Indian Journal of Agricultural Economics 79: 4 (2024):916-927
DOI:10.63040/25827510.2024.04.002

Nexus Between Intellectual Capital and Firm Performance: Evidence from the Indian Fertiliser Industry

Dhanraj Sharma, Ruchita Verma, Chidanand Patil and Mukesh Kumar Pradhan[1]

ABSTRACT

This study attempts to evaluate the relationship of Intellectual Capital (IC) and its components with the financial performance of fertiliser firms in India. The Modified Value-Added Intellectual Capital (MVAIC) method is employed to quantify Intellectual Capital, and the financial performance is measured through Return on Assets, Return on Equity (profitability indicators) and Asset Turnover Ratio (productivity indicator). The study sample consists of 20 fertiliser firms, and data have been collected for the post-implementation phase of the Companies Act 2013, i.e. 2012-13 to 2021-22. The panel regression (Robust Standard Error method) predicts the relationship between Intellectual Capital, its components and financial performance. The results of the study depict that intellectual capital has a substantial impact on the financial performance of Indian fertiliser firms. Human Capital Efficiency is the most powerful component for predicting the financial performance of fertiliser firms in India. These findings provide valuable insights to policymakers regarding the active utilisation of IC resources for firms' value creation.

Keywords: Intellectual capital, return on asset, return on equity, modified value-added intellectual capital, financial performance, fertiliser firms

JEL codes: O34, G32, G34

I

INTRODUCTION

The resource-driven approach underscores how companies can augment their income and secure a competitive advantage by astutely capitalising on their available assets (Caribano et al., 2000). These tangible or intangible resources encompass assets, capabilities, knowledge, attributes, and organisational processes, as described by Barney (1991). Intellectual Capital (IC), defined by Bontis (1998), revolves around efficiently utilising knowledge within an organisation, including both organisational and human capital. IC boosts a firm's stock market standing and contributes to macroeconomic growth (Teplova and Sokolava, 2019). Edvinsson and Malone (1997) argue that firms should prioritise IC for sustainable growth, as it can set a company apart from competitors, providing a distinct advantage and leading to financial success, a fact consistently supported by empirical studies (Gogan et al., 2016). Effective IC management is crucial for enterprise success (Abdulsalam et al., 2011), contributing significantly to the value generated by firms in knowledge-based economies, often surpassing the contributions of production and sales (Alipour, 2012). In today's global economy, intellectual capital has become indispensable for business sustainability (Bontis et al., 2000).

[1]Central University of Punjab, Bathinda, Punjab 151 401.

In conjunction with the resource-based strategy, the balanced scorecard serves as a strategic performance measurement framework, emphasising the creation and monitoring of strategy through performance metrics. Within this framework, the learning and growth dimensions are reinforced by enhancing the competencies of human resources (Bose and Thomas, 2007). Liu (2017) contends that intellectual capital is instrumental in improving company performance, advocating its application to bolster competitive advantage. While prior research has explored the relationship between IC and firm performance across diverse countries (e.g., Bontis, 1998), a significant research gap exists concerning the role of IC in Indian fertiliser firms. Thus, this study aims to investigate intellectual capital's function in the Indian context, with far-reaching implications for other emerging economies reliant on intellectual capital for their economic development. Human capital, encompassing employees' knowledge, skills, and experience, profoundly shapes value creation and competitive prowess. Consistent with the human capital theory (Becker, 1993), employee education and training investments yield sustained production enhancements. Elevating employee productivity is attainable through refining their knowledge, abilities, and experiences via education and training. In contrast, structural capital encompasses business plans, production methods, organisational structure, information systems and accessible information within a firm, primarily serving as repositories and facilitators of knowledge dissemination. Capital employed represents the total financial investment in tangible assets owned by a business. The effectiveness of these three forms of capital—human, structural, and capital employed, significantly shapes the value generated by a company (Pulic, 1998).

Shifting our focus to India's agricultural sector, it plays a pivotal role in the nation's economy, contributing significantly to its gross domestic product and employing a substantial portion of its population (Government of India, 2021-22). The green revolution programme, initiated in the late 1960s, substantially elevated agricultural output through various measures, including introducing high-yielding crop varieties, increasing the utilisation of fertilisers and pesticides, and enhancing irrigation facilities (Somvanshi et al., 2020). This initiative led to a remarkable increase in cereal crop production, tripling yields while utilising only a fraction of additional land (Srivastava et al., 2020). This success was achieved through investments, focused research, infrastructure development, and government support (Pingali, 2012). However, intensive farming practices resulted in soil nutrient depletion and the loss of organic matter, necessitating increased fertiliser usage to compensate for declining soil quality (Singh and Benbi, 2016). Over the years, fertiliser consumption in India has witnessed significant growth in meeting the demands of agricultural productivity (Government of India, 2021-22). The government's efforts to attain self-sufficiency in food grain production have led to establishing of domestic fertiliser production involving private, public, and cooperative entities (Government of India, 2021-22). These stakeholders collectively contribute to the production and distribution of fertilisers, ensuring a consistent supply for farmers.

