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Social capital, knowledge transfer, and sustainable performance: Evidence from agricultural village-owned enterprises in Central Java

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ABSTRACT

Village-owned enterprises (VOEs) in Indonesia show different levels of sustainability, even though they receive government support and are rooted in strong community traditions. However, the ways in which different dimensions of social capital affect their performance are still not well understood, especially the mediating role of knowledge transfer in collectivist cultural settings. This study investigates how cognitive, structural, and relational capital influence the sustainable performance of VOEs through knowledge transfer mechanisms. Structural equation modeling is used to analyze data collected from agricultural VOEs in several regencies of Central Java. The sample includes VOEs at different stages of development and operating in horticulture, livestock, and fisheries. Data were gathered through structured questionnaires completed by VOE managers. The results indicate that cognitive and relational capital have a significant positive effect on sustainable performance, while structural capital does not have a significant direct effect. Knowledge transfer significantly mediates the relationship between relational and structural capital and sustainable performance, but it does not mediate the effect of cognitive capital. These findings suggest that shared values and strong relationships among stakeholders are the most important factors for VOE success in collectivist cultures, while formal structures mainly support knowledge exchange rather than directly improving performance. This study contributes to rural development by showing how community-based enterprises can use social capital to improve sustainability, and it offers practical implications for managers and policymakers in designing capacity-building programs across Southeast Asia.

1. Introduction

Food insecurity and rural poverty pose serious concerns across developing countries. In Indonesia, rural poverty stood at 12.53% in 2021—significantly higher than the urban rate of 7.60%, while rice imports have risen by 5-14% annually. Village-owned enterprises (VOEs) have emerged as critical instruments for addressing these rural development challenges. Indonesia's Village Law No. 6/2014 mandated the establishment of VOEs to empower rural communities economically while advancing the Sustainable Development Goals, particularly poverty reduction (SDG 1), zero hunger (SDG 2), and decent work and economic growth (SDG 8). By 2023, over 50,000 VOEs operated nationwide, with agricultural VOEs forming a substantial portion focused on improving farmer livelihoods, strengthening local food systems, and building rural economic resilience. These community-based organizations play crucial roles in sustaining food security—primary sector VOEs diversify products at village levels while assisting farmers with product processing and market access.

Central Java offers a compelling context for examining agricultural VOEs. Home to 37 million people, the province depends heavily on agriculture, with over 40% of its workforce earning a livelihood through farming. Yet many villages lack adequate access to markets, technology, and capital—precisely the gaps VOEs were designed to address. Following Village Law No. 6/2014, agricultural VOEs surged across Central Java's 35 regencies and cities, operating in horticulture, livestock, and fisheries (Imronudin and Hussain, 2020) while connecting smallholder farmers to larger markets.

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What distinguishes Central Java's VOEs is the strong communal traditions within which they operate. Javanese cultural values—gotong royong (mutual cooperation) and musyawarah (consensus decision-making)—fundamentally shape the development of social capital in these enterprises. Despite this rich social fabric and government backing, however, performance varies widely. Some VOEs dramatically improve farmer welfare and community prosperity; others struggle with weak management, limited knowledge transfer, and inadequate structural systems. This variation, combined with Central Java's cultural distinctiveness, positions the region as an ideal setting for investigating how social capital dimensions affect sustainable performance through knowledge-transfer mechanisms.

Primary sector VOEs play a significant role in empowering local farmers by aggregating production, improving quality standards, and creating economies of scale beyond individual farmers' capacities. They advance farmer welfare by expanding access to markets, technology, and capital while promoting environmental sustainability through improved agricultural practices (Sari et al., 2024). VOEs drive innovation by introducing new technologies and strengthening collaboration among farmers, government agencies, and financial institutions (Wulandari and Wardani, 2024). Despite challenges in financing access (Imronudin and Hussain, 2020), VOE institutional capacity development can improve management effectiveness, ultimately enhancing farmer empowerment.

Sustainable performance in business organizations has become a growing research area. As examined by Haseeb et al. (2019), social and technological challenges were found affecting business sustainability. Research focusing on VOEs has emerged substantially. Sustainable Performance through integrated quality management was assessed by Prasetya et al. (2023), while governance principles and their impact on VOEs' sustainable performance were reviewed by Sari et al. (2024).

Despite this growing literature, the role of knowledge transfer in mediating social capital's influence on sustainable performance remains unexamined, particularly in ASEAN collectivist cultural contexts. Our study addresses this gap by investigating how knowledge transfer optimization mediates relationships between social capital dimensions and VOE sustainable performance in Central Java, Indonesia. The findings offer insights applicable to community enterprise development across ASEAN member states, sharing similar cultural values of mutual cooperation and consensus decision-making.

Section 2 reviews relevant literature and develops hypotheses; Section 3 describes data and methodology; Section 4 presents and discusses empirical findings with regional implications; Section 5 concludes.

2. Literature review and hypothesis development

2.1. Triple bottom line (TBL) theory

Elkington (1997) introduced the "Triple Bottom Line" (TBL) concept during a period of growing awareness about environmental problems, sustainability, and pollution. Tseng et al. (2020) described TBL as a sustainability framework that emphasizes three dimensions: profit (economy), people (social), and planet (environment). From a business perspective, social sustainability involves recognizing how operations affect society and communities. Organizations frequently adopt TBL to measure their social Sustainable Performance, as it encourages thinking beyond financial profit to consider social and environmental impacts.

2.2. Social capital and sustainable business growth

Social capital contributes significantly to sustainable business growth across various sectors. In Indonesian cooperatives—community-based organizations structurally like VOEs —Yuliarmi et al. (2020) demonstrated that social capital serves as an organizational asset for increasing productivity and professionalism, ultimately improving members' social and economic lives. Without strong social capital, cooperatives struggle to operate optimally and achieve welfare objectives, underscoring their critical role in community enterprises. Zhang et al. (2024) found that social capital is a key factor in sustainable development, promoting balanced growth across social, economic, and environmental dimensions.

2.3. The effect of relational capital on VOE sustainable performance

Relational capital represents the value that arises from the relationships of organizations built with stakeholders, customers, suppliers, and partners. This capital significantly impacts sustainable performance by increasing efficiency, reducing risk, and facilitating knowledge sharing (Zhang et al., 2024). Trust, as a relational dimension of social capital, facilitates knowledge transfer by increasing partners' willingness to share and creating necessary conditions such as openness in communication (Ismail, 2015). Qiao and Wang (2021) showed that relational capital positively affects SME sustainable performance by enabling both explicit and tacit knowledge sharing.

