

Assessment of intellectual capital influence on corporate value as a field for further investigations in corporate finance

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Abstract

This study presents the results of an empirical study analysis about the impact of intellectual capital on corporate value. The aim of this study is to identify the direction for research development dealing with the impact of intellectual capital on business value, financial performance indicators, and the indicators that reflect the state of the individual components and subcomponents of intellectual capital. This study used general scientific methods such as comparison, deduction, induction and analysis.

Based on the results of the literature review, it was shown that when developing a model for assessing the impact of intellectual capital on business value and the performance indicators of business activities, it is necessary to include the factors that describe the state of all the components and subcomponents of intellectual capital, as well as the synergistic effects caused by the interaction of the individual components of intellectual capital. In addition, it makes sense to include the factors that describe the state of the components of intellectual capital for prior periods of time in the model.

At the present time, there is also a need for research on the evaluation of the mutual influence of the individual components and subcomponents of intellectual capital. In order to identify the industry specificity of the influence of the intellectual capital components on business value, the developed models should be tested separately using data of companies from different industries. When carrying out the analysis, it is important to take into account the factors related to the company's external environment, such as the level of economic development of the country in which the company operates, as well as fluctuations in economic activity.

Keywords: intellectual capital, financial performance, market value, empirical studies, intellectual capital components

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According to the report “Supporting Investment in Knowledge Capital, Growth and Innovation”, prepared by the Organization for Economic Cooperation and Development (OECD), investments made by companies in intellectual capital (IC) contribute to their growth and productivity and, in particular, due to these investments, the average productivity in the USA and the European Union has increased by 20–34% [OECD, 2013]. Moreover, the OECD states that a positive correlation also takes place between the market value of firms and investments in intellectual capital. These facts support the resource-based theory, which claims that intellectual capital is one of the most important strategic resources, which enable firms to gain a competitive advantage [Wernerfelt, 1984].

The importance of intellectual capital determines the need for the development of effective intellectual capital measurement tools. It is worth noting that already by the end of the 20th century, researchers were focusing on the problem of intellectual capital measurement [Stewart, 1997; Pulic, 1998]. In the 21st century, intellectual capital measurement has already become a separate area for investigations in the field of intellectual capital and continues to be under debate. Furthermore, in the 21st century, empirical studies devoted to the interrelation between intellectual capital and company value appeared. These studies are rooted in the fundamentals of resource-based theory. In order to test the hypothesis that intellectual capital and its components influence company value, investigators received data on the state of intellectual capital through a variety of IC measurement methods, so these empirical studies are linked with research in the field of intellectual capital measurement.

Currently there is vast literature on both intellectual capital measurement [Edvinsson, 1997; Lev, 2001; Pulic, 1998; Litschka, 2006; Nazari and Herremans, 2007; Sveiby, 2010; Zegal, 2010] and the assessment of the impact of IC on corporate value and company performance operating in developed countries [Artie, 2006; Zegal, 2010; Clarke, 2011; Liu, 2009; Liu, 2017] and developing countries [Garanina, 2010; Pucar, 2012; Rizun, 2014; Singh, 2015, Andreeva, 2016]. These problems have been hotly debated time and again, so it is vital to identify the issues that still remain unsolved.

The primary aim of the present study is to review the assessment field for the influence of intellectual capital on corporate value, financial performance and the value of the IC components, with subcomponents as a special issue, and to identify potential areas for further investigation.

To achieve this aim, we are going to identify the types of empirical studies in the field of assessment of the influence of intellectual capital. We will make an attempt to analyze the methodology used to assess the influence of intellectual capital on financial performance and the corporate value of companies. In particular, we are going to review and summarize the metrics for the components and subcomponents of intellectual capital, financial performance, corporate value, the methods used in these types of

investigations to measure intellectual capital the models that represent the relationships between the components of intellectual capital and corporate financial performance and value, along with the results obtained with the help of the models, methods, and metrics for both developing and developed countries. After that, we will also make an attempt to find the areas that remain under-researched and put forward ideas for further investigation.