A comprehensive review of studies on the relationship between intellectual capital and firm performance, as given in Annexure-1, has unveiled a noteworthy research gap that pertains to fertiliser firms in India. Despite various studies conducted in international and national contexts on IC and firm performance, there are not many studies related to Indian agribusiness firms, especially those related to the Indian fertilisers sector. In light of the research gap, the present study attempts to evaluate the relationship between IC and the financial performance of fertiliser companies in India. The hypothesis is formulated as follows:

H_0: IC and its components do not affect the financial performance of fertiliser firms.

H_a: IC and its components do affect the financial performance of fertiliser firms.

II

METHODOLOGY

2.1 Sample Size and Study Period

Initially, the list of 175 Indian fertiliser firms was obtained from the Ministry of Chemicals and Fertilisers, and 63 companies gave access to annual reports among all companies. In the second stage, 31 companies were eliminated due to the absence of annual reports for the entire study period to maintain uniformity. Finally, the sample size is 20 fertiliser firms, and the remaining companies were excluded due to the unavailability of required data. The sample size is consistent with Balaji and Mamilla (2024), who considered a sample of 17 agri-business firms, especially those related to fertilisers and pesticides, for their study. The data is collected from the Prowess IQ database and annual reports obtained from the authentic websites of sample firms for the study period, i.e. 2012-13 to 2021-22 (10 years). The study period is the post-implementation phase of the Companies Act 2013. It consists of various phases of the economic cycle that contribute to the selection of the study period. The list of selected sample companies is presented in Table 1.

TABLE 1. LIST OF SELECTED SAMPLE OF FERTILISER FIRMS

Sl. No. (1)	Name of the Fertiliser Firm (2)	Year of Establishment (3)
1	Aarti Fertilisers	1984
2	Asian Fertiliser Limited	1986
3	Basant Agro	1990
4	CFCL (Chambal Fertilisers and Chemicals Ltd)	1985
5	CIL (Coal India Ltd)	1975
6	Excel Industries	1941
7	GNFC (Gujarat Narmada Valley Fertilisers and Chemicals Limited)	1976
8	GSFC (Gujarat State Fertiliser and Chemicals)	1962
9	Hindalco Industries Limited	1958
10	IFFCO (Indian Farmers Fertilisers Cooperative Limited)	1967

(Contd.)

TABLE 1. CONCLD.

Sl. No. (1)	Name of the Fertiliser Firm (2)	Year of Establishment (3)
11	IIL (Insecticide India Limited)	1996
12	Jayshree Chemicals Limited	1962
13	MCFL (Mangalore Chemicals and Fertilisers Limited)	1974
14	MFL (Madras Fertiliser Limited)	1966
15	NFCL (Nagarjuna fertiliser and chemicals Ltd)	1985
16	NFL (National Fertilisers Limited)	1974
17	Phosphate Company Limited	1949
18	RCF (Rashtriya Chemicals and Fertilisers Limited)	1978
19	SPIC (Southern Petrochemicals Industries Corporation Limited)	1969
20	Zuari Agro Chemicals Limited	1967

Source: Authors' Compilation

2.2 Variable Descriptions

The study used ROA, ROE and ATO as dependent variables and Intellectual Capital components as Independent variables. These ROA and ROE are extensively used as a proxy of profitability and ATO as a proxy of productivity in the existing literature. The MVAIC model where IC Efficiency and MVAIC are calculated is given as follows:

$$ICE = \text{Human Capital Efficiency (HCE)} + \text{Structural Capital Efficiency (SCE)} + \text{Relational capital Efficiency (RCE)}$$

$$MVAIC = \text{Intellectual Capital Efficiency (ICE)} + \text{Capital Employed Efficiency (CEE)}$$

The description of the dependent, independent and control variables used in the study is given in Table 2.

