

FARMER GROUP PARTICIPATION WITH SOCIAL CAPITAL IN ENHANCING TECHNICAL CAPACITY, ECONOMIC, AND SOCIAL EMPOWERMENT OF CATTLE FARMERS

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ABSTRAK

Kelompok peternak sapi berfungsi sebagai platform institusional yang penting untuk meningkatkan ketahanan dan pemberdayaan produsen sapi potong kecil, terutama di tengah transformasi agraria struktural Indonesia yang dipicu oleh pengembangan Ibu Kota Nusantara. Studi ini bertujuan untuk mengevaluasi peran partisipasi kelompok tani dan modal sosial multidimensional (bonding, bridging, dan linking) dalam membangun kapasitas teknis serta mencapai pemberdayaan ekonomi dan sosial di kalangan peternak sapi di Samarinda, Kalimantan Timur. Menggunakan pendekatan Partial Least Squares Structural Equation Modelling, diuji model struktural yang melibatkan 30 peternak sapi yang secara aktif berpartisipasi dalam kelompok tani. Konstruksi modal sosial dioperasionalkan melalui indikator yang telah divalidasi, dan data dianalisis menggunakan SmartPLS 4.0. Model tersebut mengungkapkan bahwa partisipasi ($\beta = 0.250$, $p < 0.05$), bridging ($\beta = 0.352$, $p < 0.01$), dan linking social capital ($\beta = 0.418$, $p < 0.01$) secara signifikan meningkatkan kapasitas teknis petani, yang pada gilirannya secara kuat memprediksi pemberdayaan ($\beta = 0.651$, $p < 0.001$). Modal sosial bonding tidak menunjukkan efek yang signifikan ($\beta = -0.081$, $p > 0.10$), menyoroti perannya yang terbatas dalam mendorong inovasi. Temuan tersebut menekankan bahwa pemberdayaan tidak hanya dicapai melalui solidaritas, tetapi juga melalui akuisisi pengetahuan, keterkaitan kelembagaan, dan jaringan yang berorientasi keluar. Keunikan terletak pada integrasi simultan dari ketiga dimensi modal sosial dalam satu model yang telah diuji. Rekomendasi kebijakan mencakup menginstitusionalisasi peran untuk keterlibatan eksternal, memperkuat keterkaitan horizontal dan vertikal, serta memanfaatkan alat digital untuk pengembangan kapasitas. Temuan ini memberikan wawasan empiris dalam merancang strategi pemberdayaan multidimensional yang dapat mengangkat kelompok petani dari unit yang berorientasi subsisten menjadi agen ketahanan pangan dan transformasi pedesaan.

Kata kunci : penggemukan sapi, pemberdayaan peternak, partisipasi kelompok, modal sosial

ABSTRACT

Livestock farmer groups serve as a critical institutional platform to enhance the resilience and empowerment of smallholder beef cattle producers, especially amid Indonesia's structural agrarian transformation triggered by the development of Ibu Kota Nusantara. This study aimed to evaluate the role of farmer group participation and multidimensional social capital bonding, bridging, and linking in building technical capacity and achieving economic and social empowerment among cattle farmers in Samarinda, East Kalimantan. Using a Partial Least Squares Structural Equation Modelling approach, tested a structural model involving 30 cattle farmers who were actively participating in farmer groups. Social capital constructs were operationalized through validated indicators, and data were analyzed using SmartPLS 4.0. The model revealed that participation ($\beta = 0.250$, $p < 0.05$), bridging ($\beta = 0.352$, $p < 0.01$), and linking social capital ($\beta = 0.418$, $p < 0.01$) significantly improved farmers' technical capacity,

which in turn strongly predicted empowerment ($\beta = 0.651$, $p < 0.001$). Bonding social capital had no significant effect ($\beta = -0.081$, $p > 0.10$), suggesting its limited role in driving innovation. The findings emphasize that empowerment is not solely achieved through solidarity but through knowledge acquisition, institutional linkages, and outward-oriented networks. The novelty lies in simultaneously integrating all three social capital dimensions within a single tested model. Policy recommendations include institutionalizing roles for external engagement, strengthening horizontal and vertical linkages, and leveraging digital tools for capacity development. These findings provide empirical insights into designing multidimensional empowerment strategies that can elevate farmer groups from subsistence-oriented units to become agents of food security and rural transformation.

