



The primacy of emotional bonds and behavioral dynamics in sustaining Indonesian community livestock centers beyond economic rationality

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ABSTRACT

Background: Grassroots agricultural institutions, such as Indonesia's Community Livestock Centers/*Sentra Peternakan Rakyat* (SPR), frequently experience systemic stagnation once state subsidies are withdrawn. Traditional extension models, which predominantly rely on top-down economic incentives, frequently fail to sustain long-term collective action. This study investigates the interplay of rational, emotional, and behavioral (REB) factors driving farmer participation while mapping actor-network constellations to identify specific governance bottlenecks during institutional decay. **Methods:** A mixed-methods sequential explanatory design was employed. First, quantitative survey data from 120 smallholder beef cattle farmers in Subang Regency were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). Second, qualitative data from 15 key informants were evaluated through Actor-Network Theory (ANT) to analyze the sociology of translation. **Findings:** The structural model demonstrated exceptional explanatory power ($R^2 = 0.915$). Rational and Behavioral factors were significant, but emotional factor (trust and solidarity) emerged as the primary driver ($\beta = 0.747, f^2 = 2.991$). ANT analysis revealed that failure typically occurs during the "enrollment" phase, when top-down metrics clash with local psychosocial realities, leaving non-human artifacts (communal pens and biogas digesters) abandoned. **Conclusion:** Emotional factors have the strongest influence on SPR participation compared with the other factors, which highlights the importance of fostering social motivation within the community. Consequently, we recommend integrating 'Social Fabric Indicators' into regional agricultural extension policies to foster more resilient, community-based farming institutions. **Novelty/Originality of this article:** This study empirically challenges the classical homo economicus assumption by innovatively integrating the REB framework with ANT. The study robustly demonstrates the predominance of emotional capital over economic rationality for institutional sustainability.

KEYWORDS: actor-network analysis; community engagement; community livestock centers; emotional attachment; structural equation modeling.

1. Introduction

Global food security critically depends on the sustainability of grassroots agricultural and livestock sectors, particularly under the mounting pressures of climate change, population growth, and evolving dietary preferences. In developing countries, smallholder farmers represent the backbone of beef cattle production, playing a pivotal role in meeting domestic protein demand, alleviating rural poverty, and driving regional economic

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development (Thornton et al., 2009; Mehrabi et al., 2020). Livestock farming in rural landscapes is not merely an economic enterprise; it is deeply embedded in the sociocultural fabric, functioning as a primary mechanism for household savings, social status elevation, and ecological balance within mixed crop-livestock systems (Godde et al., 2021). These smallholders frequently confront systemic challenges despite their critical socio-economic contributions. Structural barriers include limited access to formal credit markets, highly asymmetric market information, suboptimal livestock management practices, and limited institutional bargaining power (Han et al., 2022).

The Indonesian government introduced the Community Livestock Center (*Sentra Peternakan Rakyat* or SPR) program as a strategic institutional intervention to mitigate these pervasive structural barriers. SPR aims to consolidate small-scale, highly fragmented livestock businesses into a collective, commercially viable institutional framework based on cooperative management and participatory governance principles. Unlike conventional, loosely structured farmer groups, SPR represents one of Indonesia's largest institutional initiatives, specifically designed to systematically transform highly fragmented, subsistence-oriented smallholders into commercially oriented collective enterprises through intensive state-led intervention. State interventions under the SPR framework have historically included the significant provision of subsidized breeding stock, the construction of communal housing facilities, the distribution of high-quality concentrated feed, and the deployment of intensive veterinary extension services (Ilham et al., 2021).

However, the institutional sustainability of SPRs remains a highly critical and unresolved issue despite the significant infusion of state resources, technical assistance, and infrastructural development over the past decade. Empirical observations across various agricultural provinces indicate a recurrent pattern of institutional stagnation, characterized by a sharp, immediate decline in farmer participation once government subsidies, external funding, or project-based supervisions are depleted (Rusdiana & Soeharsono, 2017). Subang Regency, a primary agricultural hub in West Java Province, is a notable contextual example of this phenomenon. Local SPRs in this region, having been established and subsidized during their initial implementation phases, currently suffer from severe collective action dilemmas. Specifically, while the rational economic framework remains intact through available physical infrastructure, Subang's SPRs suffer from a critical breakdown in emotional capital (such as trust and mutual solidarity among farmers) which has led to behavioral apathy, leaving communal assets underutilized and governance deadlocked. This specific case illustrates the broader challenge where institutional dysfunction, which is prevalent, is accompanied by a pervasive lack of active farmer engagement in collective decision-making processes, communal labor, and financial contribution management.

Social capital, which encompasses structural networks, cognitive norms of reciprocity, and relational trust, is recognized as the fundamental sociological foundation of sustained community engagement (Slijper et al., 2022; Deng et al., 2020). Institutional stagnation is frequently observed in the context of government-led agricultural programs when interventions rely primarily on bridging social capital while placing less emphasis on the development of bonding social capital, which refers to the internal solidarity and emotional cohesion among the farmers themselves (Bitsch et al., 2022). Institutions formed artificially through top-down bureaucratic mandates rather than organic, bottom-up grassroots mobilization typically produce highly fragile social capital. When state incentives are withdrawn due to the absence of authentic internal cohesion, the organizational structure invariably experiences rapid decay (Barnes et al., 2016; Zheng & Liu, 2021).

Classical agricultural extension models and rural development policies have traditionally been heavily anchored in technical-economic paradigms and the Rational Choice Theory (Small & Maseyk, 2022). Under this conventional theoretical framework, farmers are frequently assumed to act primarily as *homo economicus* (profitmaximizing) actors who will automatically engage in and sustain collective action if provided with sufficient financial incentives, adequate physical infrastructure, and comprehensive technical training (Meinzen-Dick et al., 2022). As a direct consequence of this dominant

paradigm, policy interventions have predominantly focused on addressing physical and technological constraints. The persistent failure of heavily funded livestock centers suggests that reliance on economic rationality and infrastructural development is insufficient to guarantee long-term institutional resilience (H. Dong & Dacre, 2024).

Over time, the conceptualization of farmer participation has evolved significantly from early adoption theories focused on economic utility to contemporary rural sociology emphasizing psychosocial dynamics. The Rational, Emotional, and Behavioral (REB) framework posits that three interconnected domains drive human behavior in collective settings, cognitive evaluation of economic costs and benefits, affective bonds and psychological ownership toward the community, and past experiences or perceived behavioral control (Daxini et al., 2019). While conventional behavioral models (such as the Theory of Planned Behavior) frequently isolate cognitive intentions from emotional states, the REB framework offers greater explanatory power by capturing the non-linear, synergistic interplay between rational calculation and deep-seated affective drivers. Emotional factors often complement or even override rational economic motives in rural farming communities. A farmer might continue to participate in an unprofitable or struggling cooperative purely out of loyalty to a local community leader, a deep sense of place attachment, or a strong desire to maintain social harmony (Wisnujati et al., 2024; Schaub et al., 2023; Sutherland & Burton, 2021). In agricultural collectives, trust is defined as the willingness to be vulnerable to the actions of others within a network. It is identified as a critical psychosocial determinant in reducing transaction costs, resolving conflicts, and preventing opportunistic free-riding behaviors (Cechin et al., 2018; Hao et al., 2023; Ji et al., 2019).

Furthermore, the complex dynamics of institutional development in modern agriculture cannot be fully understood without examining the intricate network of human and non-human actors involved in the system. Actor-Network Theory (ANT) conceptualizes society not as a static, pre-existing structure but as a continuous, dynamic process of network-building (Yao & Liu, 2022). In agricultural sociology, ANT is increasingly used to critically analyze how centralized extension programs are translated, negotiated, and adapted into local sociocultural contexts (Klerkx et al., 2017; Forney et al., 2018). The sociology of translation, a theoretical process involving four interrelated moments: problematization, interessement, enrollment, and mobilization, significantly influences the success of any agricultural institution. Many agricultural development projects fail during the translation phase, where central actors or obligatory passage points fail to align the government's rigid interests with the farmers' fluid psychosocial needs, leading to substantial network disintegration (Dolinska & d'Aquino, 2016; Darnhofer, 2020; Castella et al., 2022).

