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Dr. Rajwanti
Associate Professor, Department of Commerce, Government College for Women, Sonipat, Haryana, India

Corresponding Author:
Dr. Rajwanti
Associate Professor, Department of Commerce, Government College for Women, Sonipat, Haryana, India

Relationship between Intellectual Capital and financial performance: A study of BSE 500 companies

Rajwanti

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Abstract
The correlation analysis has been used in order to examine the relationship between intellectual capital and financial performance of the firms. Intellectual capital has been measured by Modified Value Added Intellectual Coefficient (MVAIC). Return on Assets (ROA) and Return on Equity (ROE) have been used to measure financial performance of the firms. The Pearson correlation has been applied in the study. The study found that intellectual capital efficiency and financial performance (ROA) have a significant relationship but not significantly related with Return on Equity (ROE). The results indicate that CEE has a significant positive relationship with ROA and ROE and age but significant negative relationship with size (TA) and leverage (DER). HCE is observed to have a significant negative relationship with ROA, and age but showing significant positive relationship with size (TA) and leverage (DER). SCE has a significant positive relationship with ROA, ROE, size (TA) and leverage (DER) but a significant negative association with the age of the company. RCE shows an insignificant negative relationship with ROA and ROE but a significant relationship with size (TA), age, and leverage (DER). The study also used the Modified Value Added Intellectual Coefficient (MVAIC) model to measure intellectual capital efficiency by adding an intellectual capital component called relational capital efficiency.

Keywords: Modified value added intellectual coefficient (MVAIC), return on assets (ROA) and return on equity (ROE)

1. Introduction
As Mondal and Ghosh (2012) [1] point out, the wealth of the modern economy is actually based more on intangible assets than on physical assets anymore. Creative abilities and innovation has been the cornerstone of success and development with the corresponding skills and experience; this has ultimately resulted in adding value to the company's products and improved its competitive position (Catalfo & Wolf, 2016) [2]. Rich intellectual resources and methods for identifying and documenting them have given countries and organizations a further competitive advantage (Singh & Sidhu, 2016) [9]. In the knowledge-based economy, value creation is mostly determined by the effective utilization of intangible assets, and these intangible is often referred to as intellectual capital. Intellectual capital is a key resource that needs to develop to effectively implement corporate strategy, acquire and maintain a long-term competitive advantage and improve corporate performance (Hume & Hume, 2008). Cabrita *et al.* (2017) [3] stated that intellectual capital(IC) is increasingly acknowledged as the most important asset for business performance and the foundation for competitiveness). According to Krstic and Bonic (2016) [10] in this current economic era, knowledge-based competitiveness has become the main priority for economic prosperity.

Review of Literature
Komenic & Pokrajcic (2012) used the VAIC methodology to quantify intellectual capital in a study they conducted on 37 multinational firms in Serbia between 2006 and 2008. Productivity, return on equity, and return on assets were used to gauge corporate performance. Regression studies were performed to investigate the impact of MNCs' effective utilization of intellectual capital on business performance. All three business performance measures showed a favorable correlation with human capital, according to the first empirical study conducted in Serbia using the VAIC approach. Only return on equity

demonstrated a statistically meaningful and positive link with structural capital efficiency, according to the data. In the course of the 2010-2011 financial crisis, Sumedera (2013) examined the composition of intellectual capital and how it affected the financial results of 62 non-financial enterprises listed on the Bucharest Stock Exchange. Intellectual capital has been measured using the VAIC methodology. The financial performance of companies was evaluated using three key metrics: return on assets (ROA), return on equity (ROE), and growth rate of the business (GROW). With a 95% confidence level, the regression analysis was performed with Excel Data Analysis Tools. The findings validated the link between intellectual capital and profitability and indicated that human capacities, skills, knowledge, and experience constituted explanatory variables of business development during times of crisis. Hosein *et al.* (2016) [11] used multivariate regression to investigate the impact of intellectual capital on the performance of 26 pharmaceutical businesses listed between 2008 and 2012 on the Tehran Stock Exchange. The Pulic value-added intellectual capital (VAIC) has been used to measure intellectual capital, while the Q Tobin ratio and market value measure to book value of the assets (M / B) have been used to assess market value performance. The findings showed that the market performance factors of pharmaceutical companies are significantly impacted by the VAIC coefficient. The employed efficiency and human capital efficiency of intellectual capital components have a noteworthy and favorable impact on the market value to book value of assets (M / B) and Q Tobin ratio.

