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Do intellectual capital efficiency and institutional quality influence a firm's capital structure? Evidence from India

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Abstract

Purpose – This research explores the influence of intellectual capital (IC) efficiency (ICE) and institutional quality (IQ) on a firm's capital structure (CS) in Indian firms.

Design/methodology/approach – The analysis was conducted on a sample of Indian companies from 2015 to 2019. Data were collected from the S&P database, and regression and additional analyses were performed to achieve the objectives of this research.

Findings – The findings show a significant positive effect of ICE on a firm's CS from debt (CSD) and an insignificant positive effect of IQ on CSD and CS from equity (CSE). The findings also indicate that human-capital efficiency (HCE) and capital-employed efficiency (CEE) are the main IC sub-dimensions influencing a firm's CS, compared to the structural-capital efficiency (SCE) dimension.

Practical implications – The results of this study have several practical implications, as they examine the influence of ICE and IQ on CS as potential determinants, which could help business leaders adopt optimal CS strategies.

Originality/value – The results of this study offer several novel contributions to the existing literature on CS by examining unexplored factors, such as ICE as a knowledge management strategy, ICE sub-dimensions, and IQ in the context of CS.

Keywords Intellectual capital, Institutional quality, Governance, Capital structure, Capital management, Finance

Paper type Research paper

1. Introduction

Companies often have a continuous requirement for funding, which can be met through external sources, like loans, or through internal sources, such as stocks. However, these resources vary considerably in terms of costs and their effects on business ownership and control. The structure of equity and debt employed to finance a business's processes, known as CS, has been thoroughly examined. Nevertheless, the fundamental issue of how companies

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decide on their CS and the specific factors influencing it remains unclear (Bibi and Akhtar, 2024; Rahman *et al.*, 2023; DeAngelo, 2022). Numerous phenomena in the field of strategic management are interconnected with overall organisational performance (Makadok *et al.*, 2018). Researchers have attempted to analyse this issue by developing a theoretical foundation that can explain CS determinants, or to conduct empirical studies in this regard. Initially, corporate finance theory was used to guide financial decision-making in companies, especially capital budgeting, CS, working capital management, and risk management (Habib *et al.*, 2024).

In addition, several specific theories related to CS, such as the pecking order, trade-off, market timing, and Brusov-Filatova-Orekhova (BFO) theories, have been developed from a corporate finance perspective. According to the trade-off theory (TOT), companies choose the volume of debt and equity finance to utilise for CS by offsetting costs and benefits (Henrique *et al.*, 2021; Rodrigues *et al.*, 2017). The pecking order theory (POT) is one of the main challenges for the TOT, which states that businesses prioritise their internal financing abilities over equity financing (Thakur *et al.*, 2023). The POT perspective aligns with the agency theory, as firms with intangible options tend to lessen their debt volumes to address agency problems that may arise from debt. The market timing theory (MTT) often contrasts with the TOT and the POT. Baker and Wurgler (2002) argue that market timing is the primary factor influencing a company's decision to use debt and equity in its CS, while the Modigliani-Miller theory (MMT) states that a company's market value is determined by the current value of its anticipated future earnings and its inherent assets; however, it remains unaffected by CS (Jaros and Bartosova, 2015). Therefore, the MMT contends that whether a company finances its growth through internal or external financing, the weighted average cost of capital and debt would be independent of the leverage level. In addition, the BFO theory of modern capital cost and CS was established in 2008 following the discovery of numerous novel effects not present in the MMT (Brusov *et al.*, 2022).

Furthermore, Bibi and Akhtar (2024), Fukui *et al.* (2023), and Rahman *et al.* (2023) employed the theories mentioned above. They performed empirical studies that focused on several firm-specific aspects, including profitability, firm size, tangible assets, firm growth prospects, and non-debt tax shields as potential determinants of CS. Nevertheless, these studies did not account for ICE and IQ as factors of CS.

Regarding IC, it has shaped modern economies in the past few decades. New technology and knowledge have revolutionised our lifestyles and interactions, radically changing the economic landscape and how business are conducted. Therefore, IC is becoming increasingly significant as a crucial strategic asset in knowledge-based societies. It holds more value than physical or financial capital, because it is valuable, scarce, and difficult to replicate, thus providing a competitive advantage (Habib and Dalwai, 2024).

Additionally, an IC management strategy can help companies effectively identify, evaluate, and deploy their resources. By linking their resources to their strategic intent, companies can achieve their desired positions and promote stakeholder value (Habib and Mourad, 2024a). Thus, a better ICE may be a major aspect that enables companies to obtain the external finances required to fund their investments more easily. Furthermore, insufficient IQ negatively affects financing availability, as lenders hesitate to extend credit to such companies due to concerns regarding inadequate protection (Çam and Özer, 2021). Consequently, inadequate IQ may be a significant impediment restricting certain companies from readily accessing external capital, which is crucial for financing their investments. Additionally, the factors influencing decisions regarding CS in emerging markets remain unclear.

This study aims to explore the influence of ICE and IQ on CS in the context of Indian firms as an emerging market. Furthermore, it provides significant practical outcomes that could encourage financial leaders to adopt an optimal mix of CS, fostering continuous improvement, which is essential for enhancing business performance and achieving more impactful results (Mourad *et al.*, 2021, 2022).

