employee competencies include individual experience, knowledge, and employee abilities. One of the pioneering attempts to categorize intangibles was made by Hall (1992), who categorized intangibles into two groups, depending on their ability to be viewed separately from human resources. Intangibles that reside within human resources are labeled as human capital (HC). HC is based on various forms of knowledge, which are predominantly generic or specific. This notion is in line with generally accepted ideas that organizational advantage is extracted from knowledge residing in the heads of employees and represents the most valuable asset of a company (Crane and Bontis, 2014). On the other hand, intangibles that can be separated from human resources are defined as organizational capital (e.g. company norms, rules of behavior, databases, organizational routines, and corporate culture), technological capital (e.g. patents, trade secrets, trademarks, copyrights, and intellectual property rights), and relational capital (RC) (e.g. reputation, brand, customer loyalty, long-term customer relations, trade name, and distribution channels).

The Swedish insurance company Skandia became recognizable in the field of IC management in 1994 when it published its first report on intangible assets (Skandia, 1994) as reported by Bontis (1996). The report was entitled "Visualizing Intellectual Capital" and it served as the supplement to traditional financial statements. The creator of this IC management concept was Leif Edvinsson. Within the report, intangible assets are divided into HC, SC, and customer capital (Bontis, 1999; Mouritsen *et al.*, 2001). HC consists of individual knowledge of company employees. SC includes, among other things, corporate culture, information flow, and databases. According to Edvinsson, the key role of leadership is to transform human into SC. In addition, HC cannot be owned, while SC can be owned and traded, from a shareholder's point of view. This implies that HC is more volatile, while SC can be used as leverage for corporate growth (Edvinsson, 1997). The final element of IC according to the Skandia classification is customer capital, which relates to a company's ability to capitalize the effects of quality relations with its clients as well as the external business networks of a company. Edvinsson influenced many researchers who adopted this three-element categorization of IC. One such example is the categorization made by Bontis (1998), who also focussed on HC, SC, and customer capital as the main elements of IC. Often cited and used, the classification of IC corresponds to Edvinsson's and Bontis's categorizations and entails HC, SC, and RC. This categorization was made within the project Measuring Intangibles to Understand and Improve Innovation Management (2002), also known as the MERITUM Guidelines. Another European project that used this distinction among IC components is the project "InCaS: Intellectual Capital Statement – Made in Europe, European Intellectual Capital Guideline," which was developed by the InCaS consortium. According to the results of the project, IC comprises of HC, SC, and RC. HC was defined as "what the single employee brings into the value adding processes." SC was defined as "what happens between people, how people are connected within the company, and what remains when the employee leaves the company." RC is defined as "the relations of the company to external stakeholders" (Mertins and Will, 2008). In addition, these components were further divided into specific harmonized IC factors. In this sense, HC consists of professional competence, social competence, employee motivation, and leadership ability. The SC includes the factors like internal cooperation and knowledge transfer, management instruments and tools, IT and explicit knowledge, product innovation, process optimization and innovation, and corporate culture. Finally, RC refers to the factors like relations with customers, suppliers, the public, investors, and with cooperation partners (Mertins *et al.*, 2009).

Sullivan (2000) also adopted the three-element classification of IC, 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 (2000) adopted an IC classification consisting of two elements: organizational (structural) and HC. This classification was first presented by the Organization for Economic Cooperation and Development and was adopted by several authors in the field of IC research. Lev (2001) significantly influenced the field of intangible-asset management in terms of properly establishing the grounds for defining, setting the terminology, classifying, reporting, and managing intangibles in a company. He defined intangibles as non-physical and non-financial assets, which are the basis for claiming rights on future benefits. In addition, Lev stressed the three nexuses of intangibles that predominantly affect the value-creation process of a company. These are discovery, organizational practices, and human resources. Lev pointed out that the elements of tangible and intangible resources of companies are interrelated; therefore, it is often difficult to make a clear distinction between them. However, the connection between these resources is responsible for value creation in a company.

3. Empirical evidence of the relationship between IC and corporate performance in knowledge-intensive industries

While the theoretical foundations for investigating the importance of IC for corporate performance are clear and require no further explanations (Bontis *et al.*, 2000), the practical side of this relationship is questionable. There are three main reasons for this. The first is that the literature and practice still lack an appropriate measure of IC's absolute value, or its relative contribution to corporate performance. Therefore, the use of various (less than perfect) measures restricts the ability to compare given results adequately. The second reason is that analyses are performed in different contexts, especially in regards to different places and in different points in time. IC's impact on corporate performance differs in developed compared to developing countries. Additionally, the research results may vary depending on the time of the research. If we analyze IC's impact on corporate performance in a time of economic crisis, we might encounter results indicating that IC does not affect performance. Finally, due to the time-delay effect of IC, it is vital to analyze corporate performance several years after initial investments in IC and organizational learning have taken place (Bontis *et al.*, 2002; Bontis and Fitz-enz, 2002). Despite these restrictions in research studies, one thing is clear: the IC of a company must be seen as an asset with the potential to create extra value. The ways in which managers combine this asset with material ones lead to achieving competitive advantage. However, the main problem with IC and its impact on value is the inability to grasp its potential because many authors simply try to compare it to market or book value, for example. According to Bukh *et al.* (2001), the focus should be on how IC is being put to work, and therefore on IC-related activities.

The most commonly preferred industries for investigating IC's impact on corporate performance have been banking and finance, pharmaceuticals, and information technology (IT) (Vishnu and Gupta, 2014). In addition, several research studies have been carried out within the hospitality sector. The main reason why these sectors have been investigated is their logical and natural lean toward the use of knowledge. Bearing in mind the aforementioned restrictions on research studies carried out in the field of IC, the aim of this paper is to compare different results and conclusions among various research studies.

There are only a few extensive research studies that cover entire industry sectors. One such study was conducted by Kujansivu and Lönnqvist (2007). Their research covered firms from Finland from 2001 to 2003. Their research investigated 11 biggest industries. The results of the study revealed that in the electronics industry IC is relatively high, while the average total efficiency and average IC efficiency do not differ by the industry. IC is relatively low in industries like electricity, gas, and water supply. On the other hand, in these industries the total efficiency and efficiency of IC are higher comparing to other in the research. The reasons for these differences were not clear and the authors stressed that a deeper analysis of IC components might be warranted.

