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Intellectual capital as a key driver of firms' performance in the age of globalization: case of Croatia

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Abstract

Research background: Intellectual capital (IC) is given an increasing importance in the context of companies' activities in the knowledge – oriented economy and is thought to be a key factor of competitiveness and financial performance enhancement in modern globalized world. Many methods have been introduced over time to measure IC with value added intellectual capital (VAIC) proposed by Pulic (1998) playing an important role.
Purpose of the article: The aim of this paper is to investigate the relationship between the intellectual capital and its components, specifically, human capital, capital employed and structural efficiency on corporate performance of Croatian companies listed on Zagreb Stock Exchange (ZSE) in the period 2016 – 2020.
Methods: The performance is expressed with profitability, specifically ROA, and market valuation, i.e. Tobin's Q while the value added intellectual capital (VAIC) is used to measure IC as well as its components. A set of control variables comprising of firm size, leverage and age is also covered in the research while static panel analysis is performed to identify variables that might contribute to firm performance.
Findings & Value added: The statistically significant and positive influence of VAIC and its components indicate that an enhancement in the efficiency of firms' resources and employees' knowledge leads to creation of new economic value.

Keywords: *value added intellectual capital; performance; Croatian listed firms*

JEL Classification: *L21; L25; O34*

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1 Introduction

In the context of companies' activities in the knowledge – oriented economy intellectual capital is given an increasing importance (e. g. Xu and Wang, 2018 and Xu and Liu, 2020) and is thought to be a key factor of competitiveness and financial performance enhancement. Many methods have been introduced over time to measure intellectual capital (Xu and Wang, 2018) with value added intellectual capital proposed by Pulic (1998) playing an important role.

The value added capital efficiency presents a measure of intellectual capital efficiency suggested with pioneering work by Pulic (1998) and is in accordance with knowledge-based economy. It considers efficiency of three categories of capital including human, structural and physical and financial capital employed. It indicates an enhancement in the efficiency of firms' resources and employees' knowledge and consequently the ability of the company to create new economic value (Pulic, 1998). Companies today should not solely focus on profit achievement because only the firm "that creates value is able to survive and is effective" (Iazzolino and Laise, 2013). Moreover, though investments in intangible assets including human resources might adversely impact companies' financial results, they can definitely improve the long-term profits of the firm (Fijałkowska, 2014).

The previous research has generated a vast body of papers dealing with VAIC and its components on firm performance. Therefore, the following lines encompass papers categorized depending on the industry covered by the analysis.

There is a number of studies dealing with this issue in the field of insurance industry. E.g. Alipour (2012) applied regression model to find the relationship of intellectual capital and financial performance expressed with ROA on the sample of 39 Iranian insurance companies that were active in 2005 – 2007 period also finding positive relationship of VAIC and its components and performance. Moreover, Lu et al., (2014) conducted an analysis on influence of intellectual capital on performance of Chinese life insurance companies measured with the dynamic slack-based measure applying truncated regression approach. Using the sample of 34 life insurers that operated in the period 2006 – 2010, the authors find, among other things, the intellectual capital to be statistically significant and positively linked to insurers' operating efficiency. On the other hand, Sherif and Elsayed (2015) applied a wide range of performance measures while investigating the impact of VAIC on performance of Egyptian insurance companies in the period 2006 – 2011 finding its statistically significant contribution in defining insurer's performance taking either positive or negative sign depending on the performance measure employed.

Moreover, this is also often investigated issue in the banking industry as well. Al-Musalli and Ismail (2012) examined influence of VAIC and its components on performance of Saudi Arabian banks in the 2008 – 2010 period finding positive influence of VAIC on their performance measured with both ROA and ROE. Nevertheless, when observing influence of VAIC components, specifically HCE, SCE and CEE, their influence is either positive or remains insignificant. Ozkan et al. (2017) also investigated the relationship between VAIC and financial performance of 44 Turkish banks operating in 2005 – 2014 period revealing CEE and HCE to be positive determinant of ROA. Furthermore, Gigante (2013) analysed the influence of VAIC as well as of its components on performance of 64 banks in nine selected European countries over 2004 – 2007 period presenting performance with market/book value, return on average equity and return on average assets. The findings indicate positive influence of VAIC, HCE and CEE in some models whereas SCE proved to negatively affect return on average equity.