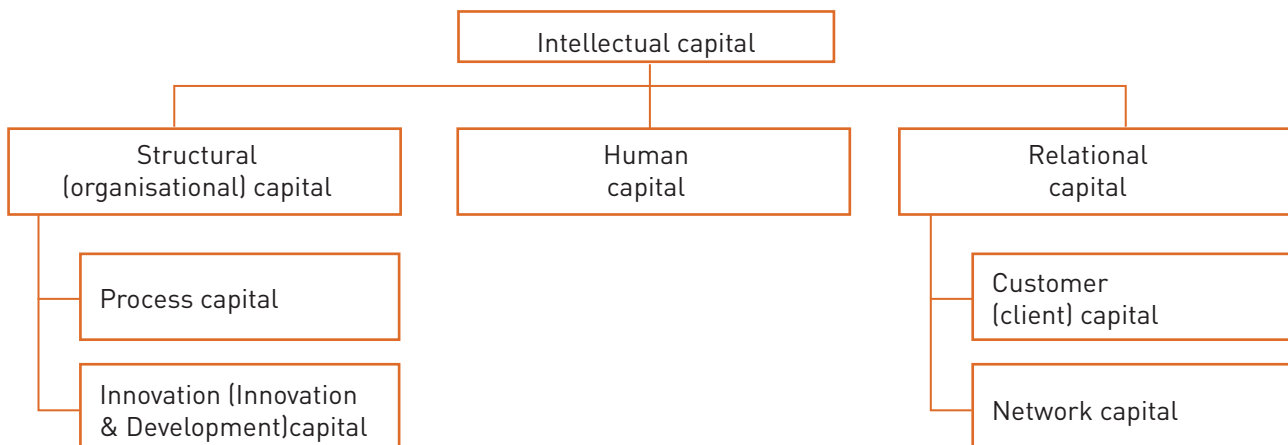
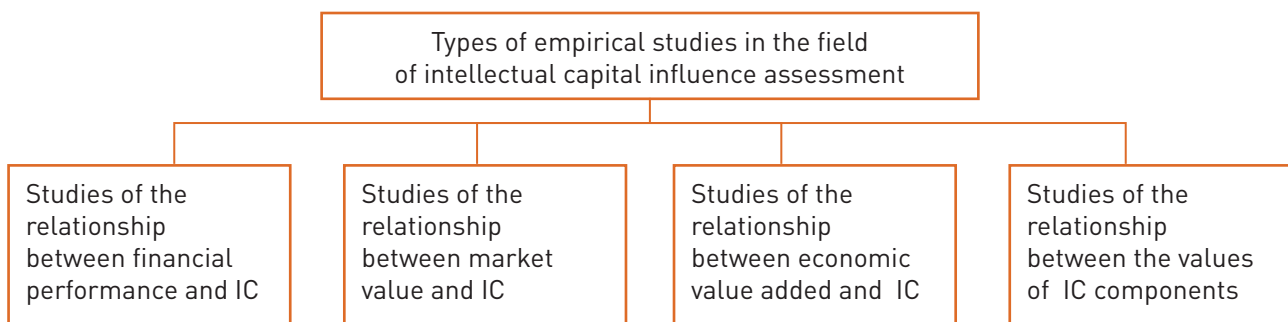
The paper is structured as follows: in the first section, we will consider the structure of intellectual capital; the second section is devoted to the types of empirical studies in the field of assessing the influence of intellectual capital. In the third and fourth sections, we will discuss the influence of intellectual capital on financial performance and market value. The fifth section is devoted to other empirical studies in the field of assessing the influence of intellectual capital.

Intellectual capital structure

Until now, a generally accepted structure for intellectual capital has not existed. This uncertainty led to difficulties that are connected with the interpretation of results obtained by other researchers. That is why before concentrating on the problems of assessing the impact of IC on financial performance and corporate value, we will focus on the structure of IC in order to identify the key components and subcomponents that should be measured.

In this paper, we use the definition for intellectual capital pushed forward by D. Zegal and consider IC as the sum of all knowledge a company is able to use in the process of conducting business in order to create value [Zegal, 2010]. Currently, there are several points of view on the main components of intellectual capital and their hierarchy: some investigators use the scheme of Skandia Navigator and presuppose that intellectual capital can be subdivided into human and structural capital, which includes innovation and process capital [Edvinsson, 1997; Zegal, 2010; Clarke, 2011], while others identify not only human and structural, but also relational capital as an equally separate component [Sharabatia, 2013; Andreeva, 2016]. The latter point of view is also shared by the business reporting network WICI. A modified model for intellectual capital structure was also developed by E. Baiburina and I. Ivashkovskaya who stressed the importance of network capital and considered it as separate component together with human, organizational (structural) and client capital [Baiburina, 2007]. So, instead of relation capital, they consider client capital and network capital.

In spite of the fact that researchers used different terms for the intellectual capital components, the majority of them identified human, structural (organizational) and relational capital. In turn, it is possible to subdivide structural capital into innovation and process capital, and relational capital into the customer (client) and the network subcomponent. So, the structure of intellectual capital can be represented in the following way (Figure 1).

Figure 1. Taxonomy of intellectual capital**Figure 2.** Types of empirical studies connected with the influence of intellectual capital on financial performance and corporate value (author classification)

So, we have identified the main components and sub-components of IC, which should be measured separately, and now we can concentrate on their influence on corporate value.