Keywords: cattle fattening, farmer empowerment, group participation, social capital

INTRODUCTION

The beef cattle sector is critical to Indonesia's national food security, providing essential animal protein for a rapidly growing population. In 2022, the national beef cattle population reached 18.05 million, with domestic consumption totaling 695,390 tons, resulting in an annual production deficit of approximately 258,690 tons (Statistics Indonesia, 2023). This gap between production and consumption is especially acute in East Kalimantan, where local beef production meets only 25-30% of regional demand. In Samarinda, the province's largest urban center, over 70% of the beef supply is imported from other provinces, making it one of the highest beef price regions in Indonesia, with prices reaching IDR 185,500 per kilogram (East Kalimantan Provincial Office of Livestock and Animal Health, 2022). This structural imbalance poses a significant threat to the region's food security and economic resilience.

The urgency of this issue is amplified by the development of Indonesia's new capital city, Ibu Kota Nusantara (IKN), in East Kalimantan. The relocation of approximately 1.5 million people and large-scale infrastructure development are expected to drive up demand for strategic food commodities, particularly beef. Government projections estimate that beef consumption in IKN will reach 17,288.44 tons annually by 2045 (Rohaeni et al., 2024). Without substantial improvements in local beef production capacity, East Kalimantan risks severe market disruptions, price volatility, and food security challenges that may extend

beyond the region, undermining inter-island food supply chains and Indonesia's role in ASEAN's regional food security agenda.

Various government initiatives, such as the "2 Million Cattle Program," palm-oil-cattle integration schemes, corporate social responsibility (CSR) initiatives by mining companies, and the establishment of Corporate Livestock Villages, have been introduced to address these vulnerabilities (Widiarta et al., 2025). However, these initiatives have had limited impact on structural change. The sector remains predominantly dominated by smallholder farmers who typically own 2-5 cattle and employ semi-traditional production systems, viewing cattle as "living savings" rather than productive commercial assets (Suryalena et al., 2025). Revitalizing grassroots institutional mechanisms is therefore essential to sustainably enhance production capacity and improve farmer welfare.

Livestock Farmer Groups (LFGs) represent a promising institutional framework for fostering collective action, improving market access, and empowering smallholder cattle farmers. Collective Action Theory suggests that individuals with shared interests can achieve common goals that would be difficult to attain independently (Purnomo et al., 2020). Social Capital Theory further emphasizes the importance of networks, trust, and shared norms in facilitating practical group cooperation (Abdullah & Mustabi, 2025). In this context, social capital can be operationalized through three dimensions:

bonding (intra-group solidarity), bridging (horizontal connections across groups), and linking (vertical ties to institutional actors).

Empirical studies support the relevance of these frameworks. Abdullah and Mustabi (2025) found that reciprocity and social norms significantly enhance group performance in the beef cattle sector of South Sulawesi. Indrayani (2023) identified a strong positive correlation ($r = 0.674$) between farmer group participation and empowerment in West Sumatra. Despite these contributions, much of the

existing research remains descriptive or correlational, with limited empirical testing of causal pathways linking group participation, social capital dimensions, and measurable empowerment outcomes, particularly in dynamic markets such as Samarinda. This study aims to address these gaps by developing and empirically testing an integrated empowerment model based on Livestock Farmer Group participation and multidimensional social capital, using PLS-SEM in Samarinda, East Kalimantan.

MATERIAL AND METHODS

This study employed a quantitative approach with an explanatory-causal design to examine the relationships between farmer group participation, dimensions of social capital, technical capacity building, and farmer empowerment in the context of beef cattle fattening. The study was conducted purposively in Samarinda City, East Kalimantan, as it is home to active farmer groups engaged in consistent beef cattle fattening practices. Data collection was conducted from February to May 2025.