TABLE 2. DESCRIPTION OF THE VARIABLES USED IN THE VARIOUS MODELS

Variable (1)	Description (2)	References (3)
Dependent Variable		
Return on assets (ROA)	Earnings after Taxes (EAT)/Average total assets	(Xu and Liu, 2020), (Ge and Xu, 2021), (Xu and Zhang, 2021), (Xu et al., 2022)
Return on equity (ROE)	(EAT-Preference Dividend)/Average shareholder's funds	(Xu and Liu, 2020), (Ge and Xu, 2021), (Xu and Zhang, 2021), (Xu et al., 2022)
Asset Turnover Ratio (ATO)	Net Sales/Average Total Assets	Skhvediani et al. (2023), Yousaf (2022)
Independent Variable		
Human capital efficiency (HCE)	VA/HC	(Xu and Liu, 2020), (Ge and Xu, 2021), (Xu and Zhang, 2021), (Xu et al., 2022).
Structural capital efficiency (SCE)	SC/VA	
Relational capital efficiency (RCE)	VA/RC	
Capital Employed Efficiency (CEE)	VA/CE	
Modified Value-Added Intellectual Capital (MVAIC)	HCE+SCE+RCE+CEE	
Control Variable		
Ln_Size	Log of total assets	(Xu and Liu, 2020), (Ge and Xu, 2021), (Xu and Zhang, 2021), (Xu et al., 2022),
Leverage	Total debt/total assets	
Ln_Age	Log of Age of the Firm since its year of incorporation	

Source: Authors' Compilation.

Analytical Tools

A range of statistical techniques, such as descriptive statistics (mean, median, mode, standard deviation, skewness, and kurtosis) and correlation matrix, were employed to conduct a thorough data analysis. Furthermore, the Robust Standard Error of Panel regression was applied to check the impact of independent variables on the dependent variable based on the result of assumption tests. The following models are used in the study to investigate the impact of independent variables on the dependent variable:

Model-I

$$ROA = \beta_0 + \beta_1 HCE + \beta_2 SCE_{it} + \beta_3 RCE_{it} + \beta_4 CEE_{it} + \beta_5 Ln\_Size_{it} + \beta_6 Leverage_{it} + \beta_7 Ln\_Age_{it} + \mathcal{E}_{it}$$

Model-II

$$ROA = \beta_0 + \beta_1 MVAIC_{it} + \beta_2 Ln\_Size_{it} + \beta_3 Leverage_{it} + \beta_4 Ln\_Age_{it} + \mathcal{E}_{it}$$

Model-III

$$ROE = \beta_0 + \beta_1 HCE + \beta_2 SCE_{it} + \beta_3 RCE_{it} + \beta_4 CEE_{it} + \beta_5 Ln\_Size_{it} + \beta_6 Leverage_{it} + \beta_7 Ln\_Age_{it} + \mathcal{E}_{it}$$

Model-IV

$$ROE = \beta_0 + \beta_1 MVAIC_{it} + \beta_2 Ln\_Size_{it} + \beta_3 Leverage_{it} + \beta_4 Ln\_Age_{it} + \mathcal{E}_{it}$$

Model-V

$$ATO = \beta_0 + \beta_1 HCE + \beta_2 SCE_{it} + \beta_3 RCE_{it} + \beta_4 CEE_{it} + \beta_5 Ln\_Size_{it} + \beta_6 Leverage_{it} + \beta_7 Ln\_Age_{it} + \mathcal{E}_{it}$$

Model-VI

$$ATO = \beta_0 + \beta_1 MVAIC_{it} + \beta_2 Ln\_Size_{it} + \beta_3 Leverage_{it} + \beta_4 Ln\_Age_{it} + \mathcal{E}_{it}$$

III

RESULTS AND DISCUSSION

Table 3 on the descriptive statistics presents a positive financial picture for fertiliser firms, with an average ROA of 0.083, indicating efficient asset utilisation and a mean ROE of 4.203, demonstrating healthy returns for shareholders. The mean value of ATO also confirms its value, which shows that fertiliser firms could convert their assets into sales 1.2 times during the study period. These firms primarily draw wealth from their well-optimised HCE at -0.395. However, challenges arise in SCE and CEE

at -2.123 and -0.061, respectively, suggesting room for resource and capital improvement. Despite this, RCE at 0.168 highlights the value of their network. The cumulative mean of HCE, SCE, and RCE at -2.350 indicates significant challenges in optimising intangible assets and relationships. Lastly, the mean MVAIC at -2.417 implies the under-utilisation of intangible assets, potentially hindering the overall performance. Furthermore, the mean values for SIZE, LEV, and AGE are 5.437, 0.554, and 1.635, respectively.