The study also suggested that in order to boost the performance of intellectual capital, businesses should create a system of encouragement and support for their most intelligent workers. The study conducted by Ozkan *et al.* (2017) [6] investigated the effect of intellectual capital efficiency on the financial performance of forty-four Turkish banks from 2005 to 2014. The financial performance of banks was represented in the study by return on assets, one of the conventional performance measures, and independent variables were elements of the VAIC model. The outcome of the regression analysis indicated that the efficiency of capital utilized had a greater impact on the financial performance of banks than the efficiency of human capital, while the profitability level of banks was not significantly impacted by the efficiency of structural capital. According to the study's findings, Turkish banks should make better use of their physical and financial capital in order to increase their level of profitability. The study conducted by Kaawaase *et al.* (2019) [7] examined the interplay between professionalism and intellectual capital (IC) performance in small and medium audit practices (SMPs) enterprises located in Uganda. Following a questionnaire survey of seventy-seven SMPs who were registered through their managing partners with the Institute of Certified Public Accountants of Uganda, the study came to the conclusion that intellectual capital (IC) significantly affects Ugandan firms and that professionalism interacts with IC to improve the performance of the firms. Xu and Li (2019) [8] studied the relationship between intellectual capital and the performance of high-tech and non-high-tech enterprises by looking at 116 high-tech and 380 non-high-tech SMEs in China's manufacturing sector that were listed on the Shenzhen stock exchanges between 2012 and 2016. Through the introduction of relational capital (RC) in the MVAIC model, the study examined the multifaceted nature of intellectual capital. Three indicators were used in the study to assess the sample firms' performance: earnings, profitability, and efficiency. Multiple regression models were used to test research hypotheses. The study revealed a significant difference in MVAIC between high-tech and non-high- tech SMEs. The empirical results found that intellectual capital has a positive impact on the performance of SMEs in China regardless of firm type. The effect of intellectual capital on earnings and efficiency is more significant in non- high-tech SMEs in China. CEE, HCE and SCE largely influenced the Earnings of Chinese SMEs. Lotfi *et al.* (2021) [12] conducted a study to investigate the impact of intellectual capital (IC) on fraud in listed firms' financial statements on the Tehran Stock Exchange (TSE). The logistic regression model has been used to test the hypothesis using data of 187 listed firms on the TSE during 2011-2018. The empirical analysis demonstrated that fraud in financial statements has a substantial negative correlation with the efficiency of intellectual capital, human capital (HC), structural capital (SC), relational capital (RC), and customer capital (CC). The study found that investment in the IC and its components reduced financial statement fraud in businesses.

Research Objectives and Methodology

The main objective of this paper is to investigate the impact of components of intellectual capital efficiency on the financial performance of BSE 500 companies. The sample of BSE 500 companies have been considered for the study however, companies whose key variables for measuring intellectual capital (MVAIC) and financial performance from 2009-10 to 2018-19 were missing and excluded from the study. The companies with negative value-added were also excluded from the study. Thus, the final sample consists of 351 companies out of these 255 are from manufacturing sector and 96 are from service sector. Data are gathered from the prowess database, which is created, managed, and updated by the Centre for Monitoring Indian Economy (CMIE), throughout a ten-year period from 2009-10 to 2018-19.

Measurement of Variables: The variables used in this study can be classified into three categories: dependent variables, independent and control variables.

Dependent variable: Return on Assets (ROA) and Return on Equity (ROE) is taken as dependent variables for regression equations.

Independent variable: This study uses the Modified Value Added Intellectual Coefficient (MVAIC) and its four components-Capital employed efficiency (CEE), Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE), and Relational Capital Efficiency (RCE)—as independent variables to assess the effectiveness of intellectual capital, as recommended by Nimtrakoon (2015) and Xu and Li (2019) [8]. A higher MVAIC rating denotes superior management of a firm's capacity for value creation.The calculation of MVAIC can be elaborated as follow:

- Value Added (VA)=W+I+T+NI (Riahi-Belkaoui, 2003) [13]
- W=Total employee expenditures, I=Interest T=corporate tax, NI=Profit after tax

- Capital Employed Efficiency (CEE)=VA/CE
- Human Capital Efficiency (HCE)=VA/HC
- Structural Capital Efficiency(SCE)=SC/VA
- Relational Capital Efficiency (RCE)=RC/VA

MVAIC=CEE+HCE+SCE+RCE

Value Added (VA) by a company within a specific financial year is needed to calculate the intellectual capital efficiency. CEE is the capital employed efficiency of the firm; Capital Employed (CE) is the total of all tangible assets. Human Capital efficiency (HCE) determines the efficiency of human capital on the value creation of the firm; HC is human capital measured by total employee expenditures. Structural Capital Efficiency (SCE) measures the efficiency of structural capital and the structural capital (SC) measured by VA-HC Relational Capital Efficiency (RCE) calculates the effectiveness of relational capital on value creation, and relational capital (RC) is measured by marketing, selling, and advertising expenses. Control variables: In this study, Size, Age, Leverage and Industry Type is taken as control variable in the regression equation.