For VOEs, strong relational ties with village communities generate legitimacy and social license to operate. Connections with government agencies provide access to policy support and resources. Trust-based relationships with suppliers ensure reliable access to inputs, and customer relationships built on mutual respect foster loyalty and repeat transactions. These relational advantages translate

directly into sustainable performance through multiple pathways. Economic sustainability improves via stable revenue streams and reduced transaction costs. Social sustainability is strengthened through enhanced community welfare and stakeholder satisfaction. Environmental sustainability advances when trusted partnerships enable the adoption of sustainable practices. Given relational capital's significant role across these dimensions, we hypothesize:

H1: Relational Capital has a positive effect on VOE Sustainable Performance.

2.4. The effect of structural capital on sustainable VOE performance

Structural capital encompasses infrastructure, processes, and databases that facilitate the flow of information and knowledge within organizations (Birasnav et al., 2019). For SMEs, structural social capital influences not only the flow and variety of resources available to entrepreneurs but also their business and funding opportunities (Ojong and Simba, 2019). Birasnav et al. (2019) demonstrated that structural capital improves the efficiency of buyer-supplier relationships by enabling information sharing and building trust and commitment.

Well-developed structural capital provides VOEs with several performance advantages. Formalized procedures and documented processes enable consistent quality, reduce errors, and facilitate training of new members. Information systems and databases allow VOEs to track inventory, monitor financial performance, and make data-informed decisions. Organizational routines and governance structures clarify roles and responsibilities, reducing conflicts and improving coordination. These structural elements become particularly valuable as VOEs scale operations beyond what informal arrangements can effectively manage. By institutionalizing knowledge and creating reliable operational systems, structural capital supports all three sustainability dimensions. It enables economic efficiency, ensures equitable treatment through standardized processes, and systematically monitors environmental impacts.

H2: Structural capital positively affects the sustainable performance of VOEs.

2.5. The effect of cognitive capital on VOE sustainable performance

Cognitive social capital refers to shared values and understanding in social networks (Sánchez-García et al., 2023). It facilitates effective communication and collaboration, builds strong relationships, and promotes cooperation (Wojciechowska, 2021). Mishchuk et al. (2022) found that cognitive social capital plays an important role in encouraging sustainable competitiveness.

Cognitive capital operates through shared mental models and common interpretations, reducing coordination costs and enabling collective action. When VOE members share a common understanding of organizational goals, priorities, and appropriate behaviors, they can work together more effectively without constant explicit negotiation. Shared norms regarding quality standards, fair treatment, and environmental stewardship shape how members approach their work and interact with stakeholders. This cognitive alignment proves especially valuable in community-based enterprises where members come from the same village and already share cultural values. Cognitive capital builds on existing communal bonds to create organizational-specific understandings. High cognitive capital enables VOEs to respond adaptively to challenges, innovate collaboratively, and maintain commitment to sustainability goals even when short-term pressures arise.

H3: Cognitive capital has a positive effect on VOE Sustainable Performance.

2.6. The mediating role of knowledge transfer in the relationship between social capital and sustainable performance

Knowledge transfer represents a critical organizational capability for agricultural VOEs operating in dynamic rural environments. Agricultural enterprises must continuously acquire, share, and apply diverse knowledge forms—technical expertise in cultivation practices, market intelligence about prices and demand, processing techniques that add value, and managerial skills for coordinating complex operations. For VOEs specifically, knowledge transfer proves essential. Mahfud et al. (2024) noted that individual farmers often possess fragmented knowledge, whereas collective enterprises need an integrated understanding to compete effectively in the agricultural market, a finding supported by Ahado et al. (2021). When VOEs successfully transfer knowledge about sustainable farming practices, quality standards, or market requirements to member farmers, they enhance productivity while reducing environmental impacts. Transferring knowledge about financial management, stakeholder engagement, or partnership development strengthens the social and economic dimensions of sustainability. Ahado et al. (2021) and Harun et al. (2024) demonstrated that knowledge transfer through training and extension services enhances farming capabilities and promotes sustainable practices. Cooperative structures enable farmers to pool knowledge effectively, strengthening their collective capabilities.

Effective knowledge transfer in VOEs extends beyond agricultural practices. This involves sharing insights into environmentally friendly cultivation methods that mitigate negative impacts on rural ecosystems. Murshed and Uddin (2020) described

organic farming techniques that utilize indigenous knowledge to reduce reliance on synthetic chemical inputs. Engaging in cooperative frameworks allows farmers to access better market information and pricing mechanisms, reducing the risks associated with agricultural investments and operational decisions (Ahado et al., 2021). Agricultural extension services play a pivotal role in this context. Vamba et al. (2023) found that these services help bridge knowledge gaps within the community. They increase access to vital information and support the implementation of innovative technologies and practices, thereby improving farm productivity. By fostering such partnerships, VOEs can significantly enhance operational efficiency and market responsiveness, aligning with broader goals of sustainable rural development. Agricultural cooperatives that adapt to new technological advancements and evolving market demands demonstrate improved adaptability and resilience in the face of economic shifts (Ajates, 2020). Knowledge transfer thus directly enables VOEs to achieve balanced performance (Somiartha et al., 2024) across economic, social, and environmental domains that define sustainable performance.

H4: Optimizing Knowledge Transfer has a positive effect on VOE Sustainable Performance.

Knowledge transfer serves as a crucial mechanism through which social capital translates into sustainable performance outcomes. Social capital creates conditions for knowledge flows. But actual performance improvements require this potential to be realized through effective knowledge-transfer processes. Huang et al. (2024) conceptualized this mechanism. Achieving desirable outcomes involves sequential processes—first accessing social capital resources such as trust and shared vision, then mobilizing them to facilitate actual knowledge acquisition and application. High cognitive capital means VOE members share similar values and understandings. This shared mental foundation must be leveraged through knowledge exchange to yield performance benefits. Strong relational capital generates trust and reciprocity. These make stakeholders willing to share knowledge openly. Seng and Taha (2017) demonstrated that strong relational fit between partners enhances knowledge sharing and organizational innovativeness, highlighting how the quality of inter-partner relationships directly influences knowledge transfer effectiveness. Nguyen and Ha (2020) noted that trust can smooth transaction costs but may decrease the perceived need for monitoring knowledge transfer processes. Yet this willingness only produces results when knowledge actually moves between individuals and gets applied to improve practices. Well-developed structural capital provides channels and systems through which knowledge can flow (Nahapiet and Ghoshal, 1998). These structures matter primarily because they facilitate transfer. Empty systems without knowledge moving through them create little value (Joseph and Totawar, 2021).