TABLE 3. DESCRIPTIVE STATISTICS OF THE VARIABLES USED IN THE VARIOUS MODELS

(1)	ROA (2)	ROE (3)	ATO (4)	HCE (5)	SCE (6)	RCE (7)	CEE (8)	MVAIC (9)	SIZE (10)	LEVERAGE (11)	AGE (12)
Mean	0.083	4.203	1.257	-0.395	-2.123	0.168	-0.061	-2.417	5.437	0.554	1.635
Median	0.049	1.449	0.893	0.571	0.369	0.004	0.031	0.799	5.619	0.312	1.653
Maximum	1.923	88.171	63.549	10.684	23.948	7.413	0.857	23.855	9.554	45.906	1.908
Minimum	-0.140	-17.492	0.000	-29.719	-455.304	-0.185	-9.211	-447.889	3.155	0.000	1.230
Std. Dev.	0.180	9.145	4.462	4.852	32.749	0.739	0.701	32.571	1.020	3.231	0.138
Skewness	7.274	5.027	13.811	-3.149	-13.372	6.516	-11.397	-12.915	-0.046	13.927	-0.389
Kurtosis	65.937	40.172	193.620	16.398	185.257	53.942	147.476	176.774	3.755	195.977	2.903
Observations	200	200	200	200	200	200	200	200	200	200	200

Source: Authors' Compilation

Table 4 presents the results of the correlation analysis. Initially, a mild positive correlation (0.159) emerges between ROE and ROA; ROE and ATO (0.057) while the coefficient between ATO and ROA is high, i.e. 0.762. ROA and ROE reveal slight positive correlations with the independent variables HCE, SCE, MVAIC, and CEE. In contrast, they exhibit minor negative correlations with RCE. The correlation of ATO with SCE and MVAIC is reversed compared to other dependent variables, i.e. ROA and ROE. Furthermore, ROA displays a negligible positive correlation with size (0.001) and age (0.042) but a moderate positive correlation with Leverage (0.718). Conversely, ROE demonstrates a moderate positive correlation solely with Size, while its associations with Age and Leverage remain weak. Turning to the control variables, RCE displays negative correlations with all of them. HCE exhibits negative correlations with Size and Age, while CEE shows a negative correlation only with Leverage (-0.008). Notably, MVAIC showcases positive correlations with all of the control variables. The results of correlation analysis are also helpful in the detection of multicollinearity. Multicollinearity should be considered a serious concern only if the correlation between predictors exceeds 0.8 (Kennedy, 1985; Scafarto, Ricci, and Scafarto, 2016). The coefficients range from -0.692 to a high of 0.787, showing no multicollinearity among independent variables.

TABLE 4. CORRELATION MATRIX OF THE VARIABLES USED IN THE VARIOUS MODELS

(1)	ROA (2)	ROE (3)	ATO (4)	HCE (5)	SCE (6)	RCE (7)	CEE (8)	MVAIC (9)	SIZE (10)	LEVERAGE (11)	AGE (12)
ROA	1										
ROE	0.159	1									
ATO	0.762	0.057	1								
HCE	0.033	0.129	0.040	1							
SCE	0.018	0.030	-0.020	-0.014	1						
RCE	-0.068	-0.084	0.001	0.063	-0.692	1					
CEE	0.040	0.074	0.007	0.287	-0.011	0.031	1				
MVAIC	0.023	0.050	-0.014	0.142	0.787	-0.663	0.054	1			
SIZE	0.001	0.291	-0.054	-0.117	0.130	-0.264	0.091	0.109	1		
LEVERAGE	0.718	0.058	0.690	0.000	0.001	-0.016	-0.008	0.001	-0.017	1	
AGE	0.042	0.247	0.022	-0.151	0.081	-0.247	0.037	0.054	0.080	0.060	1

Source: Authors' Compilation.

Assumptions Test

The study considers other assumptions, such as stationarity and heteroscedasticity, to proceed for further analysis. The Levin, Lin and Chu test is conducted to check the stationarity of data. The p-value of the test (0.00) is less than 0.05, indicating the rejection of the null hypothesis and concluding that there is no unit root problem in the data. Further, the Breusch-Pagan / Cook-Weisberg test for heteroscedasticity is also conducted. Generally, Breusch-Pagan test statistics require $p > 0.05$, which shows that the null hypothesis of homoscedasticity (equal variance) is accepted, heteroscedasticity is not assumed, and vice versa. The p-value is found to be 0.000, which is less than the level of significance (0.05) of the test statistics, indicating the null hypothesis is rejected and heteroscedasticity is assumed to be present in the residuals. The robust standard error method of panel regression has been used to control heteroscedasticity and endogeneity instead of ordinary least squares, and the results are depicted in Table 5.

Table 5 shows the impact of IC on the performance of Indian fertiliser firms, using the panel regression (robust standard error method) for models I - VI. It is observed that R-Square values are slightly higher in VAIC models (I, III and V) than in MVAIC Models (II, IV and VI), indicating higher explanatory power of the Intellectual Capital and its components than MVAIC to estimate the financial performance of fertiliser firms. The positive and significant value of F-statistics shows that models are the best fit for the prediction.

