Accounting and Management Information Systems
Vol. 23, No. 1, pp. 237-260, 2024
DOI: http://dx.doi.org/10.24818/jamis.2024.01010

Intellectual capital: A key driver of financial performance in the Macedonian banking industry

Bojan Malchev[1,a], Atanasko Atanasovski[a] and Marina Trpeska[a]

[a]*Faculty of Economics - Skopje, Ss. Cyril and Methodius University in Skopje, North Macedonia*

Abstract

Research Question: How does intellectual capital, measured by the Value Added Intellectual Coefficient (VAIC) and its components, influence the financial performance of banks in North Macedonia?

Motivation: In the evolving landscape of the banking sector, understanding the impact of intellectual capital on financial performance is crucial. This study builds upon existing research (Appuhami, 2007; Ozkan *et al.*, 2017; Joshi *et al.*, 2013) to explore this relationship in the specific context of North Macedonia. It addresses the research gap by using the VAIC model to quantify intellectual capital and examines its effect on Return on Assets (ROA) and Return on Equity (ROE).

Idea: The research employs linear regression models to analyze the effect of intellectual capital, as measured by VAIC and its components, on the financial performance indicators ROA and ROE in Macedonian banks.

Data: The study analyzes a decade of data (2012-2021) from ten Macedonian banks, using the VAIC model to measure intellectual capital.

Tools: The study utilizes linear regression analyses with the Statistical Package for the Social Sciences (SPSS) to examine the relationship between intellectual capital and financial performance.

Findings: The study finds a significant and positive impact of VAIC and its components on both ROA and ROE. These results underscore the importance of intellectual capital in enhancing financial performance in the banking sector. Notably, the study reveals a high

[1] *Corresponding author*: Faculty of Economics - Skopje, Ss. Cyril and Methodius University in Skopje; Blvdv Goce Delchev 9v, Skopje 1000, North Macedonia; tel. +389 2 329 3293; email address: bojan.malcev@eccf.ukim.edu.mk
Acknowledgement: This paper was presented at AMIS 2023 conference.

average VAIC value among Macedonian banks, indicating their substantial intellectual capability.

Contribution: This research adds to the literature by elucidating the relationship between intellectual capital, measured through VAIC, and financial performance in the banking sector of North Macedonia.

Keywords: Intellectual capital, Financial performance, North Macedonia, Value Added Intellectual Coefficient (VAIC), Banking sector.

JEL codes: G21, O34, M41.

1. Introduction

In this scholarly investigation, we delve into the realm of intellectual capital, a domain of increasing prominence in the contemporary corporate milieu. This exploration is premised on the recognition of the intrinsic value of intangible assets and seeks to elucidate methods for their quantification and management. Intellectual capital, encompassing knowledge, skills, and other non-tangible resources, is pivotal in enabling organizations to generate value and maintain competitiveness. This is particularly salient in the banking sector, where intellectual assets are fundamental to operations that are inherently knowledge-based, involving customer interactions and services rooted in intellectual domains such as human resources, branding, and system processes (Ahuja & Ahuja, 2012).

The banking sector's reliance on intellectual capital for delivering financial services and sustaining market competition is undeniable. Several scholarly inquiries have underscored intellectual capital as a vital and strategic asset in the banking sector's success (Celenza & Rossi, 2014; Inkinen, 2015; Nimtrakoon, 2015; Sarea & Alansari, 2016). The burgeoning corpus of literature examining the interplay between intellectual capital and financial performance reflects the escalating significance of intangible assets in the business world.

Intellectual capital, while variably defined, commonly refers to the knowledge, skills, and other intangible assets that empower businesses to create value and compete effectively. This concept has found application across various industries, including banking. The subjective nature of intellectual capital poses challenges in its measurement, prompting the development of several methodologies to estimate it. Among these, the Value Added Intellectual Coefficient (VAIC), proposed by Pulic (1998), stands out as a widely recognized measure across diverse industries. VAIC, a holistic measure of intellectual capital, encompasses the contributions of human, structural, and relational capital. Its components include Human Capital Efficiency (HCE), assessing efficiency in utilizing human capital; Structural Capital

Efficiency (SCE), gauging efficiency in using structural capital; and Capital Employed Efficiency (CEE), evaluating the efficiency in employing capital. Research focusing on the relationship between intellectual capital and financial performance in the banking sector has yielded mixed outcomes, ranging from significant to negligible correlations. These variances can be attributed to the complexities in measuring intellectual capital and accounting for other influential factors on financial performance.

In the context of North Macedonia's banking sector, which has recently undergone significant transformations, including intensified competition and regulatory changes, understanding the impact of intellectual capital on financial performance is crucial. This research presents an empirical examination of how intellectual capital influences the financial performance of banks in North Macedonia. Employing linear regression models, the study investigates the correlation between VAIC and its components with financial performance indicators such as Return on Assets (ROA) and Return on Equity (ROE). The sample comprises ten banks active in North Macedonia from 2012 to 2021.

This research contributes to the extant body of knowledge by examining the impact of intellectual capital on financial performance in the banking sector of North Macedonia. It seeks to address the inconsistencies observed in previous studies regarding this relationship. Furthermore, the study formulates hypotheses and ensures adherence to key regression model assumptions such as linearity, normal distribution, homoscedasticity, the absence of multicollinearity, and the absence of autocorrelation. In addressing the limitations of this study, it is imperative to acknowledge the specific scope and geographical concentration of our research. The investigation is confined to the banking sector in North Macedonia and may not be universally applicable to other industries or geographical regions. Additionally, the reliance on VAIC as the sole measure of intellectual capital might overlook other potential models or metrics that could provide a more nuanced understanding of intellectual capital's impact on financial performance. Future research directions should consider expanding the scope of inquiry to include diverse industries and broader geographical regions to validate the generalizability of the findings. It would also be beneficial to explore alternative methodologies for measuring intellectual capital, thereby providing a more comprehensive view of its multifaceted nature. Furthermore, longitudinal studies could offer insights into the evolving impact of intellectual capital on financial performance over time.

The paper is structured as follows: Section 2 provides a literature review on intellectual capital and financial performance; Section 3 details the research methodology, including sample selection, data collection, and analysis procedures; Section 4 discusses the implications of the findings for banks and managers, including the estimated coefficients and statistical significance of VAIC and its components; and Section 6 concludes the paper.

2. Literature review

2.1 Intellectual capital measurement

The scholarly literature on the measurement and reporting of intellectual capital (IC) spans a diverse array of academic disciplines and business sectors. A key theme in this body of work is the necessity for organizations to implement systematic approaches for the monitoring and reporting of their IC assets. Karl-Erik Sveiby's seminal 1997 book, "The New Organizational Wealth," was foundational in defining the concept of IC and offering a methodology for its measurement and management. Since its publication, numerous methods for quantifying and disclosing IC have been developed. Research in this field has often focused on devising specific metrics to assess individual components of IC, such as customer capital as explored by Edvinsson and Malone (1997), or human capital as examined by Bontis (1998). Other researchers have proposed more holistic approaches to encapsulate the entire spectrum of IC, including tools like the Balanced Scorecard by Kaplan & Norton (1996) and the Intellectual Capital Navigator developed by Bontis and colleagues in 2001.

Ante Pulic introduced the Value Added Intellectual Coefficient (VAIC) model in 1998, marking a significant contribution to the research on IC and its impact on financial success. The VAIC model offers an analysis of the interplay between a firm's tangible assets and its human, structural, and relational capital, providing a measure of the value generated through a company's intellectual resources.