It should be noted that Indian companies are continuously moving toward economic development, which is largely reflected in the state's policies toward all countries, especially

Latin American countries (Domínguez, 2023; Giordano *et al.*, 2019). India and Latin America have never been more economically relevant to each other than they are today, due to a tendency to redraw India-Latin America relationships in the 21st century (Maloney *et al.*, 2024; Urrego-Sandoval and Pacheco Pardo, 2023; Gonzalo, 2022). India's trade with Latin America increased from $2bn in 2000 to more than $49bn by 2022. In recent years, the key to improving economic ties has been the increased political will on both sides (Domínguez, 2023). Latin American politicians and governments have become more inclined to enhance their countries' relationships with India. Brazil remains, by a large margin, the country in Latin America with the greatest number of political linkages with India. This may be due to the membership of both India and Brazil in multilateral groupings, such as BRICS, IBSA, and the G20 (Rodríguez *et al.*, 2023). Finally, this study aims to answer the following questions:

Q1. Do ICE and its sub-dimensions impact a firm's CSD and CSE?

Q2. Does IQ affect a firm's CSD and CSE?

The remaining structure of this study is organised as follows: Section 2 presents the literature review, Section 3 describes the methods used, Section 4 shows the research results, Section 5 explores the research discussion, and Section 6 provides the conclusions.

2. Literature review

2.1 Intellectual capital and capital structure

Knowledge management plays a pivotal role in enabling business sustainability and helps promoting competition and excellence (Gorry and Westbrook, 2013). As a result, in recent years, knowledge has become indispensable to contemporary businesses (Bloem and Salimi, 2022). The main purpose of knowledge management is to develop a firm's IC by enabling the organisation to consistently develop innovative and efficient solutions to its potential challenges. Therefore, IC directly impacts a firm's growth prospects and financial returns, as empirical research shows that IC affects firm performance (Mukaro *et al.*, 2023) and sustainability (Alvino *et al.*, 2021).

In addition, IC is a well-known concept in economics and accounting; it examines business employees' awareness levels and the flow of knowledge within organisations (Habib and Dalwai, 2024). Furthermore, ICE drives regulatory changes and promotes new knowledge and innovation through research and development. The inclination to reveal ICE is strongly associated with company attributes, such as capitalisation, intangibility, productivity, profitability, and financial structure (Amendola *et al.*, 2023). A firm's performance improves when its individual, group, and organisational knowledge stock increases.

In this regard, research, in the context of intellectual capital, explores multiple directions. Jordão *et al.* (2025) investigated the influence of IC on company value using a sample of 47 Brazilian companies from 2012 to 2020. The conclusions demonstrated that IC directly affects the value of Brazilian firms. Singhania and Panda (2025) analysed the impact of IC disclosure on firm performance using a sample of 72 Indian companies from 2016 to 2020. The findings showed that human capital disclosure favourably influences company performance, while structural and relational capital disclosures have a negative influence. Barak and Sharma (2024) examined the impact of IC on banks' performance using a sample of 23 Indian banks from 2010 to 2021. The findings revealed that IC favourably influences bank performance.

Furthermore, Ghosh (2024) examined the impact of IC disclosure on companies' cost of equity capital using a sample of 43 Indian companies from 2015 to 2019. The findings indicated an inverse association between IC disclosure and equity capital costs. Sharma *et al.* (2024) investigated the effect of IC on the performance of sugar mill firms using a sample of 19 Indian firms from 2012 to 2021. The findings suggested that IC favourably influences a company's performance. Costa *et al.* (2022) investigated the influence of IC investment on the

performance of Brazilian companies using a sample of 957 observations from 2010 to 2018. The findings revealed that IC investment has a significantly positive effect on business performance. Dalwai and Sewpersadh (2023) studied the connection between IC and CS using a sample of 45 tourism businesses in the Middle East from 2014 to 2018. The findings showed no significant association between IC and CS. Mondal and Ghosh (2021) examined the influence of IC disclosure on companies' equity capital costs using a sample of 30 Indian companies from 2018 to 2019. The findings demonstrated an adverse connection between IC disclosure and companies' equity capital costs. D'Amato (2021) analysed the association between IC and CS by selecting Italian non-financial organisations. The findings illustrated a negative association between IC and CS. Suryani and Nadhiroh (2020) explored the effect of IC and CS on firms' performance using a sample of 140 firms in Indonesia from 2015 to 2019. The findings suggested that IC significantly influences firms' performance; however, CS had a negative impact.

According to Chen *et al.* (2004), the key components of ICE significantly influence its business performance and sustainability. Firer and Mitchell Williams (2003) stated that a company needs to have a performance matrix and measurement of intellectual components as they directly influence its performance. In addition, Habib and Dalwai (2024) confirmed that IC plays an essential role as a strategic asset in enriching a company's competitiveness, performance, and asset-managing capacities, consequently, underestimating the risk of financial distress. However, a firm's debt capability relates to its liquidation value (Liu and Wong, 2011). Therefore, debt capability may also be low if the degree of asset redeployment ability is low. In this context, it is reasonable to acknowledge that IC has a low degree of asset redeployment ability, and IC-intensive corporations are anticipated to rely slightly on debt. For this reason, based on the POT and agency theories, it can be hypothesised that firms with ICE are likely to have higher profitability and market value and, hence, be better able to minimise debt financing from various sources. As a result, this study proposes the following hypotheses:

H1a. Firms with higher ICE have lower CSD and CSE.

H1b. Firms with higher CEE have lower CSD and CSE.

H1c. Firms with higher HCE have lower CSD and CSE.

H1d. Firms with higher SCE have lower CSD and CSE.