If we observe the papers on this issue dealing with firms in manufacturing industry, we can point out the paper by Bayraktaroglu et al., (2019) who proposed adjusted VAIC model adding some components such as customer capital (CC) efficiency as well as innovation capital efficiency to reveal their impact on firm performance, i.e. profitability, productivity

and market performance. Multiple regression analysis has been applied on the sample of Turkish manufacturers listed on Istanbul Stock Exchange. Results of the original VAIC model show significant and positive influence of HCE, CEE and SCE in ROA model, CEE positively influences productivity, HCE has positive effect on ROE whereas the only statistically significant determinant of market performance is SCE with negative sign. Moreover, the results of the modified model show, among other things, that innovation capital efficiency expressed with R&D has a moderating effect on SCE and both ROA and ROE relationship as well as positive impact on productivity. Xu and Liu (2020) also proposed extended VAIC model with the aim of exploring influence of IC and its components on the performance of 415 South Korean manufacturers listed on the Korea Stock Exchange operating in the 2013 – 2018 period. These authors, as the previously mentioned ones, also employed profitability, productivity as well as market value to express performance while modified VAIC model includes innovation capital efficiency and relational capital efficiency as well. Results of the originally estimated model show all components of VAIC to be statistically significant and positive determinant of ROA and ROE while in other models only CEE component is statistically significant and positively impacts productivity. However, findings of the alternated VAIC model reveal that innovation as well as relational capital efficiency has adverse effects on profitability presented with both ROA and ROE.

After Pulic's work a number of papers have arisen suggesting its drawbacks (see e.g. papers by Ståhle et al., 2011) whereas Iazzolino and Laise (2013) point out that all critics regarding Pulic's (1998) approach stem from the different meanings he assigned to particular terms. Still, it is suitable measure in a knowledge economy setting and "allows the productivity of knowledge workers and the creation of new value generated from them to be measured" (Iazzolino and Laise (2013). Or, as pointed out by Fijałkowska (2014), "one should be aware of its weaknesses but also of the fact that there is no perfect way to capture, measure and disclose the complexity of business organization."

Therefore, our aim is to investigate the effects of composite VAIC and its components separately on performance of Croatian listed non-financial firms in the period 2016 – 2020. For the purpose of conducting an analysis, static panel model will be employed while performance will be expressed using accounting and market based measures, i.e. ROA and Tobin's Q.

Paper by Pulic (1998) compares 200 Austrian and 400 largest Croatian firms from different sectors as well as 24 Austrian and 30 Croatian banks. Since then, a number of papers dealing with the issue of influence of intellectual capital on companies' performance in Croatia have arisen dealing with smaller samples of firms and encompassing shorter period of time (e.g. Gomezelj Omerzel and Smolcic Jurdana, 2016 and Dabic et al., 2019). Thus, our paper adds to the literature in a way that it is, to the best of authors' knowledge, the first paper to empirically analyse influence of value added intellectual capital and its components on performance of Croatian listed firms. Besides providing a useful perception on the relationship between value added intellectual capital and firm performance using static panel model, the sample consists of non-financial listed firms while the analysis encompasses longer period of time, i.e. five years while controlling for other factors that might play an influential role in determining form performance.

The rest of the paper proceeds as follows. After the introduction, literature review describing relevant papers in the field follows. The third part of the paper provides variables calculation and description. Sample description is also provided in this section. Empirical research and findings follow afterwards while the fifth section provides discussion and concluding remarks.

2 Methods

Traditionally employed measure of firm profitability expressed with ROA is used in this study as well is in other numerous studies dealing with the issue of VAIC influencing corporate performance such as Chen et al., (2005) and Nawaz and Haniffa (2017). As stated by the latter authors it "gives an idea as to how efficient management is at using its assets to generate earnings." Following Chen et al., (2005) we calculate ROA as pre-tax income over total assets.

