CHAPTER 2

A Study on Intellectual Capital in the Indian Construction Contracting Firms

Hemant Hindurao Lokhande[1], Pratik Yashwant Jadhav[2],
Aman Kumar Sinha[2], Abhishek Sunil Chaskar[2]

ABSTRACT

This study explores the impact of intellectual capital on the performance of Indian construction contracting firms, emphasizing its role in sustaining competitive advantage. The research examines human capital (HC), structural capital (SC), and relational capital (RC) as key independent variables influencing firm performance (FP). Control variables include firm age, size, work experience, experience within the firm, and position. Using a questionnaire survey methodology, data was collected from professionals in the Indian construction industry. Statistical data analysis was performed to evaluate the relationships between intellectual capital components and firm performance. The hypothesis testing reveals that while human capital (HC) does not significantly impact firm performance, both structural capital (SC) and relational capital (RC) have a positive influence on the overall efficiency and success of construction firms. This research provides empirical evidence on the importance of intellectual capital in organisational performance by testing the impacts of human, structural, and relational capital on total factor productivity (TFP) in the corporate market. The research offers insight into how companies can apply intangible assets to enhance productivity and competitiveness using quantitative and qualitative measurements. Findings contribute to intellectual research and practice, supporting business executives to make strategic decisions that optimize intellectual capital. Policymakers, managers, and academics concerned with knowledge economies and sustainable business development may be interested in this study very highly.

Keywords: Intellectual capital; Human capital; Structural capital; Relational capital; Firm performance.

1.0 Introduction

1.1 Intellectual capital

Intellectual Capital Intellectual Capital (IC) refers to the collective intangible assets, knowledge resources and competencies that drive organizational value creation, competitive advantage, and sustainable performance.

[1]*Corresponding author; School of Construction, NICMAR University, Pune, Maharashtra, India (E-mail: P2370234@student.nicmar.ac.in)*
[2]*School of Construction, NICMAR University, Pune, Maharashtra, India*

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It is an aggregation of human expertise, organizational knowledge infrastructure, and external stakeholder relationships that contribute to the efficiency, innovation, and long-term success of a firm. Intellectual Capital is widely recognized as a fundamental component in knowledge-driven economies, where traditional financial and tangible assets alone do not determine success. Intellectual capital is made up of three main components: 1. Human Capital: The individual knowledge, expertise, skills, and innovation of workers that aid organizational performance. (Duodu & Tsai 2020, Andreeva & Kianto 2016, Hussinki *et al.*, 2017) 3 2. Structural Capital: The company's non-human assets such as organizational processes, patents, databases, and technology that ensure operating efficiency. (Garcia-Perez & Ayres 2019, Secundo *et al.* 2017) 3. Relational Capital: The value acquired from relations with stakeholders like suppliers to clients' clients, investors, and government bodies. (Duodu & Rowlinson 2019, MacDougall & Hurst 2005) Though critical to its success, Intellectual Capital of the Indian construction industry remains untapped, with companies depending mostly on tangible and traditional financial assets. This research seeks to fill in the lacuna by investigating the contribution of Intellectual Capital towards Firm Performance and competitiveness.

1.2 Goals

The main goals of this research are:

- Identification of pertinent intellectual elements contributing to Firm Performance.
- Empirical verification of the extent to which identified intellectual impact Firm Performance of Indian Construction Contracting Organizations.

2.0 Literature Review

Based on 26 research publications, this study of the literature aims to investigate the notion of intellectual capital, its factors, and effects on the performance of construction companies. Intellectual capital, according to the body of research, is three-component: human capital, structural capital, and relational capital (Stewart, 1997; MacDougall, 2005). While structural capital relates to the organizational knowledge, procedures, and technology applied by the company, human capital is the skill acquired by employees of the company. Relational capital covers corporate private networks, stakeholders, and other corporate relationships. Effective control and integration of these intellectual resources results in higher knowledge generation, innovation, and construction companies' profitability enhancement.

2.1 Intellectual capital

Prusak defines Intellectual capital (IC) as "Intellectual material that has been formalized, captured, and leveraged to produce a higher valued asset" (Egbu 2004). Intellectual capital in the Indian construction companies can be categorized into three main components: human, structural, and relational capital (Stewart, 1997). Human capital involves the knowledge,

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experience, and skills of engineers, architects, and project managers. Structural capital includes firm procedures, technical infrastructure, and intellectual assets, whereas relational capital is the relations with the clients, government departments, vendors, and other parties.