Mavridis (2004) investigated the relationship between IC and performance of 141 Japanese banks and concluded that the best-performing banks were those that have generally very good results in the usage of their IC and less in the usage of their physical capital. An analysis of the 17 largest Greek banks over the period 1996-1999 (Mavridis and Kyrmizoglou, 2005) showed that corporate performance of these banks is significantly affected by IC (mainly HC). A research study in eight Asian economies (Hong Kong, Indonesia, Malaysia, the Philippines, Singapore, South Korea, Taiwan, and Thailand) over the six-year period 1996-2001 (Young *et al.*, 2009) found that HC and physical capital were the main driving forces of value creation for commercial banks, but during the financial crisis, the value-creation potential of HC was diminished while physical capital continued to create value without losing its significance. An analysis of the Italian banking sector by Puntillo (2009) aimed to determine the relationship between IC and market performance between 2005 and 2007. The research found a positive relationship only between capital-employed efficiency (CEE) and return on assets (ROA) and return on equity (ROE), while the CEE demonstrated a negative impact on market-to-book value. Another research study investigated 11 Australian banks for the period 2005-2007 using the value-added intellectual coefficient (VAIC) methodology (Joshi *et al.*, 2010). The study revealed that IC has a significant relation to human costs and benefit, and that the most influential component of IC in Australian banks is HC. The performance of banks in terms of physical and SC demonstrated little or no impact on the overall efficiency of banks and the process of value creation. In a research study undertaken by Abdulsalam *et al.* (2011) over a ten-year period (1996-2006), commercial and non-commercial Kuwaiti banks were analyzed regarding IC performance. It was found that commercial banks outperformed non-commercial ones over the latter three years (2004-2006). In a more recent study by Ang and Hatane (2014) of the banking sector of Indonesia, physical capital was determined as the most consistent variable in influencing profitability, employee productivity, and asset turnover (ATO).

In recent literature, numerous empirical studies have been implemented in order to determine the IC's impact on corporate performance in IC-intensive industries. One such industry is the ICT industry. Firer and Williams (2003) examined IC's impact on corporate performance of 75 South African IC-intensive enterprises that operated within the banking, electrical, IT, and service industries. The empirical findings suggested that physical capital remained the most significant underlying resource of corporate performance in South Africa at the time of the research. In a study conducted by Shiu (2006), the VAIC was applied in order to measure the contribution of IC to corporate performance of 80 listed technological firms in Taiwan in 2003. The research concluded that VAIC has a significant positive correlation with profitability and market value, while there is negative correlation with productivity. Gan and Saleh (2008) investigated the relationship between IC and corporate performance of technology-intensive companies in Malaysia and found that these companies are primarily dependent on physical capital. The results also indicated that physical capital efficiency is the most significant variable related to profitability, while human capital efficiency (HCE) is of great importance in enhancing the productivity of a company. Erickson and Rothberg (2009) carried out a longitudinal assessment of three US hi-tech industries for a period of eight years, in two separate data sets (1993-1996 and 2003-2006). One of the conclusions of the research was that IC and effective knowledge management can contribute to market performance in these industries. Findings of a research study conducted within the Irish ICT sector (Cleary, 2009) strongly supported the positive impact of human, structural, and relational dimensions on IC and business performance.

Kavida and Sivakoumar (2010) evaluated the role of IC in the performance of the Indian IT industry. Their objective was to understand the relevance of IC for this industry. The results showed that IC was relevant to corporate performance. Fan *et al.* (2011) investigated the relationship between IC and company performance in China's IC-intensive manufacturing, IT, and banking and insurance industries. The study covered the period 2007-2009, and the results showed that significant differences between the efficiency of IC among different industries exist. The efficiency of IC in the finance and insurance industry was the highest. On the other hand, the efficiency of IC in the IT sector was not quite clear because this industry was still at an early stage of development at the time of the study. Additionally, the authors concluded that the driving force of value creation lies in human and SC, while the effect of physical capital is relatively low. Recent research on IC's impact on corporate performance was performed by Osman (2014), who investigated the issue on a sample of small- and medium-sized ICT enterprises in Malaysia. The study revealed that IC had direct, significant, and positive effect on capability to innovate and on company performance.

While the ICT sector has been extensively investigated by researchers in various national economies, the performance of companies that operate in the whole ICT sector in Serbia in relation to IC has not been analyzed. One research study undertaken in Serbia explored the ICT manufacturing sector, with 594 enterprises analyzed (Janošević and Dženopoljac, 2014). The study showed that, in case of ICT manufacturing companies in Serbia, only HCE affects financial performance, while physical capital has a partial significant impact. SC has no impact on any indicator of financial performance. In order to deepen the scope and validity of Janošević and Dženopoljac's (2014) research, in this paper we include the entire Serbian ICT sector. The main goal of this comprehensive research is to further reveal the dependence of the ICT industry's corporate performance on IC.

4. Research methodology

Sample description

If we analyze key macroeconomic indicators of the Serbian economy in 2013 and 2014, it can be seen that industry growth was insufficient, with realistic risks of industry activity decreases in 2015. The Serbian economy slipped into recession in 2014. Forecasts for Q4 showed that the GDP contracted by 3.6 percent. Industrial activity in Q4 fell by 10.5 percent on a quarter-to-quarter basis. Exports declined by 5.7 percent (vs 26 percent growth in 2013). Imports stagnated, so that the trade gap fell by 1.6 percent (Đuričin and Vukasnović, 2015). This data shows the reality of the Serbian economy and the necessity to focus on industries with potential for creating added value. This is one of the main reasons why we conducted research on the entire ICT sector in Serbia.