Although previous studies have examined farmer participation from economic, behavioral, and social capital perspectives, research integrating these approaches has rarely evaluated whether emotional attachment exerts a stronger influence than economic rationality in sustaining collective livestock institutions. Furthermore, limited research has integrated these individual psychosocial mechanisms with actor-network analysis to map structural governance bottlenecks during institutional decay. To address the critical research gap regarding why top-down agricultural institutions frequently collapse after the cessation of state support, this study provides a multi-dimensional analysis that transcends purely technical-economic evaluations. Specifically, we aim to: (1) quantitatively evaluate the interplay of rational, emotional, and behavioral (REB) factors on farmer participation using PLS-SEM and (2) qualitatively map the actor-network constellations to identify systemic bottlenecks in institutional governance. We hypothesize that emotional dimensions, such as interpersonal trust and psychological ownership, are more potent predictors of sustained engagement than rational economic calculations. By integrating the REB framework and ANT, this study offers a novel theoretical contribution to rural sociology while providing an evidence-based framework for designing resilient agricultural interventions.

2. Methods

2.1 Study site and institutional context

The research was conducted in Subang Regency, West Java, a region strategically designated as one of Indonesia's primary beef cattle production hubs. Subang was purposefully selected as the research site based on the following criteria: (1) its strategic position as a high-density beef cattle production center, (2) the long-term presence of SPR institutional frameworks that have received consistent state interventions since their national inception, and (3) the representative nature of its socio-demographic profile for Indonesian smallholder livestock farming. Unlike other regions where livestock farming is a secondary occupation, the farmers in the studied SPR clusters in Subang exhibit a high degree of dependence on cattle as a primary household asset. This socio-economic characteristic provides fertile ground for analyzing the tension between rational economic calculations and emotional communal bonds. This study focuses on three active SPR clusters that represent the diverse geographical and administrative landscape of the regency, ensuring that the findings capture a broad spectrum of institutional dynamics.

The Sentra Peternakan Rakyat (SPR) was selected as the primary institutional object of this study because of its unique positioning as a flagship national program designed to transition smallholder farmers from individualistic traditional practices to collective, business-oriented entities. Unlike conventional farmer groups, the SPR framework explicitly mandates a large-scale consolidation of at least 1,000 productive cows within a single administrative network, making it a complex socio-technical laboratory for studying collective action. This institution provides a critical case for analysis because it represents the pinnacle of top-down social engineering in Indonesian agriculture, where the government attempts to "manufacture" community engagement through a combination of significant physical inputs and bureaucratic restructuring, thus offering a clear visibility into the friction between state-led initiatives and local psychosocial realities.

Subang Regency has implemented the SPR program since its inception as a national pilot project in West Java, thereby providing a mature institutional setting where different stages of long-term institutional development and stagnation can be longitudinally observed over a decade of operation. The local beef cattle sector also represents a vital livelihood source for numerous rural households, making the region highly suitable for systematically investigating the dynamics of long-term farmer participation within collective livestock institutions.

2.2 Research design and methodological rationale

A mixed-methods sequential explanatory design was rigorously employed in this research. First, we quantitatively analyzed the relationships between rational, emotional, and behavioral (REB) factors and farmer participation using survey data analyzed via Partial Least Squares Structural Equation Modeling (PLS-SEM). Second, we qualitatively examined the Actor-Network Theory (ANT) framework within the community using data collected through semi-structured interviews and participatory observation.

A sequential explanatory design was specifically selected because the initial quantitative findings mapped out the statistically significant relationships among the study variables, whereas the subsequent qualitative phase was essential to explain, contextualize, and unravel the underlying sociological mechanisms and network translations that numbers alone could not capture (Creswell & Creswell, 2018). Complex sociopsychological phenomena in rural agriculture cannot be adequately captured through numbers alone; qualitative narrative is required to understand the contextual mechanisms driving statistical correlations (Winarto et al., 2025). The synthesis of this qualitative translation and the quantitative structural model provides a holistic understanding of the institutional trajectory (Figure 1).

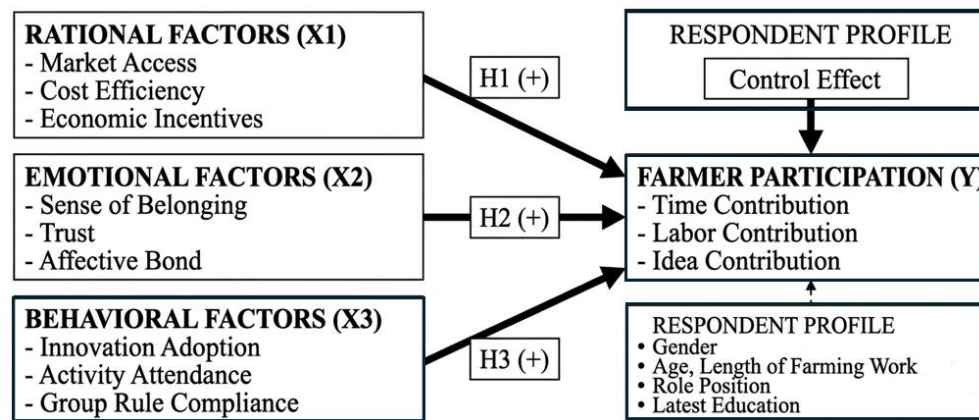


Fig. 1. Research conceptual framework and structural model of hypothesis

2.3 Quantitative phase: Sampling, data collection, and instrumentation

The quantitative population comprised smallholder beef cattle farmers registered in the Subang Regency SPR framework. A stratified random sampling method was used to select 120 respondents, with strata based on geographical sub-districts and cooperative size to ensure proportional representation. This specific sample size of 120 was determined based on a statistical power analysis relative to the structural model's complexity. Given that the primary endogenous construct (farmer participation) is predicted by three latent variables (Rational, Emotional, and Behavioral factors), a sample of 120 significantly exceeds the minimum requirement of approximately 76 observations needed to detect a medium effect size ($f^2 = 0.15$) at a 5% significance level with 80% statistical power (Hair et al., 2019; Cohen, 1988). Moreover, establishing the sample at 120 provided a practical safety margin to account for potential non-response or incomplete questionnaires across the stratified sub-districts while ensuring robust predictive validity (Sarstedt et al., 2022).

Primary data were gathered through face-to-face personal interviews conducted by a trained team of enumerators using a meticulously designed questionnaire. This direct interaction was essential to bridge technical academic constructs with farmers' local cognitive frameworks. Before the full-scale collection, the instrument was subjected to a pilot test involving 30 non-sampled farmers to ensure linguistic clarity and cultural appropriateness. Each interview session lasted 45 to 60 minutes and was conducted 'in-situ' at respondents' homes or communal pens (kandang kelompok), allowing for the cross-verification of verbal responses with physical farming realities. A mobile-based data entry system was used for real-time validation and the minimization of manual entry errors to maintain data integrity.

The survey instrument employed a standardized five-point Likert scale (1 = strongly disagree to 5 = strongly agree) and was divided into four specialized modules corresponding to the model's latent variables: Rational, Emotional, Behavioral, and Participation modules. The rational module examined perceptions of economic utility and government-led insurance; the emotional module examined psychosocial layers such as affective trust in leaders and communal pride; the Behavioral module assessed habitual patterns, including attendance in meetings and labor contributions to biogas infrastructure; and the Participation module focused on the willingness to sustain collective action without state subsidies. This comprehensive modular approach ensures that the subsequent PLS-SEM outputs are grounded in the grassroots agricultural community's authentic and multi-dimensional experiences.