Types of empirical studies in the field of assessing the influence of intellectual capital

The classification of the components and sub-components of intellectual capital is used by researchers when they analyze how intellectual capital, namely its components and sub-components, influence corporate value and financial performance. Currently, there exists an enormous amount of literature on these empirical studies and we will try to identify the main types of studies in this field (Figure 2). It is worth stressing that currently most empirical studies are devoted to analyzing the impact that intellectual capital has on the financial performance and market value of companies, whereas the relationship between economic value added and intellectual capital, and the relationship between the value of the components of

intellectual capital are relatively little researched. We will start with the most widespread types of empirical research and after, we will focus our attention on the problems that tend to be seldom discussed.

The influence of intellectual capital on financial performance

The issue of intellectual capital influence on companies' financial performance has been at the heart of numerous discussions [Artie, 2006; Clarke, 2011; Pucar, 2012; Kamath, 2015; Singh, 2015; Liu, 2017]. The researchers tested the hypothesis that a higher value intellectual capital and its components and sub-components leads to a higher financial performance of companies operating in both developed (Table 1) and developing countries (Table 2). In our review, we consider the results for the developed and developing countries separately. For example, T. Andreeva, referring to the results obtained by PricewaterhouseCoopers, states that in emerging markets, the effects might be different because of political, institutional, cultural, and economic peculiarities [Andreeva, 2016]. We tried to choose studies that could demonstrate the variety of approaches used by investigators in this field.

Table 1. The influence of intellectual capital on the financial performance of companies operating in developed countries

Author	Sample	Regression model	Dependent variable (proxy for performance)	The impact of IC and IC components (for the current period) on performance						Method of IC measurement/ group of IC measurement method	Source of data	Notes
				IC	RC		HC	SC				
					CC	NC		PC	InC			
Zéghal, Maaloul (2010)	300 firms listed on the LSE, UK, 2005		Operating income	+	n/a	n/a	n/a	n/a	n/a	VAIC method/ ROA methods	Financial reports	-
			Total Sales									
			ROA									
			Operating income									
			Total Sales									
			ROA									
	49 high – tech firms listed on the LSE, UK, 2005	$Performance = b_0 + b_1VAIN + b_2VACA + b_3Size + b_4Lev + \varepsilon;$ VAIN – value added IC coefficient; VACA – value added CE coefficient; Size – log of book value of total assets; Lev – book value of total assets to book value of common equity	Operating income	+	n/a	n/a	n/a	n/a	n/a			
			Total Sales									
			ROA									
			Operating income									
			Total Sales									
			ROA									
90 traditional firms, listed on the LSE, UK, 2005		Operating income	+	n/a	n/a	n/a	n/a	n/a				
		Total Sales										
		ROA										
		Operating income										
		Total Sales										
		ROA										
161 service companies, listed on the LSE, UK, 2005		Operating income	+	n/a	n/a	n/a	n/a	n/a				
		Total Sales										
		ROA										
		Operating income										
		Total Sales										
		ROA										
Artie (2006)	6 venture capital funded wireless technology companies, Canada, 2000–2005	$Performance = b_0 + b_1Year + b_2InC(t) + b_3HC(t) + b_4SC(t) + b_5Cash\ balance + b_6SC(t-1) + b_7InC(t-1) + b_8SC(t-2) + b_9InC(t-2) + b_{10}SC(t-1)*InC(t-1) + b_{11}SC(t-2)*InC(t-2) + \varepsilon;$ InC – R&D expenses; SC – investments in computer equipment, systems facilities; HC – general and administrative expenses; t – period	Revenue	n/a	n/a	n/a	+	+	no	Method of proxy indicators/ Direct intellectual capital methods	Financial reports	- the author uses the term “structural capital” for process capital; - innovation capital for previous periods has negative influence on revenue; - interaction between innovation capital and structural capital for preceding period influences positively; - interaction between innovation and structural capital for current period has negative impact on performance