Relational capital specifically enhances knowledge transfer by building trust that encourages open sharing and reciprocity, which motivates continued exchange (Aisyah et al., 2019). Strong relationships reduce fears about knowledge exploitation. They increase confidence that shared knowledge will be valued and reciprocated. This trust-based environment proves particularly important for transferring tacit knowledge. Tacit knowledge includes practical skills and contextual understanding that resist easy codification. Research shows that strong relational ties facilitate effective knowledge exchange across organizational boundaries. This is particularly important when partners must overcome cultural and contextual differences. For VOEs, relational capital with farmers, suppliers, and government agencies facilitates knowledge flows. These flows drive performance improvements. Therefore, we propose:

H5: Optimizing knowledge transfer mediates the effect of relational capital on VOE sustainable performance.

Structural capital facilitates knowledge transfer through established mechanisms for socialization, internalization, externalization, and combination—processes through which knowledge moves and transforms within organizations. Organizational structures, documented procedures, and information systems create reliable channels through which knowledge flows systematically rather than haphazardly. Alshahrani and Salam (2024) confirmed that social capital affects knowledge transfer processes, thereby improving organizational performance. Hussien et al. (2024) further demonstrated that while sustainable innovation requires robust organizational capabilities, its effects on business success are mediated through information technology capability and knowledge management, underscoring the critical role of knowledge transfer mechanisms in translating organizational resources into performance outcomes. Recent studies demonstrate that structural capital enhances sustainable performance by optimizing knowledge transfer, with organizational systems and routines serving as crucial conduits for knowledge diffusion.

H6: Optimizing Knowledge Transfer mediates the effect of Structural Capital on VOE Sustainable Performance.

Cognitive capital's relationship with knowledge transfer operates somewhat differently. Shared values and common understanding reduce communication barriers and interpretation difficulties, making knowledge transfer more efficient when it occurs (Chandhasa and Pattanapanithipong, 2021). Alshahrani and Salam (2024) showed that effective knowledge transfer

optimizes the contribution of cognitive capital to performance. However, high cognitive capital may also enable direct coordination without requiring elaborate knowledge transfer systems—when everyone already thinks similarly, explicit knowledge sharing becomes less necessary. Business managers can leverage external knowledge through internal transfer processes to achieve superior performance (Téllez et al., 2021), but the strength of this mediation may vary depending on the social capital dimension involved.

H7: Optimizing knowledge transfer mediates the effect of Cognitive Capital on VOE Sustainable Performance.

Fig. 1 shows a conceptual model. Cognitive Capital, Relational Capital, and Structural Capital (collectively representing social capital dimensions), one mediating variable (Knowledge Transfer), and one dependent variable (Sustainable Performance). Arrows indicate the seven hypothesized direct and indirect pathways. Direct paths from each capital dimension led to both Knowledge Transfer and Sustainable Performance. Optimizing Knowledge Transfer also leads to Sustainable Performance. The indirect paths represent mediation hypotheses in which the effects of social capital dimensions on performance are transmitted through Knowledge Transfer.

This proposed model operationalizes social capital as a three-dimensional construct, with each dimension theoretically influencing sustainable performance through two pathways: direct effects and indirect effects mediated by knowledge transfer. The theoretical framework is grounded in social capital theory (Nahapiet and Ghoshal, 1998), knowledge management literature, and Sustainable Performance research (Elkington, 1997; Tseng et al., 2020).

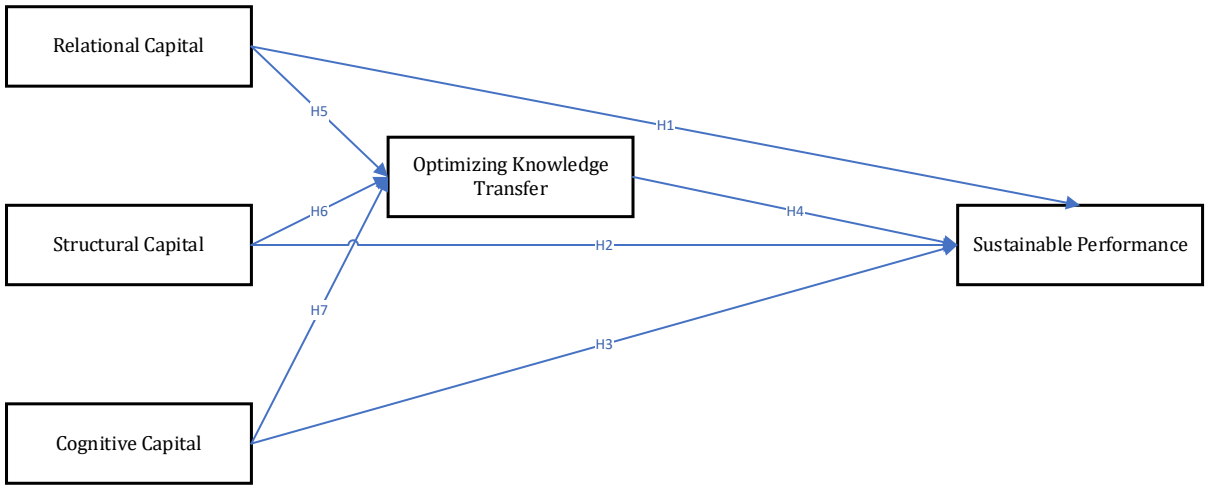

Fig. 1: Conceptual model

3. Methodology

This research employs quantitative methods using primary data to test hypotheses through systematic measurement and analysis. We selected agricultural VOEs in Central Java as our research population—specifically those operating in horticulture, livestock, and fisheries. The final sample consists of 190 VOEs distributed across eight regencies: Klaten (23.7%), Pemalang (23.3%), Blora (13.4%), Boyolali (8%), Sragen, Karanganyar, Pekalongan, and Sukoharjo (combined 26.6%). We employed stratified random sampling with disproportionate allocation, stratifying VOEs by developmental stage (advanced, growing, and developing) to capture performance variation across maturity levels.

Data collection occurred between March and June 2024 through structured questionnaires administered to VOE managers or directors—individuals with comprehensive knowledge of their enterprise's operations, stakeholder relationships, and performance outcomes. We initially contacted 267 VOEs; 200 returned questionnaires, yielding a response rate of 74.9%. Of the 200 questionnaires that were returned and completed, 10 were incomplete. Therefore, 190 questionnaires could be processed. Questionnaires were distributed and collected through a combination of direct field visits by trained enumerators and facilitated sessions coordinated with local government officials overseeing VOE development. This approach ensured high response quality while building rapport that encouraged honest responses. Prior to full-scale data collection, we pilot-tested the instrument with 30 VOEs from districts outside our main sample to identify ambiguous items and refine wording for clarity in the Indonesian agricultural VOE context.

3.1. Operational definitions and variable measurements

Sustainable performance encompasses financial, social, and environmental dimensions consistent with the Triple Bottom Line (TBL) framework (Purnama, 2024). We measured this construct using nine items assessing economic viability (profitability,

revenue growth), social impact (farmer welfare, community benefits, employment), and environmental responsibility (sustainable practices, resource management).

