The impacts of intellectual capital of microfinance institutions on poverty alleviation

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ABSTRACT

This study examines the impact of Intellectual Capital (IC) on poverty alleviation using a panel dataset of 3,114 Microfinance Institutions (MFIs) across 120 countries from 2009 - 2018. Intellectual capital is measured using the Value Added Intellectual Coefficient (VAIC), which comprises Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE), and relational Capital Efficiency (CEE). The study adopts the Generalized Method of Moments (GMM) as the primary estimation technique to address potential endogeneity and dynamic relationships. The findings indicate that overall intellectual capital positively and significantly affects poverty alleviation. However, the impacts of its components are mixed. While relational capital contributes positively to poverty reduction, human capital shows no statistically significant effect, and structural capital efficiency unexpectedly displays a negative association with poverty mitigation. As a result, rather than merely expanding human capital, emphasis should be placed on skill specialization to improve efficiency. Additionally, fostering gradual technological adoption and facilitating knowledge-sharing can help optimize structural capital deployment, ultimately enhancing poverty reduction outcomes.

1. Introduction

Many developing countries have exerted considerable efforts to find suitable measures to combat poverty and promote economic development. Research by Quinones and Remenyi (2000) highlights access to financial services as crucial for enhancing the income and productivity of low-income people. Microfinance, facilitated by Microfinance Institutions (MFIs), has become a widely adopted approach. By providing small loans, savings, and insurance to low-income communities excluded from traditional banking, MFIs promote self-employment and income generation (Chikwira et al., 2022; Irobi et al., 2008). These services help stabilize household expenditures, build resilience to economic shocks, and ultimately break the cycle of poverty (Samer et al., 2015). In India, Latifee (2003) finds that 40% of clients moved from extreme to moderate poverty with services provided by MFIs. Ghulam Hussain et al. (2019) also report an 8% rise in self-employment hours among 2,500 Bangladeshi households participating in MFIs initiatives.

While the provision of financial capital is fundamental, the long-term effectiveness of MFIs largely depends on their effective utilization and development of Intellectual Capital

(IC). IC, including human capital, structural capital, and relational capital, is crucial in strengthening MFIs' overall performance (Majumder et al., 2023; Navin & Sinha, 2021). Prior studies highlight IC as a driver of long-term sustainability (Bontis et al., 2000; Edvinsson & Malone, 1997). Similarly, IC strongly predicts competitive advantage, with relational, structural, and human capital contributing significantly (Hashim et al., 2018; Kamukama & Sulait, 2017).

As poverty persists as a significant global challenge, understanding the role of IC in enhancing MFIs' poverty mitigation capacity becomes increasingly vital. Existing literature predominantly examines the impact of IC on MFIs' social outreach capacity, which is widely regarded as a proxy for poverty alleviation. This perspective is justified because poverty reduction constitutes a fundamental social objective of MFIs (Fadikpe et al., 2022). Since social performance is a direct measure of the MFIs' ability to fulfill their poverty alleviation mission, effective social performance management enables these institutions to expand outreach to marginalized communities and improve their economic well-being (Khalid & Kamaruddin, 2019; Ledgerwood, 2013).

Accordingly, a critical gap remains in understanding how IC and its components directly contribute to poverty reduction. This study seeks to bridge this gap by addressing three core objectives: first, to clarify the theoretical basis for the impact of the intellectual capital of microfinance institutions on poverty reduction; second, to provide empirical evidence for the effects of the intellectual capital of microfinance institutions on poverty reduction; and third, to propose recommendations to enhance poverty alleviation outcomes by leveraging intellectual capital within microfinance institutions.

2. Literature review and hypothesis development

2.1. Literature review

2.1.1. Concepts of microfinance institutions and intellectual capital

Microfinance Institutions (MFIs) are organizations established to allow easier ways to obtain loans than conventional banking (Tripathi, 2015). Generally, these institutions provide various services, including loans, savings, insurance, and remittance transfers to clients restricted from the formal banking sector (Meyer & Nagarajan, 2006). MFIs operate under the premise that providing financial support to people experiencing poverty is an effective strategy for alleviation (Quinones & Remenyi, 2000). Specifically, services provided by those institutions to underserved communities can help them increase their income levels and productivity by acquiring productive assets for self-employment (Chikwira et al., 2022). Somewhat similar to other organizations, MFIs assess their growth potential based on their performance, which then relies on the availability of capital in the organizations. Traditionally, capital is measured as the financial capacity to generate returns on lending products (Wirasedana et al., 2024). However, moving toward a knowledge-based economy where knowledge, information, and soft assets hold more importance alongside financial capital, IC is one of the prominent factors contributing to the growth and competitiveness of MFIs (Hashim et al., 2018).