Table 1: Literature Review

Year	Name of Journal	Title	Geography
2001	SJM	Constructing intellectual capital statements	Denmark
2004	ECAM	Managing knowledge and intellectual capital for improved organizational innovations in the construction industry: an examination of critical success factors	Scotland, UK
2005	IC	Identifying tangible costs, benefits and risks of an investment in intellectual capital Contracting contingent knowledge workers	Wolfville, Canada
2009	JCEM	Fuzzy Intellectual Capital Index for Construction Firms	Turkey
2009	JHRCA	Construction of Intellectual Capital- the case of purchase analysis	Sweden
2010	JCEM	A study on the relationship between intellectual capital and business performance in the engineering consulting industry: A path analysis	Taiwan
2011	IC	Construction and valuation of intellectual capital: A case study	
2015	K&PM	Assessment and Management of Intellectual Capital: A Single Case Study on the Construction and Implementation of an IC Index	Italy
2016	ECKM	The Effect of Intellectual Capital and Strategic Partnerships in Construction Companies	Portugal
2016	IC	Do all elements of intellectual capital matter for organizational performance? Evidence from Russian context	Russia
2016	EPOC	Intellectual Capital and Innovation in Construction Organizations: A Conceptual Framework	USA
2016	JIC	Do all elements of intellectual capital matter for organizational performance?	St Petersburg
2016	IC	Intellectual capital, knowledge management practices and firm performance	Finland
2017	TFSC	An Intellectual Capital framework to measure universities' third mission activities	Italy
2017	IJCM	Correlation between intellectual capital and business performance of construction industry	Taiwan
2017	IC	Intellectual capital, knowledge management practices and firm performance	Finland
2017	Elsevier	An Intellectual Capital framework to measure universities' third mission activities	European countries
2019	KM	Knowledge Management and Intellectual Capital in Knowledge-based Organisations	USA
2019	KM	Knowledge Management and Intellectual Capital in Knowledge-based Organisations: A Review and Theoretical Perspectives	USA
2019	JIC	Intellectual capital for exploratory and exploitative innovation	Austria

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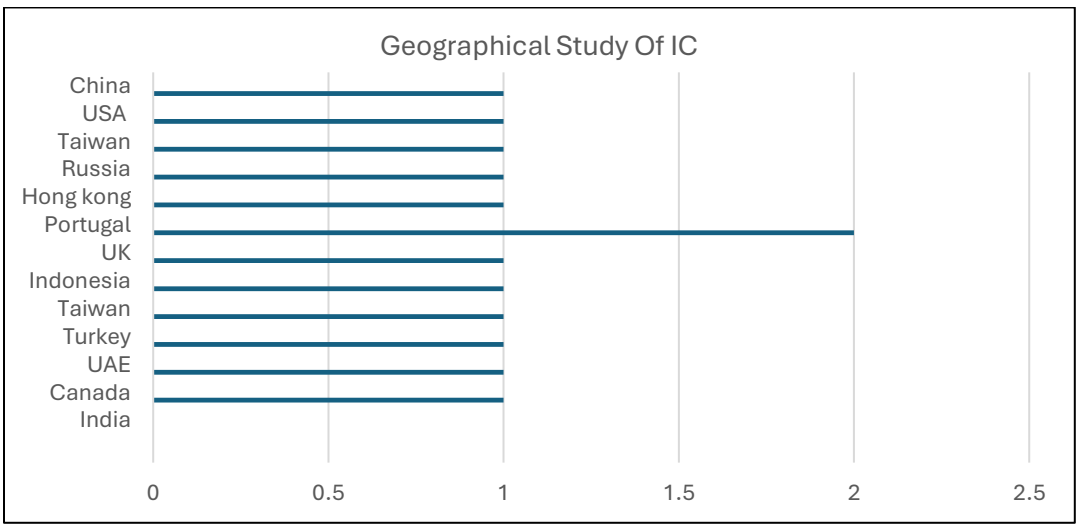
2019	Sustainability	Intellectual Capital, Knowledge Sharing, and Innovation Performance: Evidence from the Chinese Construction Industry	China
2020	ASSEHR	The Influence of Financial Ratios and Intellectual Capital on Financial Difficulties in Construction Companies	
2020	JME	Intellectual Capital, Innovation, and Performance in Construction Contracting Firms	Hong Kong
2022	IJAFB	Examining the Role of Intellectual Capital in determining the firm's performance: A study from the construction industry of UAE	UAE
2022	ECKM	Intellectual Capital and Performance: A Case Study of Construction Companies	Portugal
2022	JMT	Impact of attracting intellectual capital on the innovative development of construction engineering enterprises	Moscow

Figure 1: Geographical Studies of IC



2.2 Industrial and geographical context

After going through the thorough review of 26 articles in IC in various industries, we learned that the study has been conducted in various regions of the world but not in India. Therefore, it is essential to study that how Indian Construction Industry is impacted by IC because Indian Construction Industry is also a complex industry and that too in the Indian Construction Contracting Firms.