Cognitive capital was measured through six items capturing shared values, common understanding of goals, mutual agreement on priorities, and collective interpretation of challenges among VOE members. Relational capital employed five items measuring trust quality, relationship strength, and mutual respect between VOEs and key stakeholders, including village communities, government, suppliers, and customers (Kan and Lejano, 2023). Structural capital uses four items assessing organizational systems, documented procedures, information management infrastructure, and formal coordination mechanisms. Knowledge transfer was operationalized through seven items evaluating knowledge acquisition, sharing, application, and integration processes within VOEs, adapted from established knowledge management scales (Birasnav et al., 2019).

All variables used a five-point Likert scale (1=strongly disagree to 5=strongly agree). Items were translated from English to Bahasa Indonesia using back-translation procedures to ensure semantic equivalence. To address potential common-method bias—a concern when collecting self-reported data from a single respondent—we conducted Harman's single-factor test. Results showed that the largest factor explained 34.2% of the variance, well below the 50% threshold, suggesting that common method bias does not severely threaten our findings. Additionally, we ensured procedural remedies by guaranteeing respondent anonymity, randomizing item order, and using clear, unambiguous language throughout the questionnaire.

3.2. Data analysis

We employed Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 4.0 software to test our theoretical model and hypotheses. PLS-SEM is particularly suited to this research given its superior performance with complex prediction models involving multiple mediators, its ability to handle latent constructs measured by reflective indicators, and its robustness with moderately sized samples—all characteristics relevant to our 190-VOE sample and seven-hypothesis model examining direct and indirect effects.

The analysis proceeded through two distinct phases: measurement model evaluation and structural model assessment, following established PLS-SEM protocols (Hair et al., 2019; Henseler et al., 2016).

3.2.1. Measurement model assessment

The measurement model phase evaluated both convergent and discriminant validity to ensure our constructs were measured reliably and distinctly. Convergent validity was assessed through three criteria: (1) individual item loadings, which we required to exceed the 0.70 threshold; (2) Average Variance Extracted (AVE), using the 0.50 benchmark to confirm that each latent variable explained more than half of its indicators' variance; and (3) Composite Reliability (CR), applying the 0.70 threshold and evaluating Cronbach's alpha values to confirm internal consistency and reliability.

Discriminant validity was rigorously tested using two complementary methods. First, we examined the Heterotrait-Monotrait (HTMT) ratio of correlations, which compares each construct pair's correlation to the geometric mean of their internal correlations (Henseler et al., 2015), using the 0.85 threshold as the acceptance criterion. Second, we verified the Fornell-Larcker criterion by confirming that each construct's AVE square root should exceed its correlation with all other constructs. This two-pronged approach to discriminant validity testing represents best-practice PLS-SEM measurement model assessment (Franke and Sarstedt, 2019).

3.2.2. Structural model assessment

Following successful measurement model validation, we evaluated the structural model to test hypothesized relationships. Initial model evaluation employed standardized path coefficients and R^2 values to assess explained variance. Specifically, R^2 values measured the proportion of variance in endogenous constructs explained by their predictors.

Model fit was assessed through two key indices: (1) the Standardized Root Mean Square Residual (SRMR)—a measure of the discrepancy between observed and predicted correlations, with values below 0.08 indicating acceptable model fit; and (2) the Normed Fit Index (NFI)—evaluating the relative improvement of our model over a baseline null model, with values approaching 1.0 indicating superior fit.

Hypothesis testing employed 5,000 bootstrap iterations, a resampling technique that generates empirical distributions of parameter estimates without distributional assumptions. Bootstrapping produced standard errors and t-statistics for all paths, enabling calculation of 95% confidence intervals and two-tailed significance tests. Paths achieving t-statistics exceeding the critical value of 1.96 (corresponding to $p < 0.05$) were considered statistically significant. This robust, distribution-free approach proves particularly valuable for complex mediational models where normality assumptions may be violated.

Indirect effects testing—essential for evaluating our seven hypotheses involving knowledge transfer as a mediating mechanism—employed specific indirect effect calculations multiplying the path from predictor to mediator by the path from mediator to outcome. Standardized indirect effects, bootstrap standard errors, and t-statistics for all mediational

pathways were computed using the same 5,000 bootstrap iterations, allowing rigorous assessment of mediation effects and confidence intervals for indirect effects (Preacher and Hayes, 2008).

The analysis incorporated variable standardization to enhance interpretability, enabling direct comparison of path coefficients across constructs measured on identical Likert scales. Missing data were minimal, and no imputation procedures were required.

4. Results and discussion

4.1. Sample characteristics and descriptive statistics

Fig. 2 illustrates the distribution of 190 sample VOEs across three income tiers: low (< Rp. 100 million annually), medium (Rp. 101 million - Rp. 1 billion), and high (> Rp. 1 billion). This distribution reveals notable regional variation in VOE economic performance. The low-income tier contains the largest number of VOEs, distributed across all eight regencies, with Klaten contributing 48 enterprises, the highest concentration, while Sukoharjo shows minimal representation. This pattern suggests varying levels of VOE maturity and market access across regencies. The middle-income tier draws exclusively from four regencies (Boyolali, Klaten, Pemalang, Pekalongan), with Pekalongan dominating this category. Only two regencies—Klaten and Pekalongan—host high-performing VOEs generating annual revenues exceeding Rp. 1 billion, indicating that successful scaling remains concentrated in specific geographic areas. This heterogeneity in economic performance across our sample provides valuable variation for analyzing how social capital and knowledge transfer influence sustainable outcomes across different VOE maturity levels.

4.2. Measurement model results

Hair et al. (2017a) emphasized that measurement models must demonstrate both convergent and discriminant validity before structural relationships can be meaningfully interpreted. Social capital comprises three theoretically distinct dimensions that operate as separate variables: cognitive (CC), relational (RC), and structural (SC). Cognitive capital reflects shared values; relational capital captures stakeholder trust; structural capital encompasses organizational systems (Nahapiet and Ghoshal, 1998). Each dimension influences performance through distinct pathways—some direct, others mediated through knowledge transfer (OKT).

Table 1 presents outer loadings for item-construct relationships, with all indicators ranging from 0.745 to 0.905 and exceeding the 0.70 threshold, confirming strong item correlations. The highest loading was 0.905 (SC2) and the lowest was 0.745 (RC5). These values reflect established PLS-SEM protocols (Hair et al., 2017b), ensuring adequate measurement precision.