The VAIC model presents several advantages, as noted in studies by Firer & Williams (2003), Laing *et al.* (2010), and Nimtrakoon (2015). It provides a straightforward and accessible means for calculating IC's value, aiding stakeholders in evaluating the overall resources and their efficiency in value creation. The model's reliance on data from audited corporate financial reports lends it a level of objectivity and verifiability. Additionally, the use of standardized financial reports as a data source allows for comparisons across different organizations and countries. Companies can utilize the VAIC model to assess their own IC and its impact on business performance. However, the VAIC model is not without its limitations. Critics like Joshi *et al.* (2013) and Mohammad *et al.* (2018) have pointed out its failure to include certain aspects traditionally considered part of intellectual nature, such as research and development expenditure, intellectual property rights, and relational capital. Another significant limitation, as identified by Chu (2011), is the model's inadequacy in evaluating IC in companies that report negative operating profits, rendering it less useful for firms with higher inputs than outputs.

2.2 Previous empirical researches

Mondal and Ghosh's (2012) study on Indian banks underscores the pivotal role of intellectual capital (IC) in enhancing competitive advantage, establishing diverse correlations between IC and financial performance metrics like profitability and productivity. Similarly, Al-Musali and Ismail (2014) observed that the performance of IC in Saudi banks, although modest, positively influences financial performance. However, they noted variations in these relationships when deconstructing the Value Added Intellectual Coefficient (VAIC) into its components.

Appuhami (2007) in Thailand found a significant positive correlation between a firm's IC and shareholder gains, whereas Ozkan *et al.* (2017) identified human capital efficiency (HCE) as a key driver of IC in the Turkish banking sector, overshadowing capital employed efficiency (CEE) and structural capital efficiency (SCE) in terms of value generation. Joshi *et al.* (2013) reported varying performances of VAIC components across Australian financial subsectors, with investment companies showing higher VAIC values due to enhanced human capital efficiency compared to banks, insurance companies, and other financial entities. Ahangar (2011) highlighted that IC performance in an Iranian company was instrumental in explaining its profitability, employee productivity, and sales growth. This notion is reinforced by Maditinos *et al.* (2011), who established a significant link between financial success and human capital efficiency.

Ismail and Karem (2011) found that Bahraini banks' financial success is positively associated with CEE and HCE, although no definitive relationship was found with SCE. The study by Soewarno and Tjahjadi (2020) in Indonesia suggests that IC broadly impacts financial performance, illuminating the relationship between various components of IC efficiency and financial metrics like ROA, ROE, asset turnover, and price to book ratio. In the context of Islamic banking, Tasawar and Haniffa (2017) identified a notable relationship between VAIC and accounting profitability, particularly through CEE and HCE, but not SCE. Haris *et al.* (2019) demonstrated both linear and non-linear effects of IC on profitability in Pakistani banks, confirming an inverted U-shaped relationship. Specifically, CEE and HCE positively influenced bank profitability, whereas SCE had a negative impact. Forte *et al.* (2019) examined 135 Italian listed companies and found that while IC as a whole positively affects firms' financial performance, individual components like human capital efficiency positively impacted financial performance, in contrast to structural capital efficiency and CEE.

Neves and Proença (2021) emphasized the significant influence of IC components on Portuguese banks, suggesting strategic implications for future decision-making. ANIK *et al.* (2021) explored the mediation role of financial performance between IC, Good Corporate Governance, and Corporate Value, revealing that financial

performance bridges the relationship between IC and GCG. During the COVID-19 pandemic, Xu *et al.* (2022) investigated the impact of IC on bank profitability among Chinese and Pakistani banks, finding that IC, especially human capital, continued to positively affect profitability, underscoring the importance of IC management during crises. Buallay *et al.* (2020) observed a positive correlation between intellectual capital efficiency and financial (ROE) and market performance (TQ) in banks, highlighting the need to address the imperfect relationship between IC and asset efficiency (ROA).

Ivanovic *et al.* (2021) identified CEE as the most crucial component of IC in West Balkan agricultural firms, with HCE having minimal effect and SCE adversely affecting financial outcomes. Paunović (2021) utilized factor and multiple regression analysis to reveal that elements of human capital such as team interaction, social skills, and entrepreneurial knowledge positively impact ROA in Serbian entrepreneurial firms. Nawaz and Ohlrogge's (2023) longitudinal study of Deutsche Bank from 1957 to 2019 uncovered that intellectual capital efficiency, particularly in human capital, consistently improved financial performance as evidenced by ROA and ROE. Their research also highlighted the diminishing impact of larger board sizes on the effect of intangible resources, particularly when a former CEO assumes the role of board chairman, emphasizing the importance of CEO education quality in times of crisis.

Costa *et al.* (2020) delved into the Portuguese tourism sector, applying the VAIC™ method to analyze data from 46,951 firms. They discovered a positive correlation between VAIC™, human capital, and capital employed efficiency with profitability, whereas structural capital showed a negative association, and relational capital did not exhibit a significant effect. Yaseen and Al-Amarneh (2021) studied the Jordanian banking sector over 2005-2018, using the VAIC model. Their findings indicated a significant positive relationship between VAIC and ROA, with capital employed efficiency being the most influential factor on bank performance, providing insights into the strategic role of intellectual capital in emerging markets like Jordan. Awwad and Qtaishat (2023) analyzed 13 commercial banks in Jordan through a panel data study, finding that both intellectual capital and competitive advantage, as measured by the VAIC™ model, positively influenced financial performance in terms of ROA. Notably, competitive advantage also served as a mediator in this relationship.

Putri *et al.* (2020) explored the influence of intellectual capital on the market capitalization of IDX-listed companies in the LQ45 index from 2014 to 2018. Using multiple linear regression, they concluded that while intellectual capital and ROA did not significantly affect market capitalization, ROE and dividends did, indicating a preference among investors for companies skilled in capital management and generous dividend distribution. Gupta and Raman (2021) investigated the relationship between intellectual capital and financial performance across 48 firms over a decade. They applied the modified Pulic's VAIC method and Granger

causality analysis, finding significant effects of human, relational, process, and financial capital on ROA, although innovation capital did not show a substantial impact. Prasojo *et al.* (2022) utilized the VAIC model to assess the performance of Islamic banks, using ROA and IFIB as metrics. They concluded that intellectual capital positively affects bank performance, with human capital and capital employed efficiency being positively correlated with both ROA and IFIB, while structural capital efficiency was only related to ROA.

Vishnu and Gupta (2015) refined the VAIC™ model by incorporating relational capital and tested its effectiveness on Indian healthcare firms. They concluded that the extended model outperformed the traditional VAIC™ in predicting firm performance across various financial indicators, despite its lack of support for including relational capital. Suseno *et al.* (2019) applied the VAIC method to financial data from BPRS PNM Mentari Garut, revealing that while Human Capital Efficiency and Structural Capital Efficiency did not impact ROA, Capital Employed Efficiency significantly positively influenced it. Chowdhury *et al.* (2018) assessed the Bangladeshi textile industry using the VAIC model and found that structural capital significantly impacted ATO and ROA, while human capital had a minimal impact on financial performance, highlighting the importance of tangible capital in productivity and profitability.

Skhvediani *et al.* (2022) conducted a quantitative analysis of 323 Russian IT companies, employing regression analysis to determine the influence of intellectual capital on asset profitability. Their findings confirmed positive impacts from structural, human, and employed capital, although relational capital exhibited a negative relationship. Radić (2018) investigated the Serbian commercial banking sector using VAIC methodology on panel data from 27 banks from 2008-2016. The study revealed that the effect of intellectual capital efficiency on profitability varied depending on the measure used; it negatively impacted profitability at higher debt levels when using ROA, while bank size did not significantly influence this relationship and no significant impact was observed on ROE. Their study called for further investigation into the complex relationship between intellectual capital and operational efficiency (ROA).