ROA and ROE are proxy variables for measuring profitability, and ATO measures productivity. In VAIC results, it is observed in Model -I that SCE and RCE were significant predictors for ROA where SCE is positively and RCE is negatively associated with ROA. In Models–III and V, HCE is the only component that has positive and significant coefficients at a 1% level of significance for the prediction of dependent variables, i.e. ROA and ATO, indicating that Human Capital is the utmost powerful component, contributing appositely to the performance of fertiliser firms in India. It suggests that if the firm invests in Human Capital for one additional unit, the

ROA of the Indian fertilisers firms is expected to increase by 0.394 units, and productivity is likely to increase by 0.027 units. In terms of MVAIC models, Model-II and IV indicate that MVAIC coefficients are positively associated with both profitability measures and are significant only for the prediction of ROA. In Model VI, the MVAIC coefficient is significant and negatively associated with ATO. Among the control variables, leverage shows a similar relationship with the profitability and productivity of Indian fertiliser firms, as signified by its positive and highly significant coefficients. It shows that highly profitable and productive fertiliser firms employed more debt than equity in their capital structure during the study period. Size coefficients are positive and significant for ROA but negative and significant for ATO. It indicates that the large size of Indian fertiliser firms is pertinent to the enhancement of profitability but not to productivity. Similar findings are observed for age also. Finally, the results support the Signalling theory, which states that if a firm has healthier financial performance, it could be an indication to evaluate the efficacy of IC, which further increases a firm's profitability.

TABLE 5. RESULTS FOR RELATIONSHIP BETWEEN INTELLECTUAL CAPITAL AND FINANCIAL PERFORMANCE OF FERTILISER FIRMS

	Model – I (Dependent Variable ROA)	Model – II (Dependent Variable ROA)	Model – III (Dependent Variable ROE)	Model – IV (Dependent Variable ROE)	Model – V (Dependent Variable ATO)	Model – VI (Dependent Variable ATO)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	0.112*	0.056	-39.785***	-33.143***	3.100***	3.07***
	(0.063)	(0.299)	(0.004)	(0.005)	(0.000)	(0.000)
HCE	0.001		0.394***		0.027***	
	(0.422)		(0.001)		(0.000)	
SCE	0.000***		0.004		-0.004***	
	(0.003)		(0.544)		(0.000)	
RCE	-0.024***		0.764		-0.135***	
	(0.000)		(0.186)		(0.025)	
CEE	0.011		-0.333		0.068	
	(0.324)		(0.224)		(0.35)	
MVAIC	-	0.000**	-	0.002		-0.001**
		(0.015)		(0.818)		(0.053)
SIZE	-0.013	0.002	2.794***	2.448***	-0.151***	-0.148)***
	(0.439)	(0.795)	(0.004)	(0.006)	(0.01)	(0.005
LEVERAGE	0.041***	0.041***	0.136***	0.14***	1.369***	1.369***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
AGE	-0.025	-0.04	17.573***	14.656***	-1.070***	-1.083***
	(0.439)	(0.909)	(0.005)	(0.006)	(0.000)	(0.000)
R^2	0.802	0.786	0.531	0.530	0.984	0.982
F-Statistics	609.998***	899.560***	15.240***	12.295***	7501.595	11283.636***
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Source: Author's Compilation

Overall, the results from all the models depict the positive impact of IC on performance indicators in Indian fertiliser firms, aligned with previous studies by

Smriti and Das (2018) and Xu and Wang (2019). Sardo and Serrasqueiro (2018) also emphasise the IC's potential to enhance financial performance and wealth creation in developing countries. However, when ROA is used as the performance metric, RCE exhibits negative relationships, consistent with findings from Smriti and Das (2018), Soewarno and Tjahjadi (2020), and Dalwai and Salehi (2021) but inconsistent with studies by Sardo and Serrasqueiro (2017) and Bataineh et al. (2022). Conversely, when ROE is the performance measure, HCE shows a positive association, consistent with Xu and Wang (2019) but inconsistent with Carmona-Lavado et al. (2013). MVAIC exhibits a positive relationship with ROA and ROE, in line with the findings of Ordonez de Pablos (2004) and Lee and Lin (2019), inconsistent with Zang et al. (2021) and Xu and Zhang (2021).

IV

CONCLUSION

This study extensively examines the well-established role of Intellectual Capital (IC) as a formidable driver, fortifying a firm's performance and ensuring its enduring competitive edge. The research unravels the intricate relationship between intellectual capital and financial performance within the Indian fertiliser sector. Spanning a decade, from 2012-13 to 2021-22, and encompassing a sample of 20 fertiliser firms, the study's primary objective is to assess how IC, along with its constituent elements (human capital, structural capital, and relational capital), influences firms' performance. It also scrutinises the impact of industry type on this dynamic interplay. Employing the MVAIC model for IC quantification, the research leverages various statistical tools such as descriptive statistics, correlation matrices, and panel regression (Robust Standard Error method). The findings of the study suggest that intellectual capital has a substantial impact on the financial performance of Indian fertiliser firms. Among the components, HCE is the only component that has positive and significant coefficients for the prediction of financial performance measures, i.e., profitability and productivity.