As conceptualized, Intellectual Capital (IC) is an organization's valuable knowledge asset. It is further implied that it is the accumulated organizational knowledge and intelligent action (Edvinsson & Malone, 1997). Numerous articles have a broad consensus on the dimensions of IC, including three components: human capital, structural capital, and relational capital. Initially, human capital is employees' abilities, expertise, attitudes, and

mindset essential for creating organizational values (Roos et al., 1997; Snell & Dean, 1992). Secondly, structural capital is the underlying infrastructure that facilitates an organization's innovative capabilities and human effectiveness (Saint-Onge, 1996). Finally, relational capital, or customer capital, refers to a firm's relationships with its stakeholders externally and internally, as well as their satisfaction and loyalty (Bontis et al., 2000; Roos et al., 1997). In several studies, the term "capital employed" is alternatively used for this type of capital (Vidyarthi & Tiwari, 2019).

2.1.2. Impacts of intellectual capital within microfinance institutions on poverty alleviation

To date, no existing studies have explicitly examined the direct impacts of IC within MFIs on poverty alleviation. Existing literature mainly involves synthesizing evidence on the broader link between IC and MFIs' social performance. Researchers define social performance as MFIs' capacity to meet the immediate needs of impoverished populations and contribute to long-term improvements in their living conditions (Fadikpe et al., 2022).

a. Direct impacts of intellectual capital on microfinance institutions' social outreach

The extant literature consistently supports a positive correlation between IC and MFIs' social performance. Ahamad et al. (2022) and Barpanda and Bontis (2021) indicate that IC positively and significantly influences social efficiency, implying that MFIs with higher IC can reduce poverty.

However, the impact of each component of IC on MFIs' social outreach, and thus poverty alleviation, presents a mixed picture. Ahamad et al. (2022) find Human Capital Efficiency (HCE) and relational Capital Efficiency (CEE) insignificant to MFIs' social performance. Meanwhile, Hashim et al. (2015) confirm that relational capital contributes more to organizational performance than other types of capital, implying that strong client relationships are crucial for expanding financial inclusion and reducing poverty. Conversely, Adesina (2019) argues that only HCE positively impacts all efficiency measures, emphasizing the importance of skilled staff in tailoring services to impoverished clients.

Research consistently demonstrates that comprehensive IC enhances firm efficiency, directly impacting social outreach and poverty reduction. Kamaluddin and Rahman (2013) show that MFIs with balanced IC possess greater resources, achieving a sustained competitive advantage in serving impoverished communities through tailored financial services. Conversely, Hermans and Kauranen (2005) emphasize that skilled human capital alone is insufficient; efficient processes and strong stakeholder relations are equally vital for successful social outreach. Consequently, well-organized organizational structures, knowledgeable and professional employees, and efficient service enhance the performance of the MFIs in empowering impoverished individuals and driving sustainable livelihood improvements.

b. Indirect impacts of intellectual capital on microfinance institutions' social outreach

Robust IC within MFIs can indirectly amplify poverty reduction by bolstering financial sustainability, defined as the capacity for profitable and self-sufficient operations. Financially efficient MFIs, driven by effective utilization of IC, are better equipped to achieve their social goals, including poverty alleviation (Ahamad et al., 2022; Khalid & Kamaruddin, 2019; Vidyarthi & Tiwari, 2019). This can be attributed to the fact that MFIs with well-managed ICs are more self-sufficient in extending credit and services to underserved populations.