Ousama *et al.* (2020) conducted a regression analysis using the VAIC model on data from Islamic banks in the GCC from 2011 to 2013. Their study found a positive influence of intellectual capital on financial performance indicators, highlighting the strategic role of human capital and the underutilization of structural capital in the Islamic banking sector. Shubita (2022) used regression models and the VAIC to analyze 77 Jordanian industrial firms, finding that intellectual capital significantly impacted firm performance, with human and capital employed efficiencies positively influencing ROE and structural capital efficiency negatively affecting it. AL Shubiri (2015) examined the financial sector in Oman from 2009 to 2013 using market capitalization methods on 32 firms. The study revealed a significant influence of

Tobin's q and market to book value on profitability, as measured by ROE and EPS, emphasizing the importance of intellectual capital in enhancing sector productivity and effectiveness.

Papíková and Papík (2022) investigated the relationship between intellectual capital and profitability in Slovak SMEs before and during the COVID-19 pandemic. Their study, using linear mixed-effects models on 24,351 firms, found that higher VAIC scores correlated with increased profitability pre-pandemic, but structured and capital employed efficiencies had negative impacts during the pandemic, particularly in sectors like tourism and gambling. Chen and Rahman (2023) analyzed the Chinese retail sector, using data from firms listed on the Shanghai and Shenzhen Stock Exchanges from 2011 to 2020. Their findings indicated that intellectual capital, measured via the value-added intellectual coefficient, positively correlated with multiple financial performance indicators, underscoring its significant role in enhancing firm value. Janošević and Dženopoljać (2012) scrutinized the impact of intellectual capital on Serbian firms, using financial data from the top 15 traded companies on the Belgrade Stock Exchange between 2007 and 2010. They found a positive influence of intellectual capital on ROE and employee productivity, although its impact on ROA was not significant, suggesting a need for enhanced investment in human capital.

2.3 Hypotheses development

The literature review extensively discusses the role of intellectual capital in shaping the financial performance of banks, with a specific focus on the VAIC model. Studies have consistently shown that dimensions of IC are integral to enhancing profitability and market value (Edvinsson and Malone, 1997; Bontis, 1998; Firer & Williams, 2003; Laing *et al.*, 2010; Nimtrakoon, 2015). In the banking sector, particularly, the efficiency of intellectual capital plays a critical role in determining financial success (Mondal & Ghosh, 2012; Al-Musali & Ismail, 2014; Appuhami, 2007; Ozkan *et al.*, 2017). This link is further emphasized in the context of Macedonian banks, where the banking sector's evolving landscape makes the efficient utilization of intellectual capital a strategic imperative. Given the empirical evidence and theoretical insights, this study posits two hypotheses in the context of Macedonian banks:

H1: The efficiency of intellectual capital, measured through the Value Added Intellectual Coefficient (VAIC) has a positive and significant impact on Return on Assets (ROA) in Macedonian banks.

This hypothesis is grounded in findings from various studies, such as those by Appuhami (2007) and Ozkan *et al.* (2017), which have identified a significant positive relationship between a firm's IC and shareholder gains, and the predominance of human capital efficiency in driving IC in the banking sector.

H2: The efficiency of intellectual capital, measured through the Value Added Intellectual Coefficient (VAIC) has a positive and significant impact on Return on equity (ROE) in Macedonian banks.

Support for this hypothesis stems from the varied performances of VAIC components across different financial subsectors (Joshi *et al.*, 2013; Ahangar, 2011). These studies suggest that IC components like human capital efficiency play a significant role in explaining profitability and productivity, directly impacting ROE. The selection of ROA as a performance metric is based on its ability to demonstrate a bank's profitability in comparison to its overall assets, offering a view into how effectively assets are used. Conversely, ROE is utilized to gauge a bank's profitability against its shareholders' equity, showcasing the returns yielded on shareholder investments. The incorporation of both ROA and ROE as dependent variables in the study is intended to thoroughly examine the financial health of banks and to analyze how intellectual capital influences their profitability and returns.

These hypotheses are reflective of the critical role of IC in shaping the financial performance indicators in the banking sector. They align with the broader narrative in the literature review, emphasizing the multifaceted impact of intellectual capital on financial metrics, particularly in the dynamic and competitive banking sector of North Macedonia. The subsequent sections will delve into the methodology employed to test these hypotheses and discuss the implications of the findings.

3 Research methodology

The papers' investigation centers on North Macedonia's banking sector, encompassing a dozen institutions. Excluded from the analytical scope were two banks, owing to their unfavorable operational outcomes throughout the decade spanning 2012 to 2021. Consequently, the aggregate data points amount to 100, derived from a decade-long scrutiny of ten banking establishments. The compilation of data involved multiple channels, such as the official portal of the Macedonian Stock Exchange (www.mse.mk), the electronic platform for data on publicly traded companies (www.seinet.com.mk), and the respective online presences of these banks. A concise depiction of the utilized variables is presented in Table 1.

Table 1. Description of the variables

Variables	Abbreviation	Measurement
The Value Added Intellectual Coefficient	VAIC	Sum of HCE, SCE and CEE
Human Capital Efficiency	HCE	Value Added / Human Capital
Structural Capital Efficiency	SCE	Structural Capital / Value Added
Capital Employed Efficienc	CEE	Value Added / Capital Employed

Variables	Abbreviation	Measurement
Return on Assets	ROA	The Ratio between net profit after tax and total assets.
Return on Equity	ROE	The Ratio between net profit after tax and shareholders' equity

The VAIC framework is devised to evaluate the magnitude of value generation a corporation achieves through intellectual efficiency or resources. This model computes VAIC based on three principal elements: Human Capital (HC), typically perceived as the total expenditure on employees; Structural Capital (SC), calculated as the differential between Value Added (VA) and Human Capital (HC), denoted as SC = VA - HC; and Capital Employed (CE), which encompasses both financial and physical capital. Financial Capital (FC) comprises the sum of cash, central bank balances, net financial assets valued at fair value through profit or loss, interbank receivables, and net financial assets available for sale on the balance sheet, while Physical Capital (PC) refers to the net amount of tangible fixed assets recorded on the balance sheet. Following these parameters, VAIC is derived as the aggregate of three efficiency ratios:

1) Human Capital Efficiency (HCE) = VA / HC;
2) Structural Capital Efficiency (SCE) = (VA - HC) / VA or SC / VA; and
3) Capital Employed Efficiency (CEE) = VA / CE.

Additionally, Intellectual Capital Efficiency (ICE) is articulated as ICE = HCE + SCE as an intermediary result, leading to VAIC = ICE + CEE as the ultimate outcome.

To gauge a firm's efficiency, it is crucial to ascertain its proficiency in generating Value Added (VA), delineated as the discrepancy between output (OUT) and input (IN). OUT represents a bank's operating revenues, encompassing interest income, fees, commission income, and other operational income, whereas IN includes operational costs such as interest, finance, administrative expenses, and other operational expenses, excluding personnel expenses which are treated as investments rather than costs. In this context, labor costs are reinterpreted as contributions to value creation rather than mere expenses. Value Added epitomizes the net wealth accrued during a specific period due to ongoing operations.

Incorporating VAIC into the analysis, the study seeks to encapsulate the comprehensive efficacy of intellectual capital in value creation and the augmentation of financial performance in banks. This holistic measure facilitates an expansive assessment of the interplay between intellectual capital and profitability, encompassing human capital as well as structural and capital employed dimensions. The application of VAIC within this research underscores the multifaceted nature of intellectual capital and its pertinence in the banking sector. It offers a paradigm for discerning how banks can optimize their knowledge, skills, and resources for superior financial results. The investigation of VAIC's influence, alongside its

constituent elements on Return on Assets (ROA) and Return on Equity (ROE), yields critical insights into the specific segments of intellectual capital that most substantially bolster the financial efficacy of banks.