The study's outcomes underscore the affirmative influence of intellectual capital, inclusive of its individual components, on the fertiliser industry. This indicates that investments in IC can notably enhance the sector's performance. In light of these findings, the report provides actionable insights. Firstly, it recommends that fertiliser companies should prioritise and sustain their investments in IC, given the evident value it brings. Furthermore, despite the absence of a direct impact of relational capital and innovation capital, industry managers are encouraged to concentrate on developing innovative, high-tech products to attract and retain customers. Incorporating customer feedback during product development is also vital. Establishing robust connections with financial institutions, government agencies, and research organisations becomes pivotal for securing funding and fostering collaborative efforts. The report underscores the importance of policymakers enacting favourable policies that promote institutional

collaboration and increased investments in IC. These measures hold the potential to enhance efficiency and nurture long-term growth. The researchers may also have the advantage as they will get the pertinent input to conduct the research in the agribusiness sector, focusing on the relationship between IC and Firm Performance. It is essential to acknowledge certain limitations of the study. The sample is confined to the fertiliser industry, prompting future research to encompass diverse industries or explore cross-country and cross-regional comparisons.

Received January 2024. *Revision accepted July 2024.*

REFERENCES

Abdulsalam, F., Al-Qaheri, H.and Al-Khayyat, R. (2011). The intellectual capital performance of Kuwaiti banks: An application of VAIC model, *Îbusiness, 3*(1), 88–96. https://doi.org/10.4236/ib.2011.31014

Adegbayibi, A. (2022). Intellectual capital and firm performance of listed firms in Nigeria: Moderating role of corporate governance, *Jurnal Akuntansi Dan Auditing, 17*(2), 33-46, DOI:10.14710/jaa.17.2.33-46.

Ahmed, Z., Amir Hussin, M. and Pirzada, K. (2022). The impact of intellectual capital and ownership structure on firm performance, *Journal of Risk and Financial Management, 15*(12), 553, DOI:10.3390/jrfm15120553.

Alipour, M. (2012). The effect of intellectual capital on firm performance: An investigation of Iran insurance companies, *Measuring Business Excellence, 16*(1), 53–66. https://doi.org/10.1108/13683041211204671

Al Momani, K., Jamaludin, N. and Wan Abdullah, W. (2021). The effect of relational capital on the intellectual capital and firm performance nexus: Evidence from the Jordanian industrial sector, *Journal of Sustainability Science and Management, 16*(5), 307-326.

Balaji, V. and Mamilla, R. (2024). Intellectual capital and corporate sustainable growth: An empirical study on Indian agribusinesses specific to pesticides and fertiliser companies, *Qubahan Academic Journal, 4*(1), 1-18.

Bataineh, H., Abbadi, S. S., Alabood, E. and Alkurdi, A. (2022). The effect of intellectual capital on firm performance: The mediating role of family management, *Journal of Islamic Accounting and Business Research, 13*(5), 845-863.

Barney, J. (1991). Firm resources and sustained competitive advantage, *Journal of Management, 17*(1), 99-120.Available at: https://doi.org/10.1177/014920639101700108.

Becker, G. S. (1993). *Human capital: A theoretical and empirical analysis, with special reference to education (3rd ed.)*, Chicago: University of Chicago Press.

Bontis, N. (1998). Intellectual capital: An exploratory study that develops measures and models, *Management Decision, 36*(2), 63–76.

Bontis, N., Kew, W. C. and Richardson, S. (2000). Intellectual capital and business performance in Malaysian industries, *Journal of Intellectual Capital, 1*(1), 85-100.

Bose, S. and Thomas, K. (2007). Applying the balanced scorecard for better performance of intellectual capital, *Journal of Intellectual Capital, 8*(4), 653–665. doi:10.1108/14691930710830819

Caribano, L., Garcia-Ayuso, M. and Sanchez, P. (2000). Accounting for intangibles: A literature review, *Journal of Accounting Literature, 19*, 102-130.

Carmona-Lavado, A., Cuevas-Rodríguez, G.and Cabello-Medina, C. (2013). Service innovativeness and innovation success in technology-based knowledge-intensive business services: an intellectual capital approach, *Industry and Innovation, 20*(2), 133-156.

Dalwai, T. and Salehi, M. (2021). Business strategy, intellectual capital, firm performance, and bankruptcy risk: evidence from Oman's non-financial sector companies, *Asian Review of Accounting*, 29(3), 474-504.