Since our sample deals with listed firms, besides traditional profitability measures, corporate performance is expressed with market valuation using Tobin's Q as it is often the case in papers dealing with determinants of firm performance as well as in those employing VAIC as a potential factor influencing companies' performance (e.g. Hejazi et al., 2016; Lin et al., 2018). For the purpose of calculating Tobin's Q, the following formula is used:

$$Tobin's\ Q = \frac{market\ value\ of\ shares + book\ value\ of\ debt}{total\ assets} \quad (1)$$

Explanatory variables encompassed with this analysis comprise of VAIC and its components, specifically, human capital efficiency (HCE), capital employed efficiency (CEE) and structural capital efficiency (SCE). To measure intellectual capital, the authors apply an approach presented by Pulic (2004) as well as studies that followed (e.g. Ståhle et al., 2011; Alipour, 2012; Lu et al., 2014; Fijałkowska, 2014).

Value added is calculated using the following expression:

$$Value\ added\ (VA) = OP + HC\ + D\ + A \quad (2)$$

where OP stands for operating profit, EC presents human capital or employees' costs, D is depreciation while A stands for amortization.

The further step is to calculate components of VAIC. So, HCE or human capital efficiency is calculated as follows:

$$HCE = \frac{VA}{HC} \quad (3)$$

where VA denotes value added while HC stands for human capital expressed with employees' expenses.

Furthermore, the authors calculated CEE or capital employed efficiency using following formula:

$$CEE = \frac{VA}{CA} \quad (4)$$

where VA stands for value added, CE denotes capital employed calculated as total assets reduced for intangible assets as suggested by Alipour (2012) and Sheriff and Elsayed (2016).

As the last step, SCE or structural capital efficiency is calculated applying the following equation:

$$SCE = \frac{SC}{VA} \quad (5)$$

where SC denotes structural capital calculated as produced value added reduced by human capital.

Finally, VAIC is calculated as:

$$VAIC = HCE\ + CEE\ + SCE \quad (6)$$

Although previous research provides inconsistent findings regarding on influence of VAIC on firm performance, we expect its positive influence since "the competitiveness of a company results from possessing valuable and inimitable resources, which enables the firm

to achieve a favourable competitive position to maintain its market position and get superior performance" (Xu and Liu, 2020). Specifically, if IC is observed as unique and rare resource under the resource based view it should provide competitive advantage and have positive impact on performance. It is also useful to keep in mind rationale provided by Kamukama et al. (2011) cited by Bayraktaroglu et al. (2019) stating that differences in findings might stem from IC components' industry as well as from country-specific factors.

Besides these variables referring to intellectual capital, a set of control variables that might influence corporate performance are employed as well including, size, leverage and age of the firm. These are explained in more detail in the following lines.

Firm size variable is often employed in research papers dealing with determinants of corporate performance (e.g. Ibhagui and Olokoyo, 2018 and Secinaro et al., 2020) as well as in those investigating influence of VAIC and its components on performance (e.g. Alipour, 2012 and Xu and Liu, 2020). We have opted for calculation of firm size based on total assets as the latter authors. Over the years, numerous papers have offered contradictory findings on influence of size on firm performance. This is rationalized with the fact that if companies achieve advantages from scale or scope economies as they grow in size, a positive influence could be expected whereas if firm growth leads to diseconomies of scale, this influence might be negative (Goddard et al., 2005). Thus, the sign of this variable is ambiguous.

Leverage of the firm is compassed with the analysis as control variable calculated as total book value of debts over book value of total assets applying e.g. Alipour (2012) approach when investigating determinants of firm performance. As stated in Alipour (2012), leverage stands for corporate risks and those firms that depend on to a large extent upon leverage might experience lack of the protection that is needed to attract investors, and consequently have higher interest payments affecting the returns (Sherif and Elsayed, 2016). Having this in mind, negative sign of leverage variable could be expected. Alipour (2012) found inverse relationship of leverage and firm profitability, while Lu et al. (2014) found both positive and negative influence of leverage on performance while investigating intellectual capital and of Chinese life insurance companies' performance. Therefore, the expected sign of this variable is uncertain.

Firm age is calculated as natural logarithm of number of years elapsed since incorporation of the firm plus one in order to avoid zero values. Negative influence of firm age on corporate performance is found by e.g. Akben Selçuk (2016) and Loderer and Waelchli (2010) who explain firm aging problem with organizational rigidities including unwillingness to innovate, increased overhead expenses, slower growth etc. as well as with rent seeking behaviour that indicates worse corporate governance, growth of boards and CEO compensations. However, the same authors also state that firm age might reduce costs due to "various learning effects within the firm and learning spillovers from other firms in the same or in other industries". Moreover, Coad (2018) states the benefits of firm aging that can be found in established and defined routines, accumulated experience, higher levels of reliability etc. Therefore, the influence of firm age on corporate performance is unclear.