This investigation adopts a quantitative approach, endeavoring to ascertain the influence of the independent variables, namely the Value Added Intellectual Coefficient (VAIC) and its constituents—Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE), and Capital Employed Efficiency (CEE)—on the dependent variables, Return on Assets (ROA) and Return on Equity (ROE). To achieve this objective, linear regression analysis was employed utilizing the Statistical Package for the Social Sciences (SPSS). A simple linear regression assesses the association between a dependent variable y and a solitary independent variable x within a dataset encompassing both variables for a specified sample. Expanding upon simple linear regression, multiple linear regression incorporates multiple explanatory variables (Tranmer *et al.*, 2020). The models are expressed as follows:

Simple linear regression model: $\boldsymbol{Y = \beta 0 + \beta 1 X + \mathcal{E}}$
Multiple linear regression model: $\boldsymbol{Y = \beta 0 + \beta 1 X1 + \beta 2 X2 + \beta 3 X3 + \mathcal{E}}$
Here, Y represents ROA/ROE; X denotes VAIC; X1, X2, X3 correspond to HCE, SCE, CEE respectively, and $\boldsymbol{\mathcal{E}}$ symbolizes random error.

Multiple linear regression necessitates several prerequisites for validity and reliability. The foremost condition is a linear relationship between dependent and independent variables. In scenarios lacking this linearity, standard multiple regression may exaggerate the true relationship (Osborne & Waters, 2002). The second prerequisite involves the normal distribution of variables, as non-normal distributions (skewed, kurtotic, or with significant outliers) can influence correlations and significance testing (Osborne & Waters, 2002). Another requirement is homoscedasticity, referring to the uniform variance of errors across all levels of independent variables. The presence of heteroscedasticity, indicative of variable error variances at different values of independent variables, can affect the analysis. While minor heteroscedasticity may not significantly impact significance testing, substantial heteroscedasticity can lead to distorted results and an increased risk of Type I error (Berry & Feldman, 1985; Tabachnick & Fidell, 2001). Additionally, the presence of multicollinearity, particularly when moderate to large, necessitates attention and rectification, as it can severely impede the analysis (Daoud I., 2017). Finally, the absence of autocorrelation is crucial, as its occurrence typically stems from a lack of independence among residuals (Getis, 2007).

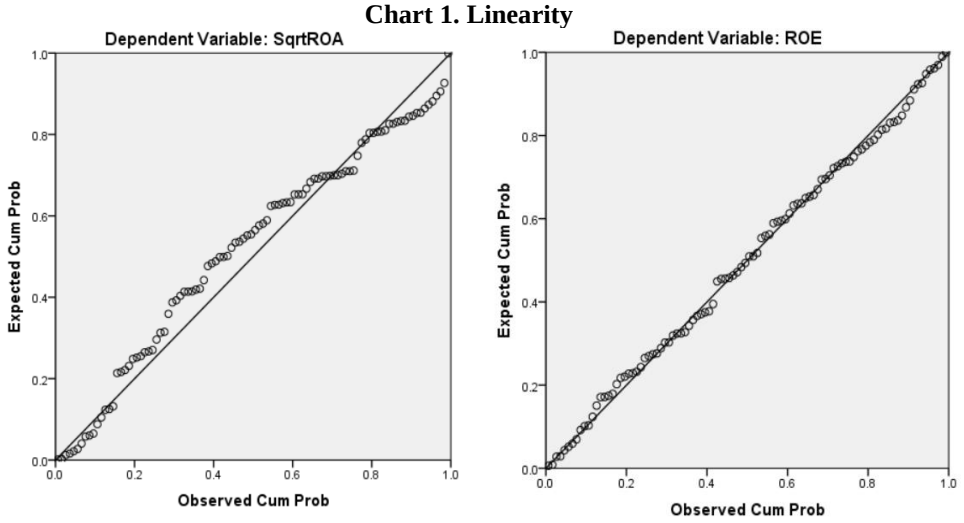
4 Results and discussion

Prior to unveiling the outcomes of the regression model, the assumptions underpinning the multiple linear regression analysis will be delineated and examined. This step is essential to ascertain the influence of the Value Added

Intellectual Coefficient (VAIC) and its constituent elements (Human Capital Efficiency, Structural Capital Efficiency, and Capital Employed Efficiency) on key financial profitability metrics (Return on Assets and Return on Equity) within the banking sector of North Macedonia.

Chart 1 presents the empirical findings, which indicate a linear association among the studied variables. Notably, the majority of data points in Chart 1 align closely with a linear trajectory, implying the existence of a linear correlation.

Chart 1. Linearity



An examination of normality was conducted to verify the presupposition that the residuals of the dependent variables (Return on Assets and Return on Equity) are normally distributed. This critical assumption was assessed utilizing the Kolmogorov-Smirnov and Shapiro-Wilk tests within the Statistical Package for the Social Sciences (SPSS). The results of this assessment are systematically displayed in Table 2.

Table 2. Tests of Normality

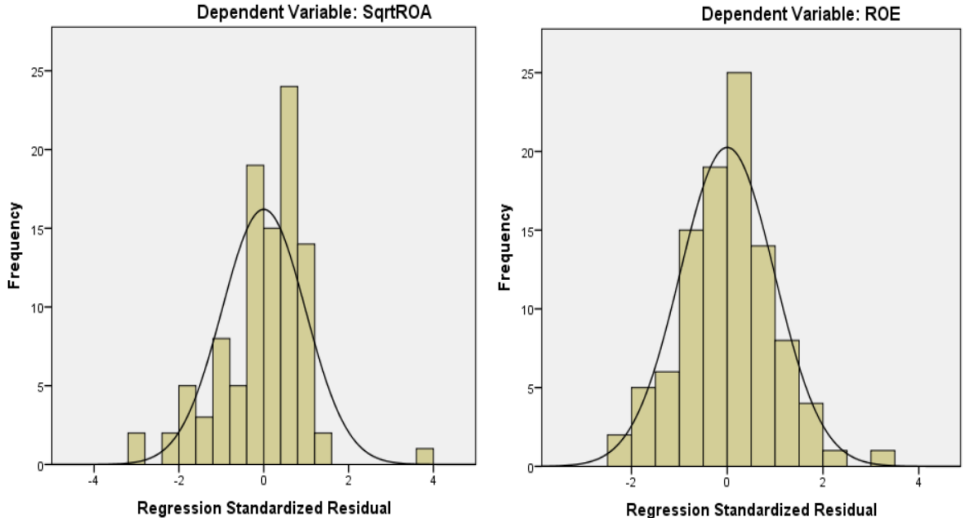
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
ROA	0.092	100	0.038	0.943	100	0.000
SqrtROA	0.067	100	0.200	0.980	100	0.126
ROE	0.056	100	0.200	0.974	100	0.047

Table 2 delineates the preliminary evaluation of the normality assumption for the dependent variables, specifically Return on Assets (ROA) and Return on Equity (ROE). This analysis revealed a non-normal distribution of residuals for ROA, as evidenced by a p-value (Sig.) below 0.05 in both the Kolmogorov-Smirnov and

Shapiro-Wilk tests, indicating a statistically significant deviation from normality. Conversely, ROE demonstrated a normal distribution of residuals according to the Kolmogorov-Smirnov test ($p>0.05$), though the Shapiro-Wilk test yielded a p-value (0.047) close to the threshold value of 0.05.