ICT infrastructure represents one of the four pillars of the knowledge-economy framework, along with an educated and skilled labor force, an effective innovation system, and a conducive economic and institutional regime. A modern and adequate information infrastructure is the pillar of the knowledge economy in the sense that it facilitates effective communication, dissemination, and processing of information and knowledge (Chen and Dahlman, 2005). In terms of the ICT sector, the basic classification used in this paper relies on International Standard Industrial Classification of All Economic Activities (Revision 4) from 2008, issued by The Department of Economic and Social Affairs of the United Nations Secretariat (2008), Statistics Division. By following the logic of Revision 4, the research is primarily oriented on the broader scope of the ICT sector, which incorporates three major segments: manufacturing, trade, and the services. In Serbia, the European Classification of Economic Activities (EU – NACE Revision 2) was accepted without any changes on January 1, 2008 (Eurostat, 2008). ICT manufacturing industries include the production of electronic components, boards, computers, peripheral equipment, communication equipment, consumer electronics, and magnetic and optical media. ICT trade industries include wholesale of computers, peripherals, software, as well as electronic and telecommunications equipment and parts. Finally, the ICT services industry consists of businesses in the field of software publishing (publishing of computer games and other software); telecommunications (wired, wireless, satellite, and other telecommunications activities); programming for computers, consulting, and linked activities (programming, consultancy, computer facilities management, and other activities); information services (processing of data, web hosting and alike; web portals); and repair of computers and communication equipment (The Department of Economic and Social Affairs of the United Nations Secretariat, 2008).

The total number of enterprises operating in the ICT sector of Serbia is 13,989, according to official data published by the Serbian Agency for Business Registers. Of these, 12,207 operate within the ICT services sector (87.3 percent), 1,583 belong to the ICT manufacturing industry (11.3 percent), and 199 enterprises are in the ICT trade segment (1.4 percent). This observation period spanned five consecutive years, from 2009 to 2013. The original observations of the 13,989 firms were matched with firm-level data from the Serbian Agency for Business Registers, which annually compiles and publishes a comprehensive list of firms' financial statements. The research was unable to include all of the companies in the ICT sector for several reasons. First, the ICT sector includes small- and medium-sized enterprises that have an entrepreneurial legal form. Firms in this category are not all legally bound to maintain and publish financial statements according to Serbian law. Second, many firms in the ICT sector do not have complete data for the observed period. Some of these firms were founded later than 2009, and some were liquidated before 2013, which narrows the sample. The final data set consisted of 2,137 firms with complete and valid data for appropriate statistical analysis. A detailed description of the firms that were included in the final data set is given in Table I.

The final data set is comprised of 15.28 percent of the population. The majority (1,508) of the analyzed firms belong to the ICT services subsector, which accounts for 70 percent of the whole ICT sector in Serbia. After services, the ICT manufacturing subsector accounts for about 28 percent, with 595 firms included in the final data set. The ICT trade subsector has less than 2 percent of firms; 34 in total. These 2,137 firms represent the valid and complete data set required for appropriate implementation of statistical analysis.

Sector	Number of firms in the ICT sector	Number of enterprises in the sample	% of the entire ICT industry
ICT manufacturing			
Electronic components	166	58	34.94
Electronic boards	10	2	20.00
Computers and peripheral equipment	1,146	432	37.70
Communication equipment	155	69	44.52
Consumer electronics	101	32	31.68
Magnetic and optical media	5	2	40.00
Total ICT manufacturing	1,583	595	37.59
ICT trade			
Computers, computer peripherals, software (wholesale)	127	23	18.11
Electronic and telecommunications equipment (wholesale)	72	11	15.28
Total ICT trade	199	34	17.09
ICT services			
Publishing of computer games	6	0	0.00
Publishing of other software	60	2	3.33
Wired telecommunications activities	887	261	29.43
Wireless telecommunications activities	86	22	25.58
Satellite telecommunications activities	5	1	20.00
Other telecommunications activities	90	9	10.00
Computer programming	5,457	769	14.09
Consultancy in the field of IT	1,120	67	5.98
Other IT and computer service activities	860	106	12.33
Processing of data, web hosting, and related activities	1,106	78	7.05
Web portals	236	5	2.12
Repair of computers and peripheral equipment	2,055	181	8.81
Repair of communication equipment	239	7	2.93
Total ICT services	12,207	1,508	12.35
Total ICT sector (Final data set)	13,389	2,137	15.28

Table I.
The research sample

Variables used in the research

Performance indicators for the ICT sector in Serbia, whose variations are analyzed, will serve as dependent variables. The first is ROE, which is obtained by dividing net income with total shareholder's equity; the second is ROA, which is calculated as the ratio between net profit and total assets of a firm; the third is return on invested capital (ROIC), calculated as the ratio between operating profit (OP) in the current year and amount of invested capital in the previous year. The next variable in the model is firm profitability. This performance measure is viewed as the ratio between the OP and book value of total assets. Finally, the research model uses ATO as the performance indicator for Serbian ICT-sector firms, which is also viewed as a productivity indicator for firms. ATO represents the ratio between total revenues and book value of total assets. These financial performance indicators have often been used in similar empirical studies that have investigated the relationship between IC and company financial performance (Firer and Williams, 2003; Gan and Saleh, 2008; Calisir *et al.*, 2010; Janošević *et al.*, 2013).

The main goal of this research is identifying the nature of relationship that exists between the efficient use of IC and enterprise performance of companies operating in the ICT sector of Serbia. Therefore, the research model separates the impact of IC efficiency from the impact of physical and financial capital, whose influence on financial performance is measured through CEE. The research results should therefore show whether the corporate success of ICT firms in Serbia relies more on intellectual or physical and financial capital, or both. This is why the independent variables that are used in the research model are the constitutive elements of VAIC developed by Ante Pulic (1998, 2004). The first step toward establishing company's efficient use of IC is obtaining value added (VA). In this fashion, the model can identify each of the company's resources to the creation of extra value. This extra value is calculated by subtracting the costs of managing the firm (except the costs of human resources, which are treated as an investment) from total sales. VA can be calculated from the company financial statements in the following manner:

$$\text{Value added} = \text{operating profit} + \text{employee costs} + \text{depreciation} + \text{amortization}$$