2.4 Operationalization of latent constructs and SEM analysis

The structural model evaluated four main variables, which were measured using a 5-point Likert scale. To clarify the measurement framework, these variables were explicitly

operationalized through a total of 17 questionnaire items distributed as follows, (1) rational factor (RAT, 4 items) measured perceived economic incentives and financial risk reduction; (2) emotional factor (EMO, 5 items) assessed collective solidarity, trust, and attachment to leadership (Schaub et al., 2023; Sutherland & Burton, 2021); (3) behavioral factor (BEH, 4 items) evaluated perceived behavioral control and peer influence (Yu et al., 2023), and (4) farmer Participation (PAR, 4 items) measured actual behavioral consistency in meeting attendance, financial contributions, and communal labor (Zeng et al., 2023). Advanced data analysis was performed via Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS version 3.0. This variance-based approach was selected for its superior capability in handling complex exploratory models and robustness with non-normally distributed behavioral data (Sarstedt et al., 2022). The statistical evaluation followed a two-stage protocol. In the first stage, the measurement model (outer model) was assessed to establish indicator reliability (loadings > 0.708), internal consistency (Cronbach's Alpha and Composite Reliability > 0.70), and convergent validity (AVE > 0.50). Discriminant validity was strictly verified using the Heterotrait-Monotrait (HTMT) ratio, with a conservative threshold of 0.85 to ensure each construct's distinctiveness (Hair et al., 2019).

The structural model (inner model) was evaluated in the second stage to test the hypothesized paths. A non-parametric bootstrapping procedure with 5,000 subsamples was used to generate stable *t-statistics* and *p-values*. Beyond mere significance, the model's predictive power was assessed through the coefficient of determination (R^2), while the substantive impact of each independent variable was determined using effect size (f^2) calculations. This rigorous two-tiered analysis ensures that the findings are not only statistically significant but also possess high predictive relevance for institutional sustainability.

2.5 Qualitative phase: Actor-network theory (ANT) and data collection

Following the quantitative analysis, a comprehensive qualitative phase was initiated to explore the sociocultural mechanisms dictating the statistical findings. Purposive and snowball sampling techniques were strategically combined to identify 15 key informants, including local farmer champions, respected community leaders, government extension agents, and senior agricultural officials. The final number of 15 informants was determined based on the principle of theoretical saturation, the point at which subsequent interviews yielded no additional insights, novel codes, or emerging themes regarding the actor-network dynamics. These actors were selected on the basis of their central roles within the livestock network, ensuring a multi-layered perspective on institutional dynamics.

Primary qualitative data were collected through in-depth, semi-structured interviews and prolonged participatory observations conducted over a continuous period of three months, comprising intensive weekly field visits (3–4 days per week) that accumulated approximately 160 hours of direct fieldwork. This deep ethnographic immersion involved actively engaging in daily farming routines, attending six formal cooperative meetings, and observing informal interactions around communal pens. Such an approach allowed for the critical cross-validation of self-reported narratives against actual behavioral patterns on the ground. The interview guides were specifically designed to elicit rich narratives regarding the evolution of trust and the socio-technical factors behind the decline in collective participation.

A rigorous triangulation strategy was applied by synthesizing interview transcripts, field notes, and observational data to ensure empirical credibility. All interviews were audio-recorded, transcribed verbatim, and systematically anonymized to maintain respondent confidentiality. Data collection was officially concluded only when theoretical saturation was achieved, the point where no new substantive themes or novel network actors emerged from the fieldwork. This robust qualitative foundation provides the necessary context to interpret the "human" and "non-human" interactions that define the SPR's institutional trajectory.

2.6 The sociology of translation

The transcribed qualitative data were rigorously analyzed using the interactive qualitative model, which encompasses systematic data condensation, organized data display, and robust conclusion drawing (Miles et al., 2020). The coding process was systematically managed using Microsoft Excel for qualitative data indexing and categorization to ensure methodological transparency. The initial coding of interview transcripts and field notes generated 42 open codes, which were subsequently condensed into 6 core thematic categories. These specific categories were then operationally mapped onto the ANT framework by directly aligning participants' narratives regarding conflicts, elite capture, and material abandonment to the specific phases of translation. Therefore, the specific analytical lens of ANT was exclusively applied to dissect institutional dynamics, mapping the complex web of interactions between human actors (farmers, officials, elites) and non-human artifacts (government decrees, subsidized cattle, and communal pens) (Klerkx et al., 2017; Ngissah et al., 2025).

The analysis traced the four sequential translation moments to examine potential institutional bottlenecks. Problematization scrutinized how the state defined the livestock crisis and established the SPR as the Obligatory Passage Point (OPP). Interestement examined the material and symbolic incentives used to lock farmers into defined roles. Enrollment investigated the negotiations and social frictions that occurred as farmers integrated into the formal bureaucracy. Finally, Mobilization evaluated the sustainability of the network and the legitimacy of its designated spokespersons. Grounded in established actor-network literature, this translation protocol serves as a robust analytical framework to map how diverse network components align, stabilize, or experience structural divergence (Darnhofer, 2020; Wang & Ma, 2025).

3. Results and Discussion

3.1 Socio-demographic characteristics of respondents

Table 1 presents the socio-demographic profile of the 120 respondents in Subang Regency. Beef cattle farming is predominantly a male-dominated activity (88.3%), with most farmers falling within the productive age range of 41–60 years (61.7%). Most respondents have completed primary or secondary schooling, indicating a moderate level of formal literacy. Furthermore, the participants are highly experienced, with 74.2% having more than 10 years of farming experience. However, the scale of ownership remains small, as 65.8% of farmers manage only 1–2 heads of cattle, highlighting the typical smallholder nature of the SPR members in this region.

Table 1. Socio-demographic profile of respondents (n = 120)

Variable	Category	Frequency	Percentage (%)
Gender	Male	106	88.3
	Female	14	11.7
Age (Years)	20 – 40	28	23.3
	41 – 60	74	61.7
	> 60	18	15.0
Education Level	Primary School	52	43.3
	Secondary School	58	48.4
	Higher Education	10	8.30
Farming Experience	< 10 years	31	25.8
	10 – 20 years	67	55.8
	> 20 years	22	18.4
Livestock Ownership	1 – 2 heads	79	65.8
	3 – 5 heads	33	27.5
	> 5 heads	8	6.70

Notes: n: number of respondents; SPR: Sentra Peternakan Rakyat (Community Livestock Center).

3.2 Analysis of demographic profile and control variables

Prior to evaluating the primary structural relationships hypothesized within the Rational, Emotional, and Behavioral (REB) framework, it is empirical to isolate the potential confounding effects exerted by individual socio-demographic characteristics. Accordingly, key attributes (namely age, educational background, gender, work experience, and organizational roles) were integrated into the PLS-SEM model as control variables to ensure that the subsequent structural estimations are free from demographic bias. The empirical outputs, path coefficients (β), and corresponding significance values derived from this baseline analysis are systematically compiled in Table 2.

Table 2. Structural path analysis for demographic control variables

Control Variable	Path Coefficient (β)	<i>p</i> -value
Age	0.036	0.369
Education Background	-0.063	0.117
Gender	-0.013	0.702
Work Experience	-0.047	0.241
Organizational Role / Position	0.095	0.027

The initial phase of the empirical analysis involved examining the demographic profile of the 120 respondents and evaluating the influence of these demographic attributes as control variables within the structural model. As presented in Table 2, the structural path analysis revealed critical insights into the socio-demographic determinants of institutional engagement. Age ($\beta = 0.036$, $p = 0.369$), educational background ($\beta = -0.063$, $p = 0.117$), gender ($\beta = -0.013$, $p = 0.702$), and work experience ($\beta = -0.047$, $p = 0.241$) were found to exert no statistically significant influence on farmer participation. The insignificant influence of age and educational background toward participation indicated that farmer's participation appears to be relatively consistent across these demographic groups. Conversely, the official position or role held within the organization was identified as a significant positive predictor of participation ($\beta = 0.095$, $p = 0.027$).