The aberration in the normal distribution of ROA residuals is not merely a statistical irregularity; rather, it reflects deeper economic dimensions and complexities within the banking sector. This highlights the critical role of intellectual capital, diverse management practices, and the impact of external economic elements on a bank's efficiency in profit generation from its assets. To address this issue for ROA, a transformation was applied to this variable in SPSS, employing the Square Root transformation and renaming it as SqrtROA. Subsequently, the transformed variable met the criterion for residual normality, rendering it applicable for further analysis in the regression model. This approach aligns with the methodology advocated by Osborne (2002), where both the Kolmogorov-Smirnov and Shapiro-Wilk tests post-transformation indicate p-values exceeding 0.05.

Chart 2. Distribution of the residuals



The visual representation, as depicted in Chart 2, corroborates the fulfillment of the normality assumption. This chart graphically illustrates the distribution of the dependent variable's residuals, distinctly indicating their adherence to a normal distribution. The utilization of the transformed variable, SqrtROA, facilitates precise modeling and analysis, thus ensuring the validity and reliability of the resultant findings. In the context of this study, SqrtROA effectively replaces ROA as a measure for examining the influence of the independent variables - the Value Added Intellectual Coefficient (VAIC) and its elements - on the financial performance of banks in North Macedonia. The incorporation of SqrtROA into the regression model

empowers the research to yield substantive insights into the nexus between intellectual capital and bank profitability. This strategic approach permits a more nuanced and accurate assessment of the impact and significance of the independent variables under consideration.

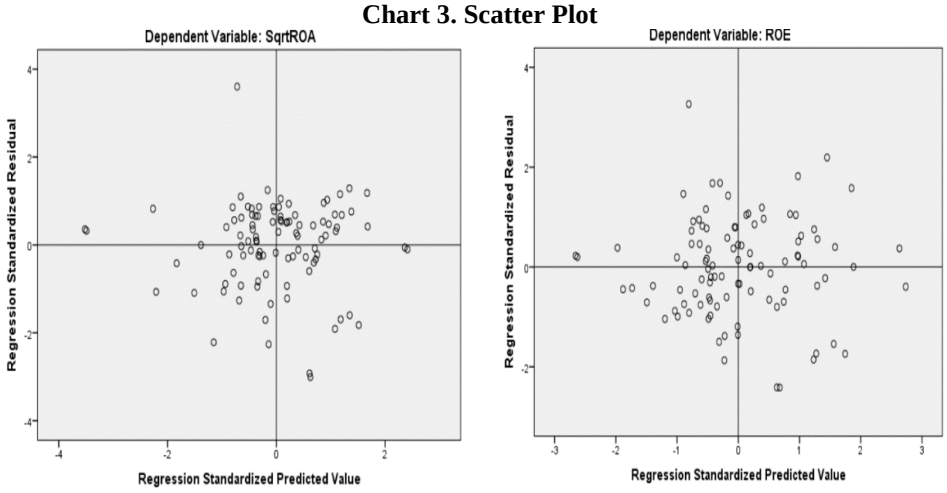
Table 3. Tests of Collinearity

Model	Tolerance		VIF	
(Constant)	ROA	ROE	**ROA**	**ROE**
HCE	0.408	0.408	**2.451**	**2.451**
SCE	0.463	0.463	**2.160**	**2.160**
CEE	0.588	0.588	**1.700**	**1.700**

Table 3 presents the collinearity test, a crucial step in detecting the presence or absence of multicollinearity among the independent variables. According to O'Brien (2007), to affirm the non-existence of multicollinearity, the Variance Inflation Factor (VIF) should be less than 10. The collinearity statistics from the test confirm that the VIF values are below this threshold, leading to the conclusion that multicollinearity is absent. This lack of correlation among the independent variables ensures the reliability and precision of the regression analysis. Such assurance is vital for robust economic decision-making and enhances the understanding of the influence of intellectual capital on the financial performance of the banking sector.

Chart 3 visually represents the assumption of homoscedasticity, indicated by the clustering of values around zero. This pattern suggests that the error variance remains consistent across all levels of the independent variables, thereby implying the absence of heteroscedasticity in the data.

Chart 3. Scatter Plot



Autocorrelation occurs when the residuals from one observation are correlated with the residuals from a previous observation. The Durbin-Watson statistic ranges from

0 to 4, with values around 2 indicating no autocorrelation, values closer to 0 indicating positive autocorrelation, and values closer to 4 indicating negative autocorrelation (Tillman, 1975). In your document, the Durbin-Watson statistic values for both regression models (SqrtROA and ROE) are 1.128 and 1.008, respectively. These values are closer to 2, suggesting that there is no significant autocorrelation in the residuals of the regression models. This is important because significant autocorrelation can invalidate the regression model's assumptions, leading to unreliable results.

Table 4. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson Test
SqrtROA	0.741	0.549	**0.535**	0.02696	**1.128**
ROE	0.661	0.437	**0.420**	0.04033	**1.008**

Following the validation of key assumptions for effective and precise regression models, as indicated by the initial tests, the models can be employed to evaluate the impact of the independent variables (Value Added Intellectual Coefficient and its components: Human Capital Efficiency, Structural Capital Efficiency, and Capital Employed Efficiency) on the dependent variables (Square Root of Return on Assets and Return on Equity). Initially, the Simultaneous F test was applied to ascertain whether the independent variables collectively influence the dependent variables. This test assesses if the empirical data sufficiently support the notion that the regression model provides a better fit than a model devoid of independent variables, as elaborated by Steiger (2004). The results, displayed in Table 5, show that the test values are statistically significant, evidenced by values less than 0.05 (0.000 for both Square Root of Return on Assets and Return on Equity). This outcome suggests that the independent variables (Human Capital Efficiency, Structural Capital Efficiency, and Capital Employed Efficiency) concurrently affect the dependent variables (Square Root of Return on Assets and Return on Equity).

Table 5. ANOVA Simultaneous F Test

Model		Sum of Squares	df	Mean Square	F	Sig.
SqrtROA	Regession	0.085	3	0.028	38.893	**0.000**
	Residual	0.070	96	0.001		
	Total	0.155	99			
ROE	Regression	0.121	3	0.040	24.874	**0.000**
	Residual	0.156	96	0.002		
	Total	0.278	99			

We may now test the multiple linear regression model after confirming that the independent variables affect the dependent variable simultaneously. Table 6 exhibits the model testing results' calculated coefficients.

Table 6. Multiple Linear Regression Model - Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
SqrtROA	(Constant)	0.008	0.011		0.748	0.456
	HCE	0.010	0.003	0.326	3.035	0.003
	SCE	0.033	0.012	0.265	2.629	0.010
	CEE	1.112	0.385	0.259	2.891	0.005
ROE	(Constant)	-0.017	0.016		-1.088	0.279
	HCE	0.019	0.005	0.455	3.799	0.000
	SCE	0.014	0.019	0.086	0.762	0.448
	CEE	1.120	0.575	0.194	1.946	0.045

Analyzing the data in Table 6, it is evident that the components of the Value Added Intellectual Coefficient (VAIC), namely Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE), and Capital Employed Efficiency (CEE), exert a statistically significant and positive effect on both Square Root of Return on Assets (SqrtROA) and Return on Equity (ROE). Specifically, the p-values for all three independent variables are below the established significance threshold of 0.05, with the exception of the SCE coefficient for ROA. Furthermore, the correlation coefficients are positive. This leads to the dismissal of the null hypotheses and the endorsement of the alternative hypotheses, which are: H1, stating that the efficiency of intellectual capital, as measured by VAIC, significantly and positively influences Return on Assets in Macedonian banks; and H2, asserting that the efficiency of intellectual capital, as gauged by VAIC, significantly and positively impacts Return on Equity in Macedonian banks.

