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Intellectual capital impact on firm value – An integrated reporting approach for Johannesburg Stock Exchange listed companies

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Abstract

The measurement and reporting of the impact of intellectual capital on firm value has remained an elusive empirical and practitioner question. The advent of Integrated Reporting (IR) was initially considered as presenting an opportunity for firms to measure and report on the contribution of non-financial capitals towards firm value creation. However, the IR framework fell short of providing a holistic solution as it lacked a measurement tool that could be used by IR report preparers, analysts and other users of corporate reports. Intellectual capital is one of the five non-financial capitals identified in the IR framework. This study, focusing on intellectual capital, offers a measurement solution using regression modelling. Adopting the intellectual capital theory lens, this study decomposed intellectual capital into the Value-Added Intellectual Coefficient (VAIC) that was used in the regression model. Using VAIC as an independent variable and company value as the dependent variable, the results of the study indicated that Intellectual capital has a statistically significant relationship to firm value. The dominant proxy for firm value was the market share price while EVA, TobinQ and share price at book value were used to check the robustness of the former. The dummy variable for the model was COVID-19.

Key Words: *firm value, intellectual capital, integrated reporting, non-financial capitals*

INTRODUCTION

Intellectual capital has been identified in the Integrated Reporting (IR) framework as one of the five non-financial capitals that are crucial for firms to be able to create value (IIRC, 2013, 2021). The identification of more capitals other than financial capital came after the realisation that for firms to create value, it is important that the contribution of the other capitals be considered (King, 2018). The International Integrated Reporting Council (IIRC), renamed the Value Reporting Foundation (VRF) in 2022, developed the IR framework which identified intellectual capital as an essential part of the non-financial capitals that are necessary accessories to financial capital. The other capitals are human, social and relationship, manufactured and natural capital (IIRC, 2013, 2021). The measurement and reporting of the impact of the different capitals has remained an elusive empirical and

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practitioner question in the domain of IR. The IIRC states that the Integrated Report is not there to report on how a company created or reduced value (IIRC, 2013, 2021). This statement by the IIRC left users of IR reports in a dilemma as the purported solution to holistic corporate reporting became vague. It is against this background that this research is carried out, focusing on the subject of the effect of intellectual capital on the value of firms listed on the Johannesburg Stock Exchange (JSE). The selection of intellectual capital is based on the assumption that intangible assets (of which intellectual capital is a part of) is overtaking tangible assets in the value creation processes of companies (Ocean Tomo, 2021).

Intellectual Capital emanates from the knowledge base that is in the company's possession. This is represented by intangible assets such as intellectual property (examples such as copyrights, software, rights and licences) (IIRC, 2021). Other rooted and tacit pieces of knowledge, systems, protocols, stories and legacies are also in the cohort of intellectual capital (IIRC, 2021).

Before IR, Intellectual Capital was considered separately in company reports and the focus was on its impact on a company's value rather than it being part of the organisation's value (Camodeca et al., 2019). Intellectual capital, which is becoming the backbone of the knowledge worker era, has the potential to be a basis for improved productivity in companies (Schultz & Molele, 2019). Some empirical research results show that the inclusion of Intellectual Capital in corporate reporting positively impacted a company's market capitalisation (Gamerschlag, 2013).

LITERATURE REVIEW

Intellectual capital theory

This study follows the intellectual capital theory lens and in the following sub-sections, the background to intellectual capital theory and a review of some of the empirical studies on the theory are given.

Intellectual capital theory background

Intellectual capital is considered a critical resource in the modern knowledge-based economy. As of the 1980s, intellectual capital has emerged as the most important driver of company growth and differentiation (Radjenovic & Krstic, 2017). Although intellectual capital theory seemingly appears to be a recent phenomenon, its background goes back to the pioneering classical works of Taylor (1911), Robinson (1934), Chamberlin (1947), Schumpeter (1934), Moore and Penrose (1960) and Polanyi (1966). These early scholars managed to identify that employee skill, knowledge and experience were vital in the value-creation process of the company. Patents, trademarks and brands became the embodiments of intellectual capital aiming to internalise it within the company (Robinson, 1934; Chamberlin, 1947). Moore & Penrose (1960) assigned intellectual capital as a resource similar to financial and tangible assets that the company requires for production.