4. Results and Discussion

4.1 Descriptive Statistics

Table 1: Descriptive Statistics

Variables	Mean	Median	Skewness	Kurtosis	Minimum	Maximum
Modified Value Added Intellectual Coefficient(MVAIC)	9.7500	4.911	9.799	128.837	0.860	452.777
Capital Employed Efficienct(CEE)	0.336	0.270	3.597	27.570	0.0004	4.418
Human Capital Efficiency(HCE)	8.433	3.545	9.802	128.807	0.0150	451.662
Structural Capital Efficiency(SCE)	0.698	0.717	-0.701	3.188	0.0105	0.998
Relational Capital Efficiency(RCE)	0.281	0.138	23.470	964.800	0.000	24.375
Return on Assets(ROA)	8.460	6.590	3.292	32.514	-25.33	131.040
Return on Equity(ROE)	19.121	16.655	5.073	61.181	-72.59	317.710
Total Assets(TA) (Rs. cr.)	31958.78	3193.655	13.810	265.887	23.820	3680914.
Age	39.57407	33.000	1.018	3.534	3.000	124.000
Debt Equity Ratio(DER)	0.849	0.350	3.986	22.086	0.000	12.710

Table 1 shows the descriptive statistics of the included variables for the period from 2009-10 to 2018-19. The results reported that the estimated value of the MVAIC coefficient of sample companies varies from 0.86 to 452.777. The HCE is found to have a mean value of 8.433 compared to CEE, SCE and RCE with mean values of 0.336, 0.698, and 0.281. Among the financial performance, the average ROA and ROE is 8.460 and 19.121 percent, respectively. The sample companies are observed to have an average total asset of 31958.78 crores and the average age of 40 years approx. The leverage ratio on average is 0.849, whereas the maximum value is 12.71.

4.2 Correlation Analysis

The correlation analysis has been used in order to examine the relationship between different selected variables (MVAIC, ROA, ROE, TA, AGE, DER,) in the study. The Pearson correlation has been applied in the study. There are three types of variables considered in the study namely dependent variable (ROA and ROE), independent variable (MVAIC, CEE, HCE and RCE) and control variables i.e., Size (TA), Age and Leverage (DER). Following hypothesis is assumed to be tested with the help of correlation analysis.

Hypothesis

There is significant relationship between intellectual capital (MVAIC) and financial performance (ROA, ROE) of the BSE 500 companies.

Hypothesis: There is significant relationship between components of intellectual capital (MVAIC) and financial performance (ROA, ROE) of BSE 500 companies.

Table 2: Correlation Analysis between Intellectual capital (MVAIC) and Selected Variables

Correlation between	Overall	Manufacturing	Service
MVAIC and ROA	0.0500 (.003*)	0.092 (0.000*)	-0.150 (0.000*)
MVAIC and ROE	0.0183 (0.276)	0.072 (0.000*)	0.003 (0.909)
MVAIC and Log (TA)	0.252 (0.000*)	0.116 (0.000*)	0.295 (0.000*)
MVAIC and Log (AGE)	-0.073 (0.000*)	-0.140 (0.000*)	0.017 (0.588)
MVAIC and DER	0.392 (0.000*)	0.034 (0.081)	0.433 (0.000*)

Note: ** Significant at 5% significance level *Significant at 1% significance level

Table 2 reported that the intellectual capital efficiency as calculated with the help of MVAIC is significantly correlated with return on assets (ROA), size (TA), age and leverage (DER) of the selected companies. However, the correlation is not found to be significant with return on equity (ROE). Thus, the hypothesis that *there is significant relationship between intellectual capital (MVAIC) and financial performance (ROA, ROE) of the BSE 500 companies.* is supported for the selected companies (except ROE). It can be concluded that intellectual capital efficiency and financial performance (ROA) have a significant relationship for the selected companies. In the case of the manufacturing sector, intellectual capital as calculated with the help of MVAIC, it is significantly correlated with ROA, ROE, size (TA) and age of the company. Intellectual capital efficiency of service sector companies is showing significant relationship with ROA, size (TA) and leverage (DER). However, correlation is not found significant with ROE. Thus, significant relationship exists between intellectual capital efficiency and financial performance is supported for the service sector companies (except ROE).