Author	Sample	Regression model	Dependent variable (proxy for performance)	The impact of IC and IC components (for the current period) on performance					Method of IC measurement/ group of IC measurement method	Source of data	Notes			
				IC	RC		HC	SC						
					CC	NC		PC				InC		
Clarke (2011)	2161 firms listed on the Australian Stock Exchange, Australia, 2003-2008	$Performance = b_0 + b_1VAIC(t) + b_2VAIC(t-1) + b_3 R\&DI + b_4Lev + b_5Year + b_6Industry + \epsilon;$ VAIC – value added IC coefficient; Lev – book value of total assets to book value of equity; R&DI – research intensive; t – period	ROA	+	n/a	n/a	n/a	n/a	VAIC method/ ROA methods	Financial reports	- VAIC for preceding period influences positively on ROA, ROE and employee productivity; - VAIC for preceding period has no influence on sales growth rate			
			ROE	+	n/a	n/a	n/a	n/a						
			$\frac{Sales_t}{Sales_{t-1}}$	+	n/a	n/a	n/a	n/a						
			$\frac{Sales_t}{Number\ of\ workers_t}$	+	n/a	n/a	n/a	n/a						
					$Performance = b_0 + b_1HCE(t) + b_2SCE(t) + b_3CEE(t) + b_4HCE(t-1) + b_5SCE(t-1) + b_6CEE(t-1) + b_7HCE(t)*CEE(t) + b_8SCE(t)*CEE(t) + b_9R\&DI + b_{10}Lev + b_{11}Year + b_{12}Industry + \epsilon;$ HCE, SCE and CEE – human, structural capital and capital employed efficiency; Lev – book value of total assets to book value of equity; R&DI – research intensive; t – period	ROA	n/a	n/a	n/a	+	no	VAIC method/ ROA methods	Financial reports	- human capital for preceding period has no influence on performance; -structural capital for proceeding period influences ROA, ROE, sales growth positively, but has no impact on employee productivity; - interaction between capital employed and structural capital for preceding period influences sales growth rate and employee productivity positively; - interaction between human and structural capital for preceding period influences ROA and employee productivity positively
						ROE	n/a	n/a	n/a	+	no			
						$\frac{Sales_t}{Sales_{t-1}}$	n/a	n/a	n/a	+	no			
						$\frac{Sales_t}{Number\ of\ workers_t}$	n/a	n/a	n/a	no	no			
Liu (2017)	434 companies, operating in cultural and creative industry, Taiwan, 2016	$Performance = b_0 + b_1 SC + b_2BT + b_3EU + b_4SC*BT + b_5SC*EU + b_6gender + b_7firm\ age + b_8\ firm\ size + b_9entrepreneurial\ experience + \epsilon;$ BT – business ties; SC-social capital; EU – environment uncertainty	Organizational performance (measures based on point scale)	+	+	+	+	+	Scoring method (measures based on point scale)/ Scorecard Methods	Survey	- the author considers networking capital separately form intellectual capital and uses business ties as proxy for it; - the direct influence of human, customer and structural capital on performance has not been analyzed: the investigator revealed that customer, human and structural capital have significant positive impact on social capital and after that checked the hypothesis that there is positive significant correlation between the performance and social capital			

Notes: IC – intellectual capital; HC – human capital; RC – relational capital; InC – innovation capital; SC – structural capital; NC – network capital; CC – customer capital; PC – process capital; (+)– a positive relationship was found; no – no relationship was found: n/a – the data on the relationship is not available.

Table 2. The influence of intellectual capital on the financial performance of companies operating in developing countries

Author	Sample	Regression model	Dependent variable (proxy for performance)	The impact of IC and IC components on performance					Method of IC measurement/ group of IC measurement method	Source of data
				IC	RC	HC	SC			
							PC	InC		
Pucar (2012)	134 firms, Bosnia and Herzegovina, 2004–2007	$Performance = b_0 + b_1 HCE + \varepsilon$; HCE – human capital efficiency	Growth rate of export per worker	n/a	n/a	no	n/a	n/a	VAIC method/ ROA methods	Financial reports
		$Performance = b_0 + b_1 VAIC + \varepsilon$; VAIC – value added intellectual capital		no	n/a	n/a	n/a	n/a		
	14 firms, producing food and beverage, Bosnia and Herzegovina, 2004–2007	$Performance = b_0 + b_1 HCE + \varepsilon$; HCE – human capital efficiency		n/a	n/a	+	n/a	n/a	VAIC method/ ROA methods	
		$Performance = b_0 + b_1 VAIC + \varepsilon$; VAIC – value added intellectual capital		+	n/a	n/a	n/a	n/a		
	12 firms, manufacturing furniture and other wood products, Bosnia and Herzegovina, 2004–2007	$Performance = b_0 + b_1 HCE + \varepsilon$; HCE – human capital efficiency		n/a	n/a	+	n/a	n/a	VAIC method/ ROA methods	
		$Performance = b_0 + b_1 VAIC + \varepsilon$; VAIC – value added intellectual capital		+	n/a	n/a	n/a	n/a		
Rizun (2014)	5 ore mining and processing plants, each company has been considered separately, Ukraine, 2006–2013	$Performance = b_0 + b_1 WF + b_2 ERD + b_3 VIA + b_4 EE + \varepsilon$; WF – wages fund; ERD – expenses on R&D; VIA – residual value of intangible assets; EE – expenses per employee	Net profit	n/a	n/a	+	n/a	+	Method of proxy indicators/ Direct intellectual capital methods	Financial reports
					(EE, 3 firms) – (EE, 1 firm) – (WF, 1 firm) no (others)		(ERD, 3 firms) + (VIA, 1 firm) no (others)			
Singh, Narwal (2015)	top-50 electronic companies listed on NSE and Bombay Stock Exchange (BSE), India, 2004/2005–2013/2014	$Performance = b_0 + b_1 VAIC + b_2 DER + b_3 SIZE + \varepsilon$; VAIC – value added intellectual capital; DER – Debt to Equity ratio; SIZE – log of total assets	ATO	+	n/a	n/a	n/a	n/a	VAIC method/ ROA methods	Financial reports
			ROA	+	n/a	n/a	n/a	n/a		
		$Performance = b_0 + b_1 HCE + b_2 SCE + b_3 CEE + b_4 DER + b_5 SIZE + \varepsilon$; HCE, SCE and CEE – human, structural capital and capital employed efficiency; DER – Debt to Equity ratio; SIZE – log of total assets	ATO	n/a	n/a	no		no	VAIC method/ ROA methods	
			ROA	n/a	n/a	+		no		