2.2 Institutional quality and capital structure

CS is a significant factor in determining the business value. The relative levels of equity and debt influence risk and cash flow, and consequently, affect the price an investor would be willing to pay for an ownership stake in the business. According to Handoo and Sharma (2014), choosing a CS financing model is more of a continual step than a final decision. Viviani (2008) asserted the importance of CS and methods to minimise costs and enhance firm value within an ideal CS. Decision-making regarding CS is highly sensitive to all businesses due to its internal and external influence on companies. In addition, when examined globally, decision-making on CS is even more complicated, especially in developing nations, where markets are characterised by institutional and control restrictions (Boateng, 2004). Meanwhile, Groth and Anderson (1997) stated that an organisation must control its CS and establish an optimal level. CS management is affected by imperfections in the capital markets, taxes, and other functional aspects.

Nevertheless, in every organisation, CS management is essential, regardless of the industry. A company's trustworthiness, insolvency risks, financial stability, and growth opportunities may lead to misguided capital structure decisions. To ensure short- and long-term performance, present and future capital structures must be evaluated, and complex risks and opportunities must be determined to retain market share and self-sustainability.

Moreover, IQ is relevant in enhancing business value and financial stability. Chowdhury *et al.* (2024) examined the influence of IQ on sovereign debt and financial resilience employing a sample of 133 countries from 2002 to 2020. The findings demonstrated that IQ positively affects financial stability, whereas government sovereign debt has a negative impact. Danta and Rath (2024) analysed the link between IQ and CS using a sample of 75 microfinance institutions in Asia from 2009 to 2018. The findings indicated that IQ strengthens the development of CS. Dosso (2023) analysed the link between natural resources, IQ, and economic development using a sample of 100 countries from 1996 to 2017. The findings established that an improvement in IQ drastically reduces the adverse influence of natural resources on economic growth. Ramzan *et al.* (2023) examined the effect of IQ on the connection between debt and financial growth in Pakistan, using yearly time series data from 1996 to 2020. The findings suggested that a better IQ could mitigate the adverse effect of debt on financial growth. Cherni (2022) studied the link between IQ and CS using 442 listed firms from ten countries in the MENA region. This study confirms that enhancing IQ can promote the financial development of CS. Adusei and Sarpong-Danquah (2021) used 532 microfinance institutions across 73 nations to explore the impact of IQ on CS. They confirmed that IQ negatively affects CS, suggesting that institutions with high IQ are less likely to use debt.

Based on Matemilola *et al.* (2019), more than 3,891 firms across 23 developing countries were examined, and they concluded that IQ had a significant positive influence on a company's CS in many cases. IQ positively affected CS for 2,187 Asian firms and 1,091 Latin American and Eastern European firms. However, this was insignificant for the 613 African firms. Santarelli and Tran (2018) investigated the link between IQ and CS in Vietnamese companies, using a sample of 2,000 companies from 2003 to 2014. The findings showed that IQ influences CS by deterring debt financing. Öztekin and Flannery (2012) confirmed that IQ helps companies adjust their CS.

Furthermore, the main components of financial and legal traditions affect the adjustment speed. Lower transaction costs result from institutional arrangements when adjusting for leverage. Therefore, based on the POT and agency theories, it can be hypothesised that firms with IQ are likely to have higher performance and profitability and, hence, be better able to minimise debt financing from various sources. As a result, this study suggests the following hypothesis:

H2. Firms with higher IQ have lower CSD and CSE.

3. Methods

3.1 Research design

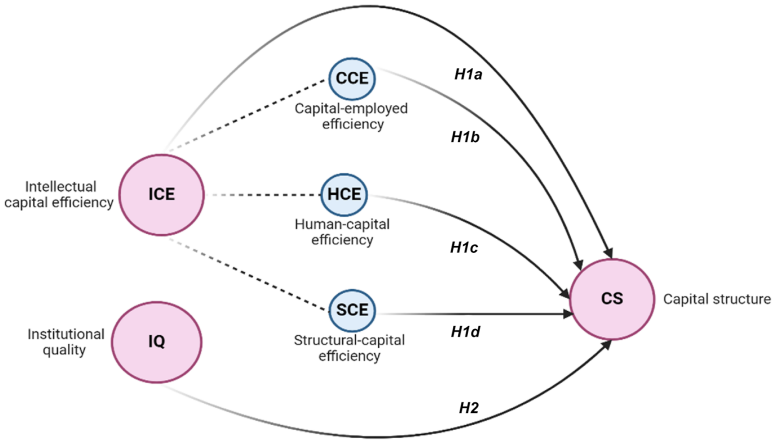
This study explores the influence of ICE and IQ on a firm's CS. Figure 1 illustrates the conceptual model proposed, and an ordinary least squares (OLS) regression was adopted as the main estimator. The OLS estimator is a prevalent and extensively utilised technique for statistical modelling due to its simplicity, effectiveness, and adaptability. It is considered the optimal unbiased estimator according to Gauss-Markov's theorem, as it has the lowest variance (Moser, 1996; Baksalary and Puntanen, 1990).

The models of the study are as follows:

$$CSD_{i,t} = \beta_0 + \beta_1 ICE_{i,t} + \beta_2 IQ_{i,t} + \beta_3 C_{i,t} + \beta_4 \varepsilon_{i,t} \quad (1)$$

$$CSE_{i,t} = \beta_0 + \beta_1 ICE_{i,t} + \beta_2 IQ_{i,t} + \beta_3 C_{i,t} + \beta_4 \varepsilon_{i,t} \quad (2)$$

where i represents the firm and t is the time (year). CSD denotes a firm's CS from debt, while CSE indicates a firm's CS from equity. ICE measures a firm's IC efficiency, whereas IQ captures the firm's institutional quality. C represents a set of control variables that correspond to McDermott's (2023) guidance, such as firm size (SIZE) as a proxy for a scale on which a



Source(s): Own elaboration

Figure 1. The conceptual model

firm operates; firm profitability (PRO) as a proxy for financial performance; current ratio (CR) as a proxy for liquidity; year fixed-effect (τ); industry fixed-effect ($\mathit{Я}$); and $\mathit{\mathcal{E}}$ represents the error term. Table 1 presents the definitions of the variables.