Primary data were collected using structured questionnaires developed from established theoretical constructs and validated by subject-matter experts. A total of 30 respondents were selected using convenience sampling, with inclusion criteria requiring at least 2 years of active membership in a farmer group and direct involvement in cattle fattening activities. The study population consisted of farmers actively involved in beef cattle fattening in Samarinda City, East Kalimantan. Secondary data were obtained from institutional records, statistical publications, and official documents provided by relevant government agencies.

The latent variables analyzed in this study included group participation,

bonding, bridging, and linking social capital, as well as technical capacity and empowerment. Each variable was measured through multiple indicators using a five-point Likert scale. Construct validity and internal consistency were assessed through Confirmatory Factor Analysis (CFA), Cronbach's Alpha, and Composite Reliability, all of which met the recommended thresholds for reliability and validity.

Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0 software. The outer model was evaluated for convergent and discriminant validity, while the inner model was tested to assess path significance, coefficient of determination (R^2), and predictive relevance (Q^2). Descriptive statistics were applied to analyze the first objective, while the second and third objectives were examined through the structural model. The fourth objective, policy recommendation, was developed based on a synthesis of quantitative findings and qualitative insights derived from field observations and group discussions.

RESULT AND DISCUSSION

Socio-Economic Characteristics of Respondents

A descriptive analysis was conducted on 30 beef cattle farmers in the city of Samarinda to provide an overview of their socio-economic characteristics. This background is essential for contextualizing

the results of the structural model, particularly in understanding behavioral patterns, access to resources, and the capacity to adopt innovations within smallholder livestock systems (He et al., 2024).

Table 1. Socio-Economic Characteristics of Respondents

Characteristic	Category	Frequency	Percentage (%)
Age	< 30 years	2	6.7
	30 - 40 years	8	26.7
	41 - 50 years	15	50.0
	> 50 years	5	16.6
Education Level	Primary School	4	13.3
	Junior High School	9	30.0
	Senior High School	14	46.7
	Diploma/Bachelor's Degree	3	10.0
Farming Experience	< 5 years	3	10.0
	5 - 10 years	11	36.7
	> 10 years	16	53.3
Farm Scale (Cattle)	1 - 4 heads	18	60.0
	5 - 9 heads	9	30.0
	≥ 10 heads	3	10.0

Source: Primary data analysis (2025)

As shown in Table 1, a significant proportion of respondents (50.0%) fall within the 41-50 age range, indicating that the majority of farmers are in their productive years. This age group is characterized by a balance between physical ability and accumulated experience, both of which are essential for agricultural decision-making. This finding aligns with the research of Amrullah et al. (2025), which emphasizes that middle-aged farmers are often more receptive to adopting new practices when these practices yield clear economic benefits.

Regarding educational attainment, the data show that 76.7% of respondents have completed only primary through senior high school, with the largest group being high school graduates (46.7%). A small proportion (10.0%) have attained higher education, either at the diploma or bachelor's degree level. This educational distribution suggests a moderate literacy level, which may limit access to more complex information, such as financial literacy, digital tools, and data-driven livestock management (Al Abbasi et al.,

2025). In rural contexts, education plays a crucial role in farmers' ability to engage with modern extension services and adopt productivity-enhancing technologies.

The data also reveals significant experience in cattle farming, with 53.3% of respondents possessing more than 10 years of experience. This indicates a deep reservoir of local knowledge, cultural familiarity, and long-term involvement in livestock production systems. According to Muzaqi et al. (2025), such experience is often linked to resilience and adaptive behavior. However, in the absence of continuous capacity development, long-term experience may lead to stagnation, necessitating innovation and external support mechanisms to complement local expertise.

Despite the high levels of experience, most farmers operate on a small scale. As indicated in Table 1, 60.0% of respondents manage only 1-4 cattle, while 10.0% manage 10 or more. This scale of operation classifies the majority of respondents as subsistence or semi-commercial producers. The prevalence of

small-scale operations reflects limited access to capital, land, and market networks. As noted by He et al. (2024), the scale of production significantly influences income potential and the ability to participate in formal value chains.