2.3 Methods

This research adopts a systematic review of literature in exploring the position of Intellectual Capital (IC) among Indian construction contracting companies. The study is based

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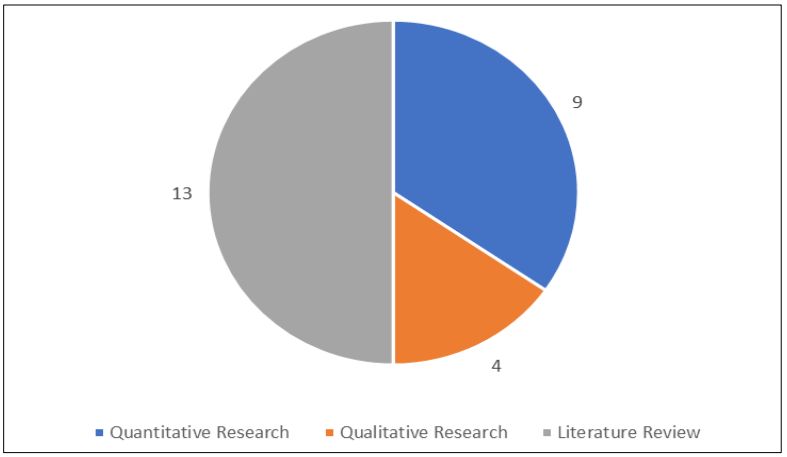
on an in-depth scrutiny of 26 academic papers consisting of diverse types of research methodology including qualitative research, quantitative analysis, and reviews of literature.

Figure 2: Methods of LR



2.4 Hypothesis Development

H1: Human Capital (HC) has a significant positive impact on firm performance.
H2: Structural Capital (SC) has a significant positive impact on firm performance.
H3: Relational Capital (RC) has a significant positive impact on firm performance.

3.0 Research Methodology

3.1 Study context, sampling criteria and data collection procedure

This study focuses on collecting data from construction managers and engineers, specifically within the contracting firms of the Indian construction industry. These professionals are chosen because their roles are critical in ensuring the successful execution of construction projects, and they hold significant accountability in project performance and organizational success. The study aims to collect approximately 200 responses from the selected strata. Given that the survey consists of fifty questions, a response size of at least 200 participants (calculated as 50*4) is required, as per Hair *et al.* (1998).

This sample size will allow for a comprehensive examination of the hypotheses related to intellectual capital and its impact on firm performance. A structured questionnaire will be developed and distributed to construction professionals through an online survey platform. The questionnaire will utilize a 5-point Likert scale to gauge respondents' opinions, ranging from "strongly disagree" to "strongly agree." Confidentiality and anonymity of all respondents will be strictly maintained, ensuring that the responses are used solely for research purposes.

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3.2 Measures

3.2.1 Dependent variable

Firm Performance: Firm Performance comprises the firm's revenue growth, market share, service quality and customer satisfaction. (Henri, 2017)

3.2.2 Independent variables

Human Capital (HC): The individual knowledge, expertise, skills, and innovation of workers that aid organizational performance. (Duodu & Tsai 2020, Andreeva & Kianto 2016, Hussinki *et al.*, 2017)

Structural Capital (SC): The company's non-human assets such as organizational processes, patents, databases, and technology that ensure operating efficiency. (Garcia-Perez & Ayres 2019, Secundo *et al.* 2017)

Relational Capital (RC): The value acquired from relations with stakeholders like suppliers to clients' clients, investors, and government bodies. (Duodu & Rowlinson 2019, MacDougall & Hurst 2005)

Control Variables:

- Age of Firm
- Size of Firm
- Total Work Experience
- Experience with existing firm
- Firm position

4.0 Data Analysis and Findings

4.1 Reliability assessment (Cronbach's Alpha)

The reliability of all the scales was also tested for all the items from the questionnaire to measure the degree of consistency achieved in justifying that the findings are reliable (Nunnaly & Bernstein 1994). The Cronbach's Alpha of all the scales were found to be above 0.70 (Hulin *et al.*, 2001). The Cronbach's Alpha value for all the scales has been tabulated below.

Table 2: Reliability Test

Variable	Reliability (α)
Total Human Capital (THC)	0.926
Total Structural Capital (TSC)	0.897
Total Relational Capital (TRC)	0.905

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4.2 Hypothesis testing

As proposed earlier in the hypothesis chapter, where initially we concluded three hypotheses for our study and then several iterations had been conducted to find the extent of significance of those variables as well as the nature of association with outcome variables. The results generated showed us that out of three variables two variables (TSC and TRC) were significant and one (THC) was found insignificant.