The data for calculation of variables employed in the analysis was taken from the financial statements publicly available through web pages of ZSE. Moreover, the data on share price and number of shares listed were manually collected also from web pages of ZSE. Moreover, data on the year of firm incorporation were traced from corporate web pages of a particular firm.

The sample consists of companies listed on ZSE including prime, official and regular market. At the time of conducting this research there were 94 companies listed on the stock exchange, however, this sample was adjusted in a way that all financial companies were excluded from the analysis following Haniffa and Hudaib (2006), Akben Selçuk (2016) and Bennouri et al. (2018) due to their specific nature of conducting business activities and regulatory framework. Moreover, firms that reported negative equity were also omitted from

further analysis following e.g. as well as those whose shares were not traded in the entire observed period in order to obtain more reliable data.

3 Results

With the aim of conducting econometric data analysis, static balanced panel data analysis is performed. Two static panel analyses are conducted depending on the dependent variables used, one static panel analysis is done with ROA and second one is done with Tobin's Q serving as dependent variable. Firstly, the influence of VAIC is investigated on each dependent variable, and in the next step the influence of its components.

Before panel analysis is employed, the authors primarily tested stationarity in a panel dataset. Specifically, Fisher-type unit-root test based on an augmented Dickey Fuller test has been applied. Since the results reveal that variables VAIC, SCE, CEE, leverage and size are not stationary, after calculating the first difference for these non-stationary variables, the same unit-root test is conducted again finding that the first differences of variables VAIC (D_VAIC), SCE (D_SCE), CEE (D_CEE), leverage (D_lev) and size (D_size) are stationary. The results of conducted stationarity test are presented in table 1.

Table 1. Fisher-type unit-root test

Variable	Inverse chi-squared	Inverse normal	Inverse logit	Modified inverse chi-squared
	p-value	p-value	p-value	p-value
ROA	0.0000	0.0305	0.0000	0.0000
Tobin's Q	0.0000	0.0000	0.0000	0.0000
VAIC	0.0000	0.2253	0.0000	0.0000
HCE	0.0000	0.0793	0.0000	0.0000
SCE	0.0000	0.2567	0.0000	0.0000
CEE	0.0000	0.4762	0.0005	0.0000
lev	0.0000	0.2395	0.0000	0.0000
size	0.0000	0.4786	0.0000	0.0000
ln_age	0.0000	0.0000	0.0000	0.0000

Source: authors' calculation

Further step in a research was to check whether the problem of multicollinearity between independent variables exists. For this purpose, the matrix of Pearson correlation coefficients, provided with Table 2, is implemented. As it can be seen, absolute values of the Pearson coefficient do not exceed 0.7 indicating that the problem with multicollinearity between independent variables does not exist.

Table 2. Correlation matrix

	VAIC	HCE	SCE	CEE	lev	size	ln_age
D_VAIC	1.0000						
HCE	0.4211	1.0000					
D_SCE	0.6057	0.0362	1.0000				
D_CEE	0.6467	0.4717	0.0520	1.0000			
D_lev	-0.1135	-0.1495	-0.0800	-0.1221	1.0000		
D_size	0.2000	0.4313	0.0289	0.1514	-0.0395	1.0000	
ln_age	0.0997	-0.0410	0.0794	0.0453	-0.0812	-0.0736	1.0000

Source: authors' calculation

Moreover, F test, Lagrangian multiplier test for random effects and Hausman test are used to find out the most appropriate panel model. In order to detect the problem of heteroscedasticity, Breusch-Pagan test is used in each model since heteroscedasticity can lead to bias in test statistics as well as in confidence intervals. Therefore, after finding proper static panel model, robust standard errors are used in that same model. Table 3 shows the results of the analysis as well as the results of F test, Lagrangian multiplier test for random effects and Hausman test suggesting that the most appropriate model is the one with random effects (RE).