Edvinsson, L.and Malone, M. S. (1997). Intellectual capital: Realising your company's true value by finding its hidden brainpower, *Harper Business*

Ge, F. and Xu, J. (2021). Does intellectual capital investment enhance firm performance? Evidence from the pharmaceutical sector in China, *Technol. Anal. Strateg. Manag, 33*, 1006–1021.

Gogan, L. M., Artene, A., Sarca, I., and Draghici, A. (2016). The impact of intellectual capital on organisational performance, *Procedia - Social and Behavioral Sciences, 221*, 194–202.

Government of India. (2021-22). *Annual report*. Ministry of Chemicals and Fertilisers, Department of Fertiliser.

Habib, A. and Dalwai, T. (2023). Does the efficiency of a firm's intellectual capital and working capital management affect its performance?, *Journal of the Knowledge Economy*, 1-28, DOI:10.1007/s13132-023-01138-7.

Kennedy, P. (1985). *A guide to econometrics*, 2nd ed., The MIT Press, Cambridge, MA.

Lee, C. C.and Lin, C. K. (2019). The major determinants of influencing the operating performance from the perspective of intellectual capital: Evidence on CPA industry, *Asia Pacific Management Review*, *24*(2), 124-139.

Liu, C. H. (2017). The relationships among intellectual capital, social capital, and performance - The moderating role of business ties and environmental uncertainty, *Tourism Management*, *61*, 553–561. doi:10.1016/j.tourman.2017.03.017

Odat, M.and Bsoul, R. (2022). The role of intellectual capital in firms' performance and market value: evidence from Jordan, *International Journal of Management and Sustainability*, *11*(4), 258-272. doi:10.18488/11.v11i4.3232

Ordóñez de Pablos, P. (2004). Intellectual capital reporting in Spain: A comparative view, *Journal of intellectual capital*, *4*(1), 61-81.

Pingali, P. L. (2012). Green revolution: impacts, limits, and the path ahead. *Proc. Natl. Acad. Sci. U.S.A. 109*, 12302–12308. doi: 10.1073/pnas.0912953109

Pulic, A. (1998). *Measuring the performance of intellectual potential (ip) in the knowledge economy. In C. Tiffany, and S. Jennifer (Eds.).* Paper presented at the 19th Annual National Business Conference. DeGroote School of Business.

Sardo, F. and Serrasqueiro, Z. (2017). A European empirical study of the relationship between firms' intellectual capital, financial performance and market value, *Journal of Intellectual Capital*, *18*(4), 771-788.

Sardo, F.and Serrasqueiro, Z. (2018). Intellectual capital, growth opportunities, and financial performance in European firms: Dynamic panel data analysis. *Journal of Intellectual Capital*, *19*(4), 747-767.

Scafarto, V., Ricci, F. and Scafarto, F. (2016). Intellectual capital and firm performance in the global agribusiness industry: The moderating role of human capital, *Journal of Intellectual Capital*, *17*(3), 530-552

Shubita, M. (2022). Intellectual capital components and industrial firm's performance, *Problems and Perspectives in Management*, *20*(1), 554-563. DOI:10.21511/ppm.20(1).2022.44.

Singh, S., and Benbi, D. K. (2016). Punjab-soil health and green revolution: a quantitative analysis of major soil parameters, *J. Crop Improv. 30*, 323–340. doi: 10.1080/15427528.2016.1157540

Skhvediani, A., Koklina, A., Kudryavtseva, T. and Maksimenko, D. (2023). The impact of intellectual capital on the firm performance of Russian manufacturing companies, *Risks*, *11*(4), 1-25.

Smriti, N. and Das, N. (2018). The impact of intellectual capital on firm performance: A study of Indian firms listed in COSPI, *Journal of Intellectual Capital*, *19*(5), 935-964. https://doi.org/10.1108/jic-11-2017-0156.

Soewarno, N. and Tjahjadi, B. (2020). Measures that matter: an empirical investigation of intellectual capital and financial performance of banking firms in Indonesia, *Journal of Intellectual Capital*, *21*(6), 1085-1106.

Sohel Rana, M. and Hossain, S. Z. (2023). Intellectual capital, firm performance, and sustainable growth: A study on DSE-listed nonfinancial companies in Bangladesh, *Sustainability*, 15(9), 7206.

Somvanshi, P. S., Pandiaraj, T. and Singh, R. P. (2020). An unexplored story of the successful green revolution of India and steps towards evergreen revolution, *J. Pharmacogn. Phytochem.* 9, 1270–1273.