The first part of the VAIC model determines a firm's IC efficiency. The calculation of IC efficiency entails the calculation of HCE and SCE. The HCE coefficient can be obtained as follows:

$$\text{HCE} = \text{VA}/\text{HC}$$

where HC refers to employees' wages and salaries paid annually. The model focusses on human resources' contribution to the creation of added value. SC entails software and hardware, company's organization, trademarks, licenses, patents, and other elements that positively affect productivity of employees. The equation for determining SCE is:

$$\text{SCE} = \text{SC}/\text{VA}$$

SC is calculated by subtracting HC costs from VA. Therefore, the SC of a firm is viewed as everything that created value besides human resources. IC efficiency represents the summary of HC and SC efficiencies:

$$\text{ICE} = \text{HCE} + \text{SCE}$$

Lastly, CEE or the efficiency of using physical capital in a company, represents the ratio between VA and net assets:

$$\text{CEE} = \text{VA}/\text{CE}$$

The capital that was invested in a company in the past is presented as capital employed (CE) in the previous equation. The CE is also known as company's net assets. At the end, VAIC is the sum of IC efficiency and CEE:

$$\text{VAIC} = \text{ICE} + \text{CEE}, \text{ or } \text{VAIC} = \text{HCE} + \text{SCE} + \text{CEE}$$

In its aggregated form, VAIC emphasizes company's total efficiency, both in using IC and physical and financial capital. In other words, the VAIC approach focusses on determining the relative contribution of IC, physical and financial capital to the creation of value.

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 RC of a firm. Another critical review of the VAIC measure was conducted by Ståhle *et al.* (2011), who stressed out several issues. First, the authors mentioned that VAIC model measures only operational efficiency of a company (in a different way), and that real connection with IC does not exist. For example, in case of HC, the model only takes into account annual salaries, neglecting their knowledge, skills, motivation, experience, or training. It is similar when analyzing SC, while there is no RC in the model. Additional issue is treating IC and performance linearly.

Another drawback of the model is its calculation. In case of HC, the higher the HC, the higher HC is. However, when computing the HCE (HCE = VA/HC), lower value for HC implies better HCE. This can be explained up to a level by stating that HCE is relative measure and it shows the intensity of HC exploitation. In addition, the application of 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, SC represents VA minus HC costs (OP+A+D) and in this manner, VAIC is linearly linked with SC and at the end it is not possible to fully compare the capital-intensive industries with others, due to the differences in HC costs.

Another form of disadvantage arises from the concept of measuring and analyzing IC by applying the VAIC logic. The model does not take into account the holistic aspect of IC. One such framework for better understanding this is given by InCaS structural model. This model analyzes IC as the driving forces of business processes in a company that also significantly affect the knowledge process (Mertins and Will, 2008). Despite its disadvantages, VAIC has 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 (Zéghal and Maaloul, 2010).

Several studies that have investigated IC and business performance have used firm size, leverage, firm age, growth ability, and industry as control variables (e.g. Firer and Williams, 2003; Shiu, 2006; Fan *et al.*, 2011). However, because the firms in our present study belong to the same industry, and bearing in mind that the period is limited to five years, our research model includes two control variables: firm size (using total assets as a proxy) and financial leverage of firms in the ICT sector in Serbia (similar to Chan, 2009; Calisir *et al.*, 2010).

Development of research hypotheses

In accordance with the main objective of the research, four logical and distinctive hypotheses were tested. The first three hypotheses address the important issue of establishing and explaining the relationship between IC efficiency and financial performance of firms in the Serbian ICT sector. The fourth tests whether various subsectors have significantly different financial performance due to different application of IC. Therefore, the authors hypothesize that HCE, SCE, and CEE have direct positive impacts on financial performance of firms in the Serbian ICT industry. In addition, given the fact that the Serbian ICT industry is not yet fully developed, and that the majority of firms adopt a similar business model, it is hypothesized that there should not be significant difference in financial performance within subsectors of the ICT industry in Serbia for the five-year period considered (2009-2013). The research hypotheses are thus described as follows:

H1. HCE has a direct positive impact on financial performance of enterprises in the ICT industry.

H1a. Enterprises that have greater HCE are more likely to have higher ROE.

H1b. Enterprises that have greater HCE are more likely to have higher ROA.

H1c. Enterprises that have greater HCE are more likely to have higher ROIC.

H1d. Enterprises that have greater HCE are more likely to be profitable.

H1e. Enterprises that have greater HCE are more likely to have higher ATO.

H2. SCE has a direct positive impact on financial performance of enterprises in the ICT industry.

H2a. Enterprises that have greater SCE are more likely to have higher ROE.

H2b. Enterprises that have greater SCE are more likely to have higher ROA.

H2c. Enterprises that have greater SCE are more likely to have higher ROIC.

H2d. Enterprises that have greater SCE are more likely to be profitable.

H2e. Enterprises that have greater SCE are more likely to have higher ATO.

H3. CEE has a direct positive impact on financial performance of enterprises in ICT industry.

H3a. Enterprises that have greater CEE are more likely to have higher ROE.

H3b. Enterprises that have greater CEE are more likely to have higher ROA.

H3c. Enterprises that have greater CEE are more likely to have higher ROIC.

H3d. Enterprises that have greater CEE are more likely to be profitable.

H3e. Enterprises that have greater CEE are more likely to have higher ATO.

H4. The contribution of IC to a company's financial performance will not be significantly different among different ICT subsectors.

5. Results and discussion

Descriptive statistics

This section presents the values for minimum, maximum, mean, and standard deviation for each of used variables in the research (Table II), after which we point to the normality tests for the given variables and research sample. The basic test of normality applied for this purpose is the Kolmogorov-Smirnov test. The results of the normality test are presented in Table III.

The results of the normality test show that the analyzed variables do not have a normal distribution of data ($p < 0.05$). The importance of these normality tests lies in their explanatory power regarding the choices made in the correlation analysis that follows. The normality tests confirm that further analysis should use Spearman's correlation coefficient.

Correlation analysis

The results of the implemented correlation analysis depicted in Table IV point to the conclusion that independent variables significantly correlate with identified measures of financial performance. The strongest positive correlation exists in the case of the HC component and profitability. SC has the strongest positive correlation with profitability. However, the analysis shows that SC correlates moderately with all dependent variables in the research. It should be noted that efficiency in the use of SC has a significant negative correlation with productivity of ICT firms, expressed through ATO.