The same conclusion is drawn when employing a simple linear regression model where VAIC is used as a singular independent variable, instead of the three components (HCE, SCE, and CEE). The findings of this approach, presented in Table 7, confirm that VAIC significantly and positively affects both SqrtROA and ROE. Hence, the outcomes of the simple linear regression align with those obtained from the multiple linear regression analysis.

Table 7. Simple Linear Regression Model - Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
SqrtROA	(Constant)	0.030	0.007		4.255	0.000
	VAIC	0.018	0.002	0.704	9.826	0.000
ROE	(Constant)	0.006	0.010		0.598	0.551
	VAIC	0.023	0.003	0.645	8.355	0.000

The Adjusted R Square, a coefficient of determination ranging from 0 to 1, quantifies the extent of influence exerted by independent variables on dependent variables, with values closer to 1 indicating a stronger correlation, as noted by Harel (2009). In the context of this study, the Adjusted R Square values are 0.535 for Square Root of Return on Assets (SqrtROA) and 0.420 for Return on Equity (ROE), as shown in Table 4. These values suggest a moderate strength in the regression relationship. This means that the independent variables (Value Added Intellectual Coefficient and its components: Human Capital Efficiency, Structural Capital Efficiency, and Capital Employed Efficiency) account for 53.5% of the variability in SqrtROA and 42% in ROE. The remaining 46.5% and 58% of the variability in SqrtROA and ROE, respectively, are influenced by other variables.

Having established the positive influence of VAIC on Return on Assets and Return on Equity as indicators of profitability in North Macedonia's banking sector, it is now pertinent to conduct a brief analysis of the average VAIC value per bank.

Table 8. Average value of intellectual capital coefficients for 2012-2021 period

BANK	HCE	SCE	CEE	ICE	VAIC
Stopanska banka Skopje	4.8291	0.7892	0.0434	5.6183	5.6618
Komercijalna banka	4.3940	0.7694	0.0378	5.1634	5.2012
NLB banka	4.1422	0.7505	0.0413	4.8927	4.9341
ProKredit banka	2.7673	0.6252	0.0276	3.3925	3.4201
Halk banka	2.6171	0.6083	0.0287	3.2254	3.2541
Shparkase banka	2.3599	0.5488	0.0310	2.9087	2.9397
Uni banka	2.1899	0.5229	0.0355	2.7128	2.7482
TTK banka	2.1639	0.5340	0.0437	2.6979	2.7416
Stopanska banka Bitola	1.7983	0.3951	0.0284	2.1934	2.2217
Silk Roud banka	1.3281	-0.0468	0.0270	1.2813	1.3082
TOTAL	**2.8590**	**0.5497**	**0.0344**	**3.4086**	**3.4431**

The capacity of banks to generate value and the efficiency of resource utilization both escalate with rising VAIC (Value Added Intellectual Coefficient) values. According to the data in Table 8, each evaluated bank displayed a positive VAIC value, with the sector's average being notably high at 3.4431. This indicates a substantial intellectual capability within Macedonian banks, translating to the creation of 3.4431 MKD in additional value for every 1 MKD invested, as identified by Fijałkowska (2014). The analysis further reveals that three banks – Stopanska banka Skopje, Komercijalna banka, and NLB banka – have surpassed the average VAIC value. Among them, Stopanska banka Skopje stands out with the highest VAIC of 5.6618, implying an added value of 5.6618 MKD for every 1 MKD invested.

This study uncovers several critical economic dimensions. Primarily, it validates a statistically significant and positive correlation between VAIC and its elements (Human Capital Efficiency, Structural Capital Efficiency, and Capital Employed Efficiency) with key financial profitability indicators (Return on Assets and Return on Equity) in Macedonian banks. This underscores the pivotal role of intellectual capital, as quantified by VAIC, in augmenting the financial performance of banks. Additionally, the research delineates that each component of VAIC positively influences both ROA and ROE, suggesting that effective management of human capital, structural capital, and capital employed enhances bank profitability and returns. The study also points out the relatively high average VAIC value among Macedonian banks, signifying their considerable intellectual capacity. The uniformly positive VAIC values across all examined banks further accentuate their proficiency in value creation and resource optimization. Notably, the exceptional VAIC values of Stopanska banka Skopje, Komercijalna banka, and NLB banka highlight their superior capability in generating additional value per investment unit. These economic implications underscore the significance of intellectual capital in the banking sector, reinforcing the concept that banks can boost their financial performance through effective management and utilization of intellectual assets. The findings offer valuable insights for bank managers, policymakers, and stakeholders, advocating the prioritization of intellectual capital investments and strategies to enhance profitability and competitive edge in the banking arena.

5. Conclusions

This research was designed to explore the nexus between intellectual capital and the financial performance of banks in North Macedonia. Utilizing linear regression models, the study examined the relationship between intellectual capital, as quantified by the Value Added Intellectual Coefficient (VAIC) and its constituents (Human Capital Efficiency, Structural Capital Efficiency, and Capital Employed Efficiency), and the financial performance of banks, as measured by Return on Assets (ROA) and Return on Equity (ROE).

The study's findings substantiated the significant and positive impact of VAIC and its components on both ROA and ROE, thus affirming the established hypotheses. Specifically, concerning ROA, it was found that VAIC and all its components significantly positively affected it. In contrast, for ROE, VAIC, HCE, and CEE exhibited a significant positive influence, while SCE did not demonstrate a significant impact. An analysis of the 10-year average VAIC values was also performed, revealing a high sector average of 3.4431. This underscores the considerable intellectual prowess typically exhibited by Macedonian banks, with an additional 3.4431 MKD value generated for every 1 MKD invested.

The data highlighted that three banks - Stopanska banka Skopje, Komercijalna banka, and NLB banka - exceeded the average VAIC, with Stopanska banka Skopje attaining the highest value (5.6618). The implications of this study are profound for investors, policymakers, and bank managers. Bank managers are encouraged to focus on the development and management of intellectual capital to enhance their banks' financial performance. Policymakers can leverage these findings to formulate regulations fostering the growth and management of intellectual capital within the banking industry. For investors, these insights can guide informed investment decisions.

This study represents a pioneering effort in North Macedonia, examining the correlation between intellectual capital and the financial performance of banks. It contributes valuable knowledge regarding the significance of intellectual capital in the Macedonian banking sector and its potential impact on financial performance. Additionally, this study enriches the existing literature by elucidating the relationship between intellectual capital and financial performance in the banking domain. However, the study is not without limitations that warrant attention in future research. Its focus on the banking sector in North Macedonia means the findings may not be generalizable to other sectors or countries.

The study primarily considers the quantitative aspects of intellectual capital and employs a quantitative approach. Future research could adopt a mixed-methods strategy to gain a more comprehensive understanding of the relationship between intellectual capital and financial performance. Furthermore, the study's 10-year timeframe might not fully capture the long-term dynamics between intellectual capital and financial performance. Considering these limitations, future research could extend the inquiry to various industries and countries, comparing the relationship between financial performance and intellectual capital. Qualitative studies could delve deeper into intellectual capital, its components, and their influence on financial performance. Additionally, extending the research period could provide more insight into the long-term relationship between intellectual capital and financial performance.