Specifically, using the institutional approach, Waddock and Graves (1997) posit that financial soundness provides MFIs with the necessary resources and competencies to achieve

social missions in alleviating poverty. Being financially sustainable allows MFIs to grow and serve impoverished entrepreneurs without the constraints imposed by donor budgets (Morduch, 2000). Quayes (2012) showed evidence that strong financial efficiency is linked to increased outreach to poor people in Africa, East Asia, and the Pacific. These findings suggest that by strengthening financial sustainability, MFIs expand their capacity to serve marginalized communities.

In summary, while existing literature has extensively explored the impact of IC on MFI's social performance, a direct link between IC and poverty alleviation remains understudied. Additionally, most studies are conducted within a single-country context, for instance, Hashim et al. (2018) in Malaysia, Irobi et al. (2008) in Nigeria, and Ndambuki and Alala (2014) in Kenya. Therefore, our study differs by examining the direct link between IC and its components on poverty reduction through a large sample of nations.

2.2. Hypotheses

The positive impact of IC can extend beyond financial metrics by influencing social outreach efforts (Ahamad et al., 2022). To be more specific, effective utilization of IC can enhance the ability of MFIs to reach underserved populations, thereby contributing to poverty reduction. Hashim et al. (2018) demonstrate that IC positively influences the performance of MFIs by optimizing the allocation of physical and financial resources, leading to more efficient lending practices and improved outcomes for poor households. These arguments lead to the following hypothesis:

H1: Intellectual capital within microfinance institutions positively affects poverty reduction

As part of IC, human capital is believed to be a firm's core. Through training and skill development, MFIs can increase employee effectiveness and satisfaction, improving organizational performance (Ahamad et al., 2016). Nawaz and Haniffa (2017) highlight that human capital is crucial as employees must combine extensive knowledge, skills, and expertise to offer innovative products. For MFIs, investing in human capital equips employees with the ability to assess loan applications accurately, provide tailored advice, and support clients in achieving financial goals. Therefore, we hypothesize that:

H1a: Human capital within microfinance institutions positively affects poverty reduction

As noted by Ling (2012) and Nimtrakoon (2015), structural capital is essential for an organization's ability to meet customers' evolving needs due to its ability to enhance employee capability using technological advancements. For MFIs, structural capital facilitates efficient resource management, reduces operational risks, and ensures financial stability - critical factors for delivering reliable services to underprivileged communities, thereby contributing to long-term poverty reduction. Based on that, the following hypothesis is proposed:

H1b: Structural capital within microfinance institutions positively affects poverty reduction

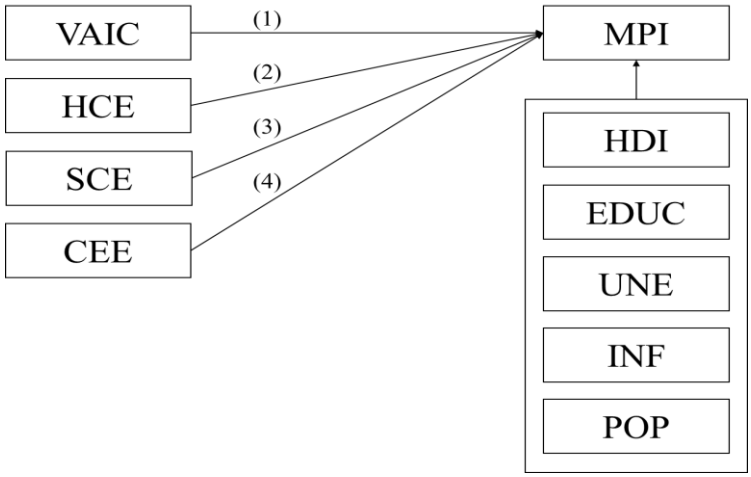
Relational capital enhances performance through strong relationships with internal and external stakeholders, such as clients, employees, and partners (Bontis et al., 2000). MFIs can leverage relational capital by enhancing trust, loyalty, and collaboration, leading to better operational efficiency and expanding outreach to impoverished communities. Within MFIs, advertising costs do not measure relational capital but rather by asset value (or specifically Relational capital). The greater the value of this employed capital, the higher the value generated for the organizations, hence, the better the performance of poverty alleviation (Vidyarthi & Tiwari, 2019). Therefore, the proposed hypothesis is as follows:

H1c: Relational capital within microfinance institutions positively affects poverty reduction

From these hypotheses, the theoretical framework is proposed as follows:

Figure 1

Theoretical Framework



Note. Produced by authors

3. Research methodology

3.1. Research model

3.1.1. Measurement of Intellectual Capital (IC)

Measurement of Intellectual Capital (IC)

This study measures IC using the Value-Added Intellectual Coefficient (VAIC), a widely adopted metric developed by Pulic (2004). It is calculated as:

$$AIC = CEE + HCE + SCE \quad (1)$$

Where:

CEE (Capital Employed Efficiency): Value added per unit of capital employed

HCE (Human Capital Efficiency): Value added per unit of investment in human capital

SCE (Structural Capital Efficiency): Efficiency of structural capital in supporting value creation

The total Value Added (VA) is computed as:

$$VA = OP + EC + A \quad (2)$$

Where:

OP: Operating profit

EC: Employee remuneration

A: Amortization of non-current assets

Human Capital (HC) in this model is represented by the bonus payments to employees, signifying compensation for their efficiency. HC is extracted from the cash flow statement, and the Human Capital Efficiency (HCE) is determined as follows:

$$HCE = \frac{VA}{HC} \tag{3}$$

The difference between VA and HC constitutes Structural Capital (SC) (Pulic, 2004). Structural Capital Efficiency (SCE) is computed as the ratio of SC to the firm's total Value Added (VA):

$$SCE = \frac{VA - HC}{VA} \tag{4}$$

Relational Capital Efficiency (CEE) is further calculated as the ratio of Value Added (VA) to the total tangible and intangible relational capital (CE), adjusted for accumulated amortization:

$$CEE = \frac{VA}{CE} \tag{5}$$

CE represents the book value of all assets minus accumulated amortization for the analyzed period.

3.1.2. Empirical model

$$MPI_{it} = \alpha_0 + \alpha_1 VAIC_{ijt} + \alpha_2 INF_{it} + \alpha_3 EDUC_{it} + \alpha_4 UNE_{it} + \alpha_5 HDI_{it} + \alpha_6 POP_{it} + CYR_{ijt} + \varepsilon_{ijt} \tag{6}$$

$$MPI_{it} = \beta_0 + \beta_1 HCE_{ijt} + \beta_2 INF_{it} + \beta_3 EDUC_{it} + \beta_4 UNE_{it} + \beta_5 HDI_{it} + \beta_6 POP_{it} + CYR_{ijt} + \varepsilon_{ijt} \tag{7}$$

$$MPI_{it} = \gamma_0 + \gamma_1 SCE_{ijt} + \gamma_2 INF_{it} + \gamma_3 EDUC_{it} + \gamma_4 UNE_{it} + \gamma_5 HDI_{it} + \gamma_6 POP_{it} + CYR_{ijt} + \varepsilon_{ijt} \tag{8}$$

$$MPI_{it} = \delta_0 + \delta_1 CEE_{ijt} + \delta_2 INF_{it} + \delta_3 EDUC_{it} + \delta_4 UNE_{it} + \delta_5 HDI_{it} + \delta_6 POP_{it} + CYR_{ijt} + \varepsilon_{ijt} \tag{9}$$

Where:

MPI_{ijt}: Multidimensional poverty index of country i at year t.

$VAIC_{ijt}$: The value-added intellectual capital of microfinance institution j in country i at year t.

HCE_{ijt}: The sum of added value from the human capital of microfinance institution j in country i at year t.

SCE_{ijt}: The sum of added value from the structural capital of microfinance institution j in country i at year t.

CEE_{ijt}: The sum of added value from the Relational capital of microfinance institution j in country i at year t.

INF_{it}: The inflation rate of country i at year t.

$EDUC_{it}$: The percentage of government spending on education to GDP of country i at year t.

UNE_{it}: The unemployment rate of country i at year t.

HDI_{it}: The human development index of country i at year t.

POP_{it}: The total population of country i at year t.

CYR_{ijt}: The time effect on microfinance institution j in country i.

$\alpha_0, \beta_0, \gamma_0, \delta_0$: The Intercept.

$\alpha_{1-6}, \beta_{1-6}, \gamma_{1-6}, \delta_{1-6}$: The estimated coefficient.