Table II.
Descriptive statistics

	n Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	SD Statistic
ROE	10,685	−3,823.000	675.7143	−0.215462	38.1021319
ROA	10,685	−3,823.000	675.7143	−0.278679	38.1068135
ROIC	8,548	−241.6705	416.6105	0.647597	10.7781100
Profitability	10,685	−1,074.000	675.7143	0.062086	12.3736201
HCE	10,685	−622.3152	2,693.9412	1.702097	28.5522289
SCE	10,685	−983.0000	4,789.0000	1.169509	49.6001394
CEE	10,685	−78.0000	8,951.0000	4.341544	90.7746197
Valid *n*	8,548				

Table III.
Normality test

	Kolmogorov-Smirnov Statistic	df	Sig.
ROE	0.471	8,548	0.000
ROA	0.486	8,548	0.000
ROIC	0.399	8,548	0.000
Profitability	0.456	8,548	0.000
ATO	0.486	8,548	0.000

Table IV.
Correlation analysis

		ROE	ROA	ROIC	Profitability	ATO
HCE	Correlation coefficient	0.594*	0.625*	0.674*	0.712*	0.293*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
SCE	Correlation coefficient	0.205*	0.209*	0.251*	0.263*	−0.219*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
CEE	Correlation coefficient	0.616*	0.508*	0.590*	0.549*	0.614*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000

Note: *Correlation is significant at the 0.01 level (two-tailed)

Finally, physical and financial capital positively correlate all the dependent variables with ROE being the strongest. The correlation analysis here clearly suggests that although there is a significant correlation between all VAIC components and the selected dependent variables, physical and financial capital of Serbian ICT firms still show the strongest relationship with financial performance indicators.

Multiple regression analysis

Multiple linear regression analysis was used to assess the relationships between elements of VAIC and the selected indicators of financial performance, and determine the value drivers in Serbian ICT firms. Since there are five dependent variables in the research, five distinct multiple regression models were identified. Formally, the model for multiple linear regression, given n observations, is:

$$Y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \ \ldots \ + \beta_p x_{ip} + \varepsilon_{i,} \quad \text{for } i = 1, 2, 3, \ \ldots \ , n$$

In the presented model of multiple linear regression, Y_i is a dependent variable, β_0, β_1, $\beta_2, ..., \beta_p$ are regression coefficients, x_{i1}, $x_{i2}, ..., x_{ip}$ are independent variables, and ε_i represents the notation for the model deviations. The regression models were developed using structural equation modeling (SEM) software (Amos) and in-depth analysis was performed using Statistical Package for the Social Sciences.

Table V reveals the quality of the model, as well as the nature of the relationship between ROE and the independent variables in the model. As we can see from the Table V, the presented regression model has a high degree of fit because the R^2 value reaches 0.849. The regression model can explain 84.9 percent of the variations in ROE by using components of VAIC, after controlling for firm size and leverage. However, the model also shows that only physical capital and financial capital have a significant impact on ROE. Additionally, the results show that this influence is inverse because the β coefficient has a negative value (−0.926). By employing SEM, the relationship between ROE and components of VAIC can be presented graphically (Figure 1).

Model description

Model no.	R	R^2	R^2 adjusted	SE	Durbin-Watson
1	0.037[a]	0.001	0.001	38.0802512	
2	0.921[b]	0.849	0.849	14.8090349	1.992

Coefficients[c]

Model		Coefficients – unstandardized B	SE	Coefficients – standardized β	t	Significance	Collinearity Tolerance	VIF
1	Constant	−0.006	0.373		−0.016	0.987		
	Total assets	2.288E−01	0.000	0.000	0.028	0.978	1.000	1.000
	Leverage	−0.054	0.014	−0.037	−3.779	0.000	1.000	1.000
2	Constant	1.101	0.145		7.573	0.000		
	Total assets	−1.016E−01	0.000	−0.001	−0.321	0.748	1.000	1.000
	Leverage	0.096	0.006	0.065	17.115	0.000	0.988	1.012
	HCE	0.001	0.005	0.001	0.217	0.828	1.000	1.000
	SCE	0.000	0.003	−0.001	−0.140	0.888	1.000	1.000
	CEE	−0.389	0.002	−0.926	−244.852	0.000	0.988	1.012

Notes: [a]Predictors: (Constant), leverage, total assets; [b]predictors: (Constant), leverage, total assets, SCE, HCE, CEE; [c]dependent variable: ROE

Table V. The relationship between VAIC and ROE

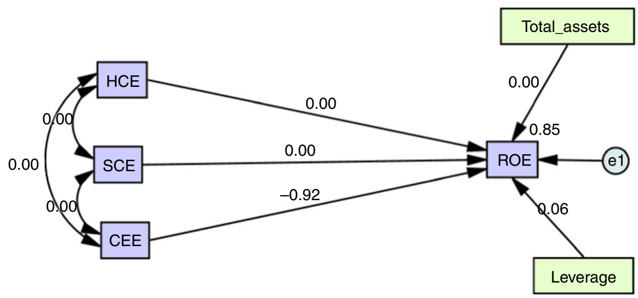

Figure 1. The relationship between ROE and VAIC

The regression equation for the first presented regression model can be presented in the following manner:

$$ROE = 1.101 - 0.389 \times CEE + 0.096 \times FL$$

In the second regression model, which uses ROA as the dependent variable, the model fit ranks at 84.3 percent. As in the first regression model, the explanatory power of this model is high. However, the regression analysis results are consistent with the previous model in part, where CEE is the only independent variable that significantly influences the volatility of ROA. As was the case with the previous regression model, this relationship is inversely related. (Table VI).