This specific finding suggests that collective participation is highly malleable and deeply dependent on organizational empowerment rather than immutable personal characteristics. Because inherent demographic traits do not automatically predispose certain farmers to be more or less active, a pattern that aligns with previous studies indicating that institutional design often overrides demographic variance in collective action (Fischer & Qaim, 2012; Mojo et al., 2017), future interventions must strategically focus on reshaping internal governance structures. Deliberately delegating meaningful administrative tasks, rotating committee responsibilities, and granting formal structural recognition to ordinary members could serve as a highly effective mechanism for bridging the profound participation gap between institutional elites and the broader grassroots community, as supported by established literature on cooperative democracy and participant empowerment (Ostrom, 2009; Cechin et al., 2018).

To explain the underlying reasons behind this demographic neutrality, we triangulated these quantitative results with our qualitative interview data. Our key informants consistently revealed that in the context of Subang Regency, the SPR framework is viewed as a collective survival mechanism rather than a personal career or economic advancement ladder. Because farmers of all ages and educational levels face identical structural pressures (such as climate unpredictability and highly asymmetric market prices), they view communal cooperation as a vital safety net for household asset protection.

This implies that the 'participation crisis' is not a problem of individual competence or generational gaps, but a systemic failure of the institution to resonate with the collective spirit of the community. When education ($p = 0.117$) fails to predict engagement, the current extension materials may be too technocratic or detached from the practical realities of farmers, regardless of their formal schooling. Consequently, the institutional burden shifts from 'training the individual' to 'reforming the collective structure.' The significance of

'Position' ($p = 0.027$) further reinforces that participation in the studied region is driven by structural 'visibility' where only those with formal titles feel the weight of responsibility, while the majority remain passive observers due to a lack of meaningful roles.

3.3 Measurement model evaluation (outer model)

The measurement model was conducted to establish the reliability and validity of the latent constructs (Rational, Emotional, Behavioral, and Participation). Indicator reliability was confirmed as all outer loadings substantially exceeded the conservative threshold of 0.708, ranging from 0.806 to 0.917. Internal consistency was robustly established; Cronbach's Alpha values for all constructs ranged from 0.916 to 0.928, and Composite Reliability (CR) scores ranged from 0.935 to 0.943, well above the 0.70 benchmark. The average variance extracted (AVE) values, which spanned from 0.705 to 0.767, definitively proved the convergence validity, demonstrating that each latent variable explained more than 70% of the variance of its underlying indicators. The comprehensive summary of the evaluation of the measurement model, detailing the reliability and convergent validity metrics for each construct, is presented in Table 3. The high validity (AVE = 0.731) and reliability (CR = 0.942) of the emotional construct suggest that these 'social fabric' variables are not abstract concepts but tangible psychosocial realities that farmers consistently experience. This provides the empirical baseline necessary to challenge the prevailing economic-centric status quo in agricultural extension (Kolhe & Bhat, 2025).

Table 3. Measurement model evaluation (reliability and convergent validity)

Latent Construct / Indicator	Outer Loading	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
Behavioral Factor (BEH)		0.924	0.943	0.767
BEH1	0.917			
BEH2	0.861			
BEH3	0.834			
BEH4	0.881			
BEH5	0.883			
Emotional Factor (EMO)		0.926	0.942	0.731
EMO1	0.877			
EMO2	0.846			
EMO3	0.842			
EMO4	0.893			
EMO5	0.821			
EMO6	0.851			
Farmer Participation (PAR)		0.916	0.935	0.705
PAR1	0.869			
PAR2	0.826			
PAR3	0.827			
PAR4	0.874			
PAR5	0.806			
PAR6	0.834			
Rational Factor (RAT)		0.928	0.943	0.733
RAT1	0.860			
RAT2	0.860			
RAT3	0.830			
RAT4	0.898			
RAT5	0.819			
RAT6	0.869			

Notes: BEH: Behavioral Factor; EMO: Emotional Factor; PAR: Farmer Participation; RAT: Rational Factor; CR: Composite Reliability; AVE: Average Variance Extracted

Discriminant validity was strictly assessed using the Heterotrait-Monotrait (HTMT) ratio of correlations, which is recognized as the most robust contemporary metric for this purpose (Henseler et al., 2015). All HTMT values across the entire construct matrix

remained substantially below the conservative 0.85 threshold. The highest recorded correlation was observed between the Rational and Participation constructs (0.757), which is fully acceptable. Thus, the empirical distinctiveness of each psychosocial dimension was robustly confirmed. Table 4 shows the complete HTMT matrix, verifying the absolute absence of multicollinearity across all variables. The distinctiveness confirmed by the HTMT ratios proves that farmers' emotional loyalty and social trust are empirically distinct from their rational calculations of financial gain, rather than being mere byproducts of economic incentives. This suggests that psychosocial and economic dimensions represent independent cognitive processes in the farmers' decision-making framework, meaning that both aspects must be addressed as distinct, non-interchangeable components in institutional design.

Table 4. Discriminant validity assessment (htmt ratio)

Construct	BEH	EMO	PAR	RAT
Behavioral (BEH)				
Emotional (EMO)	0.713			
Participation (PAR)	0.781	0.215		
Rational (RAT)	0.688	0.664	0.757	

Notes: HTMT: Heterotrait-Monotrait Ratio; BEH: Behavioral; EMO: Emotional; PAR: Participation; RAT: Rational.

3.4 Structural model evaluation and hypothesis testing (inner model)

To test the central hypotheses, the structural model was evaluated using a non-parametric bootstrapping procedure encompassing 5,000 subsamples. The model demonstrated an extraordinary degree of explanatory power, capturing 91.5% of the variance in Farmer Participation ($R^2 = 0.915$). All three core psychosocial dimensions hypothesized in the REB framework significantly dictated institutional participation, albeit with drastically different magnitudes. The visual representation of the path analysis is shown in Figure 2.

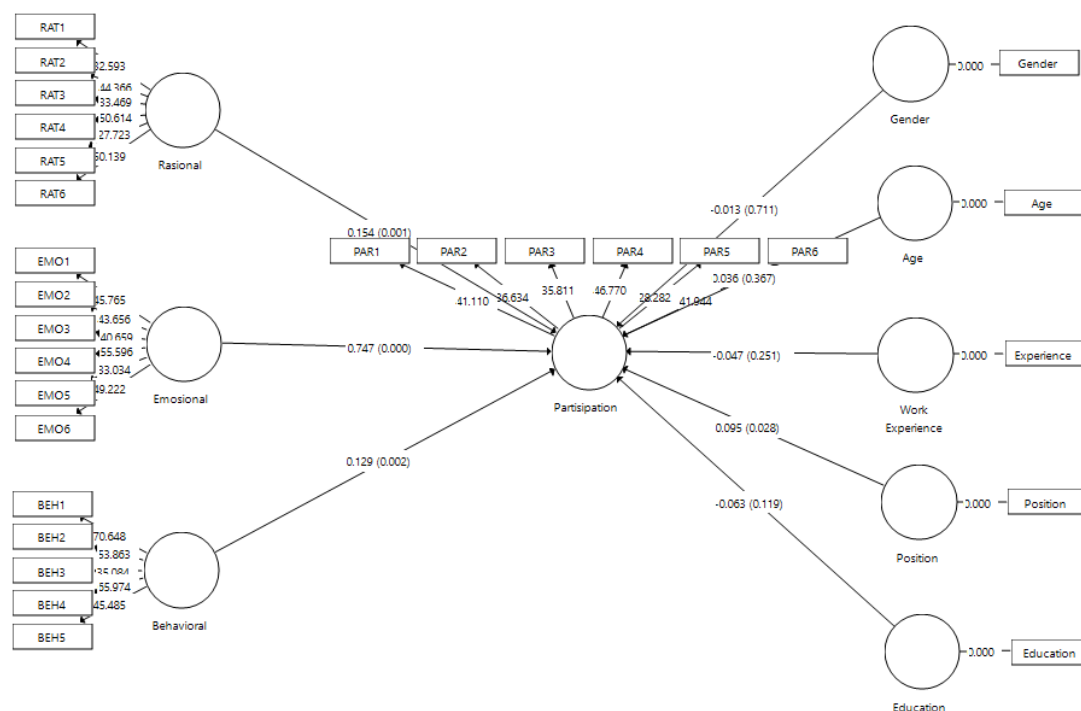


Fig. 2. Structural equation model analysis output via SmartPLS

The path diagram in Figure 2 illustrates the positive directional relationships between the independent and dependent psychosocial constructs. However, a more rigorous