For further analysis regarding ICE, this study also assesses the influence on CS of the ICE sub-key components, such as CEE, HCE, and SCE, as follows:

$$CSD_{i,t} = \beta_0 + \beta_1\, CEE_{i,t} + \beta_2\, HCE_{i,t} + \beta_3\, SCE_{i,t} + \beta_4\, IQ_{i,t} + \beta_5\, C_{i,t} + \beta_6\, \mathfrak{E}_{i,t} \quad (3)$$

$$CSE_{i,t} = \beta_0 + \beta_1\, CEE_{i,t} + \beta_2\, HCE_{i,t} + \beta_3\, SCE_{i,t} + \beta_4\, IQ_{i,t} + \beta_5\, C_{i,t} + \beta_6\, \mathfrak{E}_{i,t} \quad (4)$$

where *i* represents the firm and *t* is the time (year). CSD denotes a firm's CS from debt, while CSE indicates a firm's CS from equity. CEE measures a firm's capital-employed efficiency,

Table 1. Variable definitions

Variable	Definition
CSD	A firm's CS from debt is calculated by dividing total debt by the book value of its total assets (Ferris *et al.*, 2018; Ozdagli, 2012)
CSE	A firm's CS from equity is calculated by dividing total debt by the market value of its total assets (Ferris *et al.*, 2018; Ozdagli, 2012)
ICE	A firm's ICE is calculated using the value-added intellectual coefficient, which consists of CEE, HCE, and SCE (Acuña-Opazo and González, 2021; Isola *et al.*, 2020)
CEE	A firm's CEE is calculated by dividing value-added by capital employed (Acuña-Opazo and González, 2021; Isola *et al.*, 2020)
HCE	A firm's HCE is calculated by dividing value added by human-capital costs (Acuña-Opazo and González, 2021; Isola *et al.*, 2020)
SCE	A firm's SCE is calculated by dividing capital structure by value added (Acuña-Opazo and González, 2021; Isola *et al.*, 2020)
IQ	A firm's IQ was calculated using the institutional governance index (Canh *et al.*, 2021; Tresierra and Reyes, 2018)
SIZE	A firm's SIZE is calculated using the natural logarithm of its total assets (Habib and Mourad, 2024b)
PRO	A firm's PRO is calculated by dividing net income by total assets (Acuña-Opazo and González, 2021)
CR	A firm's CR is calculated by dividing current assets by current liabilities (Dalwai *et al.*, 2023)

Source(s): Authors' own elaboration

whereas HCE captures a firm's human-capital efficiency. Similarly, SCE reflects a firm's structural-capital efficiency, and IQ characterises a firm's institutional quality features that could promote the implementation of financial contracts, affecting the cost of borrowing and CS policy (Chang *et al.*, 2014). *C* represents a set of control variables following McDermott's (2023) guidance, such as firm size (SIZE) as a proxy for the scale on which a firm operates; firm profitability (PRO) as a proxy for financial performance; current ratio (CR) as a proxy for liquidity; year-fixed effect (τ); industry fixed-effect ($\mathit{Я}$); while $\mathit{\mathcal{E}}$ represents the error term. Table 1 presents the definitions of the variables.

3.2 Data

This research uses a sample of Indian companies from 2015 to 2019. During this period, the human capital index per person in India increased from 2.077 in 2015 to 2.171 in 2019. This indicates a moderate and increased level over time compared with other countries. For instance, Pakistan achieved 1.778 and 1.770 in 2015 and 2019, respectively. In addition, it should be noted that during this period, Singapore was largely classified first in terms of this index, achieving 3.657 in 2015 and 4.351 in 2019. The annual data were gathered from the S&P database. Out of the 78 firms originally included in this study, 37 were excluded due to insufficient data. As a result, the sample consists of 41 firms, with 205 firm-year observations.

Furthermore, Indian companies are advancing economically because of common policies that promote global development, particularly with their partners in Latin America (Domínguez, 2023; Giordano *et al.*, 2019). Today, India and Latin America are more economically interdependent than ever before. Modernising India-Latin American ties is a key goal, and the improvement in economic relations in recent years is driven by increased political will on both sides (Domínguez, 2023). Latin American leaders are increasingly likely to strengthen their relations with India, particularly with Brazil, which maintains close political ties with India. The participation of India and Brazil in multilateral groupings, such as BRICS, IBSA, and the G20, may explain this (Rodríguez *et al.*, 2023).

3.3 Analytical procedures

This study follows an empirical approach to explore the effect of ICE and IQ on a firm's CS. Regressions and additional analyses were conducted to fulfil the research objectives. OLS regression was adopted as the main estimator to test the hypotheses. Simultaneously, OLS regression with a bootstrapping technique of 5,000 replications, a generalised least squares (GLS) estimator, and a generalised method of moments (GMM) were used as additional analyses.