ε_{ijt}: Error term.

3.2. Research design

3.2.1. Data source and selection

The data used in this study are secondary data drawn from World Bank Mix Market data, covering the information about the IC of 3,114 MFIs from 120 nations worldwide. Data for five control variables were collected from World Development Indicators (WDI). The study period is 10 years, ranging from 2009 to 2018. The sample size of our research is 3114 * 10 = 31,140 observations.

3.2.2. Variable description

Table 1

Variable Description

Variable name	Description	Time	Previous investigation	Source
Dependent variables				
MPI	The percentage of households in a country deprived along three dimensions (monetary poverty, education, and basic infrastructure services)	2009 - 2018	Alkire et al. (2021)	World Bank
Independent variables				
VAIC	The sum of added values from employed capital, human capital, and structural capital	2009 - 2018	Phan et al. (2022)	World Bank
HCE	The sum of added value from the human capital	2009 - 2018	Phan et al. (2022)	World Bank
SCE	The sum of added value from the structural capital	2009 - 2018	Kamaluddin and Rahman (2013)	World Bank
CEE	The sum of added value from the employed capital	2009 - 2018	Vidyarthi and Tiwari (2019)	World Bank
Control variables				
INF	The inflation rate of the country i at year t	2009 - 2018	Talukdar (2012)	World Bank
EDUC	The percentage of government spending on education to the GDP in the country i at year t	2009 - 2018	Robichaud et al. (2014)	World Bank
UNE	The unemployment rate of the country i at year t	2009 - 2018		World Bank
HDI	The HDI (Human Development Index) of the country i at year t	2009 - 2018		World Bank
POP	The total population of the country i at year t	2009 - 2018	Kibirige (1997)	World Bank

Note. Collected by authors

3.3. Methodology

The empirical analysis begins with model estimation using three-panel data techniques: Pooled Ordinary Least Squares (OLS), Fixed Effects Model (FEM), and Random Effects Model (REM). The Hausman test is employed to determine the most appropriate baseline model to examine whether individual-specific effects correlate with the regressors (Wooldridge, 2010). Following these initial estimations, diagnostic tests are conducted to identify common specification issues, including heteroskedasticity, autocorrelation, and endogeneity. If such problems are detected, the Generalized Method of Moments (GMM) is adopted as the primary estimation technique to address them.

GMM is particularly well-suited for this empirical context due to its ability to address endogeneity through the use of internal instruments and its robustness to violations of classical assumptions such as homoscedasticity and serial independence (Ullah et al., 2020; Wooldridge, 2010). The likelihood of endogeneity, stemming from reverse causality, simultaneity, or omitted variable bias, is supported by formal statistical tests. Specifically, certain key explanatory variables are likely determined jointly with firm performance, rendering conventional estimators such as OLS or FEM biased and inconsistent. This study implements the different GMM estimators, following the approach of Arellano and Bond (1991). The model is estimated in first differences to eliminate unobserved time-invariant heterogeneity, while endogenous regressors are instrumented using their own lagged levels. This method relies on the assumption of no second-order serial correlation in the differenced residuals. The two-step robust GMM procedure is applied to obtain efficient estimates and heteroskedasticity-consistent standard errors.

4. Empirical results and discussion

4.1. Empirical results

Table 2

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
MPI	3,985	37.02585	27.22194	3	96
VAIC	3,985	10.94861	11.30565	0.635721	44.04829
HCE	3,985	1.485571	0.636316	0.171853	2.888888
SCE	3,985	0.294067	0.302041	-0.49415	0.829234
CEE	3,985	8.893367	10.79377	0.162666	40.75522
INF	3,916	5.21456	3.515283	-1.5448	48.69986
INF	3,916	5.21456	3.515283	-1.5448	48.69986
UNE	3,977	5.680787	2.921298	0.13	24.023
HDI	3,985	0.677506	0.087021	0.472	0.869
EDUC	3,795	3.906809	1.167876	1.567	8.09724

Note. Summarized by authors using STATA18

The average MPI value is 37.03, with a standard deviation of 27.22, reflecting substantial variability in poverty levels across observations. The minimum and maximum

values of 03 and 96 indicate a wide range of household poverty experiences. This variability underscores disparities in multidimensional poverty, with some regions or individuals experiencing severe deprivation while others are relatively better off.