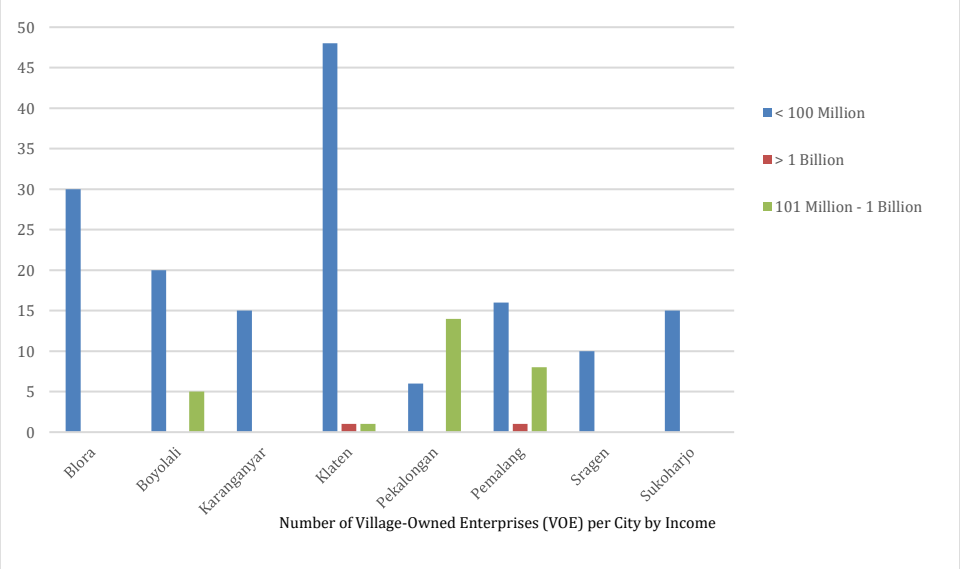

Fig. 2: Number of VOEs by cities of origin and income level

Table 2 presents a convergent validity assessment demonstrating robust measurement across all constructs. Average Variance Extracted (AVE) values exceeded 0.50, confirming each construct explains more than half its indicators' variance.

Table 3 reports the Heterotrait-Monotrait (HTMT) ratio of correlations, which provides superior sensitivity for detecting violations of discriminant validity (Henseler et al., 2015). All values in Table 3 remained below the 0.85 threshold, confirming strong discriminant validity. The highest HTMT value was 0.733 (between Relational Capital and Sustainable Performance), substantially below the 0.85 threshold. Values approaching 1.0 would indicate problematic validity; our results, which are substantially below this, demonstrate that the latent constructions measure sufficiently distinct concepts.

Table 1: Validity test using outer loading

Items	Cognitive capital	Optimizing knowledge transfer	Relational capital	Structural capital	Sustainable performance
CC1	0.771				
CC2	0.858				
CC3	0.871				
CC4	0.816				
CC5	0.811				
CC6	0.831				
OKT3		0.801			
OKT4		0.783			
OKT1		0.764			
OKT2		0.805			
OKT5		0.814			
OKT6		0.804			
OKT7		0.867			
RC1			0.808		
RC2			0.786		
RC3			0.804		
RC4			0.802		
RC5			0.745		
SC1				0.783	
SC2				0.905	
SC3				0.864	
SC4				0.809	
SP1					0.754
SP2					0.762
SP3					0.740
SP4					0.829
SP5					0.838
SP6					0.838
SP7					0.784
SP8					0.775
SP9					0.823

The Fornell-Larcker criterion provided additional verification of discriminant validity in Table 4 by confirming that each construct's AVE square root (shown on the diagonal) exceeded its correlations with all other constructs (off-diagonal values). For example, Cognitive Capital's AVE square root is 0.827, which exceeds all its correlations with other constructs (ranging from 0.483 to 0.631). This stricter test complements the HTMT approach, representing best-practice dual-method discriminant validity assessment in PLS-SEM (Franke and Sarstedt, 2019).

Table 2: Convergent validity

Variable	Average variance extracted (AVE)
Cognitive capital	0.684
Optimizing knowledge transfer	0.649
Relational capital	0.623
Structural capital	0.709
Sustainable performance	0.631

Table 3: Discriminant validity test (HTMT – matrix)

Constructs	Cognitive capital	Optimizing knowledge transfer	Relational capital	Structural capital
Cognitive capital				
Optimizing knowledge transfer	0.531			
Relational capital	0.719	0.650		
Structural capital	0.544	0.520	0.677	
Sustainable performance	0.629	0.664	0.733	0.561

Internal consistency was rigorously evaluated using complementary approaches outlined in Table 5. Cronbach's alpha values ranged from 0.849 (Relational Capital) to 0.927 (Sustainable Performance)—substantially exceeding the 0.70 threshold (Hair et al., 2021). Composite Reliability (rho_c) values provide more accurate PLS-SEM assessments than Cronbach's alpha (Henseler et al., 2016), as it proves less sensitive to indicator count, with all constructs achieving composite reliability exceeding 0.89, indicating that approximately 89-94% of variance attributable to underlying scales was reliably captured. Specifically, the lowest composite reliability was 0.892 (Relational Capital) and the highest was 0.939 (Sustainable Performance). This meets stringent standards for multi-item construction. Outer loadings, AVE, Cronbach's alpha, and composite reliability collectively confirm measurement validity and reliability. Following the comprehensive evaluation of measurement model reliability and validity, we will assess the overall fit of our structural and measurement model in the next section after presenting the data.

4.3. Structural model results and hypothesis testing

Multicollinearity assessment proved critical for ensuring independent variables did not exhibit problematic linear combinations (Hair et al., 2017a). As shown in Table 6, Variance Inflation Factor (VIF) values for all paths remain well below the 5.0 threshold, with a maximum VIF of 2.232 (RC -> SP). These results indicate negligible multicollinearity, confirming that structural model estimates reflect genuine relationships rather than artifacts of predictor redundancy.

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Table 4: Fornell-Larcker criterion

Constructs	Cognitive capital	Optimizing knowledge transfer	Relational capital	Structural capital	Sustainable performance
Cognitive capital	0.827				
Optimizing knowledge transfer	0.493	0.806			
Relational capital	0.631	0.578	0.789		
Structural capital	0.483	0.461	0.589	0.842	
Sustainable performance	0.582	0.618	0.653	0.509	0.794

Table 5: Reliability assessment through composite reliability and Cronbach's alpha

Constructs	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)
Cognitive capital	0.907	0.910	0.928
Optimizing knowledge transfer	0.910	0.914	0.928
Relational capital	0.849	0.852	0.892
Structural capital	0.862	0.866	0.906
Sustainable performance	0.927	0.930	0.939

Table 6: Multicollinearity test among variables

Relationships	VIF
Cognitive capital -> optimizing knowledge transfer	1.716
Cognitive capital -> sustainable performance	1.771
Optimizing knowledge transfer -> sustainable performance	1.602
Relational capital -> optimizing knowledge transfer	2.012
Relational capital -> sustainable performance	2.232
Structural capital -> optimizing knowledge transfer	1.581
Structural capital -> sustainable performance	1.619

The R^2 value of 0.547 for Sustainable Performance (Table 7) indicates that social capital dimensions and knowledge transfer explained 54.7% of the variance in outcomes. This demonstrates that the model captured substantially important performance drivers. The remaining 45.3% is attributable to factors beyond scope—regional economic conditions, policy environments, manager capabilities, or external market dynamics.