Table 3. Parameter estimates of static panel model

Variables	Tobin's Q		ROA	
	Model with VAIC	Model with components of VAIC	Model with VAIC	Model with components of VAIC
VAIC	0.0072381** (0.002198)	-	0.7217495*** (0.2307048)	-
HCE	-	0.017032 (0.0143877)	-	1.833246*** (0.5316127)
D_SCE	-	-0.0006563 (0.0079077)	-	-0.059156 (0.2331803)
D_CEE	-	0.2769622 (0.2864123)	-	27.80979*** (8.83113)
D_lev	-0.0011858 (0.002198)	-0.0008006 (0.001939)	-0.0891495 (0.0706813)	-0.0361912 (0.0271861)
D_size	-0.40905** (0.2049484)	-0.558441** (0.2691554)	26.46112* (14.27204)	9.067075 (5.520736)
ln_age	-0.1053609 (0.1106088)	-0.0987905 (0.1125366)	-0.190007 (1.005987)	0.412045 (0.7400272)
_cons	1.56409*** (0.4218482)	1.509712*** (0.4270969)	1.57486 (4.039699)	-3.836181 (3.117897)
R2 within	0.0131	0.0256	0.3237	0.7712
R2 between	0.0033	0.0061	0.2858	0.5723
R2 overall	0.0060	0.0119	0.3092	0.7058
Model p value	0.0780	0.0912	0.0035	0.0000
F test (p value)	0.0000	0.0000	0.0246	0.0000
Lagrangian multiplier test for random effects	chi = 105.91	chi = 107.70	chi = 3.77	chi = 26.18
	p value = 0.0000	p value = 0.0000	p value = 0.0521	p value = 0.0000
Hausman test	chi = 5.12	chi = 3.96	chi = 4.57	chi = 2.91
	p value = 0.2750	p value = 0.6822	p value = 0.3348	p value = 0.8197
Breusch-Pagan test for heteroskedasticity	chi2 = 3.19	chi2 = 6.42	chi2 = 85.15	chi2 = 75.45
	p value = 0.0742	p value = 0.0113	p value = 0.0000	p value = 0.0000

*, **, *** Statistically significant at the; 10%, 5%, 1% level, respectively. Robust standard errors are between parentheses.

Source: authors' calculation

4 Discussion and conclusion

For the purpose of empirical analysis, we examine how composite VAIC as well as its individual components HCE, CEE and SCE affect performance of Croatian listed non-financial companies. The findings of the analysis reveal significant and positive influence of intellectual capital on both, Croatian listed firms' profitability and their market value similar to Chen et al. (2005).

Specifically, when observing the models with performance expressed with ROA positive influence of VAIC is evident. This suggests that firms with higher IC outperform their counterparts in terms of profitability. This is also found by e.g. Chen et al. (2005), Alipour (2012), Sherif and Elsayed (2016) and Xu and Wang (2018).

Moreover, when observing components of VAIC, variables HCE and CEE positively affect profitability, i.e. ROA while SCE is not statistically significant determinant of firm profitability. In papers by Xu and Wang (2018) and Xu and Liu (2020), SCE variable is also insignificant when additional components of VAIC were introduced in the model. Moreover, Ozkan et al. (2017) also find HCE and CEE to positively affect ROA. Thus, capital employed and human capital efficiency are assumed to be valuable intellectual capital suggesting that expenditure on employees should be viewed as an investment since efficient use of human resources creates more wealth. Or, as stated by Pulic (2004), "employees and their intellectual capital ought to receive the official status of key resource." However, particular components of VAIC seem not to be significant predictors of firms' market value, i.e. Tobin's Q as found by Xu and Liu (2020).

Regarding the control variables, size of the firm based on total assets plays significant role in determining firm performance, though taking an opposite sign in these two models. Beneficial influence of size is found when performance is expressed with ROA variable suggesting that an increase in company's assets leads to improved profitability as found by Xu and Wang (2018) and Xu and Liu (2020). However, performance expressed with market value, i.e. Tobin's Q deteriorates if size of the firm increases as found by Sherif and Elsayed (2016) as well.

Although the paper provides a useful insight into the value added intellectual capital and its individual components on firm performance which firm leaders might find helpful as a starting point for improving firm performance, the authors are aware of its limitations. Thus, the suggestions for future research might encompass the use of specific sectors such as insurance, banking sector or manufacturers. Moreover, some additional potential determinants might be included as well as comparison with other countries with similar level of economic development.

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