4.3 Correlation Analysis between Components of Intellectual Capital (MVAIC) and Selected Variables

Table 3: Correlation Analysis between MVAIC Components and Selected Variables

Correlation between	Overall	Manufacturing sector	Service sector
CEE and ROA	0.571* (0.000)	0.736* (0.000)	0.461* (0.000)
CEE and ROE	0.582* (0.000)	0.858* (0.000)	0.295* (0.000)
CEE and Log (TA)	-0.156* (0.000)	-0.253* (0.000)	-0.151* (0.000)
CEE and Log (AGE)	0.059* (0.000)	0.066* (0.000)	0.119* (0.000)
CEE and DER	-0.243* (0.000)	-0.326* (0.000)	-0.342* (0.000)
HCE and ROA	-0.057* (0.000)	0.080* (0.000)	-0.152* (0.000)
HCE and ROE	0.010 (0.530)	0.056* (0.0043)	0.001 (0.974)
HCE and Log (TA)	0.253* (0.000)	0.118* (0.000)	0.294* (0.000)
HCE and Log (AGE)	-0.075* (0.000)	-0.140*(0.000)	0.015 (0.625)
HCE and DER	0.393* (0.000	0.035 (0.0730)	0.434* (0.000)
SCE and ROA	0.088* (0.000)	0.337* (0.000)	-0.356* (0.000)
SCE and ROE	0.125* (0.000)	0.274* (0.000)	-0.056 (0.078)
SCE and Log (TA)	0.350* (0.000)	0.200* (0.000)	0.515* (0.000)
SCE and Log (AGE)	-0.068* (0.000)	-0.184* (0.000)	0.124* (0.000)
SCE and DER	0.270* (0.000)	-0.056* (0.0047)	0.448* (0.000)
RCE and ROA	*-0.028 (0.091)*	*-0.069* (0.000)*	*-0.010 (0.739)*
RCE and ROE	-0.022 (0.178)	-0.043** (0.0269)	-0.010 (0.740)
RCE and Log (TA)	-0.086* (0.000	-0.0157 (0.4277)	-0.149* (0.000)
RCE and Log (AGE)	0.076* (0.000)	0.067* (0.000)	-0.045 (0.160)
RCE and DER	-0.047* (0.0050	0.113* (0.000)	-0.090* (0.004)

Note: ** Significant at 5% significance level *Significant at 1% significance level

To examine the relation of MVAIC components (CEE, HCE, SCE and RCE) with other variables Pearson correlation analysis technique has been used. Table 3 exhibits the result of correlation between components of MVAIC and measures of financial performance and control variables. The results indicate that CEE has a significant positive relationship with ROA and ROE and age but significant negative relationship with size (TA) and leverage (DER). HCE is observed to have a significant negative relationship with ROA, and age but showing significant positive relationship with size (TA) and leverage (DER). SCE has a significant positive relationship with ROA, ROE,size (TA) and leverage (DER) but a significant negative association with the age of the company. RCE shows an insignificant negative relationship with ROA and ROE but a significant relationship with size (TA), age, and leverage (DER).

CEE has a negative correlation with total size (TA), age, and leverage (DER) and a strong positive correlation with ROA, ROE, and age in the case of manufacturing sector enterprises. HCE has a strong negative association with age but a strong positive correlation with ROA, ROE, and size (TA). RCE has a substantial negative association with ROA and ROE and a positive correlation with age and leverage (DER), while SCE has a significant correlation with all the factors.

CEE is significantly positively correlated with ROA and ROE for service sector organizations. Age, size (TA), and ROA all have a substantial correlation with HCE. SCE has a strong negative link with ROA, while it has a positive correlation with age, size (TA), and leverage (DER). Size (TA) and leverage (DER) have a substantial negative association with RCE, although ROA and ROE do not significantly correlate with it.

Conclusion

This study will provide a valuable framework for managers, executives, and policymakers in managing intellectual capital within the Indian context. This study is the first to consider the intellectual capital efficiency across all sectors in the Indian economy using Modified Value Added Intellectual Coefficient (MVAIC). The study found that intellectual capital efficiency and return on assets have a significant relationship for the BSE 500 companies. In case of the manufacturing sector and service sector intellectual capital is significantly correlated with financial performance. The study concluded that company's intangible assets form the basis of intellectual capital (IC), one of the primary forces behind value creation in the knowledge-based economy. The findings may help stakeholders and policymakers in developing countries appropriately reallocate intellectual resources.

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