Table 7: R-squared

Variables	R-squared
Optimizing knowledge transfer	0.376
Sustainable performance	0.547

Optimizing Knowledge Transfer achieved an R^2 of 0.376, indicating that social capital dimensions explained 37.6% of the variance. This confirms that social capital constitutes meaningful antecedents to knowledge transfer. Together, these values support the theoretical relevance of the proposed model.

The comprehensive model fit assessment presented in Table 8 reveals acceptable fit across multiple indices. The Standardized Root Mean Square Residual (SRMR) of 0.075 (Saturated Model) fell within the acceptable range (below the 0.08 threshold), indicating that our model successfully reproduced the observed correlation structure between variables (Hair et al., 2017b). The Normed Fit Index (NFI) of 0.673 (Saturated Model) indicates the relative improvement of our specified model over a null baseline model. While NFI values approaching 1.0 indicate a superior fit, values above 0.50 indicate meaningful improvement, and our estimate of 0.673 shows that the model explains substantially greater variance than the baseline (Henseler et al., 2016). The equivalence of saturated and estimated model indices (SRMR 0.075 and NFI 0.673, both identical across both models) suggests that the model estimation process converged successfully without requiring structural simplification. These fit indices collectively confirm that our specified measurement and structural model provide an acceptable representation of the relationships among social capital dimensions, knowledge transfer, and sustainable performance in our VOE context.

Table 8: Model fit

Fit indices	Saturated model	Estimated model
SRMR	0.075	0.075
d_ULS	2.800	2.800
d_G	1.713	1.713
Chi-square	1687.370	1687.370
NFI	0.673	0.673

Fig. 3 shows the structural equation model, which is the output of SmartPLS 4. From Fig. 3, there are three independent variables, namely structural capital, cognitive capital, and relational capital, and one dependent variable, namely sustainable performance. The three independent variables are tested for their direct influence on sustainable performance. In addition, the structural equation model also tests the indirect influence of the three independent variables on sustainable performance through optimized knowledge transfer.

Bootstrapping—essential for PLS-SEM hypothesis testing (Hair et al., 2021) —generated empirical parameter distributions allowing confidence interval calculation and significance tests without distributional assumptions. All coefficients shown in Table 9 are standardized (ranging from -1 to +1), enabling direct magnitude comparison.

Several distinct patterns emerge from Table 9. Cognitive capital demonstrates a statistically

significant positive effect on sustainable performance (β = 0.199, t = 2.898, p = 0.004), supporting H3. Relational capital shows the strongest effects, significantly influencing knowledge transfer (β = 0.370, t = 4.318, p < 0.001) and sustainable performance (β = 0.293, t = 3.790, p < 0.001), supporting H1. Structural capital significantly predicts knowledge transfer (β = 0.154, t = 2.124, p = 0.034), but does not significantly affect sustainable performance directly (β = 0.099, t = 1.314, p = 0.189), failing to support H2. Knowledge transfer substantially influences sustainable performance (β = 0.305, t = 3.805, p < 0.001), supporting H4. These patterns lay the foundation for understanding the mediation analysis presented next.

Table 10 presents indirect effects examining whether knowledge transfer mediates relationships between social capital and sustainable performance (Preacher and Hayes, 2008). These represent the product of predictor-to-mediator paths multiplied by mediator-to-outcome paths. Using specific indirect effect algorithms with 5,000 bootstrap iterations, we computed the standardized effects, standard errors, and t-statistics shown in Table 10.