4. Results

4.1 Explanatory statistics

Table 2 presents the statistics on the study variables. The mean statistic of CSD is approximately 5.341, with a minimum of zero and a maximum of 373.8, indicating a low CS level from debt in the context of Indian firms. The CSE mean is approximately 0.326, with a minimum of −1.625 and a maximum of 1, suggesting a relatively high CS level from equity for Indian firms. The ICE mean is approximately 37.96, with a minimum of zero and a maximum of 431.3, highlighting a low ICE level for Indian firms. The CEE mean is approximately 1.1, with a minimum of zero and a maximum of 31.11, illustrating a low capital-employed efficiency level for Indian firms. The HCE mean is approximately 36.17, with a minimum of zero and a maximum of 425.8, showing a low human-capital efficiency level for Indian firms. The SCE mean is approximately 0.695, with a minimum of zero and a maximum of 1, revealing a relatively high structural-capital efficiency level for Indian firms. The IQ mean is approximately 46.72, with a minimum of 45.73 and a maximum of 47.89, suggesting a moderate IQ level for Indian firms. The SIZE mean is approximately 1.539, with a minimum

Table 2. Descriptive statistics

Variable	Obs.	Mean	Std. dev.	Min	Max
CSD	205	5.341	29.40	0.000	373.8
CSE	205	0.326	0.273	−1.625	1.000
ICE	205	37.96	72.21	0.000	431.3
CEE	205	1.100	3.650	0.000	31.11
HCE	205	36.17	71.71	0.000	425.8
SCE	205	0.695	0.337	0.000	1.000
IQ	205	46.72	0.978	45.73	47.89
SIZE	205	1.539	1.351	−2.398	3.822
PRO	205	0.144	0.541	0.000	6.275
CR	205	2.408	7.803	0.021	84.67

Note(s): Variables include CSD (CS from debt), CSE (CS from equity), ICE (IC efficiency), CEE (capital-employed efficiency), HCE (human-capital efficiency), SCE (structural-capital efficiency), IQ (institutional quality), SIZE (firm size), PRO (profitability), and CR (current ratio)
Source(s): Authors' own elaboration

of −2.398 and a maximum of 3.822, indicating a relatively large size of Indian firms. The PRO mean is approximately 0.144, with a minimum of zero and a maximum of 6.275, revealing a low profitability level for Indian firms. The CR mean is approximately 2.408, with a minimum of 0.021 and a maximum of 84.67, highlighting a low liquidity level for Indian firms.

4.2 Correlation statistics

Table 3 presents the correlation statistics and tests for multicollinearity. Panel A illustrates the statistics for the first and second study models. The results showed that the CSD correlated positively and significantly with ICE and SIZE, suggesting that ICE and firm size may influence CS from debt, which is verified using the OLS estimator. In addition, the results indicated that CSE correlated significantly and positively with IQ, SIZE, and PRO, whereas CSE correlated negatively and significantly with CR, showing that institutional quality, firm size, profitability, and liquidity may influence CS from equity, which is verified using the OLS estimator. Furthermore, the correlation results were useful for identifying potential multicollinearity between the elucidative variables. A pairwise correlation over 0.85 between independent variables indicates a notable multicollinearity issue (Habib, 2023a, b). The statistics also showed that none of the elucidative variables had a coefficient exceeding 0.85, and that the tolerance and variance inflation factor (VIF) measures ranged from 0.867 to 0.980 and from 1.02 to 1.15, respectively. These results confirm the absence of multicollinearity among the study variables for the first and second study models.

Panel B displays the statistics for the third and fourth study models. The statistics revealed that the CSD correlated positively and significantly with CEE, HCE, SCE, and SIZE. This finding suggests that CEE, HCE, SCE, and firm size may influence CS from debt, as verified using the OLS estimator. The results showed that CSE correlated significantly and positively with CEE, IQ, SIZE, and PRO, while it exhibited a significant negative correlation with CR. These statistics suggest that capital-employed efficiency, institutional quality, firm size, profitability, and liquidity may influence CS from equity, as verified using the OLS estimator. In addition, the statistics indicate that none of the elucidative variables have a coefficient exceeding 0.85, and that the VIF and tolerance measures range from 1.02 to 1.29 and from 0.778 to 0.980, respectively. These results confirm the absence of multicollinearity for the third and fourth study models.

4.3 Regression analysis

Table 4 shows the OLS regression results of the study models. The results demonstrated a significant and positive effect of ICE on CSD ($\beta = 0.053$; $t = 2.21$; $p < 0.05$) and a negative and

Table 3. Pairwise correlations and testing multicollinearity

Panel A: Model 1 and 2

	CSD	CSE	ICE	IQ	SIZE	PRO	CR
Variables							
CSD	1.000						
CSE	0.104	1.000					
ICE	0.205***	0.110	1.000				
IQ	−0.035	0.142**	0.088	1.000			
SIZE	0.173**	0.238***	0.236***	0.010	1.000		
PRO	−0.023	0.118*	−0.015	0.104	−0.233***	1.000	
CR	−0.041	−0.144**	−0.077	0.021	−0.182***	0.023	1.000
Criterion							
VIF	–	–	1.07	1.02	1.15	1.07	1.04
Tolerance	–	–	0.935	0.980	0.867	0.933	0.964

Panel B: Models 3 and 4

	CSD	CSE	CEE	HCE	SCE	IQ	SIZE	PRO	CR
Variables									
CSD	1.000								
CSE	0.104	1.000							
CEE	0.780***	0.164**	1.000						
HCE	0.166**	0.103	0.072	1.000					
SCE	0.130**	0.024	0.135*	0.423***	1.000				
IQ	−0.035	0.142**	0.033	0.087	0.054	1.000			
SIZE	0.173**	0.238***	0.145**	0.230***	0.102	0.010	1.000		
PRO	−0.023	0.118*	0.220***	−0.027	0.094	0.104	−0.233***	1.000	
CR	−0.041	−0.144**	−0.048	−0.076	0.030	0.021	−0.182***	0.023	1.000
Criterion									
VIF	–	–	1.11	1.29	1.25	1.02	1.19	1.16	1.04
Tolerance	–	–	0.902	0.778	0.798	0.980	0.838	0.862	0.959