Author	Sample	Regression model	Dependent variable (proxy for performance)	The impact of IC and IC components on performance					Method of IC measurement/ group of IC measurement method	Source of data
				IC	RC	HC	SC			
							PC	InC		
Sharabatia, Nourb, Shamaric (2013)	84 companies, Jordanian	$Performance = b_0 + b_1HC + b_2SC + b_3RC + \epsilon$; HC – human capital; RC – relational capital; SC – structural capital	Performance (measures based on point scale)	n/a	+	no		no	Scoring method (measures based on point scale)/Scorecard Methods	Survey
Benebou, Bouguesri (2016)	307 companies, Algeria	$Performance = b_0 + b_1HC + b_2SC + b_3OC + \epsilon$; HC – human capital; SC – social capital (relational capital in our terms); OC – organizational capital (structural capital in our terms)	Performance (measures based on point scale)	n/a	+	+		+	Scoring method (measures based on point scale)/ Scorecard Methods	Survey
Kamath (2015)	30 manufacturing and service firms, India, 2008/2009–2012/2013	$Performance = b_0 + b_1HCE + b_2SCE + b_3CEE + \epsilon$; HCE, SCE and CEE – human, structural capital and capital employed efficiency	ROA	n/a	n/a	+		–	VAIC method/ ROA methods	Financial reports
Omodero et al. (2016)	10 listed firms, Nigeria, 2011–2015	$Performance = b_0 + b_1PBC + \epsilon$; PBC – Personnel Benefit Costs (connected with education and training undertaken by individuals or groups of workers)	Profit after Tax Turnover	n/a n/a	n/a n/a	+		n/a n/a	Method of proxy indicators/ Direct IC methods	Reports of firms
Andreeva, Garanina (2016)	240 manufacturing companies, Russia, 2015	$Performance = b_0 + b_1HC + b_2RC + b_3SC + \epsilon$; HC – structural capital; RC – relational capital; SC – structural capital	Performance (measures based on point scale)	n/a	no	+		+	Scoring method (measures based on point scale)/ Scorecard Methods	Survey

Notes: IC – intellectual capital; HC – human capital; RC – relational capital; InC – innovation capital; SC – structural capital; PC – process capital; (+)– a positive relationship was found; no – no relationship was found; n/a – the data on the relationship is not available; (–) – a negative relationship was found.

When the hypothesis was tested on the sample of companies operating in developed countries, it was found that intellectual capital had a positive significant influence on financial performance. The same dependence was identified for human capital. As for structural capital, the results were quite controversial. In some cases, there was no significant correlation; while in others, the structural capital had a positive impact on performance. Perhaps, the problem is linked to the method used to evaluate structural capital: M. Clarke employed the VAIC method, which is less effective for structural capital valuation [Basuki, Kusumawardhani, 2012]. In spite of criticism for the VAIC method, it remains one of the most widespread tools used to measure intellectual capital components for further empirical investigation. But it does not enable measurement of the subcomponents of intellectual capital and it might be better to use an extended VAIC method in this case. The main advantage of this method is the opportunity to evaluate two components of IC, such as human and relational capital, and the subcomponents of structural capital (process and innovation capital) [Nazari, 2007]. Thus, employing this method makes it possible to assess the influence of human, relational and structural capital separately.

It is worth noting that for developed countries, scientists have already checked the hypothesis that the intellectual capital components for the preceding periods influence performance, but the results were controversial because in some cases there was a positive correlation [Clarke, 2011] whereas in others there was a negative one [Artie, 2006]. No doubt, this dependence should be investigated carefully because intellectual capital brings in benefits for the long-term. Furthermore, attempts to take the interrelations between the intellectual capital components into account have already been made.