The mean VAIC is 10.95, with a high standard deviation of 11.30 and values ranging from 0.63 to 44.04, highlighting significant differences in intellectual capital efficiency among entities. CEE has a mean of 8.89 and a standard deviation of 10.79, reflecting considerable variability in capital efficiency, with values spanning from 0.16 to 40.75. HCE demonstrates greater consistency, with a mean of 1.48 and a standard deviation of 0.63. However, the range of values from 0.17 to 2.88 still indicates some variation. SCE exhibits the most minor variability, with a mean of 0.29 and a standard deviation 0.30.

Table 3

Pooled OLS Model Regression Results

Variable	**(1)** **VAIC**	**(2)** **HCE**	**(3)** **SCE**	**(4)** **CEE**
VAIC	-0.162***			
HCE		1.600***		
SCE			5.623***	
CEE				-0.182***
INF	-0.942***	-0.923***	-0.929***	-0.945***
UNE	-0.653***	-0.660***	-0.663***	-0.654***
POP	-3.73e-08***	-3.83e-08***	-3.84e-08***	-3.72e-08***
HDI	-92.43***	-93.70***	-93.29***	-91.88***
EDUC	3.948***	3.857***	3.911***	3.966***
_cons	108.0***	91.80***	105.7***	107.4***
N	3734	3734	3734	3734

Robust standard errors in parentheses

*** p < 0.01, ** p < 0.05, * p < 0.1

Note. Summarized by authors using STATA18

Table 4

VIF Test Results

Model	**(1)**	**(2)**	**(3)**	**(4)**
Mean VIF	1.73	1.71	1.02	1.73

Note. Summarized by authors using STATA18

As the mean VIF of the model (1), (2), (3), and (4) are all smaller than 10, the model is free from multicollinearity.

Table 5

Appropriate Model Selection

Test	P-value	Conclusion
F-test that all u_i = 0	0.0000	The FE model is more appropriate than the Pooled OLS model
Hausman test	0.0000	The FE model is more appropriate than the RE model

Note. Summarized by authors using STATA18

From the result of Table 5, the Fixed Effects Model (FEM) was chosen. The authors check for other model deficiencies, which include heteroskedasticity and autocorrelation.

Table 6

Error Tests

Test	P-value	Conclusion
Breusch-Pagan	0.0000	Heteroskedasticity
Wooldridge	0.0000	Auto-correlation

Note. Summarized by authors using STATA18

Table 7

Wu-Hausman Test

Variable	Model	P-value	Conclusion
VAIC	(1)	0.1437	Exogenous
HCE	(2)	0.782	Exogenous
SCE	(3)	0.0063	Endogenous
CEE	(4)	0.2647	Exogenous

Note. Summarized by authors using STATA18

Equations (1), (2), and (4) show no evidence of endogeneity, affirming the robustness and reliability of their estimations. In contrast, the SCE variable in Equation (3) is identified as endogenous based on the Durbin-Wu-Hausman test. To address this issue and ensure consistent parameter estimates, the Generalized Method of Moments (GMM) will be employed for all equations. This approach helps mitigate problems related to endogeneity, heteroskedasticity, and autocorrelation, thereby offering a more reliable alternative to the Fixed Effects Model (FEM).

Table 8

Instrumental Variables GMM Regression

Variable	(1) VAIC	(2) HCE	(3) SCE	(4) CEE
VAIC	-0.274***			
HCE		0.646		
SCE			11.075***	

Variable	(1) VAIC	(2) HCE	(3) SCE	(4) CEE
CEE				-0.287***
INF	-0.806***	-0.803***	-0.801***	-0.756***
UNE	-0.161	-0.190	-0.166	-0.227
POP	-0.000***	-0.000***	-0.000***	-0.000***
HDI	-81.534***	-83.224***	-82.017***	-80.664***
EDUC	3.890***	3.636***	3.873***	3.827***
Constant	101.860***	101.076***	102.703***	96.333***
Observations	2,380	2,380	2,380	2,380
R-squared	0.545	0.536	0.544	0.533