Note(s): Variables include CSD (CS from debt), CSE (CS from equity), ICE (IC efficiency), CEE (capital-employed efficiency), HCE (human-capital efficiency), SCE (structural-capital efficiency), IQ (institutional quality), SIZE (firm size), PRO (profitability), and CR (current ratio). ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively

Source(s): Authors' own elaboration

negligible effect on CSE ($\beta = -0.080e{-}3$; $t = -0.31$; $p > 0.05$). This suggests that ICE, as a knowledge management strategy, influences a firm's CS from debt compared to its CS from equity at a threshold of 0.05. Therefore, H1a is partially supported. This conclusion partially aligns with Liu and Wong's (2011) finding that IC is positively associated with leverage in US firms. The ICE sub-dimension findings indicated a significant and positive effect of CEE on CSD ($\beta = 6.623$; $t = 2.83$; $p < 0.05$) and CSE ($\beta = 0.007$; $t = 1.75$; $p < 0.10$). This suggests that capital-employed efficiency influences a firm's CS from debt compared to CS from equity at a threshold of 0.05. Therefore, H1b is not supported. This finding highlighted a significant and positive effect of HCE on CSD ($\beta = 0.035$; $t = 1.89$; $p < 0.10$), and a positive and negligible effect on CSE ($\beta = 0.019e{-}2$; $t = 0.77$; $p > 0.05$). This suggests that, at a threshold of 0.05, human-capital efficiency does not influence a firm's CS from debt and equity. Therefore, H1c is not supported. SCE had a negative and negligible effect on CSD ($\beta = -4.250$; $t = -1.52$; $p > 0.05$) and CSE ($\beta = -0.042$; $t = -0.53$; $p > 0.05$). This suggests that structural-capital efficiency negatively influenced a firm's CS in terms of debt and equity, but this was not supported at a threshold of 0.05. Therefore, H1d is partially supported. IQ had a positive and negligible effect on CSD ($\beta = 0.730$; $t = 0.38$; $p > 0.05$) and CSE ($\beta = 0.028$; $t = 0.86$;

Table 4. Regression results

Variables	CSD	CSE	CSD	CSE
ICE	0.053**	-0.080^{e-3}	–	–
	(0.024)	(0.026^{e-2})		
CEE	–	–	6.623***	0.007*
			(2.341)	(0.004)
HCE	–	–	0.035*	0.019^{e-2}
			(0.019)	(0.025^{e-2})
SCE	–	–	−4.250	−0.042
			(2.788)	(0.078)
IQ	0.730	0.028	−0.272	0.034
	(1.913)	(0.033)	(0.809)	(0.021)
SIZE	2.196**	0.057***	−0.583	0.047**
	(1.080)	(0.019)	(0.769)	(0.020)
PRO	1.260	0.110***	−10.21**	0.075***
	(0.951)	(0.019)	(4.254)	(0.028)
CR	0.003	−0.003**	0.042	−0.003***
	(0.038)	(0.001)	(0.038)	(0.001)
τ	Yes	Yes	Yes	Yes
Я	Yes	Yes	Yes	Yes
_cons	−37.67	−1.161	14.16	−1.323
	(88.67)	(1.517)	(37.40)	(0.911)
Obs	205	205	205	205
R^2	0.086	0.217	0.684	0.123
Prob > F	>0.05	>0.05	>0.05	>0.05

Note(s): Variables include CSD (CS from debt), CSE (CS from equity), ICE (IC efficiency), CEE (capital-employed efficiency), HCE (human-capital efficiency), SCE (structural-capital efficiency), IQ (institutional quality), SIZE (firm size), PRO (profitability), CR (current ratio), τ (year fixed-effects), Я (industry fixed-effects). The standard errors in the model are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively

Source(s): Authors' own elaboration

$p > 0.05$). This suggests that IQ does not influence a firm's CS regarding debt or equity at a threshold of 0.05. Therefore, H2 is not supported.

In addition, the findings revealed a significant and positive effect of SIZE on the CSD ($\beta = 2.196$; $t = 2.03$; $p < 0.05$) and CSE ($\beta = 0.057$; $t = 2.91$; $p < 0.05$). This suggests that firm size influences a firm's CS through debt and equity at a threshold of 0.05. PRO had a positive and negligible effect on CSD ($\beta = 1.260$; $t = 1.33$; $p > 0.05$), and a significant and positive effect on CSE ($\beta = 0.110$; $t = 5.71$; $p < 0.05$). This suggests that firm profitability influences a firm's CS from equity compared with CS from debt at a threshold of 0.05. The findings revealed a positive and negligible effect of CR on CSD ($\beta = 0.003$; $t = 0.08$; $p > 0.05$), and a negative and significant effect on CSE ($\beta = -0.003$, $t = -2.38$, $p < 0.05$). This means that firm liquidity influences a firm's CS from equity compared with CS from debt at a threshold of 0.05.

4.4 Additional analyses

4.4.1 The endogeneity issue. Within the realm of statistical analysis, endogeneity is a significant issue that can result in biased findings or incorrect results. To address endogeneity, it is essential to identify its sources and implement appropriate strategies (Zimon *et al.*, 2024a; Habib, 2022). In this context, to determine whether bias exists in the model and verify its suitability, Ramsey's functional misspecification test was utilized to assess the functional form. The results confirmed that the measures used were appropriate for model 1 (Prob > F = 0.1899; >0.05), model 2 (Prob > F = 0.5220; >0.05), model 3 (Prob > F = 0.1370; >0.05), and model 4 (Prob > F = 0.6769; >0.05). This procedure

demonstrates that the models and statistical analyses are reliable and offer precise insight into the phenomena under investigation.