One of the most promising studies was conducted by C. Liu, who analyzed business ties, and found that they positively influence the performance of Taiwanese firms [Liu, 2017]. The results proved the importance of network capital for firms.

As for the results from the sample of companies operating in emerging markets, they are more controversial in comparison with the findings for the developed markets. Thus, structural capital had a significant positive impact on the financial performance of manufacturing companies in Russia [Benebou, 2016; Andreeva, 2016] and a negative impact in India [Kamath, 2015]. At the same time, R. Singh did not identify either a positive or a negative correlation on the sample of electronic companies in India [Singh, 2015]. Human and relational capital in some cases had a positive influence, whereas, in others, a significant correlation was not found.

To our mind, it seems reasonable to continue developing models for both developed and developing countries, while taking into consideration the value of all the intellectual capital components for the current and preceding periods and the interrelations between IC components. It is vital to consider the interrelations between intellectual capital components because their synergistic effect

provides competitive advantages [Rodov, 2002]. Furthermore, intangible investments show synergies both with other intangible investments and with tangible assets [Haskel, Westlake, 2018]. So, it is important to implement these synergistic effects in the models. It is also essential to analyze the relationship for each industry separately because in various industries, the role of each IC component may differ greatly.

The influence of intellectual capital on market value

According to the OECD report, there is a positive correlation between the market value of firms and investments in intellectual capital [OECD, 2013]. The OECD conducted research mainly for developed markets, and it is of interest whether there is a similar correlation for emerging markets. The matter of interest is that the quality of intellectual capital for firms operating in developed markets is higher [Pucar, 2012; Andreeva, 2016]. Moreover, the level of corporate transparency is also higher in comparison with companies operating in emerging markets. For example, according to the results from the Russian Regional Integrated Reporting Network, the level of corporate transparency in Russia is quite low [RRN, 2015]. That is why in this paper, we focused mainly on the results of the emerging market investigations (Table 3–4).

It was found that in the emerging markets, intellectual capital, in most cases, did not have any influence on market value. However, researchers identified that structural capital had a positive impact on the market value of Russian energy companies, and that relational capital is important for Russian metallurgy firms [Garanina, 2010]. Human capital has a positive influence on the market to book value for electronic companies in India [Singh, 2015].

One of the most promising research papers in this area was prepared by D. Liu, who evaluated the intellectual capital components with the help of proxy indicators on the basis of publicly available data. After that, he investigated the relationship between all the indicators and the share price and revealed a positive significant correlation [Liu, 2009] (Table 4). However, the model also had shortcomings such as the fact that Liu avoids using control variables such as the debt to equity ratio, the stock market index, and the size of the firm, despite the importance of these parameters.

We did not review any studies in which the researcher considered the relation between network capital and market value, so this question should be considered in further studies. We presupposed that investigators also ought to continue developing models for firms operating in various industries, taking into consideration the value of all the intellectual capital components, the interrelation between IC components, and industry specificity. It is also important to analyze the relationships between the intellectual capital components and the market value for developed and emerging markets separately.

Table 3. The influence of intellectual capital on the market value of companies operating in emerging markets

Author	Sample	Regression model	Dependent variable	The impact of IC and IC components on market value				Method of IC measurement/ group of IC measurement method	Source of data
				IC	RC	HC	SC		
Garanina (2010)	43 companies, Russia, 2001–2006	$P = b_0 + b_1HC + b_2RC + b_3SC + \varepsilon$		n/a	no	no	no		
	Energy companies, Russia, 2001–2006	HC – human capital (Wage fund per employee); RC – relational capital (sales growth rate to growth rate of GDP ratio); SC – structural capital (Costs per employee)	$\frac{\text{Market value of assets}}{\text{Number of shares}}$	n/a	no	no	+	Method of proxy indicators/ Direct IC methods	Financial reports, data from RTS
	Metallurgy firms, Russia, 2001–2006			n/a	+	no	no		
Singh, Narwal (2015)	top-50 electronic companies listed on NSE and Bombay Stock Exchange (BSE), India, 2004/2005– 2013/2014	$MB = b_0 + b_1 VAIC + b_2 DER + b_3 SIZE + \varepsilon$; VAIC- value added intellectual capital; SIZE – log of total assets; DER – Debt to Equity ratio	$\frac{\text{Market capitalisation}}{\text{Book value of outstanding shares}}$	+	n/a	n/a	n/a	VAIC method/ ROA methods	Financial reports, data from NSE and BSE
		$MB = b_0 + b_1HCE + b_2SCE + b_3CEE + b_4DER + b_5SIZE + \varepsilon$; HCE, SCE, CEE – human, structural capital, capital employed efficiency; DER – Debt to Equity ratio; SIZE – log of total assets	$\frac{\text{Market capitalisation}}{\text{Book value of outstanding shares}}$	n/a	n/a	+	no	VAIC method/ ROA methods	
Kamath (2015)	30 manufacturing and service firms, India, 2008/2009–2012/2013	$MB = b_0 + b_1HCE + b_2SCE + b_3CEE + b_4 ROE + b_5Lev + b_6\log(\text{market capitalization}) + \varepsilon$; HCE, SCE and CEE – human, structural capital and capital employed efficiency	$\frac{\text{Market capitalisation}}{\text{Book value of net assets}}$	n/a	n/a	no	no	VAIC method/ ROA methods	Financial reports, data from BSE
Akhavan et al. (2012)	19 pharmaceutical companies, Iran, 2004–2009	$MB = b_0 + b_1VAIC + \varepsilon$; VAIC – value added intellectual capital	$\frac{\text{Market capitalisation}}{\text{Book value of total assets}}$	no	n/a	n/a	n/a	VAIC method/ ROA methods	Financial reports, data Iranian Stock Exchange
		$MB = b_0 + b_1VACA + b_2 VAHA + b_3SCVA + \varepsilon$; VACA – value added capital employed coefficient; VAHA, SCVA – value added human and structural capital coefficients	$\frac{\text{Market capitalisation}}{\text{Book value of total assets}}$	n/a	n/a	no	no	VAIC method/ ROA methods	