4.2.1 Descriptive statistics and correlation

Each scale's mean and standard deviation were determined. To investigate the degree of correlation between the independent and dependent variables, Pearson's correlation coefficients (r) were computed. The degree of the linear relationship between two variables is shown by these correlation coefficients. The correlation between the variables as determined by SPSS is displayed in the table that is attached below.

As the study shows, Human Capital is insignificant to Firm Performance and Structural Capital and Relational Capital is significant to Firm Performance. The study also supports:

1. Structural Capital is positively related to Firm Performance.
2. Relational Capital is positively related to Firm Performance.
3. Human Capital is positively related to Firm Performance.

Table 3: Correlation

Variable	TFP	THC	TSC	TRC
TFP	1			
THC	.778**	1		
TSC	.837**	.851**	1	
TRC	.879**	.826**	.883**	1
**p< 0.01				
*p< 0.05				

TFP= Total Firm Performance; THC= Total Human Capital; TSC= Total Structural Capital; TRC= Total Relational Capital

4.2.2 Multiple regression analyses

- Total Human Capital (THC) ($\beta = 0.032$, $p = 0.659$)
- Total Structural Capital (TSC) ($\beta = 0.22$, $p = 0.01$
- Total Relational Capital (TRC) ($\beta = 0.22$, $p < 0.001$
- Control Variables (Age, Size, Work Experience, Position, and Current Experience): None of these variables were found to be significant

The detailed regression performed in SPSS software is attached below.

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MODEL SUMMARY				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error**
1	.274	.075	.048	6.301
2	.852	.726	.713	3.458

Table 4: Multiple Regression Model of Firm Performance and its Independent Variables

Model	**Variable**	**Standardized Coefficients**	**Sig.**
		Beta	
2	(Constant)	-	<.001
2	AGE	0.051	0.331
2	SIZE	0.005	0.928
2	WEX	-0.01	0.889
2	CEX	0.025	0.718
2	PSN	0.028	0.522
2	THC	0.032	**0.659**
2	TSC	0.22	**0.01**
2	TRC	0.22	**<.001**

AGE = Age of firm; SIZE = Size of company; WEX= Total Work Experience; CEX = Current Company Experience; PSN= Position in firm; THC = Total Human Capital; TSC= Total Structural Capital; TRC= Total Relational Capital

Key Findings

- TSC ($p = 0.010$) and TRC ($p < 0.001$) significantly impact TFP.
- THC ($p = 0.659$) does not show a significant direct effect.

Summary of Results: The summary of the results are as follows:

Table 5: Summary of Results

Sl. No.	**Variables**	**Results**
1	THC	Not Supported
2	TSC	Supported
3	TRC	Supported

5.0 Discussion, Implications and Conclusion

5.1 Implications for practice

5.1.1 Human capital

A lack of correlation between Human Capital and Firm Performance suggests that employee turnover may not be a determinant factor as previously thought.

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5.1.2 Structural capital

- *Technology Integration:* Firms should invest in advanced digital tools, automation, and data management systems to streamline operations and improve efficiency.
- *Process Standardization:* Developing well-documented SOPs (Standard Operating Procedures) ensures knowledge continuity and reduces dependency on individuals.
- *Innovation & R&D:* To promote innovation and keep a competitive edge, businesses should invest in research and development.

5.1.3 Relational capital

- *Customer Relationship Management:* Companies should strengthen their CRM systems to maintain long-term client relationships and enhance customer loyalty.
- *Strategic Partnerships:* Building alliances with industry leaders, suppliers, and government bodies can open new growth opportunities.
- *Brand Reputation & Trust:* Firms should invest in corporate social responsibility (CSR) initiatives and transparent business practices to enhance their market credibility.

5.2 Limitations and conclusion

This study was to find effect of Intellectual Capital on Indian Construction Contracting Firms. The thesis was done in keeping with the prescribed methodology and analysis by previous studies. We recognize that our study has some limits. We chose 3 components of Intellectual Capital but there are various components of Intellectual Capital such as spiritual capital, social capital, etc. Further, analysis of moderation and mediation is possible among components of IC. Our sample size is as per prescribed survey formulation still we think it could have been more diverse as we restricted ourselves to Indian Construction Contracting Firms. As the study shows, Human Capital is insignificant to Firm Performance and Structural Capital and Relational Capital is significant to Firm Performance.

The study also supports:

- Structural Capital is positively related to Firm Performance.
- Relational Capital is positively related to Firm Performance.
- Human Capital is positively related to Firm Performance.

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