One of the most recognised modern scholars of intellectual capital theory is Pulic (1998) who propounded the Value-added Intellectual Coefficient (VAIC). Pulic (1998) generated the VAIC model from the observation that world economics was departing from being tangible capital and financial capital-centric to a knowledge-based economy. He envisaged that the knowledge economy was epitomised by Intellectual Capital. Financial statements are ineffective in reporting the impact of intangible capital on company values (Lev, 2002). Lev (2002) studied the financial statements of USA Standard and Poor's 500 companies and concluded that more than 80% of the market value of companies was not adequately reported. Relying on previous assertions by Cronje and Moolman (2013) and Schultz and Molele (2019) highlighted the challenge of intangible capitals, that their real value is not clear due to these capitals being not quantified and resultantly not reported.

With the desire to close the gap between company values calculated using financial statements reporting and the market value of companies, Pulic (1998) posited the VAIC model.

The VAIC model, as propounded by Pulic (1998), has the following assumptions:

(a) Value addition in a company is a result of two key resources, capital employed and intellectual capital.

(b) Capital employed consists of the companies' tangible (physical) capital and financial capital.

(c) Intellectual is made up of human capital and structural capital.

(d) Labour costs are not expenses but investments or assets (human capital). Labour costs are thus transferred from the income statement to the statement of financial position.

(e) There is a positive relationship between increasing intellectual capital and increasing company value.

Having identified the assumptions above, Pulic built the formula for VAIC as:

$$VAIC = CEE + HCE + SCE$$

Where: CEE = Capital Employed Efficiency = Value Added/Capital employed

HCE = Human Capital Efficiency = Value Added/Human Capital

SCE = Structural Capital/Value Added

The advantage of VAIC is that it uses published data obtained from companies' annual financial statements (Svanadze & Kowalewska, 2017).

Intellectual capital impact on company value empirical evidence

In a study of Austrian companies, Bornemann (1999), utilising the VAIC model, was able to establish a positive relationship between company performance and intellectual capital. Applying the VAIC model in a study of manufacturing companies in Thailand, Phusavat et al. (2011) found that intellectual capital had a significant and positive influence on return on equity, return on assets, revenue growth, and employee productivity. A similar study in China concluded that intellectual capital was a significant determinant of company performance and company value.

Examining 5 500 banks in the USA, over the period 2005 to 2012, Meles et al. (2016) concluded that intellectual capital was effective in influencing returns on assets and equity. Through a study on the Athens Stock Exchange, it was confirmed that human capital was ahead of the other components of intellectual capital in having a positive impact on return on assets. No relationship could be established on the share price (Maditinos et al., 2011).

In an investigation of 2 161 Australian listed companies covering the period of 2003 to 2008, it was concluded that intellectual

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capital efficiency showed a positive relationship with company performance (Clarke et al., 2011). A similar study on 64 companies listed on Taiwan Stock Exchange, with data from 1992 to 2002, revealed that intellectual capital had a positive influence on both market value and financial performance of companies (Chen et al., 2005).

Gathering data between 2003 and 2011, a study, using the VAIC framework, of financial institutions in Ghana found that human capital efficiency and capital employed efficiency had positive correlations to productivity (Alhassan & Asare, 2016).

In South Africa, Firer and Stainbank (2003) tested the relationship between intellectual capital and productivity, profitability, and market share price on 75 listed companies on the JSE. The study concluded that there was a small positive correlation between VAIC and the share price. This set the tone for future investigations as these results were based on a short-term review of only one year, that is, 2001. In a later study, Morris (2015) researched a bigger sample of 390 JSE-listed companies and covered a longer period (2001–2011). The study wanted to establish the influence of intellectual capital on company performance. The research revealed there was a positive association between intellectual capital and earnings.

In a detailed study, Schultz and Molele (2019) used VAIC to investigate the influence of intellectual capital efficiency on company performance among 43 companies listed on the JSE. Using data gathered from 2001 to 2017 and employing panel regression analysis, their findings are summarised below:

(a) Very few statistically significant correlations exist within the model.
(b) No preliminary indicative associations between VAIC and Intellectual Capital Efficiency (ICE).
(c) No statistically significant relationship was established between VAIC and Return on Assets (ROA).
(d) No significant associations resulted from the empirical analysis concerning the role of intellectual capital as envisaged by VAIC.