Using SEM we derived the second regression model, which is given in Figure 2. We present the second regression equation as:

$$ROA = 0.819 - 0.388 \times CEE + 0.152 \times FL$$

The third regression model, which observes the relationship between ROIC and components of VAIC, is specific in three ways. The first is its very low explanatory power,

Model description

Model no.	R	R^2	R^2 adjusted	SE	Durbin-Watson
1	0.001[a]	0.000	0.000	38.1103466	
2	0.918[b]	0.843	0.843	15.0912554	1.994

Coefficients[c]

Model		Coefficients – unstandardized		Coefficients – standardized			Collinearity	
		B	SE	β	t	Significance	Tolerance	VIF
1	Constant	−0.287	0.373		−0.768	0.442		
	Total assets	3.420E−01	0.000	0.000	0.042	0.967	1.000	1.000
	Leverage	0.002	0.014	0.001	0.132	0.895	1.000	1.000
2	Constant	0.819	0.148		5.530	0.000		
	Total assets	−8.979E−01	0.000	−0.001	−0.278	0.781	1.000	1.000
	Leverage	0.152	0.006	0.102	26.540	0.000	0.988	1.012
	HCE	6,113E-01	0.005	0.000	0.012	0.990	1.000	1.000
	SCE	−0.001	0.003	−0.001	−0.187	0.851	1.000	1.000
	CEE	−0.388	0.002	−0.914	−239.673	0.000	0.988	1.012

Notes: [a]Predictors: (Constant), leverage, total assets; [b]predictors: (Constant), leverage, total assets, SCE, HCE, CEE; [c]dependent variable: ROA

Table VI.
The relationship between VAIC and ROA

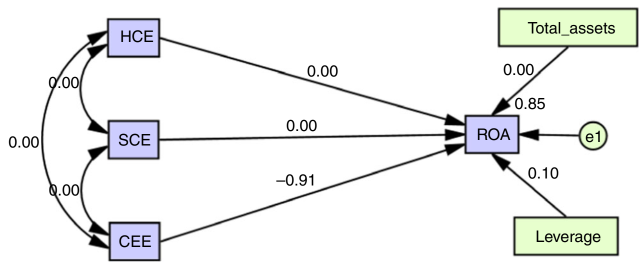

Figure 2.
The relationship between ROA and VAIC

which was able to explain only 0.04 percent of all changes in values of ROIC. The second specificity is the way in which ROIC was calculated. When retrieving ROIC, we calculated it as the ratio between OP in the current year and amount of invested capital in the previous year. In this way, two consecutive years were taken into account simultaneously. Finally, this is the only regression model that revealed a significant impact of HC on this indicator of financial performance. The results of this regression analysis are given in Table VII.

This regression model introduces the possibility that HC increases in importance when observing the indicators of financial performance with included lagging effect.

The ROIC regression model is graphically presented in Figure 3; one can see the direct positive effect of HCE on ROIC. Ultimately, the corresponding regression equation is as follows:

$$ROIC = 0.531 + 0.054 \times HCE$$

The fourth regression model analyzes the link between components of VAIC and profitability (Table VIII). Profitability of firms operating in the Serbian ICT industry is calculated as the ratio between operating income and book value of assets.

Model description

Model no.	R	R^2	R^2 adjusted	SE	Durbin-Watson
1	0.024[a]	0.001	0.000	10.7763613	
2	0.061[b]	0.004	0.003	10.7611687	1.995

Coefficients[c]

Model		Coefficients – unstandardized B	SE	Coefficients – standardized β	t	Significance	Collinearity Tolerance	VIF
1	Constant	0.612	0.118		5.193	0.000		
	Total assets	−4.526E−01	0.000	−0.002	−0.175	0.861	1.000	1.000
	Leverage	0.009	0.004	0.024	2.178	0.029	1.000	1.000
2	Constant	0.531	0.119		4.470	0.000		
	Total assets	−5.648E−01	0.000	−0.002	−0.218	0.827	1.000	1.000
	Leverage	0.008	0.004	0.021	1.889	0.059	0.990	1.010
	HCE	0.054	0.011	0.055	5.127	0.000	0.998	1.002
	SCE	0.000	0.002	−0.001	−0.106	0.916	1.000	1.000
	CEE	0.001	0.001	0.010	0.926	0.355	0.991	1.009

Notes: [a]Predictors: (Constant), leverage, total assets; [b]predictors: (Constant), leverage, total assets, SCE, HCE, CEE; [c]dependent variable: ROIC

Table VII. The relationship between VAIC and ROIC

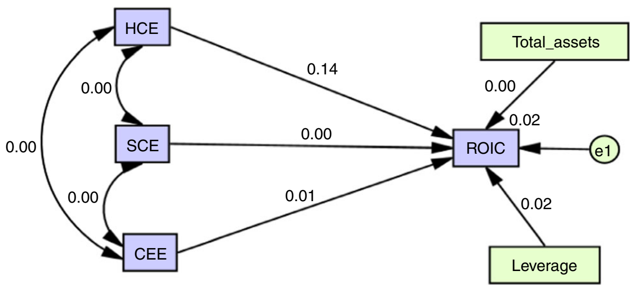

Figure 3. The relationship between ROIC and VAIC

Model description

Model no.	R	R^2	R^2 adjusted	SE	Durbin-Watson
1	0.000[a]	0.000	0.000	12.3747783	
2	0.763[b]	0.583	0.582	7.9961779	1.998

Coefficients[c]

Model		Coefficients – unstandardized B	SE	Coefficients – standardized β	t	Significance	Collinearity Tolerance	VIF
1	Constant	0.062	0.121		0.513	0.608		
	Total assets	1.581E−01	0.000	0.000	0.006	0.995	1.000	1.000
	Leverage	−4.696E−01	0.005	0.000	−0.010	0.992	1.000	1.000
2	Constant	0.360	0.079		4.587	0.000		
	Total assets	−3.201E−01	0.000	−0.001	−0.187	0.851	1.000	1.000
	Leverage	0.041	0.003	0.084	13.332	0.000	0.988	1.012
	HCE	0.001	0.003	0.001	0.218	0.827	1.000	1.000
	SCE	0.000	0.002	−0.002	−0.255	0.799	1.000	1.000
	CEE	−0.105	0.001	−0.768	−122.084	0.000	0.988	1.012

Notes: [a]Predictors: (Constant), leverage, total assets; [b]predictors: (Constant), leverage, total assets, SCE, HCE, CEE; [c]dependent variable: profitability

Table VIII. The relationship between VAIC and profitability

When viewing profitability as a dependent variable, the analysis suggests that physical and financial capital have a direct, negative, and significant impact on the level of profitability. Additionally, the model shows medium fit, bearing in mind that $R^2 = 0.583$. When using SEM to graphically present the regression model, we get the relationship as described in Figure 4.