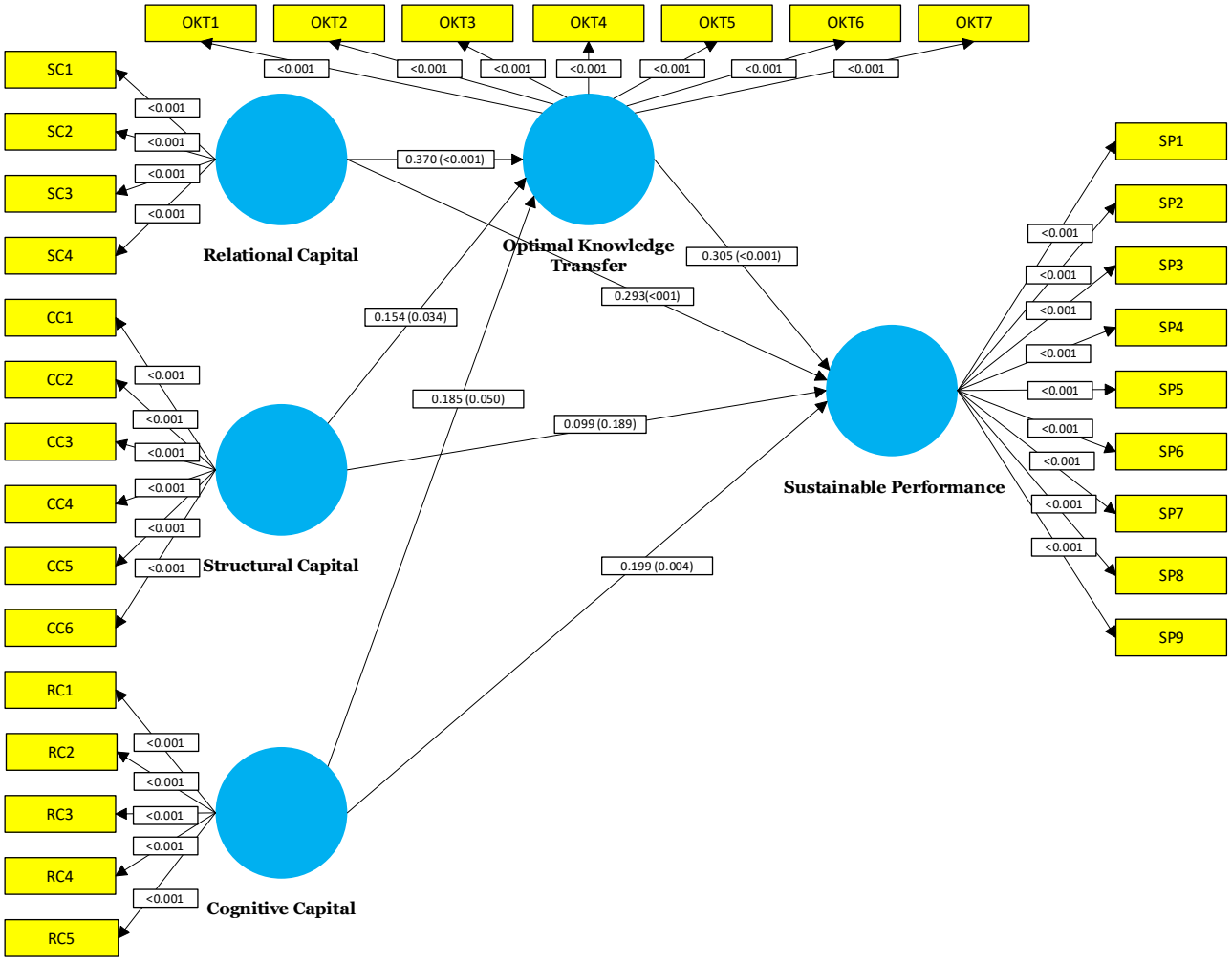

Fig. 3: Structural equation model

Table 9: Path coefficient of direct effect test

Path	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T-statistics (|O/STDEV|)	P-values
CC -> OKT	0.185	0.179	0.094	1.957	0.050
CC -> SP	0.199	0.195	0.069	2.898	0.004
OKT -> SP	0.305	0.294	0.080	3.805	0.000
RC -> OKT	0.370	0.389	0.086	4.318	0.000
RC -> SP	0.293	0.301	0.077	3.790	0.000
SC -> OKT	0.154	0.139	0.073	2.124	0.034
SC -> SP	0.099	0.100	0.076	1.314	0.189

Table 10: Specific test for mediation

Mediation path	β	Sample mean (M)	Standard deviation (STDEV)	T-statistics (|O/STDEV|)	P-values
CC -> OKT -> SP	0.056	0.055	0.036	1.561	0.118
RC -> OKT -> SP	0.113	0.114	0.040	2.792	0.005
SC -> OKT -> SP	0.047	0.041	0.025	1.914	0.056

Mediation findings reveal selective patterns. Relational capital's effect on sustainable performance through knowledge transfer proves significant (β_indirect = 0.113, t = 2.792, p = 0.005),

supporting H5. This indicates that trust-based stakeholder relationships enhance sustainability outcomes not only through direct mechanisms but also indirectly by facilitating knowledge exchange about best practices.

Structural capital's indirect effect approaches statistical significance (β_indirect = 0.047, t = 1.914, p = 0.056), providing marginal support for H6. The pattern—no direct effect but a marginally significant indirect effect—suggests formal systems primarily influence outcomes through enabling knowledge transfer rather than as direct performance drivers. This emphasizes the instrumental value of structural capital in VOE contexts.

Cognitive capital's indirect effect through knowledge transfer is not statistically significant (β_indirect = 0.056, t = 1.561, p = 0.118), failing to support H7. Notably, cognitive capital demonstrates a significant direct effect (β = 0.199, p = 0.004), indicating shared mental models operate through direct psychological mechanisms rather than through formal knowledge transfer processes. When VOE members share similar values, they coordinate effectively without elaborate knowledge transfer systems as intermediaries.

These contrasting patterns reveal theoretically important distinctions. Relational capital influences performance through both direct and indirect mechanisms, demonstrating multifaceted benefits of strong stakeholder relationships. Structural capital operates almost exclusively through mediated pathways, enabling knowledge flows. Cognitive capital influences performance directly without requiring knowledge transfer mediation. These differentiated pathways have important implications for the design of targeted interventions to enhance VOE performance.

4.4. Discussion

Cognitive capital significantly affects VOE's sustainable performance. Pham et al. (2024) found that cognitive capital impacts SME performance through affective, cognitive, and calculative trust. In Indonesian cooperatives, Yuliarmi et al. (2020) demonstrated that social capital significantly affects organizational empowerment and member welfare. These findings parallel our results, suggesting that community-based enterprises across Indonesia benefit from strong cognitive capital.

When members share a common mental framework for sustainable performance—balancing profit with environmental stewardship—this alignment consistently shapes strategic choices. A VOE in which members recognize that organic farming practices yield premium prices while reducing environmental harm can implement sustainability without extensive deliberation. With deep shared knowledge, VOEs enhance quality, better understand market dynamics, and develop more effective business strategies.

Relational capital also significantly affects sustainable performance, consistent with research by Qiao and Wang (2021). Strong connections between VOEs and diverse stakeholders—communities, government, customers, suppliers—create legitimacy and trust. The enterprise earns community support and customer engagement when relationships are solid.

In Central Java, practical mechanisms became evident. VOEs maintaining strong relationships with district agricultural offices gain access to extension services, training programs, and government contracts. Trust-based supplier relationships ensure reliable access to inputs during peak demand periods. Customer relationships built on mutual respect generate repeat transactions and word-of-mouth recommendations, reducing marketing costs. Strong networks provide access to information about business opportunities and market developments, supporting informed, timely decisions.

Structural capital shows no significant direct effect on sustainable performance—a counterintuitive finding. Beltramino et al. (2020) document that structural capital contributes to competitive advantage in Argentine SMEs; similar patterns emerge in Indonesian research (Astuti et al., 2023). Our result contradicts this prior work, though our cross-sectional design does not definitively explain this non-significant finding.

We acknowledge this as an important limitation requiring future investigation rather than evidence against structural capital's value. Several contextual explanations warrant consideration. In collectivist VOE contexts, informal arrangements may diminish the direct importance of formal structures. Javanese traditions—gotong royong and musyawarah—emphasize informal coordination over formal hierarchies. Members rely more on personal relationships than codified procedures. When communal norms provide coordination mechanisms, additional formal structures add limited marginal value.

Many agricultural VOEs remain in early developmental stages with limited organizational sophistication, limiting variation in structural capital and reducing statistical power to detect effects. Most importantly, the marginally significant indirect effect through knowledge transfer (p = 0.056) suggests structures matter primarily by enabling knowledge flows rather than as direct drivers. Systems become valuable when designed to support knowledge exchange; administrative procedures alone, without facilitating actual knowledge sharing, create limited value. Robustly testing these explanations demands future research that explicitly measures organizational maturity, assesses informal versus formal norms using cultural instruments, directly measures knowledge flow intensity through indicators such as documentation systems and extension service engagement, and employs longitudinal designs to track how structural capital effects evolve across developmental stages. Comparisons across diverse cultural contexts would isolate cultural versus universal effects.