The disparity between experience and operational scale suggests the need for targeted policy interventions. These interventions should focus on providing access to microfinance, fostering the development of farmer cooperatives, and implementing inclusive training programs that address both technical and entrepreneurial skills. Participatory extension models have been shown to effectively engage smallholder farmers in the innovation process and enhance their

decision-making capabilities (Amrullah et al., 2025). Scalable livestock development programs must be tailored to farmers' socio-economic contexts to ensure sustainability and long-term impact (Al Abbasi et al., 2025). The socio-economic profile of beef cattle farmers in Samarinda mirrors the typical smallholder structures observed across Indonesia, where producers are experienced but remain constrained by structural limitations. These findings provide essential context for interpreting the structural relationships examined in subsequent sections, underscoring the importance of designing context-sensitive, evidence-based livestock development strategies.

Table 2. Validity and Reliability Test Results

Construct	Indicator	Outer Loading	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
Participation (PAR)	PAR1	0.821	0.855	0.901	0.695
	PAR2	0.853			
	PAR3	0.809			
	PAR4	0.844			
Bonding (BND)	BND1	0.882	0.891	0.925	0.756
	BND2	0.865			
	BND3	0.879			
Bridging (BRG)	BRG1	0.833	0.870	0.911	0.720
	BRG2	0.868			
	BRG3	0.840			
Linking (LNK)	LNK1	0.901	0.915	0.941	0.801
	LNK2	0.888			
	LNK3	0.895			
Technical Capacity (KAP)	KAP1	0.798	0.880	0.917	0.734
	KAP2	0.881			
	KAP3	0.875			
	KAP4	0.850			
Empowerment (PEM)	PEM1	0.854	0.899	0.929	0.766
	PEM2	0.890			
	PEM3	0.867			
	PEM4	0.881			

Source: Primary data analysis (2025)

Measurement Model Evaluation

The evaluation of the measurement model was conducted to ensure that all observed indicators validly and reliably reflect their respective latent constructs. This step is essential in establishing the psychometric adequacy of the outer model prior to hypothesis testing, particularly in studies employing Partial Least Squares Structural Equation Modeling (PLS-SEM), where the quality of measurement directly

affects the validity of the structural paths (Mastana, 2025).

The results indicate that all indicators across the six latent constructs, Participation (PAR), Bonding (BND), Bridging (BRG), Linking (LNK), Technical Capacity (KAP), and Empowerment (PEM), exhibited outer loading values greater than 0.70, which exceeds the recommended threshold for indicator reliability (Mastana, 2025). For instance, in the Participation construct, the

four indicators (PAR1–PAR4) displayed loading values ranging from 0.809 to 0.853, with the highest loading observed for PAR2 (0.853), suggesting it is the most representative item of the construct. Similarly, the indicators for Bonding (BND1–BND3) yielded loadings between 0.865 and 0.882, reinforcing the internal coherence of this construct.

In addition to indicator reliability, construct reliability was assessed using Cronbach's Alpha and Composite Reliability (CR). All constructs reported Cronbach's Alpha values exceeding 0.85 and CR values above 0.90, indicating excellent internal consistency (Ghaleb & Yaslioglu, 2024). For example, Linking recorded the highest reliability (Cronbach's Alpha = 0.915; CR = 0.941), followed closely by Empowerment (Cronbach's

Alpha = 0.899; CR = 0.929). These results demonstrate that the set of indicators for each latent variable is statistically coherent and consistently measures the intended construct (Afthanorhan et al., 2021).

Convergent validity was confirmed through the Average Variance Extracted (AVE), which ranged from 0.695 (Participation) to 0.801 (Linking), all exceeding the minimum threshold of 0.50 (Ghaleb & Yaslioglu, 2024). This indicates that each construct captures more than 50% of the variance of its indicators, which is a prerequisite for establishing adequate convergent validity. These findings reinforce the model's capacity to accurately represent the theoretical domains of social participation, social capital dimensions, technical competencies, and empowerment in livestock entrepreneurship.