Finally, when reviewing the regression equation that corresponds to the described model, we can conclude that the relationship between profitability and components of VAIC can be presented mathematically in the following manner:

$$\text{Profitability} = 0.360 - 0.105 \times \text{CEE} + 0.041 \times \text{FL}$$

The fifth regression analysis is presented within Table IX. The model is very reliable ($R^2 = 0.936$), which means that the regression model can predict values of productivity with a high level of probability. On the other hand, when analyzing the impact of each VAIC component in particular, we can see that only CEE has significant impact on ATO. The graphical presentation of the fifth regression model is given in Figure 5.

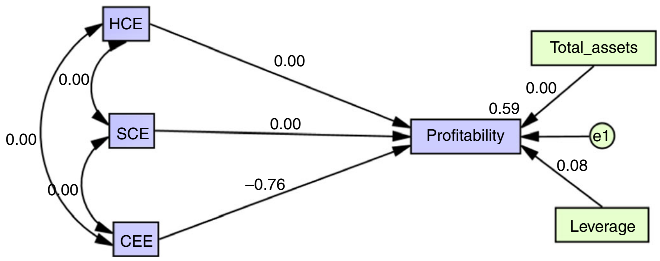

Figure 4. The relationship between profitability and VAIC

Model description					
Model no.	*R*	R^2	R^2 adjusted	SE	Durbin-Watson
1	0.003[a]	0.000	0.000	112.4057332	
2	0.968[b]	0.936	0.936	28.3523791	1.997

Coefficients[c]								
		Coefficients – unstandardized		Coefficients – standardized			Collinearity	
Model		*B*	SE	*β*	*t*	Significance	Tolerance	VIF
1	Constant	4.223	1.101		3.836	0.000		
	Total assets	−3.738E−01	0.000	−0.002	−0.156	0.876	1.000	1.000
	Leverage	−0.012	0.042	−0.003	−0.275	0.783	1.000	1.000
2	Constant	0.785	0.278		2.818	0.005		
	Total assets	1.106E−01	0.000	0.000	0.018	0.985	1.000	1.000
	Leverage	−0.479	0.011	−0.109	−44.447	0.000	0.988	1.012
	HCE	0.002	0.010	0.000	0.204	0.839	1.000	1.000
	SCE	−0.001	0.006	0.000	−0.133	0.894	1.000	1.000
	CEE	1.205	0.003	0.964	396.511	0.000	0.988	1.012

Notes: [a]Predictors: (Constant), leverage, total assets; [b]predictors: (Constant), leverage, total assets, SCE, HCE, CEE; [c]dependent variable: ATO

Table IX. The relationship between VAIC and productivity

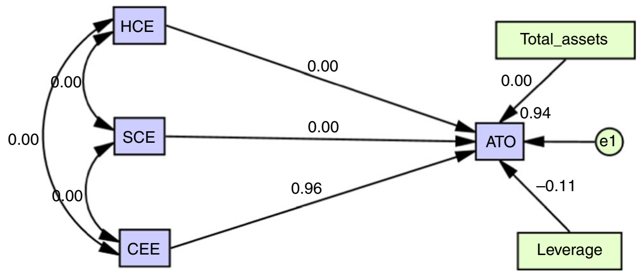

Figure 5. The relationship between productivity and VAIC

The regression equation for the model analyzing the relationship between productivity and different elements of VAIC coefficient is as follows:

$$\text{Productivity} = 0.785 + 1.205 \times \text{CEE} - 0.479 \times \text{FL}$$

The conclusion of the completed multiple regression analysis is that the first three hypotheses can only be partially confirmed. The correlation analysis showed that each of the selected dependent and independent variables correlate significantly. However, when disaggregating the effect of VAIC on selected indicators of financial performance in the Serbian ICT sector, we see that only CEE has a significant effect on selected performance measures. The only exception is ROIC, which is mainly influenced by the HC component of VAIC. As already mentioned, the regression model suffers from low explanatory power.

In order to test the fourth research hypothesis, we implemented a one-way analysis of variance test to identify significant differences in dependent variables among the observed groups of firms. The groups are firms that belong to each of the subsectors within the Serbian ICT sector (see Table I).

Table X depicts the results of the analysis, which reveals that, in case of ROIC and ATO, there are significant differences between selected groups of firms in the Serbian ICT sector. When reviewing *post-hoc* tests (which are too long to be presented here) we see that a significant difference exists in the group of firms that belong to the ICT trade subsector (electronic and telecommunications equipment wholesale). This subsector accounts only for 0.51 percent of the whole research sample; therefore, we can conclude that when observing the whole sector, there are no significant differences in financial performance caused by different components of the VAIC coefficient. Hence, the fourth hypothesis can be treated as validated.

The overview of the research results is in detail presented in Table XI.

6. Concluding remarks

The value-creation process using IC entails several important points. First, IC's value-creation potential generates future benefits for the firm. Second, IC's ability to create value is based on the intangible resources of the firm, which have no physical or financial embodiment. Third, IC rarely affects value creation directly, since IC creates value indirectly. Fourth, various components of IC are interlinked, both among themselves and with different forms of tangible resources, and hence cannot be valued separately from other assets. Fifth, IC is closely related to knowledge management. Sixth, IC is a kind of resource that is extremely difficult to imitate or substitute, which often leads to the creation of long-lasting competitive advantage if applied properly. This leads to the seventh important principle, which places IC as an important potential source of competitive advantage. The eighth principle of creating value with IC highlights that, unlike tangible resources in a firm whose value erodes with increased use, the value of IC increases with increased use. Finally, IC is the main resource for creating extra value in the information age.