Most of the above empirical studies indicate that intellectual capital influences company performance and company value. In this current study, VAIC shall be used to construct a model that tested the impact of intellectual capital on JSE-listed companies. The difference from prior studies is that intellectual capital is considered in the IR perspective where human capital and relational capital are separate capitals.

RESEARCH METHODOLOGY

Research methodology of choice – scientific research method and the quantitative approach

The study uses the scientific research method which leads to the adoption of the quantitative research methodology. The scientific research method is an investigation or enquiry where conclusions and recommendations are driven by data and facts (Kuforiji & Kuforiji, 2016). In the use of the scientific research method, measures have to be taken to minimise bias and imposition of the researcher's opinions (Cresswell and Clark, 2014).

The quantitative research approach investigates relationships that exist among variables. The relationships are exposed using numerical, statistical, and graphical analytical tools (Saunders et al., 2019). This study analyses how agency capital impact the value of the companies under review.

Guided by the post-positivist philosophy and the deductive research approach, this study matches a construction of knowledge using empirical evaluations. Empirical evaluations and statements are expressed in numerical format (Sukamolson, 2007). This study relies on numerical data, with the main dependent variable (company value) and the independent variables (proxies of financial and non-financial capitals) being values obtained from published financial statements and integrated reports.

Using Cresswell's (1994) definition of quantitative research, which states that quantitative research explains phenomena through the collection of numerical data that is analysed by utilising statistical methods, this study's characteristics require quantitative methodology:

- The collection of numerical data: the study involves the collection of numerical data for the sample companies for 11 years (2010 to 2020).
- The use of statistical methods to analyse data: the collected data was analysed through descriptive statistics and panel data regression modelling.

From the above discussion, one may conclude that the quantitative methodology is the most appropriate for this study.

The research strategy of choice – secondary data

Having identified the research methodology of choice, the researcher selects an appropriate research strategy. The selected research strategy enables the researcher to collect and analyse data to answer the research questions (Denzin & Lincoln, 2011; Saunders et al., 2019). To support the quantitative research methodology, the archival and documentary (secondary data) research strategy was used.

The archival and documentary strategy

The archival and documentary research strategy refers to the collection of data from existing documents. Documents include physical copies, online archives, digitised data, and textual, visual and audio repositories (Symon et al., 2017; Saunders et al., 2019).

This study utilises audited financial statements, integrated reports, and other company documents for companies whose data is available in the IRESS database. Due to them being public companies, the target organisations are obliged by law to publish annual reports. With the upsurge in the utilisation of internet-based publication of company reports, the accessibility of this secondary data is easy and practical. Given the speciality aspect of IR and that it is a developing discipline, a survey research strategy has the risk of not getting the sufficient mass necessary to perform meaningful data analysis, hence its exclusion from this study.

Time horizon

The time horizon of a study can be separated into two broad categories, cross-sectional and longitudinal studies. This study utilised both cross-sectional and longitudinal approaches. The study sample includes a cross-section of listed companies on the JSE, covering various industry sectors. Longitudinal data was collected covering the period from 2010 to 2020. This approach necessitates the generation of panel data to be used in the quantitative analysis.

Research techniques and procedures

In the following sub-sections, the research techniques and procedures will be covered, dealing with data collection and sampling methods.

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Data collection

Data collection involves the gathering of information necessary for the researcher to be able to answer the research questions (Dudovskiy, 2018). Data collection procedures can be classified into primary and secondary data collection.

Secondary data collection involves the collection of information from published documents, online portals, and internet archives. With the prevalence of internet sources, secondary data collection has become popular because of ease of access, the variety of sources available without geographical limitations and the big quantum of references from which to choose. Care is required in ensuring that the chosen sources of secondary data are reputable and from recent publications.

Primary data collection includes the collection of information using quantitative and qualitative approaches. In a quantitative approach, the researcher collects data using tools such as questionnaires that have close-ended questions. The research targets are usually selected using random sampling. In the collection of qualitative data, the researcher can use interviews, open-ended questionnaires, focus groups as well as case studies (Dudovskiy, 2018).

For this study, secondary data was collected from mainly the IRESS database. This secondary data is considered valid as it is collected from audited financial reports and professionally reviewed IR.

Population description of the study

The population for this study is made up of companies listed on the JSE as of 30 August 2021. As indicated in Table 1, the population is grouped into industry clusters using the Industry Classification Benchmark (ICB).