Table 3. Discriminant Validity Test Results (HTMT Ratio)

Construct	PAR	BND	BRG	LNK	KAP	PEM
PAR						
BND	0.512					
BRG	0.488	0.651				
LNK	0.530	0.499	0.715			
KAP	0.623	0.314	0.780	0.811		
PEM	0.555	0.298	0.695	0.702	0.825	

Source: Primary data analysis (2025)

Discriminant validity was evaluated using the Heterotrait-Monotrait ratio of correlations (HTMT), a more robust criterion than the Fornell-Larcker method and recommended for PLS-SEM models (Farhudi et al., 2025). All HTMT values were below the conservative cut-off value of 0.85. For instance, the HTMT value between Participation and Bonding was 0.512, between Bridging and Linking was 0.715, and between Technical Capacity and Empowerment was 0.825. These values confirm that the constructs are empirically distinct and measure different conceptual domains.

The measurement model meets all the requirements of convergent validity, construct reliability, and discriminant validity. These results provide strong empirical support for the soundness of the outer model, enabling a robust interpretation of the structural relationships in subsequent analyses. Importantly, the

validated constructs offer a reliable foundation for measuring multi-dimensional social capital and technical capacity factors that influence the empowerment of young livestock entrepreneurs in dynamic rural agribusiness environments (Nurlina et al., 2024; Chinazor et al., 2025).

Structural Model Assessment and Hypothesis Testing

The establishment of a reliable and valid measurement model enabled the evaluation of the structural model, which tested the proposed hypotheses and assessed the model's predictive power. The coefficient of determination (R^2) was used to measure the amount of variance explained in the endogenous constructs. The R^2 value for Technical Capacity Building (KAP) was 0.582, indicating that 58.2% of the variance in KAP is explained by the exogenous variables in the model. Likewise, the R^2 value for Farmer

Empowerment (PEM) was 0.424, suggesting that 42.4% of the variation in empowerment is attributable to technical capacity. These values indicate a

substantial (KAP) and moderate (PEM) explanatory power, based on the thresholds suggested by Afthanorhan et al. (2021).

Table 4. Structural Model Hypothesis Testing Results

Hypothesis	Path	Path Coefficient (β)	Std Deviation	t-statistic	p-value
H1	PAR $\rightarrow$ KAP	0.250	0.112	2.232	0.026
H2	BND $\rightarrow$ KAP	-0.081	0.105	0.771	0.441
H3	BRG $\rightarrow$ KAP	0.352	0.128	2.750	0.006
H4	LNK $\rightarrow$ KAP	0.418	0.135	3.096	0.002
H5	KAP $\rightarrow$ PEM	0.651	0.098	6.643	0.000

Source: Primary data analysis (2025)