Notes: IC – intellectual capital; HC – human capital; RC – relational capital; SC – structural capital; (+) – a positive relationship was found; no – no relationship was found; n/a – data on the relationship is not available; (–) – a negative relationship was found.

Table 4. The influence of intellectual capital on the market value of Taiwan IT corporations

Author	Sample	Dependent variable	Regression model	The impact of IC and IC components (for the current period) on market value					Method of IC measurement/ group of IC measurement method	Source of data
				RC		HC	SC			
				CC	NC		PC	InC		
Liu et al. (2009)	505 IT corporations listed on the Taiwan Stock Exchange 2001–2005	Share price of a closing quotation of common stock at the end of the period	$P = b_0 + b_1 X^\alpha + b_2 PMC + b_3 PMS + b_4 ADV + b_5 RG + b_6 BV + \varepsilon;$ X^α – current EPS; BV – book value of shares; PMC, PMS – proportion of major customers, suppliers; ADV – advertising expenses on share; RG – revenue growth rate	+	n/a	n/a	n/a	n/a		
			$P = b_0 + b_1 X^\alpha + b_2 YCE + b_3 MEPE + b_4 BV + \varepsilon;$ X^α – current EPS; YCE – year of establishment; MEPE – managerial expenses on employee	n/a	n/a	n/a	+	n/a		
			$P = b_0 + b_1 X^\alpha + b_2 PAT + b_3 RDD + b_4 BV + \varepsilon;$ X^α – current EPS; PAT – number of patents; RDD – R&D intensity	n/a	n/a	n/a	n/a	+		
			$P = b_0 + b_1 X^\alpha + b_2 RPE + b_3 RHE + b_4 AY + b_5 AA + b_6 BV + \varepsilon;$ X^α – current EPS; RPE – employees productivity; RHE – share of employees with at least college educational level; AY – average working experience; AA – average age of employees	n/a	n/a	+	n/a	n/a		
			$P = b_0 + b_1 X^\alpha + b_2 PAT + b_3 RDD + b_4 RPE + b_5 BV + \varepsilon;$ BV – book value of shares; X^α – current EPS; RPE – employees productivity; PAT – number of patents; RDD – R&D intensity	n/a	n/a	+	n/a	+		

Notes: IC – intellectual capital; HC – human capital; RC – relational capital; InC – innovation capital; SC – structural capital; NC – network capital; PC – process capital; (+) – a positive relationship was found; no – no relationship was found; n/a – the data on the relationship is not available; (-) – a negative relationship was found.

Other empirical studies in the field of assessing the influence of intellectual capital

Despite the fact that investigators often claim that intellectual capital is one of the key value drivers [Edvinsson, 1997; Daum, 2001; Liu, 2009; Andreeva, 2016], this issue, which is related to the impact of intellectual capital on a firm's economic value added, tends to be seldom discussed in the literature. One of the most promising studies in this field was conducted by E. Shakina and A. Barajas, who demonstrated with a sample of 1,600 European companies how the choice of an innovative profile influences both economic and market value added during pre-crisis, crisis, and post-crisis periods [Shakina, Barajas, 2015]. In order to determine the profile of a company, they analyzed the capability of human resources, management, customer loyalty, the network, innovation and internal processes. Employing the simultaneous equations model, they identified that an innovative profile enables faster recovery after a crisis but does not give any advantages in other periods of time. The results contradict the notion that intellectual capital is the most important factor of value creation in pre-crisis and crisis periods. To our mind, in further investigations, it would be vital to analyze the influence of the intellectual capital components on economic value added in the different phases of an economic cycle for the various industries separately in order to determine the conditions in which intellectual capital ceases to be a competitive advantage. It is also important to consider alternative proxies for evaluating the components of intellectual capital in order to identify which of them better reflects the state of intellectual capital