Table 1 Population of JSE-listed companies

Sector	Total Population	Total Capitalisation ZAR trillion	Capitalisation USD trillion
Telecommunications and Technology	21	4.23	0.29
Health Care	8	0.19	0.01
Financials and real estate	10	2.13	0.15
Consumer Services	60	5.01	0.34
Manufacturing and Industrials	55	0.41	0.03
Basic Materials/Mining and Energy	41	4.34	0.30
Grand Total	**327**	**16.30**	**1.11**

Source: *JSE (2021). Exchange rate R14.66 to USD as of 30 August 2021*

Table 1 shows the total population of 327 companies with a total market capitalisation of R16.3 trillion (USD 1.11 Trillion). The companies are grouped into six (6) sectors.

Sample description and size for this study

It is deemed impractical for most studies to adopt a census approach due to the amount of time required to reach the entire population. A sampling approach is considered effective and appropriate as it may provide a representative view of the entire population. There are two main approaches to sampling, probability and non-probability sampling (Saunders et al., 2019). Probability sampling is relevant for survey research as it offers the opportunity to generate a representative sample randomly selected. Non-probability sampling on the other hand involves the researcher's judgement in choosing the sample.

For this study, a purposive sampling approach (which is a non-probability method) on JSE-listed companies was adopted, where 327 companies listed on the JSE were grouped according to their industrial sectors and the companies were selected, as explained in the next section. This method was selected for this study due to the following reasons;

(a) Companies that have foreign stock exchanges as their primary listings (55 companies) are not mandated to produce IR in a similar way to those companies primarily listed on the JSE as they are expected to comply with the reporting requirements of their primary stock exchanges (Moolman et al., 2019). Therefore, the target population is narrowed down to 272 companies that have the JSE as their primary listing. After the exclusion of the organisations with JSE secondary listing, the following purposive sampling filters were implemented as explained in (b) and (c).

(b) 126 companies that were listed by 2001 were selected for inclusion. The JSE joined the FTSE Global Classification system in 2002 leading to its capability to release the FTSE/JSE Africa Index Series which produces indices that are comparable to other exchanges in the world markets (City of Johannesburg, 2018). In the researcher's view, these companies are expected to have matured reporting and stable data trends for the study. Therefore, 146 companies listed after 2001 are excluded.

(c) King III report was released in 2009 and the JSE made IR mandatory for reporting starting from March 2010 (Hoffman, 2012). To obtain a consistent mass of data on IR, 2010 becomes a logical starting year for data collection.

This purposive sampling approach yields a sample size of 91 companies. This provided the researcher with 1 001 company years and 2 002 possible observations considering the variables identified in Table 2. The 91 companies in the sample represent 28% of the population. The researcher considers this sufficient for a successful study. Some previous successful studies on non-financial capitals that used JSE companies had samples sizes as follows: Firer and Stainbank (2003) had a sample size of 75, Dzomonda (2020) worked with 32 companies while Schultz and Molele (2019) used a sample size of 43.

Research instruments (data collection instruments)

This study utilises quantitative data. Data was collected from the IRESS database. This database provides information extracted from published audited financial statements of JSE-listed companies.

Secondary data collection

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Secondary data may be classified into three categories, documentary, survey and multiple sources (Saunders et al., 2019). For this study, reliance is placed on documentary secondary data. Examples of relevant documents to be used in secondary data collection include organisations databases, organisations communications and company reports. With the rapid expansion of internet-based archiving of data, obtaining data through searching the company and organisational websites has become a viable research method (Johnston, 2014). In South Africa, JSE-listed companies are required to publish annual Audited Financial Statements (AFS) and Integrated Reports (CorporateContent, 2017). Companies load these reports on their websites, allowing easy accessibility.

Data was collected from company AFS from 2010 to 2020 as loaded on the IRESS database, giving data sets for 11 years.

Validity and reliability

Validity refers to the suitability of the research methodology used in delivering accurate results that can be generalised (the research method is valid if its results are accurate and can be generalised) (Saunders et al., 2019). Validity can be split into internal and external validity. Internal validity occurs when the secondary data collected is sufficient and can be analysed such that the research questions are answered leading to the establishment of a causal relationship between variables.