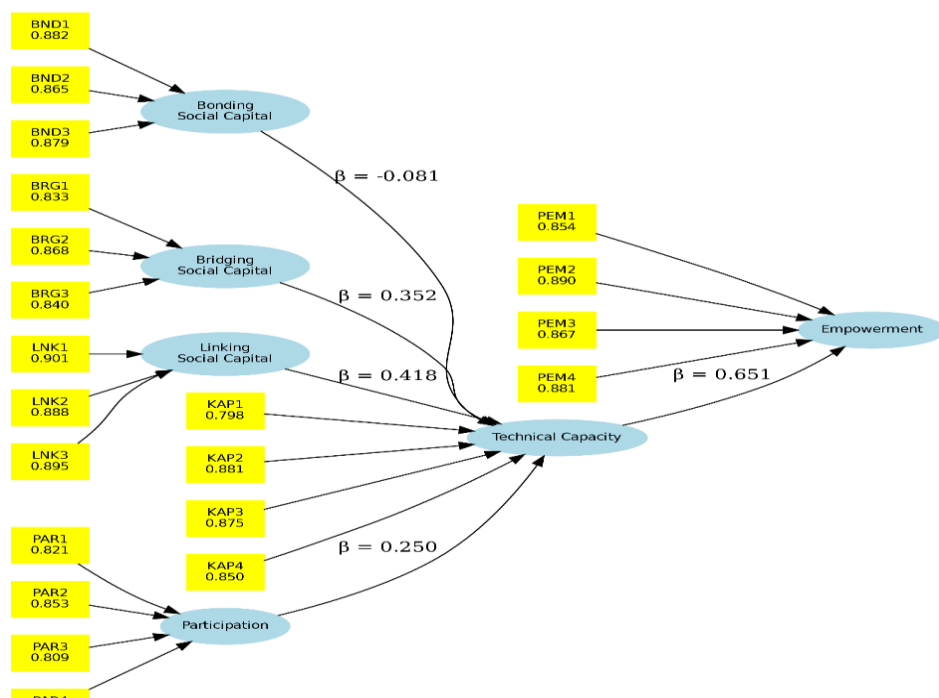


Figure 1. Path Diagram of the Structural Model: Effects of Participation and Social Capital on Empowerment

Effect size (f^2) values were also analyzed to determine the individual contribution of each exogenous variable. The constructs linking ($f^2 = 0.215$) and bridging ($f^2 = 0.158$) demonstrated medium effects, whereas participation ($f^2 = 0.075$)

Participation as a Catalyst for Learning (H1)

The finding supports H1, showing that group participation has a significant positive effect on technical capacity building ($\beta = 0.250$, $p < 0.05$). This reinforces a core principle of community development that passive membership is insufficient. Only through active

had a small effect, and bonding ($f^2 = 0.009$) had a negligible effect. Furthermore, predictive relevance (Q^2) values of 0.315 for KAP and 0.288 for PEM further confirmed the model's good predictive capacity (Sarstedt et al., 2022)

engagement in group discussions, training, and collaborative activities can livestock farmers internalize new knowledge and skills (Bakker et al., 2021). Participation acts as a catalyst that transforms membership from a nominal status into an active social learning process, facilitating the acquisition of practical competencies.

The Critical Role of Bridging and Linking Social Capital (H3 & H4)

The most prominent findings support H3 and H4, confirming that bridging ($\beta = 0.352$, $p < 0.01$) and linking ($\beta = 0.418$, $p < 0.01$) social capital have a significant and positive influence on technical capacity development. These results offer empirical validation for the theoretical proposition that external networks are crucial for "getting ahead" (Woolcock & Narayan, 2024).

Bridging social capital fosters access to diverse and novel information sources. For traditional livestock farmers in Samarinda, whose practices are often passed down and localized, exposure to external perspectives, such as alternative feed techniques or modern marketing strategies, introduces valuable innovations (Galeener, 2022). These external connections serve as conduits for "fresh air," mitigating stagnation and intellectual isolation within farmer groups.

The more substantial influence of linking social capital highlights the institutional reality of livestock development in Indonesia. Formal progress in the sector is mainly dependent on vertical ties with government agencies, universities, and private actors (Bastakoti et al., 2021). Farmers who can establish and maintain such linkages can access critical resources, such as land, improved genetics, formal

The strongest path in the model was from Technical Capacity Building to Farmer Empowerment ($\beta = 0.651$, $p < 0.001$), lending robust support to H5. This relationship confirms the logical structure

rano et al., 2021; Oppong & Safo Lartey, 2025). When farmers enhance their technical proficiency, they do not merely improve productivity and income; they also enhance their overall well-being. More importantly, they gain confidence, agency, and control over the core elements of their livelihood's empowerment. This underscores that empowerment in the livestock sector should not be approached solely through subsidies or external interventions, but rather through structured and sustained efforts to build technical and managerial capacity.

credit, and technical training, which significantly differentiate them from others (Wossen et al., 2017).

The Dark Side of Bonding: Why H2 Was Not Supported

Interestingly, H2 was not supported, as bonding social capital did not significantly affect technical capacity building ($\beta = -0.081$, $p > 0.10$). This finding challenges the assumption that strong internal cohesion automatically leads to innovation. Instead, it highlights the potential "dark side" of social capital (Portes, 2024).