statistical validation is required to definitively determine the significance and magnitude of these observed paths. The bootstrapping analysis results were meticulously examined to evaluate the path coefficients (β), *t-statistics*, *p-values*, and effect sizes (f^2). Table 5 shows the detailed numerical breakdown of these structural relationships, encompassing both the main REB hypotheses and the demographic control variables.

Table 5. Structural model evaluation (hypotheses and control variables)

Hypothesis / Path	Path Coefficient (β)	<i>t-statistics</i>	<i>p-values</i>	Effect Size (f^2)	Decision
Main Hypotheses					
Rational > Participation	0.154	3.316	0.001	0.140	Supported
Emotional > Participation	0.747	13.745	0.001	2.991	Supported
Behavioral > Participation	0.129	3.157	0.002	0.087	Supported
Control Variables					
Age > Participation	0.036	0.899	0.369	0.008	Not Sig.
Education > Participation	-0.063	1.570	0.117	0.022	Not Sig.
Gender > Participation	-0.013	0.383	0.702	0.002	Not Sig.
Position > Participation	0.095	2.215	0.027	0.050	Significant
Work Exp. > Participation	-0.047	1.173	0.241	0.013	Not Sig.

Notes: PLS-SEM: Partial Least Squares Structural Equation Modeling; β : Path Coefficient; f^2 : Effect Size.

Rational factor exerted a significant, yet moderate positive influence on participation ($\beta = 0.154$, $p = 0.001$), generating a small-to-medium effect size ($f^2 = 0.140$). The Behavioral factor exhibited a similarly significant but relatively smaller impact ($\beta = 0.129$, $p = 0.002$), with a minor effect size ($f^2 = 0.087$). The most profound and noteworthy finding of this statistical analysis was the unparalleled dominance of the Emotional factor. The affective dimension is the predominant primary driver of collective action ($\beta = 0.747$, $p < 0.001$), generating a significant, highly substantial effect size ($f^2 = 2.991$). These metrics demonstrate that emotional factors have a much stronger influence on participation than rational factors, such as financial capital. While rational-economic incentives remain statistically significant and cannot be overlooked, this stark contrast suggests that strengthening loyalty, trust, and other emotional dimensions may be more effective in increasing long-term participation in the SPR rather than solely relying on financial incentives. This quantitative evidence validates that traditional extension models target the secondary rather than the primary driver of participation (L. Dong et al., 2026).

3.5 The primary importance of psychosocial bonds over economic rationality

The traditional paradigm of agricultural extension, which often assumes that smallholder farmers act primarily as profit-maximizing *homo economicus* entities, is critically reassessed in light of these quantitative findings. Given that the Emotional factor has a remarkably stronger influence ($f^2 = 2.991$) than the Rational factor ($f^2 = 0.140$), the findings may suggest that nonmaterial incentives are the primary drivers of participation in the SPR. Consequently, interpersonal trust, a shared sense of communal identity, and psychological ownership of the local organization appear to be essential catalysts for promoting voluntary, long-term farmer participation within the grassroots framework. These compelling empirical findings corroborate and substantially extend the findings of recent critical studies in contemporary rural sociology. Deep-rooted social cohesion, affective solidarity, and horizontal interpersonal trust have consistently been shown to reduce transaction costs, eliminate administrative friction, and mitigate opportunistic free-riding behaviors far more effectively than millions of dollars in financial subsidies alone (Baur, 2020; Hatak et al., 2015; Slijper et al., 2022). Government interventions historically executed in Subang Regency were obsessively focused on delivering infrastructural hardware and short-term financial aid. This technocratic approach inadvertently and fatally neglected bonding social capital cultivation. The purely rational motivation to participate

rapidly evaporated at the moment that state subsidies were inevitably reduced. Complete institutional collapse was subsequently triggered by the profound absence of robust emotional bonds. The SPR was tragically transformed into a superficial, hollow administrative shell rather than an organic, self-sustaining community movement due to the critical lack of a psychosocial foundation (Bitsch et al., 2022; Han et al., 2022).

The substantial effect size of the Emotional factor ($f^2 = 2.991$) compared with the Rational factor ($f^2 = 0.140$) provides supporting evidence to the long-standing debate on agricultural cooperation that the emotional factor may play a more influential role than previously recognized. While economic incentives (subsidies, feed, and cattle) are necessary to initiate the 'problematization' phase (defined as the initial state where primary actors define the community's problems and establish the institution as an obligatory passage point to attract participants) they are largely insufficient to sustain the 'mobilization' phase, which is the state where the network of actors is stabilized, spokesperson roles are validated, and collective action is fully operationalized over time (Callon, 1986; Darnhofer, 2020).

This 'Rationality Trap' occurs when farmers participate only as long as the marginal benefit of the subsidy exceeds the marginal cost of their time. Once the subsidy ceases, the rational calculation immediately dictates withdrawal. In contrast, emotional bonds create a 'psychological buffer' that allows the institution to survive periods of economic scarcity, a phenomenon well-documented in rural cooperative resilience studies where social capital mitigates resource deficits (Ostrom, 2009; Mojo et al., 2017). Interpersonal trust and a sense of belonging transform the SPR from a mere delivery vehicle for government aid into a resilient social network. The findings suggest that the internal 'social glue' (composed of shared rituals, mutual help (*gotong royong*), and emotional solidarity) has the highest influential power among other factors that may have been systematically undervalued by traditional top-down planning.

3.6 Actor-network disintegration: The missing sociology of translation

Profound, highly contextual qualitative insights regarding the systemic failure in the SPR institutional governance were derived from the Actor-Network Theory (ANT) analysis. This sociology of translation process systematically progresses through four sequential phases: problematization, *interessement*, enrollment, and finally, mobilization. Within this framework, the overall translation process (particularly the highly delicate phases of *interessement* and enrollment) was found to be critically flawed. During the problematization phase, state technocrats initially defined the collective livestock center as an obligatory passage point for farmers to access state resources. Farmers were temporarily enrolled into this bureaucratic network through the significant distribution of subsidized pregnant cattle, free artificial insemination vaccines, and premium concentrated feed. However, because this initial alignment was strictly transactional and overwhelmingly reliant on tangible material incentives, the crucial cultivation of bonding social capital and emotional ownership was completely bypassed. Farmers compliance represented a purely rational response to short-term economic stimuli rather than a genuine, deeply rooted internalization of the cooperative's collective values. Table 6 comprehensively summarizes the systematic breakdown of this highly fragile socio-technical constellation, rigorously mapped across the four sequential moments of translation.