Validity can be assessed by confirming that the research instrument has measurement, content, criterion-related (predictive) and construct validity (Saunders et al., 2019). Measurement validity refers to the ability of the research tool to measure what it is intended to measure. The dilemma facing the researcher is how to declare measurement validity before the research tool is used. For this study, this challenge was managed through reference to similar studies that relied on secondary data in the area of company valuations and IR (Phusavat et al., 2011a; Joshi et al., 2013; Nadeem et al., 2017; Kheong et al., 2019; Schultz & Molele, 2019; Tlili et al., 2019; Cooray et al., 2020).

The reliability of the data used in this research is based on the reputation of the IRESS database, built by McGregor BFA, as a source of data gathered from audited financial statements (UCT, 2022). The financial statements are audited according to the Companies Act 2008, IFRS and King IV. IRESS is recognised by universities as a reliable database (UCT, 2022; UNISA, 2022).

Research questions, objectives and hypothesis

Research questions (RQ), research objectives (RO) and hypothesis (H) provide a platform from which the researcher sets out on a goal to identify and collect data for analysis and interpretation, such that new knowledge is created (Mattick et al., 2018).

Research questions and hypothesis on Intellectual Capital

Intellectual Capital (IC) has continued to grow as a significant component of the company's intangible capital structure, being referred to as the anchor of the contemporary information and knowledge economy (Nuryaman, 2015; Ocean Tomo, 2021).

One may arguably mention that the difference between IC and HC is that IC may be recorded in the company's list of intangible assets such as copyrights and licences, while HC on the other hand is presumed to be more fluid as employees may change jobs at their convenience.

Therefore:

Research Question: What is the impact of Intellectual Capital on company value?

Research Objective: Examine the impact of intellectual capital on the company value of JSE-listed companies

Null hypothesis: There is no linear relationship between Intellectual Capital and company value.

Alternative hypothesis: There is a linear relationship between Intellectual Capital and company value.

Panel regression models for Intellectual Capital

The panel regression model of the study is an augmentation of the Feltham-Ohlson model (Feltham and Ohlson, 1995).

$$\Delta Y_{it} = \beta_0 + \beta_{ij}\Delta \sum_{ij=1}^{n} X4_{ij} + D\,u_t + \varepsilon_{it} \qquad (1)$$

Expanded equation

$$\Delta Y1_{it} = \beta_0 + \beta_1 VAIC_{it} + Du_{it} + \varepsilon_{it} \qquad (2)$$

Where:

$\boldsymbol{X4_{ij}}$ Represent the vector of intangible assets which are in VAIC $_{it}$ and its components

$\boldsymbol{\beta_{ij}}$ = Constant of the data for $\boldsymbol{X4_{ij}}$

$\mathbf{VAIC}_{it}$ = Value Added Intellectual Capital Coefficient for company $\boldsymbol{i}$ at time $\boldsymbol{t}$

$\boldsymbol{\beta_1}$ = Constant of the data for VAIC

$\mathbf{Du_t}$ = Dummy variable, corona virus impact in 2020

$\boldsymbol{\varepsilon_{it}}$ = Error term

$\mathbf{VAIC}_{it}$ = Human Capital Efficiency$_{it}$ (HCE$_{it}$) + Structural Capital Efficiency$_{it}$ (SCE) $_{it}$ + Capital Employed Efficiency $_{it}$ (CEE) $_{it}$

HCE_{it} = $\frac{VAit}{\text{HC}it}$

Where:

VA_{it} = Value Added = Output $_{it}$ - Input $_{it}$

Output is defined as Revenue while Inputs are the operating costs excluding staff costs. Staff costs are considered human capital for VAIC modelling (Meles *et al.*, 2016).

SCE_{it} = $\frac{SCit}{\text{VA}it}$

Where:

SC = Intangible assets such as organisation, licences, patents, image, standards, and brand (Muhammad & Ismail, 2009; Schultz & Molele, 2019)

CEE_{it} = $\frac{VAit}{\text{CE}it}$

Where:

CE = Capital Employed = the sum of tangible assets and financial assets of the company (intangible assets are excluded as they are already dealt with in structural capital) (Muhammad & Ismail, 2009; Schultz & Molele, 2019)

For robustness of the above equation, EVA and Equity share price at book value are used:

$$\Delta Y2_{it} = \beta_0 + \beta_1 VAIC_{it} + Du_{it} + \varepsilon_{it} \qquad (3)$$

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$$\Delta Y3_{it} = \beta_0 + \beta_1 VAIC_{it} + Du_{it} + \varepsilon_{it} \quad (4)$$

$$\Delta Y4_{it} = \beta_0 + \beta_1 VAIC_{it} + Du_{it} + \varepsilon_{it} \quad (5)$$

FINDINGS

Descriptive statistics for panel data

This section presents summary statistics on the variables used in this research. Utilising pooled estimations in EViews, the independent variables that are assumed to be correlated to company value were assessed and their descriptive statistics are provided in Table 2.