Bonding may support "getting by" through mutual support and solidarity, but appears insufficient for enabling innovation. Excessive internal cohesion may foster conformity pressures, discourage risk-taking, and lead to exclusionary practices toward outsiders or new ideas. It may also limit individual autonomy, suppressing innovative behaviour perceived as deviating from group norms (Krämer et al., 2021; Qamara et al., 2025). Thus, for innovation-driven capacity building, outward-looking social capital (bridging and linking) proves more effective than inward-looking bonding ties. **Technical Capacity as the Gateway to Empowerment (H5)**

of the model and reinforces the idea that investment in skills and knowledge is the most direct and effective route to genuine empowerment (Maio

Policy Implications and Strategic Recommendations

The empirical findings presented in this study yield a series of substantive policy implications and strategic directions for advancing youth-led entrepreneurship within the beef cattle sector, particularly in rural contexts. Anchored in the theoretical discourse on social capital and rural innovation systems, this section presents a multi-level approach that encompasses group-level transformation, institutional realignment, and digital empowerment.

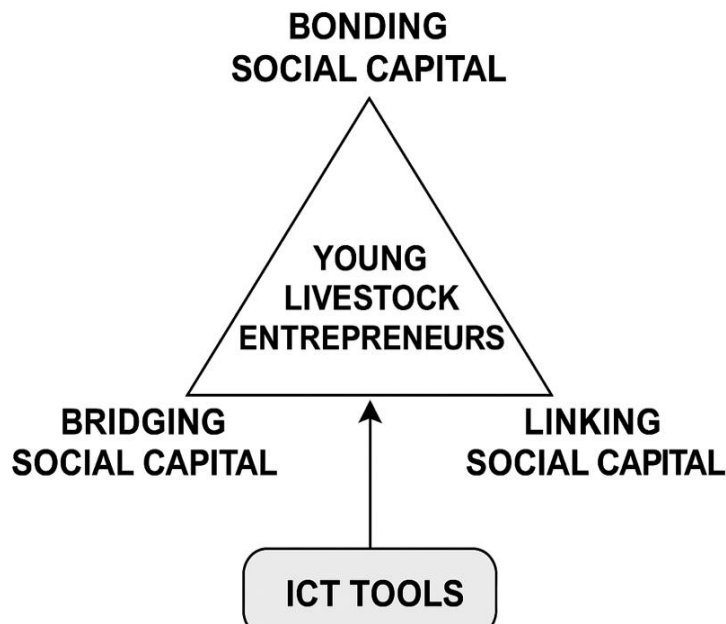


Figure 2. Integrated Social Capital Framework for Empowering Young Livestock Entrepreneurs

A critical insight emerging from the data is the differentiated role of social capital dimensions, namely, bonding, bridging, and linking, in shaping the adaptive and innovative capacities of farmer groups. While bonding social capital provides a foundational layer of trust, cohesion, and collective identity (Galeener, 2022; Woolcock & Narayan, 2024), its predominance when left unbalanced may engender inward-looking tendencies that obstruct inter-group learning, innovation diffusion, and upward institutional engagement.

To counteract these limitations, farmer groups must deliberately cultivate bridging and linking social capital by expanding relational networks beyond homogeneous circles. This transition demands both cultural adaptation and institutional structuring. Accordingly, it is proposed that farmer groups establish a formalised role of Head of Partnership and Innovation, tasked with maintaining external linkages, representing the group in regional livestock forums, initiating cross-sector collaborations, and serving as a conduit for the absorption of technical knowledge from universities and extension agencies. This role institutionalizes knowledge brokerage (Wan & Du, 2022),

allowing strategic engagement with broader innovation ecosystems and repositioning group strategies from reactive to proactive.