In practice,, a critical, irreparable void in the network constellation was observed: the notable absence trusted local figures capable of bridging rigid formal bureaucratic regulations with fluid local psychosocial realities. Official extension agents dispatched centrally by the government were frequently perceived by local farmers as administrative outsiders, rather than integrated, empathetic community members. Without a local community leader to anchor the emotional values of the community, the institutional network became increasingly fragile, brittle, and highly vulnerable. Modern agricultural innovation systems are empirically reported to strictly require empathetic social brokers

who can foster psychological safety and relational trust among deeply skeptical stakeholders to ensure long-term sustainability (Turner et al., 2017; Dong & Dacre, 2024).

Table 6. Actor-network theory (ANT) analysis of SPR institutional disintegration

Phase of Translation	Key Actors Involved (Human and Non-Human)	Strategic Mechanisms / Actions	Observed Qualitative Outcomes
Problematization	State technocrats, SPR bureaucratic framework.	Defining the collective SPR as the Obligatory Passage Point (OPP) to access national agricultural resources.	Superficial structural compliance; farmers viewed the institution as an administrative prerequisite rather than a community movement.
Interessement	Subsidized pregnant cattle, vaccines, premium feed (Non-human).	Deploy significant material incentives to temporarily lock local farmers into the rigidly defined institutional roles.	Temporary network formation is driven strictly by economic rationality, and lacks any deep-rooted emotional attachment or psychosocial ownership.
Enrollment	Official extension agents (Outsiders), formal state regulations.	Imposing top-down structural rules without a culturally embedded, trusted local champion's critical mediation.	Critical network fracture; official agents were perceived as administrative outsiders, failing to establish psychological safety among farmers.
Mobilization	Communal pens, biogas digesters, and fragmented farmers.	Attempting to sustain collective action and designating permanent spokespersons to represent the grassroots community.	Systemic disintegration; erosion of horizontal trust; and non-human physical artifacts ultimately abandoned as highly visible infrastructural ruins.

Notes: ANT: Actor-Network Theory; OPP: Obligatory Passage Point; SPR: *Sentra Peternakan Rakyat* (Community Livestock Center).

The qualitative mapping in Table 6 reveals that the 'reunification' of biogas digesters and communal pens are material manifestation of the failed 'enrollment' phase. The network collapsed into a collection of "alien objects" because the state failed to enroll the farmers' psychosocial identities. Table 5 thus proves that material infrastructure remains inert and temporary without the 'social glue' identified in the structural model (Pawlewicz & Pawlewicz, 2023; Koutsouris, 2018).

The forceful imposition of top-down bureaucratic regulations without the careful mediation of a trusted indigenous leader resulted in the study region's rapid, uncontrollable network disintegration. Farmers immediately began to prioritize individual, household-level farming practices over collective organizational responsibilities as the network's horizontal trust eroded. Non-human artifacts, such as significantly funded communal pens and shared biogas digesters, became highly visible, non-functional physical assets following the complete severing of psychosocial ties among human actors (Ngissah et al., 2025). The systemic failure to maintain the mobilization phase perfectly confirmed that concrete physical infrastructure can absolutely never substitute the essential, invisible role of social cohesion in grassroots institutions. This disintegration highlights the inherent vulnerability

of institutional networks that fail to build adaptive capacity to face unexpected socio-technical shifts (Darnhofer, 2020).

3.7 Policy implications for inclusive social engineering

A radical paradigm shift in national rural development policies is urgently required by the synthesis of these quantitative statistics and qualitative narratives. Strategies deliberately oriented toward inclusive social engineering must be adopted immediately to completely replace purely technical-administrative approaches. Modern agricultural institutions’ sustainability cannot be engineered solely through the top-down provision of physical capital or short-term financial stimuli. To operationalize these findings, policy interventions must move beyond the 'Hardware-centric' paradigm. The historical obsession with distributing cattle and building pens must be balanced with an equal, if not greater, investment in 'Heart-ware' the invisible social infrastructure. This involves a radical redesign of the extension agent's role: from a technical instructor to a social facilitator. The proposed social engineering approach focuses on the 'cultivation of ownership' through co-creation. By involving farmers not just as recipients of aid, but as architects of their own institutional rules, the 'Emotional' driver can be activated early in the process, a co-creation strategy widely supported by institutional design literature as a prerequisite for long-term collective ownership (Ostrom, 2009; Bizikova et al., 2020). This shift ensures that the network is anchored by local community leaders who possess the cultural legitimacy that external bureaucrats can never replicate. The only viable path toward the longevity of grassroots agricultural institutions is the transition from dependency on external stimuli to internal psychological motivation. To explicitly bridge the gap between empirical findings and actionable government strategies, Table 7 presents a comprehensive framework for future institutional interventions.

Table 7. Strategic matrix for grassroots institutional interventions

Core Empirical Finding (From PLS-SEM and ANT)	Identified Institutional Vulnerability	Proposed Social Engineering Policy
Absolute dominance of the Emotional factor ($f^2= 2.991$)	Fragile horizontal trust and low psychological ownership among regular cooperative members.	Shift from hardware to "heart-ware" investments: Long-term funding for community capacity building, peer-to-peer mentoring, and informal social bonding activities should be prioritized.
Temporary enrollment driven by Rational incentives	High risk of institutional collapse once state subsidies (cattle and feed) are inevitably reduced or withdrawn.	Transition to co-creation models: Direct free subsidies are gradually replaced with matched-funding or revolving fund systems to enforce collective responsibility.
Network fracture due to top-down bureaucracy (ANT)	Extension agents perceived as administrative outsiders; lack of a trusted indigenous mediator.	Empowering local champions: Officially identifying, training, and structurally empowering culturally respected local leaders to serve as primary social brokers, replacing rigid external bureaucrats.

Notes: PLS-SEM: Partial Least Squares Structural Equation Modeling; ANT: Actor-Network Theory; f^2 : Cohen's effect size impact indicator

The strategic matrix presented in Table 7 functions as a logical bridge from empirical data to actionable reform. By aligning the f^2 dominance with specific 'heart-ware' policies, we demonstrate that institutional sustainability requires a radical departure from the hardware-centric model that has dominated Indonesian agricultural policy for decades (Xu et al., 2025). The meticulous strengthening of the rural social fabric must be prioritized in all future policy interventions. Long-term, dedicated investments in community capacity building, the careful identification and empowerment of indigenous local leaders, and the deliberate fostering of horizontal trust among farmers are urgently required for the establishment of psychosocially resilient institutions. It is highly recommended that

institution designs local socio-cultural norms rather than applying a universal bureaucratic blueprint. Emotional bonds must be deliberately nurtured alongside rational economic objectives to guarantee the longevity of collective action in grassroots agriculture (Sutherland & Burton, 2021).

3.8 Theoretical contributions: Integrating REB and ANT

The theoretical integration of the Rational-Emotional-Behavioral (REB) framework with Actor-Network Theory (ANT) in this study offers a novel contribution to rural sociology and institutional theory. Historically, agricultural studies have tended to polarize between economic analyses and ethnographic accounts. By synthesizing these two lenses, this study demonstrates that institutional sustainability is not merely a product of individual rational choices, nor a sole result of rigid network structures. Instead, it is a dynamic 'socio-psychological translation' in which material artifacts (the non-human) and affective bonds (the emotion) must be continuously synchronized.

The unparalleled dominance of the Emotional factor ($f^2 = 2.991$) provides a new empirical benchmark, suggesting that in grassroots institutions, the 'emotional infrastructure' precedes the 'economic incentive.' This challenges the traditional Actor-Network Theory, which often treats human and non-human actors with 'generalized symmetry.' This study argues that that human affective agency remains the primary anchor that prevents the network from collapsing into a collection of non-functional physical assets in a rural Indonesian context. This hybrid approach allows for a more granular understanding of why even well-funded agricultural programs often fail: they successfully 'interesse' the farmers with material goods but fail to 'enroll' their hearts and 'mobilize' their long-term identity as a collective movement.