Table 2 Summary of the descriptive statistics

Variables	Variables Description	Observations	Mean	Std. Dev.	Maximum	Minimum
Y1	Share Price as a proxy of company value	1001	0.0540	0.3952	2.9128	- 0.9750
Y2	Economic Value Added (EVA) as a proxy of company value	1001	-0.0414	0.2865	2.4642	- 0.8877
Y3	TobinQ as a proxy of company value	1001	-0.0118	0.1967	0.8015	- 0.8944
Y4	Share price at book value as a proxy of company value	1001	0.0655	0.1803	0.7926	- 0.7593
VAIC	Value Added Intellectual Coefficient (Intellectual capital)	1001	0.0096	0.4500	11.0816	- 1.2681
DU	Dummy (Covid 19 year 2020 effect	1001	0.0909	0.2876	1.0000	0.0000

Source: *Calculated for this study*

Explanation of the summary statistics

The summary of the descriptive statistics shown in Table 2 indicates that on average, for the period under observation (2010 to 2020), share price returns (Y1) for the 91 JSE-listed companies studied were 5.4%. About the share price at book value (Y4) returns show a positive mean of 6.6% growth over the same period and sample. Using market share price and share price at book value as measures of company value will project positive growth over this period. The results on share returns and share price at book value returns are consistent with the assertion by Harvey (1995) and supported by Goetzmann and Jorion (1999) who stated that share returns in emerging markets demonstrate positive returns and higher volatility. A 10-year time series study of JSE shares indicated the same trend as found in the current study (Mpofu, 2011). In a later study, Schultz and Molele (2019) calculated a 4.1% mean on total share returns on JSE companies, aligning with the positive nature of shares in emerging markets.

EVA (Y2) and TobinQ (Y3) show negative means of -4.1% and -1.2% respectively. EVA relies on Net Operating Profit After Tax less Cost of Capital. A negative mean on EVA returns reflects an adverse profitability environment versus the cost of capital. In a study on EVA and share returns from 2000 to 2013, Sauro and Tafirei (2016) found a positive EVA mean of 8.9%, albeit only in the financial services sector. In an earlier study, using a wider sample of 43 JSE companies, Magwegwe (2003) found that there were wide differences between the means for share price returns compared to EVA. The findings of this current study are consistent with Magwegwe (2003), although the objectives of the studies are not the same.

A negative mean on TobinQ indicates that companies, on average, did not invest in new assets in a manner that would equal or surpass the prior year. This aligns with contemporary empirical findings that more value resides in intangible assets rather than tangible assets (Khan et al., 2018; Saleh, 2018; Ocean Tomo, 2021)

A consideration of the Standard Deviations (SD) on the measures of company value indicates that share price has the highest SD of 0.3952 followed by EVA with 0.2865. TobinQ and share price at book value have almost equal SD of 0.1967 and 0.1803 respectively. The high SD on share price returns compared with the other measures shows that share prices are more volatile than the other measures of company value. The maximums and minimums of company value follow the same characteristics as revealed by the SD, following the same ranking.

VAIC as a measure of Intellectual capital has a positive mean on returns of 0.96%. This indicates the increase, on an average basis, in the importance of intellectual capital in the face of a growing knowledge economy (Ocean Tomo, 2021). The SD for VAIC was 0.45 while the maximum and minimum were 11.0816 and -1.2681. The difference between the maximum and the minimum and the positive mean shows that VAIC is on a favourable growth trajectory. The positive mean on VAIC is in line with the positive mean recorded on share price returns showing that share price and intellectual capital tend to have the same growth characteristics (Firer & Mitchell Williams, 2003; Firer & Stainbank, 2003; Clarke et al., 2011; Phusavat et al., 2011b; Meles et al., 2016).

Diagnostics and checks for robustness

This section is used to summarise the diagnostics and check for robustness. This includes tests for collinearity, the Hausman (1978: 1251), specification test for heteroscedasticity and Durbin Watson statistic autocorrelation.