Robust standard errors in parentheses

Note. Summarized by authors using STATA18

The VAIC variable consistently exhibits a significant negative relationship with MPI across all model specifications, strongly supporting Hypothesis H1. In Model (1), a one-unit increase in VAIC corresponds to a 0.274-unit reduction in MPI, significant at the 1% level. Conversely, SCE (Structural Capital Efficiency) fails to support Hypothesis H1b by demonstrating a substantial positive effect in Model (3), where a one-unit increase in SCE results in an 11.08-unit rise in MPI, also significant at the 1% level. Meanwhile, CEE (relational Capital Efficiency) in model (4) shows a substantial adverse effect, with each additional unit of CEE leading to a 0.287-unit decrease in MPI ($p < 0.01$), thereby supporting Hypothesis H1c. In contrast, the coefficient of HCE (Human Capital Efficiency) remains statistically insignificant across all models, indicating no strong association with poverty alleviation and thus failing to support Hypothesis H1a.

Among the control variables, INF (inflation) and EDUC (government education spending) consistently exhibit positive and statistically significant effects on MPI across all models. Specifically, a one-unit increase in EDUC contributes to a rise in MPI ranging from 3.636 to 3.890 units, while inflation positively correlates with MPI by approximately 0.756 to 0.806 units. Conversely, the HDI (Human Development Index) shows a strong and significant negative relationship, with MPI decreasing by approximately 80 to 83 units per unit increase in HDI. Similarly, the variable POP has a significant positive effect on MPI but with negligible impact. The variable UNE (unemployment) remains negative but statistically insignificant throughout all model specifications.

The relevance and strength of the instrumental variable are evaluated using the first-stage F-statistic. All the tests yield values of F far exceeding the conventional threshold of 10 (Stock & Yogo, 2002), indicating that the instrument is sufficiently strong and appropriate for use in the GMM estimation (Appendix Table A3 - online version).

4.2. Discussions

The empirical results shown in Table 8 prove that, in general, MFIs with greater IC are better equipped to help alleviate poverty. Our finding aligns with indications provided by Ahamad et al. (2022), Barpanda and Bontis (2021), and Awad (2022). This might primarily

be explained by the IC theory, which highlights that this knowledge capital, as being impossible to imitate or substitute, allows firms to get a competitive advantage through effective management (Barney, 1991). Ahamad et al. (2022) justified that this type of resource strengthens organizations and enables them to implement strategies that improve their social performance. Therefore, the successful utilization eventually enhances MFIs' poverty alleviation efficiency. Additionally, it is evidenced that efficient MFIs decrease the occurrence of poverty and its intensity and severity (Imai et al., 2012).

However, the analysis of individual VAIC components yields mixed results. In our study, Human Capital Efficiency (HCE) shows a negative, yet insignificant, association with poverty alleviation. The result is strongly supported by Ahamad et al. (2022) and Hashim et al. (2018). This can be attributed to the fact that acquiring human capital requires significant time and financial investment (Crook et al., 2011), which may offset its contributions to poverty reduction. Furthermore, the negative relationship in our study may reflect trade-offs between financial and poverty alleviation goals in MFIs' operational strategies. This is consistent with Musibah and Alfattani (2014), who emphasized the adverse impact of HCE in the context of the Islamic banking sector.

The impact has been proven statistically harmful regarding the Structural Capital Efficiency (SCE). Our result can be attributed to the fact that SCE refers mainly to technological advancements, which tend to be captured in a very long time to generate tangible benefits. In other words, technological advancements often require substantial initial costs and adaptation periods before they enhance operational efficiency. This finding is strongly supported by Awad (2022), with the underlying reason being that companies may lack long-term strategies for investing in structural capital.