At the policy level, a paradigm shift is warranted in the design and implementation of livestock development programs. Current interventions often focus narrowly on strengthening intra-group solidarity without sufficiently facilitating inter-group connectivity or multi-level institutional interaction. It is therefore recommended that local governments and development agencies embed mechanisms to foster structured horizontal networks, such as quarterly knowledge-sharing platforms, inter-group innovation showcases, and comparative study visits to exemplary cooperatives. These should not be episodic but rather institutionalized within district agricultural development plans, supported by dedicated fiscal allocations to ensure continuity, replication, and measurable impact (Baltenweck et al., 2024; Widiarta et al., 2025).

Parallel to these horizontal linkages, the strategic cultivation of vertical linkages that leverage social capital must be prioritized. Formal partnerships, established through Memoranda of

Understanding (MoUs), between farmer associations (e.g., Gapoktan) and higher education institutions (e.g., the Department of Animal Science at Mulawarman University) can facilitate sustained access to scientific mentorship, curriculum-based training, and participatory research programs. Furthermore, collaboration with the private sector through Corporate Social Responsibility (CSR) programs can expand opportunities for integrated livestock–crop systems, such as cattle integration on post-mining lands or palm oil plantations. These arrangements must be underpinned by clearly articulated goals, implementation timelines, and performance evaluation metrics to ensure mutual accountability and long-term impact (Guo et al., 2022).

In tandem with these structural strategies, digital transformation must be embraced as a catalyst for inclusive network formation and the democratization of information. The proliferation of digital tools and platforms, including moderated WhatsApp groups, mobile-based extension services, online marketplaces, and interactive learning portals, provides low-cost, scalable channels for capacity building, market access, and technical consultation (Yates et al., 2025).

Development interventions must therefore integrate digital literacy training as a core component, particularly for young farmers. This should not be limited to the provision of technological tools but must encompass the cultivation of digital competencies, critical thinking, and participatory engagement in virtual knowledge communities. As highlighted by the World Bank (2021), digital literacy has become a foundational capability in modern agribusiness, comparable in importance to conventional livestock husbandry skills.

Taken together, these recommendations emphasize the necessity of a multi-dimensional policy architecture that simultaneously strengthens bonding for social cohesion, bridging for innovation diffusion, and linking for institutional integration. When synergized with digital infrastructures and capacity-building, this approach can unlock transformative potential for rural youth, positioning them not merely as beneficiaries but as active agents of change in the evolving livestock sector. Such strategic repositioning is essential for building a resilient, entrepreneurial, and future-ready agribusiness landscape in rural economies.

CONCLUSIONS

The findings of this study confirm that technical capacity building serves as a critical intermediary linking social participation and social capital dimensions to farmer empowerment. Specifically, participation in farmer groups, as well as bridging and linking social capital, positively influences technical capacity development. In contrast, bonding social capital does not significantly contribute to innovation or knowledge transfer. Furthermore, technical capacity is shown to exert a strong and direct impact on farmer empowerment outcomes. These results highlight the importance of fostering outward-facing social connections and institutional engagement mechanisms, rather than relying solely on intra-group cohesion. The integrated empowerment model developed in this research offers a

robust analytical framework and presents empirical evidence on the strategic value of social networks and learning processes in enhancing the agency, productivity, and resilience of smallholder beef cattle farmers within a context of structural agrarian transformation.

To enhance the empowerment and sustainability of smallholder beef cattle farmers, particularly in light of the Ibu Kota Nusantara development, several strategic actions are recommended. First, farmer groups should institutionalize roles focused on external engagement such as a Head of Partnership and Innovation to systematically develop bridging and linking social capital. Second, local governments should support structured inter-group collaboration and innovation platforms to facilitate knowledge exchange

and peer learning. Third, formal partnerships with universities and private stakeholders must be embedded through Memoranda of Understanding (MoUs) to ensure continuous access to technical expertise and resources. Fourth, digital transformation should be leveraged by integrating ICT tools and digital literacy training into livestock development

programs. Inclusive policies, dedicated funding mechanisms, and measurable performance indicators must underpin these strategies. Collectively, such measures will enable livestock farmer groups to transition from passive beneficiaries to active agents of change in building a resilient, market-responsive, and future-ready rural agribusiness sector.

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