Correlations

The correlation test measures the collinearity among the dependent variables and independent variables and vice versa (Hair Jr et al., 2010). The correlations checked for this study are indicated in Table 3. According to Hair Jr et al. (2010), collinearity is not considerable if the coefficients

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are less than 0.9. Based on that threshold, the coefficients in Table 3 are less than 0.9, therefore, the variables do not have a considerable problem with collinearity.

Table 3 Correlations

Variables	Y1	Y2	Y3	Y4	VAIC	DU
Y1	1.0000					
Y2	0.0350	1.0000				
Y3	-0,0895***	0,1018***	1.0000			
Y4	- 0.0468	0.0176	0,1569***	1.0000		
VAIC	0.0366	- 0.0030	0.0030	0.0033	1.0000	
DU	-0,1985***	- 0.0313	0,2147***	0,0891***	-0,0562*	1.0000

Source: Calculated for this study

Other diagnostic statistics

Several tests were conducted on the pooled OLS, fixed effects and random effects models. These included the Hausman (1978: 1251) test for the choice between random and fixed effects, specification test for heteroscedasticity, Durbin Watson statistic was employed to test for autocorrelation and Cross-sectional dependence was tested as well.

The first test was to test for heteroscedasticity and several models had a problem with heteroscedasticity. The second test that was carried out was the test of serial correlations using the Durbin Watson statistic and the results showed that all the models had no problem with serial autocorrelation. The third test that was carried out was cross-sectional dependence and most of the models showed some cross-sectional interdependence. This was addressed through the white standard robust errors that were used (White, 1980). The fourth test was the F Test**.** The model demonstrated moderate R^2 of 35.1% as indicated in Table 4. Previous studies that used the Feltham-Ohlson model recorded R^2 values of less than 40% and the results were considered acceptable because of the strength of the p values. Cooray et al. (2020) explained that their R^2 of 36.1% was due to the accounting recognition lag when returns are used. In this current study returns on accounting data for the variables were used in the regression models. In accounting data, it is observed that factors affecting the current returns may not be the same over the next same period due to the application of accounting principles such as reliability, prudence and accruals (Ota, 2005). Other studies also used returns on accounting data and obtained R^2 of less than 40% (Kothari & Zimmerman, 1995; Easton et al., 2000; Sutopo et al., 2018). In this current study, accounting data is used, and the accounting recognition lag argument would be relevant. The R^2 reported in the current study model was complimented by the F statistic whose p-values were all zero. The F statistic showed the elements which are explained by the model and also the elements that explained the error. This assures that there are associations between the dependent and predictor variables and that the models are adequately strong for use (Greene, 2012; Riffenburgh, 2012).

The fifth and last test that was applied was the Hausman (1978:1251) test, which was employed to determine whether to select the fixed effects model or the random effects model. The results from the Hausman test are presented but not discussed for brevity as the study focused on the fixed effects model given that study employed purposive sampling (Dougherty, 2007). Through the use of EViews panel data software, the FE regression models were run with Cross-section weights and White cross-section standard errors and covariance. To correct for heteroscedasticity and cross-sectional interdependence, the white standard robust errors were used (White, 1980).

Table 4 gives the summary of the FE regression results which will be explained in detail in the next sections.

Table 4 Summary of results on the Intellectual capital measures

Variable	Y1 Share price return	Y2 EVA	Y3 Tobin Q	Y4 Share price@BV
C	0.245234*** (0.049202)	-0.069193*** (0.008264)	-0.073153*** (0.006276)	0.013406 (0.012305)
VAIC	0.043012* (0.018669)	0.016161*** (0.003016)	0.018207*** (0.003976)	0.010793 (0.008531)
DU	-0.101381* (-0.101381)	-0.081489*** (-0.081489)	0.050129*** (0.050129)	-0.010763 (-0.010763)
Observations	1001	1001	1001	1001
R-squared	0.351588	0.162425	0.20962	0.301079
Adjusted R-squared	0.285102	0.076544	0.128578	0.229414
F-statistic	5.288189	1.891276	2.586549	4.201223
Prob(F-statistic)	0000	0000	0000	0000
Mean dependent var	0.063401	-0.042422	-0.019618	0.106016
S,D, dependent var	0.432780	0.29468	0.201117	0.199448
Durbin-Watson stat	2.171719	2.15112	1.93654	1.914392
Hausman Stats	0000	0000	0000	4,896855
Heteroskedasticity	514,5521***	350,5543***	404,2448***	600,5892***

Note: *Robust Standard errors in parentheses and * p < 0.05, ** p < 0.01, *** p < 0.001*

The following sections discuss the variables in more detail.