4. Conclusions

Emotional factors have the strongest influence on SPR participation compared with the other factors, which highlights the importance of fostering social motivation within the community. Overlooking this dimension may cause the institutional stagnation and declining participation in Subang, particularly when current programs highly focus on financial incentives and infrastructure support. Advanced structural model testing strongly indicates that the emotional dimension (encompassing a sense of belonging, psychological ownership, and horizontal trust) is the primary driver of farmer participation ($\beta = 0.747$, $f^2 = 2.991$), significantly outperforming pure economic rationality. This empirical evidence, corroborated by Actor-Network Theory (ANT) mapping, fundamentally challenges the outdated homo economicus paradigm in rural development by providing evidence that the psychosocial dimension may be the most influential factor for institutional sustainability, compared to the rational and behavioral factors. By integrating the REB framework with ANT, this study offers a novel "socio-psychological translation" lens, emphasizing that institutional resilience in regional agricultural communities is built upon an "invisible infrastructure" of emotional capital that must be nurtured alongside technical modernization to prevent the network from collapsing into a collection of non-functional physical assets.

Consequently, this study suggests a strategic reorientation from "hardware-centric" toward "heart-ware centric" intervention models. Such a transition would prioritize inclusive, culturally sensitive social engineering over purely technical-administrative management. Policymakers and extension agencies must consider the empowerment of "Local Champions" (indigenous leaders with cultural legitimacy to act as social brokers) while incorporating "Social Fabric Indicators" (such as horizontal trust and psychological ownership) into institutional performance metrics. Although this study provides a robust snapshot of institutional disintegration in Subang, its findings are limited by its cross-sectional nature and specific geographical focus. Therefore, future research should adopt longitudinal designs to track the fluctuation of emotional capital over time and encompass

broader comparative studies across diverse livestock hubs. Furthermore, exploring the role of digital mediation in maintaining horizontal trust offers a promising frontier for modernizing agricultural extension and ensuring grassroots livestock institutions' long-term sustainability.

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Author Contribution

F.F. conceived the study, designed the research framework, and drafted the manuscript. T.E., S.G., and R.A. supervised the research and provided critical guidance on the manuscript structure.

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Ethical Review Board Statement

Ethical review and approval were waived for this study due to its nature as a non-invasive social survey with minimal risk to participants.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study. Written informed consent has been obtained from the participant(s) to publish this paper.

Data Availability Statement

The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy and ethical restrictions concerning the identity of the research participants.

Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data, in the writing of the manuscript, or in the decision to publish the results.

Declaration of Generative AI Use

During the preparation of this work, the authors used Google Gemini/Grammarly to assist in improving grammar, clarity, and academic tone of the manuscript, as well as formatting author biographies. After using this tool, the authors reviewed and edited the content as needed and took full responsibility for the content of the publication.

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References

- Barnes, A. P., Toma, L., Willock, J., & Hall, C. (2016). Farm exit intention and wellbeing: A study of Australian farmers. *Journal of Rural Studies*, 47, 37-46. <https://doi.org/10.1016/j.jrurstud.2016.07.006>
- Baur, I. (2020). Eliciting farmers' subjective probabilities, risk, and uncertainty preferences using contextualized field experiments. *Agricultural Economics*, 51(5), 755-772. <https://doi.org/10.1111/agec.12587>
- Bitsch, L., Meemken, E. M., Belderbos, R., & Hanf, J. H. (2022). Social Capital and the Performance of Agricultural Cooperatives: A Systematic Review. *Journal of Rural Studies*, 92, 45-58. <https://doi.org/10.1016/j.jrurstud.2022.03.015>
- Bizikova, L., Nkonya, E., Minah, M., Hanisch, M., Critchley, W., Hudson, W., & Speranza, C. I. (2020). A scoping review of the contributions of farmers' organizations to smallholder agriculture. *Nature Food*, 1(10), 620-630. <https://doi.org/10.1038/s43016-020-00164-x>
- Callon, M. (1986). Some elements of a sociology of translation: Domestication of the scallops and the fishermen of St Brieuc Bay. *The Sociological Review*, 32(1), 196-233. <https://doi.org/10.1111/j.1467-954X.1984.tb00113>
- Castella, J., Lestrelin, G., Phimmason, S., Quoc, H. T., & Lienhard, P. (2022). The role of actor networks in enabling agroecological innovation: lessons from Laos. *Sustainability*, 14(06), 1-18. <https://doi.org/10.3390/su14063550>
- Cechin, A., Bijman, J., Pascucci, S., & Omta, O. (2018). Decomposing the member relationship in agricultural cooperatives: Implications for commitment. *Agribusiness*, 29(1), 39-61. <https://doi.org/10.1002/agr.21321>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates. <https://doi.org/10.4324/9780203771587>
- Creswell, J. W., & Creswell, J. D. (2018). *Research design: qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.
- Darnhofer, I. (2020). Farm resilience in the face of the unexpected: Lessons from the COVID-19 pandemic. *Agriculture and Human Values*, 37(3), 605-606. <https://doi.org/10.1007/s10460-020-10053-5>
- Daxini, A., Ryan, M., O'Donoghue, C., & Barnes, A. P. (2019). Understanding farmers' intentions to follow a nutrient management plan using the theory of planned behaviour. *Land Use Policy*, 85, 428-437. <https://doi.org/10.1016/j.landusepol.2019.04.002>
- Deng, W., Hendrikse, G., & Liang, Q. (2020). Internal social capital and the life cycle of agricultural cooperatives. *Journal of Evolutionary Economics*, 31(1), 1-23. <https://doi.org/10.1007/s00191-020-00690-8>
- Dolinska, A., & d'Aquino, P. (2016). Farmers as agents in innovation systems. Empowering farmers for innovation through communities of practice. *Agricultural Systems*, 142, 122-130. <https://doi.org/10.1016/j.agsy.2015.11.009>
- Dong, H., & Dacre, N. (2024). Commutable strategies and institutional dynamics in agricultural co-operatives: a project management perspective on crisis resilience and sustainability. *SSRN Electronic Journal*. <https://doi.org/10.22541/essoar.173134645.56504196/v1>
- Dong, L., Maesano, G., Li, Q., Yao, J., Wang, Y., & Canavari, M. (2026). Modelling farmer's intention-behavior to participate in ecological governance in the northwest China arid region. *Research Square*. <https://doi.org/10.21203/rs.3.rs-8406467/v1>
- Fischer, E., & Qaim, M. (2012). Determinants and impacts of farmer collective action in Kenya. *World Development*, 40(6), 1255-1268. <https://doi.org/10.1016/j.worlddev.2011.11.018>
- Forney, J., Rosin, C., & Campbell, H. (Eds.). (2018). *Agri-environmental governance as an assemblage: Multiplicity, power, and transformation*. Routledge.