Lastly, the regression results reveal a statistically significant and positive relationship between Capital-Employed Efficiency (CEE) within MFIs and poverty alleviation. Specifically, MFIs with more relational capital yield better outcomes in poverty reduction efforts. Capital efficiency is not just a financial metric but a critical driver of social impact (Sayed & Nefzi, 2024). Higher CEE reflects the ability of MFIs to use financial resources optimally without waste, thereby increasing their scale and scope and allowing more affordable credit to reach underserved populations. This implies that MFIs with higher CEE are more resilient and better equipped to empower underserved populations to overcome the poverty trap. Our finding is most in line with Skhvediani et al. (2023), Ge and Xu (2020), Tsai and Mutuc (2020), and Musibah and Alfattani (2014). However, it is notable that some of this research was considered in the manufacturing industry with the characteristic of capital intensity. Considering the banking industry, CEE's impact is also noteworthy but not necessarily powerful.

The remaining control variables reveal several significant findings. Among the control variables, the rise in inflation leads to a decrease in MPI, meaning that higher inflation stimulates economic growth by boosting production, expanding employment opportunities, and increasing income levels (Sipahutar, 2024). The finding aligns with Acharya and Mia (2021) and Talukdar (2012). Besides, as a measure of overall success in key aspects of human development (such as achieving a good living and receiving an education), HDI plays a crucial role in poverty reduction efforts (Tri, 2022). The finding is advocated by Ranbir (2025) and Dasic et al. (2020). Also, a larger population is proven conducive to alleviating poverty, as indicated in (Acharya & Mia, 2021; Safrita et al., 2021). By contrast, greater government

expenditure on education corresponds with a higher poverty rate. This surprising impact is supported by Addison and Rahman (2025), emphasizing that a significant portion of education funding appears to be allocated to wages and compensation. It also raises concerns about whether political leaders' funds earmarked for education are being used as intended. Finally, the unemployment rate insignificantly affects poverty alleviation, supported by Rizki and Solihati (2022) and Ipmawan et al. (2022).

5. Conclusion and policy implications

5.1. Conclusion

This study examines the role of IC within MFIs as a catalyst for poverty alleviation, along with its components, including Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE), and relational Capital Efficiency (CEE). Using a panel dataset of 3,114 Microfinance Institutions (MFIs) across 120 countries from 2009 to 2018, this study illuminates these impacts by applying the Generalized Method of Moments (GMM) as the primary estimation technique. This method is appropriate for addressing the model's potential endogeneity and dynamic effects. The findings reveal that the overall IC and CEE are strongly conducive to poverty reduction efforts. In contrast, the opposite effect is witnessed in the evidence of SCE, potentially due to the lag time of technological investments. Besides, HCE within MFIs appears to have no significant impact on poverty alleviation. In general, our results imply that although MFIs with greater IC correspond with better performance in reducing poverty in society, mixed effects of IC components reflect the dilemma of MFIs between poverty alleviation and other objectives.

However, this paper has a few limitations that must be acknowledged due to limited resources. First, this study only covers data from 2009 - 2018, which may fail to consider the transformative change of Covid-19 or the latest trends in the relationship between IC and poverty reduction. Second, when generalizing the findings, the study does not group countries with similar indicators and characteristics. This omission may cause variations in the degree of effects across regions, limiting the accuracy of policy implications. It is recommended that future researchers classify countries into different groups with similar features (i.e., regions' income levels).

5.2. Policy implications

From the perspective of local and national authorities, priority should be given to educating and incentivizing MFIs. First, a key step is the adoption of a regulatory framework that emphasizes the short- and long-term benefits of IC in mitigating poverty. This framework can include social performance ratings with criteria related to IC and its components, enabling authorities to measure progress effectively. Based on these evaluations, authorities can offer financial incentives to support well-performing institutions or impose penalties to ensure compliance and accountability. Second, authorities should facilitate knowledge-sharing platforms through IC where MFIs can exchange best practices related to poverty alleviation. It is essential to formulate a detailed marketing and education plan with a focus on established MFIs first and then promote spillovers to other smaller ones.

From the perspective of MFIs, adopting a proactive approach is essential to enhance IC for poverty reduction. MFIs should encourage efficient capital utilization and resource allocation to maximize the positive impact. Instead of indiscriminately increasing human capital investments, policies should emphasize skill specialization and performance-driven

incentives to enhance operational efficiency. Given the challenges associated with structural capital, regulators should promote gradual technological adoption through phased investments and knowledge-sharing platforms to maximize long-term gains.

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NO CONFLICT OF INTEREST STATEMENT

All authors declare that they have no conflict of interest.

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