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Impact of Intellectual capital on company value

The regression results shown in Table 4 indicate statistically significant positive relationships between VAIC and the company value proxies of market share price, EVA and TobinQ. This means that an increase in VAIC is expected to cause an increase in company value. Share price at book value has an insignificant positive correlation to VAIC, signalling that the traditional accounting methods used to derive share price at book value do not sufficiently capture intangible assets such as intellectual capital.

The results obtained in the regression model are congruent with the theory of intellectual capital. Classical scholars of intellectual capital that include Taylor (1911), Robinson (1934), Chamberlin (1947), Schumpeter (1934), Moore and Penrose (1960) and Polanyi (1966) identified that employee skill, knowledge and experience were vital for a company in the creation of competitive advantage. Patents, trademarks and brands became the symbols of intellectual capital whose value remained in the company even if skilled employees are fluid as they can leave the company (Robinson, 1934; Chamberlin, 1947). Pulic (1998) modernised the classical assertions through the VAIC model where he demonstrated that intellectual capital is central to the contemporary knowledge-based economy. It is one of the assumptions of VAIC that there is a positive relationship between increasing intellectual capital and increasing company value (Pulic, 1998).

Various empirical studies are in tally with the findings of the current study. Bornemann (1999) concluded that there was a positive relationship between company performance and value with intellectual capital in a study of Austrian firms. VAIC was used in an investigation of the relationship between intellectual capital and company value in Thailand manufacturing companies and the result concurred with the VAIC theory (Phusavat et al., 2011b). Meles et al. (2016) studied 5 500 banks in the USA using data over eight years and affirmed that intellectual capital and company value had a positive relationship. In an investigation of 390 JSE-listed companies using 12-year panel data, Morris (2015) established that there was a strong positive relationship between intellectual capital and company value. Similar results were achieved in other studies thus strengthening the VAIC assumption (Chen et al., 2005; Clarke, Seng & Whiting, 2011; Alhassan & Asare, 2016).

While the above empirical pieces of evidence support the current study, other studies, however, came with contrasting findings. Firer and Stainbank (2003) studied 75 JSE-listed companies and concluded that there was a small positive correlation between VAIC and the share price. This was, however, limited to only one year's data (2001). Taking a longer series of data, that is, from 2001 to 2017 Schultz and Molele (2019) used VAIC to investigate the influence of intellectual capital efficiency on company performance among 43 companies listed on the JSE. Their findings indicated no significant associations between intellectual and company value. Intellectual capital recognition in company balance sheets is still a growing phenomenon with accountants grappling with the valuation of intangibles such as brand value, patents, goodwill and trademarks (Moro Visconti, 2019; Yasyshena, 2019). The current study, using a bigger sample of 91 JSE-listed companies being more recent (2020), found that VAIC has a statistically significant influence on company value.

As reported by Ocean Tomo (2021), intellectual capital has grown in the USA from 17% of total assets in 1975 to 90% in 2015. Based on this trajectory one may state that by the time Firer and Stainbank (2003) and Schultz and Molele (2019) did their investigations on JSE companies, intellectual capital had not matured to the level it is today in South African companies.

Contribution to the body of knowledge

Through the findings of this study, VAIC has shown itself as a robust measure of intellectual capital's effect on company value. Its explanatory power is indicated by it having positive significant correlations to market share price, EVA and TobinQ. VAIC can, therefore, be used to measure the value-added impact of intellectual capital.

Recommendations

Based on the discussion above, intellectual capital is becoming dominant in the modern knowledge economy. The researcher advises IR practitioners, the VRF, accounting bodies, reporting standard setters and regulators, academics and valuation specialists to use VAIC in the reporting and valuation of intellectual capital. A future study may involve an investigation into intellectual capital concentration by sector so that more insights can be found.

Conclusion

In consideration of the above, the Intellectual capital model confirms that there is a positive statistically significant relationship between Intellectual capital and company value. With this conclusion, one may mention that the research question was answered and the research objective was achieved. The evidence of the study indicates that there is support for the Alternative hypothesis.

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