- Godde, C. M., Croz, D. M., Mayberry, D. E., Thornton, P. K., & Herrero, M. (2021). Impacts of climate change on the livestock food supply chain: a review of the evidence. *Global Food Security*, 28, 100488. <https://doi.org/10.1016/j.gfs.2020.100488>
- Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2-24. <https://doi.org/10.1108/EBR-11-2018-0203>
- Han, M., Liu, R., Ma, H., Zhong, K., Wang, J., & Xu, Y. (2022). The impact of social capital on farmers' willingness to adopt new agricultural technologies: empirical evidence from china. *Agriculture*, 12(9), 1-19. <https://doi.org/10.3390/agriculture12091368>
- Hao, J., Bijman, J., Heijman, W., & Gao, M. (2023). The effect of trust and social pressure on member commitment in agricultural cooperatives – evidence from China. *Annals of Public and Cooperative Economics*, 94(4), 1-26. <https://doi.org/10.1111/apce.12467>
- Hatak, I., Lang, R., & Roessl, D. (2015). Trust, social capital, and the coordination of relationships between the members of cooperatives: a comparison between member-focused cooperatives and third-party-focused cooperatives. *Voluntas: International Journal of Voluntary and Nonprofit Organizations*, 27(1), 60-70. <https://doi.org/10.1007/s11266-015-9663-2>
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, 43(1), 115-135. <https://doi.org/10.1007/s11747-014-0403-8>
- Ilham, N., Saptana, & Purwantini, T. B. (2021). Institutional performance of beef cattle farmers' group: The case of Sentra Peternakan Rakyat (SPR). *IOP Conference Series: Earth and Environmental Science*, 892(1), 012027. <https://doi.org/10.1088/1755-1315/892/1/012027>
- Ji, C., Jia, F., & Hasleberg, T. (2019). Member commitment and organizational performance in agricultural cooperatives: A systematic literature review. *Journal of Cleaner Production*, 223, 1-14. <https://doi.org/10.1016/j.jclepro.2019.03.065>
- Klerkx, L., Aarts, N., & Leeuwis, C. (2017). Adaptive management in agricultural innovation systems: The interactions between innovation networks and their environment. *Agricultural Systems*, 103(6), 390-400. <https://doi.org/10.1016/j.agsy.2010.03.012>
- Kolhe, D., & Bhat, A. (2025). Economic incentives and psychological barriers in the transition to smart agriculture. *Innovare Journal of Agricultural Science*, 13(6). <https://doi.org/10.22159/ijags.2025v13i6.56920>
- Koutsouris, A. (2018). Role of extension in agricultural innovation systems. In *Encyclopedia of the UN Sustainable Development Goals*, 1(11), Springer. https://doi.org/10.1007/978-3-319-69626-3_18-1
- Mehrabi, Z., Gill, M., van Wijk, M., Herrero, M., & Ramankutty, N. (2020). Livestock policy for sustainable development. *Nature Food*, 1(3), 160-165. <https://doi.org/10.1038/s43016-020-0042-9>
- Meinzen-Dick, R., Markelova, H., & Moore, K. (2022). The role of collective action and property rights in climate change adaptation. *Food Policy*, 109, 102241. <https://doi.org/10.2499/p15738coll2.133794>
- Miles, M. B., Huberman, A. M., & Saldaña, J. (2020). *Qualitative data analysis: A methods sourcebook* (4th ed.). SAGE Publications.
- Mojo, D., Fischer, C., & Degefa, T. (2017). The determinants and economic impacts of membership in agricultural cooperatives: Evidence from rural Ethiopia. *Journal of Rural Studies*, 50, 252-261. <https://doi.org/10.1016/j.jrurstud.2016.12.010>
- Ngissah, E., Leeuwis, C., Cieslik, K., & Freeman, C. (2025). Uberisation of mechanisation: Exploring the features and establishment of matchmaker digital tractor-hire platforms in Ghana through the lens of actor network theory. *NJAS: Impact in Agricultural and Life Sciences*, 97(1), 1-26. <https://doi.org/10.1080/27685241.2025.2531122>
- Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. *Science*, 325(5939), 419-422. <https://doi.org/10.1126/science.1172133>
- Pawlewicz, A., & Pawlewicz, K. (2023). The risk of agricultural land abandonment as a socioeconomic challenge for the development of agriculture in the European Union.

- Sustainability*, 15(4), 3233. <https://doi.org/10.3390/su15043233>
- Rusdiana, S., & Soeharsono. (2017). SIWAB Program to Improve Cattle Population and Economics Value for The Business Economics. *Forum Penelitian Agro Ekonomi*, 35(2), 125–137. <https://doi.org/10.21082/fae.v35n2.2017.125-137>
- Sarstedt, M., Hair, J. F., Pick, M., Liengaard, B. D., Radomir, L., & Ringle, C. M. (2022). Progress in partial least squares structural equation modeling use in marketing research in the last decade. *Psychology and Marketing*, 39(5), 1035–1064. <https://doi.org/10.1002/mar.21640>
- Schaub, S., Ghazoul, J., Huber, R., Zhang, W., Sander, A., Rees, C., Banerjee, S., & Finger, R. (2023). The role of behavioural factors and opportunity costs in farmers' participation in voluntary agri- environmental schemes: A systematic review. *Journal of Agricultural Economics*, 74(3), 617–660. <https://doi.org/10.1111/1477-9552.12538>
- Slijper, T., de Mey, Y., Poortvliet, P. M., & Meuwissen, M. P. M. (2022). Quantifying the resilience of European farms using FADN. *European Review of Agricultural Economics*, 49(1), 121–150. <https://doi.org/10.1093/erae/jbab042>
- Small, B., & Maseyk, F.J.F (2022). Understanding farmer behaviour: A psychological approach to encouraging pro-biodiversity actions on-farm. *New Zealand Journal of Ecology*, 46(1), 1–11. <https://doi.org/10.20417/nzjecol.46.20>
- Sutherland, L. A., & Burton, R. J. (2021). Good farmers, good environment? Re-evaluating the 'good farmer' concept. *Sociologia Ruralis*, 61(3), 619–644. <https://doi.org/10.1111/soru.12344>
- Thornton, P. K., van de Steeg, J., Notenbaert, A., & Herrero, M. (2009). Climate change and the future of livestock production in developing countries. *Climatic Change*, 96(3), 443–457. <https://doi.org/10.1007/s11027-009-9210-9>
- Turner, J. A., et al. (2017). Triggering system innovation in agriculture: A review of systemic instruments. *Outlook on Agricultural*, 46(2), 125–130. <https://doi.org/10.1177/0030727017708500>
- Wang, J., & Ma, L. (2025). A study on the impact of social trust on farmers' agricultural waste resource utilization behavior in the context of environmental regulation policy. *Agriculture*, 15(7), 1–20. <https://doi.org/10.3390/agriculture15070759>
- Winarto, P. S., Febrianto, N., Akhiroh, P., Helmi, M., Aziz, A. F., & Hartono, B. (2025). empowerment strategy for bojonegoro smallholder cattle farmers towards red-meat agribusiness sustainability. *ICESAI 2024*, 461–468. <https://doi.org/10.2991/978-94-6463-670-3>
- Wisnujati, N., et al. (2024). Understanding the Key Determinants of Farmer Loyalty in Sugarcane Farming: Insights from Indonesia. *Agro Bali: Agricultural Journal*, 7(1), 1–12. <https://doi.org/10.37637/ab.v8i3.2060>
- Xu, T., O'Shaughnessy, M., & Olmedo, L. (2025). The Role of Agricultural Co-operatives in Promoting Sustainable Development in Rural Areas: A Systematic Literature Review. *Journal of Co-operative Studies*, 58(2), 5–20. <https://doi.org/10.61869/IWDY3717>
- Yao, S., & Liu, K. (2022). Actor-network theory: insights into the study of social-ecological resilience. *International Journal of Environmental Research and Public Health*, 19(24), 1–16. <https://doi.org/10.3390/ijerph192416704>
- Yu, L., Wang, Y., Xie, H., Yao, X., & Liu, B. (2023). Does off-farm employment affect farmers' adoption of green control techniques? *International Food and Agribusiness Management Review*, 27(1), 1–20. <https://doi.org/10.22434/IFAMR2022.0140>
- Zeng, L., Wan, J., & He, Q. (2023). Member commitment in farmers' cooperatives in China: The role of contractual and relational governance mechanisms. *PLOS One*, 18(7), 1–17. <https://doi.org/10.1371/journal.pone.0288925>
- Zheng, H., & Liu, Chunhui (2021). How social capital affects willingness of farmers to accept low-carbon agricultural technology (LAT)? A case study of Jiangsu, China. *International Journal of Climate Change Strategies and Management*, 13(3), 286–301. <https://doi.org/10.1108/IJCCSM-09-2020-0100>

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