We therefore view H2's non-significant finding as highlighting gaps warranting serious future investigation. The indirect pathway indicates that structures do matter—institutional theory suggests that organizational structures primarily serve instrumental purposes, facilitating knowledge diffusion rather than serving as direct performance drivers. When structures enable effective knowledge sharing about sustainable practices, they substantially improve performance.

Knowledge transfer mediates the relationship between social capital and sustainable performance, though the patterns differ markedly. Significant mediation emerges for relational capital ($p = 0.005$) and marginal mediation for structural capital ($p = 0.056$), but not for cognitive capital ($p = 0.118$). These varied patterns reflect how distinct capital dimensions operate through different mechanisms. Relational capital creates trust-based conditions enabling knowledge exchange, which then drives improvements. Structural capital provides systems that facilitate knowledge flows, thereby enhancing outcomes. Cognitive capital operates more directly through alignment, enabling coordination without intermediary knowledge transfer.

This heterogeneous pattern enriches social capital theory by demonstrating that different capital forms operate through distinct mechanisms. Weber and Weber (2010) showed that knowledge transfer mediates the influence of social capital on organizational outcomes. Sapta et al. (2021) demonstrated that knowledge management mediates relationships between organizational culture and sustainable performance. The concept of "relational fit"—combining social capital and knowledge linkages (Seng and Taha, 2017) proves highly effective in enhancing knowledge transfer, thereby improving Sustainable Performance.

In Central Java's VOE context, this mechanism is particularly salient. Rich social capital derived from gotong royong traditions creates enormous potential for knowledge sharing, but realizing this potential requires intentional mechanisms: training programs, farmer field schools, documentation of best practices, and systematic sharing of experience. Cultural readiness for cooperation must be complemented by institutional mechanisms enabling knowledge flow. Form without function—administrative procedures lacking actual knowledge exchange—creates limited value.

4.5. Practical implications

Findings offer actionable insights for VOE managers and policymakers. Since cognitive and relational capital significantly drive performance, managers should prioritize building these dimensions through targeted interventions. For cognitive capital, VOEs can implement training programs enhancing members' shared understanding of organizational goals and operational standards. Creating forums for dialogue helps align stakeholders' frameworks, particularly in contexts that emphasize consensus-building. Regular management meetings and participatory planning sessions develop shared mental models regarding sustainability priorities.

Strengthening relational capital requires deliberate cultivation of trust-based relationships with stakeholders. VOE managers should invest time building connections with communities, government officials, suppliers, and customers through regular communication, transparency, and consistent commitment fulfillment. These relationships generate legitimacy, access to resources, and a willingness to reciprocally share knowledge. The knowledge transfer mediation effect suggests that managers cannot assume that social capital automatically translates into better performance. VOEs need explicit mechanisms for capturing, sharing, and applying knowledge—such as documentation systems, mentoring relationships, and partnerships with agricultural extension services. Farmer field schools, training workshops, and systematic documentation of successful practices enable knowledge to move from trusted relationships into organizational capacity.

Structural capital influences performance indirectly through knowledge transfer, suggesting formal structures matter primarily for their functionality rather than as ends themselves. VOE managers should ensure organizational structures support communication and learning while accommodating Javanese collaborative decision-making traditions. Governance structures should enable easy knowledge sharing, regular communication channels, and flexible procedures rather than emphasizing hierarchy and rule-following.

For policymakers, support programs should emphasize the development of social capital alongside technical training. Government support, recognizing that relationships and shared vision often matter more than formal organizational structures, proves most effective. Technical assistance programs work best when delivered through trusted relationships and translated into shared organizational understanding rather than imposed through external expertise. Extension service models emphasizing farmer-to-farmer knowledge transfer leverage existing social capital more effectively than top-down technical instruction.

5. Conclusions

This study examined how social capital dimensions influence sustainable performance in agricultural VOEs, with knowledge transfer as a mediating mechanism. Our 190 Central Java VOEs revealed that cognitive and relational capital significantly enhance sustainable performance, while structural capital shows no direct effect but influences performance indirectly through knowledge transfer. Mediation analysis key contribution—reveals that knowledge transfer proves crucial but operates selectively. Relational

and structural capital improve performance by enabling knowledge sharing, while cognitive capital operates directly without knowledge transfer as an intermediary.

The results have important implications for rural development policy. VOE support programs should prioritize social capital building alongside technical training, recognizing that relationships and shared vision often matter more than elaborate organizational structures. Findings contribute to social capital theory by demonstrating how different capital dimensions operate through distinct mechanisms in community-based enterprises, offering a nuanced understanding beyond treatments assuming uniform social capital effects.

5.1. Limitations and future research directions

Several limitations warrant acknowledgment. First, our focus on Central Java VOEs limits generalizability to other regions with different cultural and institutional contexts. Future research should conduct comparative studies across diverse regions to identify universal versus context-specific patterns. Second, the cross-sectional design cannot establish causality or track the evolution of social capital. Longitudinal studies would clarify causal directions and reveal how capital develops across organizational lifecycle stages, potentially showing reciprocal relationships. Third, single-respondent data from VOE managers may introduce response bias despite procedural safeguards. Multi-respondent designs collecting data from stakeholders, farmers, government liaisons, suppliers would provide more robust assessments.

Fourth, the model focuses on knowledge transfer as the primary mediator, but other processes may matter. Future research should explore additional pathways using complex models that capture multiple mediators—such as technological adoption, innovation diffusion, or institutional legitimacy. Finally, the agricultural focus means findings may not generalize to VOEs in commerce, tourism, or services. Mixed-method approaches combining quantitative analysis with qualitative case studies would illuminate how social capital mechanisms vary across contexts.

List of abbreviations

ASEAN	Association of Southeast Asian Nations
AVE	Average variance extracted
CC	Cognitive capital
CR	Composite reliability
d_G	Geodesic discrepancy
d_ULS	Unweighted least squares discrepancy
HTMT	Heterotrait-monotrait ratio
NFI	Normed fit index
OKT	Optimizing knowledge transfer
PLS-SEM	Partial least squares structural equation modelling
RC	Relational capital
SC	Structural capital
SDG	Sustainable development goal
SME	Small and medium enterprise
SP	Sustainable performance
SRMR	Standardized root mean square residual
STDEV	Standard deviation
TBL	Triple bottom line
VIF	Variance inflation factor
VOE	Village-owned enterprise

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Compliance with ethical standards

Ethical considerations

This study was conducted in accordance with applicable ethical standards for research involving human participants. Participation was voluntary, and informed consent was obtained from all respondents before completing the questionnaire. Participants were informed about the purpose of the study and their right to withdraw from participation. No personally identifiable information was collected, and respondents' anonymity and confidentiality were maintained throughout the study. The collected data were used solely for academic research purposes.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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