The aforementioned notions of an IC-based value-creation process explain in great detail the conclusions of this study undertaken in the Serbian ICT sector. The study began by analyzing the entire Serbian ICT sector, which contains 13,989 registered firms. The timeframe of the research was the period between 2009 and 2013. The research process involved in-depth analysis of officially available financial

		Sum of squares	df	Mean square	*F*	Sig.
ROE	Between groups	1,658.876	20	82.944	0.425	0.988
	Within groups	489,855.116	2,508	195.317		
	Total	491,513.991	2,528			
ROA	Between groups	1,699.105	20	84.955	0.343	0.997
	Within groups	823,142.308	3,324	247.636		
	Total	824,841.413	3,344			
ROIC	Between groups	123,606.658	20	6,180.333	9.534	0.000
	Within groups	9,054,188.483	13,968	648.209		
	Total	9,177,795.141	13,988			
Profitability	Between groups	8,712.383	20	435.619	0.880	0.614
	Within groups	1,646,658.655	3,325	495.236		
	Total	1,655,371.038	3,345			
ATO	Between groups	3,176.485	20	158.824	1.786	0.017
	Within groups	295,448.334	3,323	88.910		
	Total	298,624.818	3,343			

Table X. Results of the one-way ANOVA test

Hypothesis	*Variables*	*Model fit*	*β*	*Significance*	*Validated*
H1a	HCE→ROE	0.849	0.001	0.828	No
H1b	HCE→ROA	0.843	0.000	0.990	No
H1c	HCE→ROIC	0.004	0.055	0.000	Yes
H1d	HCE→Profitability	0.583	0.001	0.827	No
H1e	HCE→ATO	0.936	0.000	0.839	No
H2a	SCE→ROE	0.849	−0.001	0.888	No
H2b	SCE→ROA	0.843	−0.001	0.851	No
H2c	SCE→ROIC	0.004	−0.001	0.916	No
H2d	SCE→Profitability	0.583	−0.002	0.799	No
H2e	SCE→ATO	0.936	0.000	0.894	No
H3a	CEE→ROE	0.849	−0.926	0.000	Yes
H3b	CEE→ROA	0.843	−0.914	0.000	Yes
H3c	CEE→ROIC	0.004	0.010	0.355	No
H3d	CEE→Profitability	0.583	−0.768	0.000	Yes
H3e	CEE→ATO	0.936	0.964	0.000	Yes
Hypothesis	*Variables*	*Group*	*F*	*Significance*	*Validated*
H4	ROE	–	0.425	0.988	No
	ROA	–	0.343	0.997	No
	ROIC	Wholesale of electronic and telecommunications equipment and parts	9.534	0.000	Yes
	Profitability	–	0.880	0.614	No
	ATO	Wholesale of electronic and telecommunications equipment and parts	1.783	0.017	Yes

Table XI. The overview of research results

statements of these firms. In order to make the results of the research reliable, the research sample was narrowed to 2,137 firms. The criteria for inclusion was completeness of financial statements in the observed period. The firms founded later than 2009 or liquidated before 2013 were excluded. In addition, the research sample did not take into account firms with incomplete financial statements (which can occur when firms do not supply all of the requested data in a timely manner).

The results yielded unsatisfactory, yet consistent and reliable, conclusions. By "unsatisfactory," we mean that although we investigated this knowledge-intensive sector, the results revealed that it is not IC-intensive, at least in the case of Serbia. The multiple regression results revealed that only CEE had a significant impact on selected measures of financial performance. The only exception is ROIC, but we must view this result with caution because the model's explanatory power is very low. When we say "consistent," we mean that these results are in line with other research studies that have explored developing economies. For instance, Firer and Williams (2003) reached similar conclusions in their research in South Africa. Several studies undertaken in Serbia also showed that the ICT sector is no different in terms of efficient use of IC (Janošević *et al.*, 2012, 2013). Finally, when using the term "reliable," due to the size and scope of the research, we believe that the results provide good grounds for quality conclusions. A similar research sample was used in the work of Kujansivu and Lönnqvist (2007), who investigated IC's impact on business performance in Finland. Their research sample included 20,000 entities and produced unsatisfactory results in terms of failing to validate IC's positive impact on enterprise performance. Finally, the research study that was the objective of this paper partially confirmed the first three research hypotheses, in part by stating that CEE significantly affects financial performance. The fourth hypothesis, which aimed to prove that there is no significant difference in financial performance due to adequate use of elements of IC, was confirmed in the case of the Serbian ICT sector. The main limitation of the research study is related to the aforementioned restrictions of VAIC as a measure of the extent to which a company's IC creates value. This model does not concern the holistic aspect of IC, like the one that was given by InCaS structural model. This model analyzes IC as the driving forces of business processes in a company that also significantly affect the knowledge process (Mertins and Will, 2008). However, in recent literature and practice of managing IC, the VAIC methodology represents the most widely accepted and used measure of IC efficiency.

The complex and multi-layered role of IC in Serbian ICT industry needs to be viewed from the standpoint of national economy's context. The Serbian economy is a transitional one that has several important features that affect the IC's role in value creation. First, the level of economic development (where in 2014, the GDP was 33,075 EUR, or 4,600 EUR per capita), economy's incompetence, numerous negative economic trends in the last 25 years and the nature of economic crisis, which is structural, rather than cyclical, determine in most part the results obtained in this research. In other words, ICT sector within a developing country shares the destiny of other industries, and therefore the impact of IC on financial performance still does not determine company success. Second, the development of certain components of national IC significantly affects the level of development of IC within companies in that economy. For example, as measured by the Global Competitive Index, the Serbian economy's competitiveness was very low in 2013 (index value 3.77 on a scale of 1-7). The economy was ranked 101 (out of 148 countries analyzed) in 2013 according to the World Economic Forum. In addition, Serbia is the worst ranked country in Europe according to this index (Janošević and Dženopoljac, 2013). This also gives the better insight into why Serbian ICT companies do not rely on IC. Third, the level of sophistication of ICT companies' activities in Serbia is low when viewing them from the standpoint of research and development expenditures, quality of implemented strategies, innovativeness, and sources of competitive advantage.

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