4.4.2 Robustness analyses. For the robustness analyses, OLS regression with a bootstrapping technique of 5,000 replications, a GLS estimator, and a GMM estimator were used to match the robustness of the results reported by applying OLS regression. This study investigated whether implementing various strategies leads to significant differences in the findings.

Table 5 presents the findings of the additional analysis. According to the fundamental findings illustrated in Table 4, the basic coefficients have the same level of statistical importance and follow the same path. The results demonstrated a significant and positive effect of ICE on CSD under all additional analysis models, and an insignificant and negative effect on CSE under all additional analysis models. This refers to the same statistical importance and path level according to the fundamental findings. The CEE findings indicated a positive and significant effect on CSD and CSE in the additional analysis models. The HCE findings revealed a positive and substantial effect on the CSD under all additional analysis models. According to the fundamental findings, this refers to the same statistical importance and path level. Through these procedures, it can be ensured that the models are robust and offer precise insights into the phenomena under investigation.

5. Discussion

Scholars have emphasised the importance of knowledge management in improving performance (Jordão *et al.*, 2025; Costa *et al.*, 2022; Acuña-Opazo and González, 2021; Isola *et al.*, 2020). ICE offers many privileges as a knowledge management strategy. Jordão *et al.* (2025) confirmed that IC positively influences the value of Brazilian companies, and Costa *et al.* (2022) demonstrated that investment in IC significantly influences the performance of Brazilian companies.

As an extension of previous studies on this matter, the present research explored the effect of ICE and IQ on CS in Indian firms as an emerging market. The findings showed a positive and significant effect of ICE on CSD. In other words, the higher the efficiency of a firm's IC, the more it tends to finance its CS through debt, rather than equity. This finding is partially consistent with Liu and Wong's (2011) conclusion that IC is positively associated with leverage in US firms. On the other hand, this finding is inconsistent with D'Amato's (2021) study, which concluded that IC negatively affects CSD in Italian firms, and with Jin and Xu's (2022) study, which found that CSD decreases in Chinese companies with higher levels of IC. Likewise, the findings suggested that CEE and HCE are the main IC sub-dimensions influencing a firm's CSD compared to equity. In other words, the more efficiently a company's human capital and capital employed, the more it tends to finance its CS through debt rather than equity. Moreover, the findings indicated no significant effect of IQ on CS as well as a significantly positive effect of firm size on a firm's CS from debt in the first model, whereas profitability had a negative effect on a firm's CS from debt in the third model. The findings also suggested a significantly positive effect of firm size and profitability on a firm's CS from equity, whereas the current ratio exhibited a negative effect.

According to the agency theory, firms with intangible prospects should decrease their debt levels to mitigate potential agency issues. As a result, ICE findings were not expected from the theory, as theoretical and empirical CS research has shown that a corporation can support more outstanding debt if its investments are primarily in physical assets. Generally, companies are oriented towards developing optimal capital management strategies to ensure effective financial processes (Zimon *et al.*, 2024b). However, corporations with significant intangible investments must restrict high-risk debts (Kedzior *et al.*, 2020; Villadsen *et al.*, 2017; Faulkender and Petersen, 2006). Consequently, it would be wise to avoid financing intangible investments with debt, as they are riskier than physical assets. Tangible assets are safer and easier to appraise than intangibles, which are unattainable debt collaterals. In addition,

Table 5. Robustness analysis

Variables	CSD Bootstrap	GLS	GMM	CSE Bootstrap	GLS	GMM	CSD Bootstrap	GLS	GMM	CSE Bootstrap	GLS	GMM
ICE	0.053**	0.049**	0.063**	-0.080^{e-3}	-0.049^{e-3}	-0.092^{e-3}	–	–	–	–	–	–
	(0.026)	(0.022)	(0.030)	(0.027^{e-2})	(0.020^{e-2})	(0.013^{e-2})						
CEE	–	–	–	–	–	–	6.623***	6.623***	5.623**	0.007*	0.004*	0.002
							(2.493)	(2.327)	(2.413)	(0.004)	(0.002)	(0.004)
HCE	–	–	–	–	–	–	0.035*	0.035*	0.042*	0.019^{e-2}	-0.011^{e-2}	-0.048^{e-2}
							(0.021)	(0.020)	(0.021)	(0.025^{e-2})	(0.024^{e-2})	(0.045^{e-2})
SCE	–	–	–	–	–	–	−4.250	−4.250	−2.375	−0.042	0.007	0.155
							(2.852)	(2.651)	(1.462)	(0.078)	(0.113)	(0.202)
IQ	0.730	0.791	−7.479	0.028	0.029	−0.012	−0.272	−0.272	−5.250	0.034	0.035*	−0.015
	(1.910)	(1.809)	(8.375)	(0.033)	(0.035)	(0.042)	(0.929)	(0.826)	(3.982)	(0.021)	(0.021)	(0.020)
SIZE	2.196*	2.222*	16.64	0.057***	0.061*	0.236**	−0.583	−0.583	7.946	0.047**	0.059*	0.199***
	(1.166)	(1.242)	(13.39)	(0.020)	(0.032)	(0.122)	(0.795)	(0.911)	(10.26)	(0.021)	(0.031)	(0.043)
PRO	1.260	1.220	4.584	0.110	0.072***	0.064***	−10.21**	−10.21***	−0.265	0.075***	0.064***	0.043***
	(3.145)	(1.004)	(5.493)	(0.072)	(0.020)	(0.022)	(6.716)	(3.756)	(2.901)	(0.108)	(0.015)	(0.015)
CR	0.003	0.008	0.120	−0.003	−0.001	0.029^{e-2}	0.042	0.042	0.083	−0.003	−0.001	−0.001
	(0.254)	(0.043)	(0.151)	(0.004)	(0.001)	(0.047^{e-2})	(0.087)	(0.039)	(0.097)	(0.004)	(0.001)	(0.001)
τ	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Я	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
_cons	−37.67	−40.52	328.1	−1.161	−1.211	0.501	14.16	14.16	−23.92	−1.323	−1.480	0.323
	(88.91)	(83.44)	(375.3)	(1.496)	(1.615)	(2.640)	(43.00)	(38.16)	(177.8)	(0.916)	(0.907)	(0.835)