Another problem in need of analysis is connected to the relationship between the values of the intellectual capital components. The idea is that human capital, structural capital, and relational capital all enhance each other. Thus, the researcher N. Bontis identified that human capital depends on structural capital [Bontis, 1998]. The investigator R. Stoi states that without corporate culture, human capital cannot be exploited perfectly and without order processing, it is impossible to build a customer base [Stoi, 2003]. So, structural capital has influence on both human and relational capital.

The hypothesis that all intellectual capital components have an impact on each other was tested in paper written by L. Bollen. He considered intellectual property separately from human, relational, and structural capital and stressed that intellectual property was no less important than other components of intellectual capital [Bollen, 2005]. From a sample of 41 German pharmaceutical companies, he found that each component of intellectual capital had a significant positive influence on other IC components.

W. Artie checked the hypothesis that links the influence of the intellectual capital components with relational

capital, using a sample of six wireless technology companies who are based in Canada [Artie, 2006]. He claimed that the relational capital for such companies is a result of the interaction between three components of intellectual capital, such as structural, human and innovation capital. The investigator considered innovation capital separately from structural capital and used the research and development expenses as a proxy. W. Artie identified a positive correlation between relational capital, and both human and structural capital. As for innovation capital, its impact on relational capital was not identified. The author also made an attempt to evaluate the influence of a joint effect between innovation and structural capital (the interaction between innovation capital and structural capital) on relational capital. The results were surprising: a negative correlation between the value of this parameter, for the current period, and relational capital was found, and a positive correlation between the value of this parameter, for the preceding period, and relational capital was found.

Currently, investigators also made an attempt to reveal the correlation between the intellectual capital components, or to be more precise, the correlation between proxies that describe intellectual capital. In particular, C. Hsu identified that an increase in R&D intensity (structural capital, innovation subcomponent) leads to increased transparency (structural capital, process subcomponent) for high tech companies. [Hsu, 2016]. However, the question of causality still remains unsolved: process capital may also influence innovation for one, and women may simply choose companies with a high level of innovation rather than be the cause of their innovativeness.

We believe that it makes sense to investigate the interrelation between the intellectual capital components carefully, checking the hypotheses, put forward by researchers, not only on the sample of innovative companies, but also on the samples of firms operating in other industries. It is also important to consider whether this interference continues to remain during the years of economic crisis.

The hypotheses, put forward by scientists who deal with empirical research in the field of intellectual capital measurement, should be also checked on both the sample of companies operating in developed countries and the sample of firms operating in emerging countries.

Conclusion

Based on the results of the review, we have made an attempt to open the prospects for further studies in the field of assessment of the impact of intellectual capital (IC) on corporate value and performance. We systemized the empirical research in the field of assessing the influence of intellectual capital and it was identified that there are four main types of such studies:

- 1) The relationship between the financial performance of a company and intellectual capital.
- 2) The relationship between corporate market value and intellectual capital.

- 3) The relationship between the economic value added and intellectual capital.
- 4) The relationship between the values of the intellectual capital components.

Because of the inconsistency of the results connected to the influence of the intellectual capital components on financial performance and corporate value, this problem should be investigated carefully for firms operating in developed and developing countries. It is worth noting that when elaborating models in order to assess the influence of intellectual capital on financial performance and the value of a company, it seems reasonable to employ scorecard methods for the measurement of the IC components and subcomponents. When each component and subcomponent of intellectual capital is measured with the help of proxy indicators, it becomes possible to take into consideration and identify the role of each IC component and subcomponent in the value creation process.

Moreover, investigators ought to take into consideration the state of intellectual capital in the preceding periods because intellectual capital brings benefits in the long run. It is also important to analyze the influence of intellectual capital in the various industries separately because the state of intellectual capital in different industries is described with the help of not only general, but also of specific indicators connected with the peculiarities of each industry. The phases of an economic cycle also play a great role because they may differ greatly.

It is important to concentrate not only on the problem of the interrelation between corporate value, performance and intellectual capital, but also to analyze the relationship between the intellectual capital components. It seems reasonable to elaborate the models that include the factors associated with all the intellectual capital subcomponents and their interrelations, which are no less important indicators. The hypotheses should be tested separately on the samples of companies operating in developed and developing countries.

It is worth noting that the problem of the interrelation between network capital and corporate value, financial performance, and the value of intellectual capital components continues to remain under-researched and deserves a closer examination.

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