References

Ahangar, R. G. (2011) “The relationship between intellectual capital and financial performance: An empirical investigation in an Iranian company”, *African Journal of Business Management*, vol. 5 no. 1: 88. https://doi.org/ 10.5897/AJBM10.712

Ahuja, B. R., & Ahuja, N. I. (2012) “Intellectual capital approach to performance evaluation: A case study of the banking sector in India”, *International Research Journal of Finance and Economics*, vol. 93: 110-122. http://doi.org/10.1108/EBR-04-2019-0053

Al-Musali, M. A. K., & Ismail, K. N. I. K. (2014) "Intellectual capital and its effect on financial performance of banks: Evidence from Saudi Arabia", *Procedia-Social and Behavioral Sciences*, vol. 164: 201-207.

ALShubiri, F.N. (2015) "Impact of intellectual capital from market capitalization on profitability in financial sector of Oman", *Mediterranean Journal of Social Sciences*, vol. 6, no.2: 54-60 http://doi.org/10.5901/mjss.2015.v6n2p54

Anik, S., Chariri, A., & Isgiyarta, J. (2021) "The effect of intellectual capital and good corporate governance on financial performance and corporate value: A case study in Indonesia", *The Journal of Asian Finance, Economics and Business*, vol. 8, no. 4: 391-402 http://doi.org/10.13106/jafeb.2021.vol8. no4.0391

Appuhami, B. R. (2007) "The impact of intellectual capital on investors' capital gains on shares: an empirical investigation of Thai banking, finance and insurance sector", *International Management Review*, vol. 3 no. 2: 14-25.

Awwad, M.S., & Qtaishat, A.M. (2023) "The impact of intellectual capital on financial performance of commercial banks: the mediating role of competitive advantage", *International Journal of Learning and Intellectual Capital*, vol. 20, no. 1: 47-69 http://doi.org/10.1504/IJLIC.2023.10049257

Berry, W. D., and Feldman, S. (1985) "Multiple Regression in Practice", *Sage University Paper Series on Quantitative Applications in the Social Sciences*, series no. 07-050. Newbury Park, CA: Sage.

Bontis, N. (1998) "Intellectual Capital: an Exploratory Study That Develops Measures and Models", *Management Decision*, vol. 36: 63-76. http://dx.doi.org/10.1108/00251749810204142

Bontis, N., Dragonetti, N. C., Jacobsen, K., & Roos, G. (2001) "Assessing knowledge assets: A review of the models used to measure intellectual capital", *International Journal of Management Reviews*, vol. 3, no.1: 41-60

Buallay, A., Hamdan, A.M., Reyad, S., Badawi, S., & Madbouly, A. (2020) "The efficiency of GCC banks: the role of intellectual capital", *European Business Review*, vol. 32, no. 3: 383-404 http://doi.org/10.1108/EBR-04-2019-0053

Celenza, D., & Rossi, F. (2014) "Intellectual capital and performance of listed companies: Empirical evidence from Italy", *Measuring Business Excellence*, vol. 18, no. 1: 22-35 https://doi.org/10.1108/MBE-10-2013-0054

Chen, H., & Rahman, M.J. (2023) "Intellectual capital and financial performance: evidence from Chinese retail firms", *International Journal of Learning and Intellectual Capital*, vol. 20, no. 4: 394-409 http://doi.org/10.1504/IJLIC. 2023.132171

Chowdhury, L.A.M., Rana, T., Akter, M., & Hoque, M. (2018). "Impact of intellectual capital on financial performance: evidence from the Bangladeshi textile sector", *Journal of Accounting and Organizational Change*, vol. 14, no. 4: 429-454 http://doi.org/10.1108/JAOC-11-2017-0109

Chu, S.K.W., Chan, K.H., & Wu, W.Y. (2011) "Charting intellectual capital performance of the gateway to China", *Journal of Intellectual Capital*, vol. 12, no. 2: 249-276

Costa, V., Silva, L., & Loureiro, P. (2020) "Intellectual capital and its impact on business performance: An empirical study of Portuguese hospitality and tourism sectors", *Intangible Capital*, vol. 16, no. 2: 78-89 http://doi.org/10.3926/ic.1550

Daoud I., J. (2017) "Multicollinearity and Regression Analysis", *Journal of Physics: Conference* Series: 949.

Edvinsson, L. and Malone, M. (1997) "Intellectual Capital", *Harper Business*, New York

Fijałkowska, J. (2014) "Value Added Intellectual Coefficient (VAIC™) as a tool of performance measurement", *Przedsiębiorczość i Zarządzanie (Entrepreneurship and Management)*, vol. 15, no. 1: 129-140.

Firer, S. and Williams, S.M. (2003) "Intellectual capital and traditional measures of corporate performance", *Journal of Intellectual Capital*, vol. 4, no. 3: 348-360

Forte, W., Matonti, G., & Nicola, G. (2019) "The impact of intellectual capital on firms financial performance and market value: Empirical evidence from Italian listed firms", *African Journal of Business Management*, vol. 13, no. 5: 147-159 https://doi.org/10.5897/AJBM2018.8725

Getis, A., (2007) "Reflections on spatial autocorrelation", *Regional Science and Urban Economics*, vol. 3, no. 4: 491-496 https://doi.org/10.1016/j.regsciurbeco.2007.04.005

Gupta, K., & Raman, T.V. (2021) "Influence of intellectual capital on performance: An analysis of IT and pharmaceutical firms", *International Journal of Human Capital and Information Technology Professionals*, vol. 12, no. 2: 53-71 http://doi.org/10.4018/IJHCITP.2021040104

Harel, O. (2009) "The estimation of R^2 and adjusted R^2 in incomplete data sets using multiple imputation", *Journal of Applied Statistics*, vol. 36, no. 10: 1109-1118

Haris, M., Yao, H., Tariq, G., Malik, A., & Javaid, H. M. (2019) "Intellectual capital performance and profitability of banks: Evidence from Pakistan", *Journal of Risk and Financial Management*, vol. 12, no. 2: 56 https://doi.org/10.3390/jrfm12020056

Inkinen, H. (2015) "Review of empirical research on intellectual capital and firm performance", *Journal of Intellectual Capital*, vol, 16, no. 3: 518-565 https://doi.org/10.1108/JIC-01-2015-0002

Ivanovic, T., Maksimovic, G., Mandaric, M., Radivojevic, N., & Jovic, M. (2021) "The impact of intellectual capital on the financial performance of agricultural enterprises: Evidence from the West Balkans Counties", *Custos Agronegocio Line*, vol. 17, no. 2: 350-376

Janoševic, S., & Dženopoljać, V. (2012) "Impact of intellectual capital on financial performance of Serbian companies", *Actual Problems of Economics*, vol. 133, no. 7: 554-564 http://doi.org/10.2139/ssrn.1989223

Joshi, M., Cahill, D., Sidhu, J., & Kansal, M. (2013) "Intellectual capital and financial performance: an evaluation of the Australian financial sector", *Journal of intellectual capital*, vol. 14, no. 2: 264-285 https://doi.org/10.1108/14691931311323887

Kaplan, R. S., & Norton, D. P. (1996) ”The balanced scorecard: Translating strategy into action”, *Harvard Business Press*, Boston

Ku Ismail, K. N. I., & Karem, M. A. (2011) “Intellectual Capital and the Financial Performance of Banks in Bahrain”, *Journal of Business Management and Accounting*, vol. 1, no. 1: 63-77

Laing, G., Dunn, J. and Hughes-Lucas, S. (2010) “Applying the VAIC model to Australian hotels”, *Journal of Intellectual Capital*, vol, 1, no. 1 3: 269-283

Maditinos, D., Chatzoudes, D., Tsairidis, C., & Theriou, G. (2011) “The impact of intellectual capital on firms' market value and financial performance”, *Journal of intellectual capital*, vol. 12, no. 1: 132-151 https://doi.org/10.1108/14691931111097944