Srivastava, P., Balhara, M. and Giri, B. (2020). Soil health in India: past history and future perspective, in *Soil Health*, eds B. Giri and A. Varma (New Delhi; Noida: Springer), 1–19. doi: 10.1007/978-3-030-44364-1_1

Teplova, T. V. and Sokolova, T. V. (2019). Building the index of efficiency of FDI transformation: Economic development and intellectual capital, *Emerging Markets Finance and Trade*, *55*(10), 2164– 2184. https://doi.org/10.1080/1540496X.2018.1525356

Tran, N., Dinh, C., Hoang, H. and Vo, D. (2022). Intellectual capital and firm performance in Vietnam: The moderating role of corporate social responsibility, *Sustainability, MDPI*, *14*(19), 1-13.

Xu, J., Haris, M., Liu, F. (2022). Intellectual capital efficiency and firms' financial performance based on business life cycle, *J. Intellect. Cap*, Ahead of print.

Xu, J., Liu, F. (2020). The impact of intellectual capital on firm performance: A modified and extended VAIC model, *J. Compet*, *12*, 161–176.

Xu, J., Zhang, Y. (2021). Exploring the nonlinear effect of intellectual capital on financial performance: Evidence from listed shipping companies in China, *Complexity*, 9004907.

Xu, J. and Wang, B.H. (2019). Intellectual capital, financial performance and companies' sustainable growth: evidence from the Korean manufacturing industry. *Sustainability*, *10* (12), 4651.

Yousaf, M. (2022). Intellectual capital and firm performance: evidence from certified firms from the EFQM excellence model, *Total Quality Management and Business Excellence*, *33*(4), 312-325. doi:10.1080/14783363.2021.1972800.

Zhang, J. and Wang, Y. (2022). How to improve the corporate sustainable development? The importance of the intellectual capital and the role of the investor confidence, *Sustainability*, *14*(7), 3749, https://doi.org/10.3390/su14073749

Zhang, L., Jin, Z., Xu, J. and Yu, Q. (2021). Do intellectual capital elements spur firm performance? Evidence from the textile and apparel industry in China, *Mathematical Problems in Engineering*, 7332885, DOI:10.1155/2021/7332885.

ANNEXURE 1. REVIEW OF LITERATURE ON IMPACT OF IC ON FIRM PERFORMANCE

Author (Year)	Sample Size and Study Period	Methods used to evaluate IC	Proxy for firm performance	Relationship of IC Components on Firm Performance		
Skhvediani et al., (2023)	23,494 observations of Russian manufacturing companies; 2017–2020 period	Regression analysis	LnEBIT, ROA, and ATO	HCE (+, significant)	SCE (+, significant)	
Sohel Rana and Hossain (2023)	69 Non-financial companies in Bangladesh; 2017–2021	Diagnostic Test (Fisher-type unit-root test) and OLS	ROA, ROE, TQ, and SGR	HCE (+, significant)	SCE (+, significant)	RCE (+, significant)
Habib and Dalwai (2023)	40 public listed Industrial firms 2015 to 2019	DEA Model, Regression analysis Model	ROA, ROE, Tobin's Q	HCE (+, significant)	SCE (+, significant)	
Adegbayibi (2022)	50 listed non-financial firms in Nigeria; 2007-2017	Correlation and Multiple regression	ROA	HCE (-)	SCE (-)	
Ahmed et al., (2022)	409 listed firms of Malaysian stock exchange; 2016 to 2020	Regression analysis, and GMM	ROA	HCE (+, significant)	SCE (+, significant)	RCE (+, significant)
Odat and Bsoul (2022)	113 Manufacturing based and service based firms listed on Amman Stock Exchange; 2014 to 2018	Correlation and Regression analysis	ROA, MBV	HCE (+, significant)	SCE (+, significant)	
Shubita (2022)	77 Jordanian industrial firms; 2006–2020	Regression analysis	ROE	HCE (+, significant)	SCE (-)	
Tran et al., (2022)	60 listed companies of Ho Chi Minh Stock Exchange; 2011-2020	Assumption Tests and Regression Analysis	ROA, ROE	HCE (+, significant)	SCE (+, significant)	RCE (+, significant)
Yousaf (2022)	336 Czech firms and 20 certified firms from the European Foundation; 2015 to 2019	Fisher type unit root test, and Pooled regression analysis	ROA, ROE and ATO	HCE (+, significant)	SCE (+, significant)	
Zhang and Wang (2022)	Manufacturing companies from 2015-2020 from Shanghai and Shenzhen A-shares in China	Regression analysis, and	SGR	HCE (+, significant)	SCE (+, significant)	RCE (+, significant)
Zhang et al., (2021)	35 Chinese apparel and and companies, 2013–2018	Regression analysis	ROA, ROE, MB, and EP	HCE (+, significant)	SCE (+, significant)	RCE (-, significant)
Al Momani et al., (2021)	50 Industrial firms listed on Amman Stock Exchange (ASE); 2008–2017	Regression analysis	M/B	HCE (+, significant)	SCE (+)	RCE (-)

Source: Authors' Compilation.