Note(s): Variables include CSD (CS from debt), CSE (CS from equity), ICE (IC efficiency), CEE (capital-employed efficiency), HCE (human-capital efficiency), SCE (structural-capital efficiency), IQ (institutional quality), SIZE (firm size), PRO (profitability), CR (current ratio), τ (year fixed-effects), Я (industry fixed-effects). The standard errors in the model are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively

Source(s): Authors' own elaboration

intangible assets are linked to more complicated information than tangible assets, as their value is ambiguous (D'Amato, 2021). As a result, managers must determine the best funding and financial structure to support a firm's sustainability. Given the importance of finance for development and sustainability, managers are more likely to choose equity over debt to finance investments in organisations with high intangible asset ratios. However, firms commonly seek an effective or ideal level of debt based on the TOT, considering the associated financial benefits and costs (Yakubu *et al.*, 2021).

One benefit of debt financing is that a company retains its sole ownership without sharing it with others (Thakur *et al.*, 2023; Henrique *et al.*, 2021; Rodrigues *et al.*, 2017). When a company borrows money from a financial institution or from another lender, it has to make timely payments for the entire duration of the loan. Conversely, if a company relinquishes or distributes its ownership stake in the form of stocks in return for financial support, it may be dissatisfied with the external influence on its business (Poursoleyman *et al.*, 2023; Sadiq *et al.*, 2023). Moreover, managers and stockholders may incur lower agency costs if they use debt. On the one hand, debt limits free cash flow, which business leaders can then squander. Thus, creditors are more likely to closely monitor the actions of their debtors.

5.1 Theoretical implications

From a theoretical stance, the outcomes demonstrate that the higher the efficiency of a company's IC, the more it tends to finance its CS through debt rather than equity. As a result, managers are expected to adopt an adequate level of debt based on the TOT, considering the associated financial benefits and costs. In this context, agency costs between managers and stockholders may be reduced. CS through debt will limit the available free cash flows, which may be incorrectly oriented, and will push creditors, especially those with more influencing power, to more efficiently monitor the activities of their managers. Moreover, the results of most models confirm that the larger the firm, the more it tends to finance CS through debt and equity. As a result, it is expected that managers adopt a balanced level of debt and equity based on the TOT and POT. However, the results confirm that the larger a firm's profitability, the more it tends to finance its CS through equity and the less it tends to finance its CS through debt. Thus, it is expected that managers adopt a balanced level of debt and equity. This supports the POT. In addition, the results confirm that the larger the firm's current ratio, the less it tends to finance its CS through equity. Consequently, managers are expected to adopt a balanced level of equity, mitigating the knowledge asymmetry between managers and investors. This supports the POT.

5.2 Managerial implications

This study supports the practical perspective that knowledge management is one of the pivotal decisions that ensures the sustainability of any business, and is considered a worthwhile strategy for competition and development (Gorry and Westbrook, 2013). This study also presents substantial empirical implications that may empower leaders to adopt an optimal CS mix to enhance the continuous improvement of CS. This opens up the possibility for managers to focus on embracing sound strategies to improve the efficiency of firms, even if the improvement is small, as a continuous improvement process always initiates with a single step (Habib, 2024; Nuta *et al.*, 2024).

Moreover, this study makes a novel contribution to the literature on CS by examining unexplored factors, such as ICE, ICE sub-dimensions, and IQ, as potential determinants of CS. These insights could help firms adopt optimal CS strategies and guide future research on ICE and IQ as CS determinants.

5.3 Future research agenda

This study explored the influence of ICE and IQ on CS in Indian firms as an emerging market. Therefore, future research could benefit from investigating other regions, and could also

include additional factors, such as corporate governance efficiency, real earnings management, working capital management efficiency, competitive business strategies, and managerial ability, which are notable attributes of the CS policies.

6. Conclusions

This study investigated the influence of ICE and IQ on Indian firms' CS as an emerging market. The findings revealed a positive and significant effect of ICE and a firm's CS from debt. The outcomes also demonstrated that CEE and HCE are the main IC sub-dimensions influencing a firm's CS. However, the findings showed no significant influence of IQ on CS. Moreover, they demonstrated that the more substantial a firm is, the more it cares about financing its CS through debt and equity. They also revealed that the more significant a firm's profitability, the more it cares about financing its CS through equity, and the less it tends to finance its CS through debt. Conversely, the findings showed that the larger the firm's current ratio, the less it tends to finance its CS through equity.

Furthermore, this study supports the POT and agency theories. Additionally, it contributes to the finance and entrepreneurship literature by exploring previously unexplored factors, such as ICE as a knowledge management strategy, ICE sub-dimensions, and IQ as potential determinants of CS in Indian firms' CS as an emerging market, which could help firms adopt optimal CS. In addition, this study emphasises that IC, as a knowledge management strategy, is a pivotal choice that supports firm CS. It provides a vision that enables leaders to effectively support their CS. This opens up an opportunity for decision-makers to focus on adopting sound strategies to improve the efficiency of firms, even if the improvement is small, as the continuous improvement process always begins with a single step.

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