Mohammad, S.H., Bujang, I., & Naharu, N. (2018) “Measuring Intellectual Capital using VAIC Calculator”, *International Journal of Academic Research in Business and Social Sciences*, vol. 8, no. 9: 485–492 http://dx.doi.org/10.6007/IJARBSS/v8-i9/4607

Mondal, A. and Ghosh, S.K. (2012) “Intellectual capital and financial performance of Indian banks”, *Journal of Intellectual Capital*, vol.13, no. 4: *515-530* https://doi.org/10.1108/14691931211276115

Mrázková, S., Peržeľová, I., & Glova, J. (2016) “Impact of the value-added intellectual coefficient and its components on overall performance of selected European companies”, *Polish Journal of Management Studies*, vol. 14, no. 2: 161-171 http://doi.org/10.17512/pjms.2016.14.2.15

Nawaz, T., & Haniffa, R. (2017) “Determinants of financial performance of Islamic banks: an intellectual capital perspective” *Journal of Islamic Accounting and Business Research*, vol. 8, no. 2: 130-142 https://doi.org/10.1108/JIABR-06-2016-0071

Nawaz, T., & Ohlrogge, O. (2023) “Clarifying the impact of corporate governance and intellectual capital on financial performance: A longitudinal study of Deutsche Bank (1957-2019)”, *International Journal of Finance and Economics*, vol. 28, no. 4: 3808-3823 http://doi.org/10.1002/ijfe.2620

Neves, E., & Proença, C. (2021) “Intellectual capital and financial performance: evidence from Portuguese banks”, *International Journal of Learning and Intellectual Capital*, vol. 18, no. 1: 93-108

Nimtrakoon, S. (2015) “The relationship between intellectual capital, firms’ market value and financial performance: Empirical evidence from the Asean”, *Journal of Intellectual Capital*, vol. 16, no. 3: 587-618

Nimtrakoon, S. (2015) “The relationship between intellectual capital, firms’ market value and financial performance: Empirical evidence from the ASEAN”, *Journal of Intellectual Capital*, vol. 16, no. 3: 587-618

O’brien, R. M., (2007) “A Caution Regarding Rules of Thumb for Variance Inflation Factors”, *Quality & Quantity*, vol. 41: 673–690

Osborne, J. (2002) “Notes on the use of data transformations”, *Practical assessment, research, and evaluation*, vol. 8, no. 6 https://doi.org/10.7275/4vng-5608

Osborne, J. W. & Waters, E., (2002) "Four assumptions of multiple regression that researchers should always test", *Practical Assessment, Research, and Evaluation*, vol. 8, no. 2

Ousama, A.A., Hammami, H., & Abdulkarim, M. (2020) "The association between intellectual capital and financial performance in the Islamic banking industry: An analysis of the GCC banks", *International Journal of Islamic and Middle Eastern Finance and Management*, vol. 13, no. 1: 75-93 http://doi.org/10.1108/IMEFM-05-2016-0073

Ozkan, N., Cakan, S., & Kayacan, M. (2017) "Intellectual capital and financial performance: A study of the Turkish Banking Sector", *Borsa Istanbul Review*, vol.17. no. 3: 190-198

Papíková, L., & Papík, M. (2022) "Intellectual capital and its impacts on SMEs profitability during COVID-19 pandemic", *Journal of Eastern European and Central Asian Research*, vol. 9, no. 3: 521-531 http://doi.org/10.15549/jeecar.v9i3.894

Paunović, M. (2021) "The impact of human capital on financial performance of entrepreneurial firms in Serbia", *Management: Journal of Sustainable Business and Management Solutions in Emerging Economies*, vol. 26, no. 2: 29-46 https://doi.org/10.7595/management.fon.2020.0010

Prasojo, P., Yadiati, W., Fitrijanti, T., & Sueb, M. (2022) "Cross-Region Comparison Intellectual Capital and Its Impact on Islamic Banks Performance", *Economies*, vol. 10, no. 3: http://doi.org/10.3390/economies10030061

Pulic, A. (1998) "Measuring the Performance of Intellectual Potential in Knowledge Economy", presented in 1998 at the 2nd McMaster World Congress on Measuring and Managing Intellectual Capital by the Austrian Team for Intellectual Potential

Putri, S. A., Azwardi, & Sa'adah. (2020) "Impact of intellectual capital, profitability and dividend on market capitalization", *Finance: Theory and Practice*, vol. 24, no. 3: 174-182 http://doi.org/10.26794/2587-5671-2020-24-3-174-182

Radić, S. (2018) "The impact of intellectual capital on the profitability of commercial banks in Serbia", *Economic Annals*, vol. 63, no.216: 85-109 http://doi.org/10.2298/EKA1816085R

Sarea, A. M., & Alansari, S. H. (2016) "The relationship between intellectual capital and earnings quality: Evidence from listed firms in Bahrain Bourse", *International Journal of Learning and Intellectual Capital*, vol. 13, no. 4: 302-315 https://doi.org/10.1504/IJLIC.2016.079350

Shubita, M. (2022) "Intellectual capital components and industrial firm's performance", *Problems and Perspectives in Management*, vol. 20, no. 1: 554-563 http://doi.org/10.21511/ppm.20(1).2022.44

Skhvediani, A., Maksimenko, D., Maykova, A., & Kudryavtseva, T. (2022) "Assessment of the Impact of Intellectual Capital on the Profitability of IT Companies in Russia", *International Journal of Technology*, vol. 13, no. 7: 1558-1567 http://doi.org/10.14716/ijtech.v13i7.6203

Soewarno, N., & Tjahjadi, B. (2020) "Measures that matter: an empirical investigation of intellectual capital and financial performance of banking firms in Indonesia", *Journal of Intellectual Capital*, vol. 21, no. 6: 1085-1106 https://doi.org/10.1108/JIC-09-2019-0225

Steiger, J. H. (2004) "Beyond the F test: Effect size confidence intervals and tests of close fit in the analysis of variance and contrast analysis", *Psychological methods*, vol. 9, no. 2: 164

Suseno, N.S., Hermina, T., Ramdhani, A., & Utari, L. (2019) "The impact of intellectual capital on financial performance", *International Journal of Recent Technology and Engineering*, vol. 8, no. 1: 359-365

Sveiby, K. E. (1997) "The new organizational wealth: Managing and measuring knowledge-based assets", *Berrett-Koehler Publishers*

Tabachnick, B. G., Fidell, L. S. (2001) "Using Multivariate Statistics (4th ed.). Needham Heights", *MA: Allyn and Bacon*

Tillman, J. A. (1975) "The power of the Durbin-Watson test", *Econometrica: Journal of the Econometric* Society: 959-974

Tranmer, M., Murphy, J., Elliot, M. & Pampaka, M., (2020) "Multiple Linear Regression", 2nd ed. Manchester: *Cathie Marsh Institute*

Vishnu, S., & Gupta, V.K. (2015) "Performance of intellectual capital in Indian healthcare sector",*International Journal of Learning and Intellectual Capital*, vol. 12, no. 1: 47-60 http://doi.org/10.1504/IJLIC.2015.067831

Xu, J., Haris, M., & Irfan, M. (2022) "The impact of intellectual capital on bank profitability during COVID-19: A comparison with China and Pakistan" *Complexity*, vol. 2022: 1-10 https://doi.org/10.1155/2022/2112519

Yaseen, H., & Al-Amarneh, A. (2021) "Intellectual capital and financial performance: Case of the emerging market banks", *Journal of Governance and Regulation*, vol. 10, no. 1: 35-41 http://doi.org/10.22495/jgrv10i1art4