Cultivating Innovation: Influence of Social Capital and Extension Services on Technology Adoption among Sri Lankan Tea Smallholdings

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Abstract. This study examines the impact of social capital and agricultural extension services on the adoption of technology among smallholder tea farmers in Sri Lanka, a sector currently facing declining productivity, environmental pressure, and economic uncertainty. Based on Social Capital Theory, Diffusion of Innovation Theory, and the Theory of Planned Behaviour, this study examines bonding, bridging, and linking social capital alongside agricultural extension services. Using a cross-sectional survey design with 452 smallholder tea farmers from Kandy and Badulla districts, selected through multistage stratified random sampling, data analysis was carried out using Partial Least Squares Structural Equation Modelling (PLS-SEM). The findings of this study show that agricultural extension services have the strongest positive effect on technology adoption ($\beta = 0.343$, $p < 0.01$), followed by bridging social capital ($\beta = 0.315$, $p < 0.01$) and bonding social capital ($\beta = 0.194$, $p < 0.01$). The study model explains about 60.0% of the variation in technology acceptance ($R^2 = 0.600$), which shows a quite strong level of explanation. On the other hand, linking social capital did not show a significant relationship with technology adoption ($\beta = 0.061$, $p > 0.05$), reflecting that institutional relationships have not consistently translated into practical support for smallholder farmers. Overall, this study concludes that strengthening social networks within communities, expanding links across communities, and improving the effectiveness and reach of agricultural extension services are important to speed up technology adoption and to deal with the declining productivity of the smallholder tea sector in Sri Lanka.

Keywords: social capital; agricultural extension services; technology adoption; tea smallholders; Sri Lanka

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1 Introduction

The smallholder tea sector in Sri Lanka plays an important role in the country's economy, especially in terms of its contribution to national tea production, rural income, and employment opportunities. However, this sector is now facing various interrelated challenges, including low productivity, small farm sizes, labour constraints, ageing infrastructure, and price uncertainty of green leaf (Mahindapala, 2020). This challenge is further exacerbated by the aging of tea bushes and the slow rate of technology adoption, which ultimately affects the competitiveness and long-term sustainability of this sector.

The adoption of technology in agriculture has been identified as a key mechanism to improve operational efficiency, stabilise farmers' income, and strengthen the sustainability of production (Feder *et al*., 2004a). In the context of smallholders, the decision to accept technology does not only depend on technical factors, but is also influenced by social interactions and institutional support. Social capital, which refers to networks of relationships and trust that facilitate collective action, plays a crucial role in accelerating information flow, mitigating risks, and promoting cooperation among farmers (Hunecke *et al*., 2017; Quinn *et al*., 2020).

In addition, agricultural extension services are the main channel for spreading knowledge, transferring technology, and building farmers' capacity. The role of extension agents in guiding, providing training, and supporting farmers has been proven to increase the probability of agricultural innovation adoption (Feder *et al*., 2004a). However, the effectiveness of extension systems often differs depending on context, largely influenced by the level of access, the service quality, and how suitable the approaches used are.

Although the importance of smallholder tea farmers in Sri Lanka cannot be denied, empirical studies that simultaneously examine the role of various dimensions of social capital and extension services on technology adoption are still limited. Most previous studies have focused either on the diffusion of technology or on institutional constraints separately, without adequately examining how social networks and extension support interact with each other in shaping technology adoption behaviour (Amarathunga *et al*., 2008; Mahaliyanarachchi, 1996; Mahindapala, 2020).

In relation to that, this study aims to fill the knowledge gap by developing an integrated analytical model that combines bonding, bridging and linking social capital together with agricultural extension services. By using the PLS-SEM approach, this study gives a more comprehensive picture of how social and institutional factors collectively influence the acceptance of technology among smallholder tea farmers in Sri Lanka.

2 Literature Review

Sustainable agricultural development requires improving productivity, added value, and farmers' income while facing economic and climate conditions that are increasingly more challenging. In the context of Sri Lanka's plantation sector, particularly the smallholder tea subsector, the adoption of technology is seen as a strategic need to maintain competitiveness and the sustainability of production (Malkanthi and Routray, 2012). However, the level of technology adoption among smallholder farmers remains low, even though various innovations have been introduced by research institutions and relevant agencies.

Previous studies show that technology diffusion models in the tea sector in Sri Lanka largely emphasise the aspects of knowledge creation, transfer, and application. However, several structural constraints persist, including a weak relationship between researchers and farmers, inconsistent flow of information, and the tendency of farmers to rely on traditional practices that are considered safer and already proven (Amarathunga *et al*., 2008; Mahaliyanarachchi, 1996). This situation contributes to a gap between the technology that is recommended and the actual level of acceptance in the field.

In an effort to address these constraints, agricultural extension services play an important role as an intermediary between research institutions and farmers. Extension agents are not only responsible for delivering technical information, but also act as facilitators in solving problems, connecting farmers with relevant resources, and guiding the process of change in agricultural practices (Rogers, 2003; Shah *et al*., 2013). Although this role is widely recognised, the effectiveness of extension services is often influenced by factors such as the ratio of agents to farmers, the quality of interaction, and the suitability of the approaches used within the local context.

Besides institutional support, social factors also play an important role in shaping decisions toward technology adoption. Social capital, which includes networks of relationships, trust, and shared norms, has been identified as an important element in facilitating information exchange, joint learning, and risk reduction among farmers (Grootaert and Van Bastelaer, 2002; Hunecke *et al*., 2017). Social capital is often divided into three main dimensions, namely bonding, bridging, and linking, which respectively refer to relationships within the community, relationships across communities, and relationships with formal institutions.

Previous studies show that bonding social capital helps to strengthen internal support and cooperation within farming communities, while bridging social capital opens access to new ideas, outside experiences, and innovative practices from wider networks (Katungi *et al*., 2008; Van Rijn *et al*., 2012). Linking social capital, on the other hand, has the potential to connect farmers with sources of power, finance, and policy through formal institutions. However, empirical evidence on the effectiveness of the linking dimension in encouraging technology adoption is mixed and often depends on institutional context as well as the level of accessibility to actual support.

Although many studies have examined the role of social capital and extension services separately, research that integrates both of these factors within a single analytical framework remains limited, particularly in the smallholder tea sector in Sri Lanka. The lack of these integrated studies limits the understanding of how social and institutional factors interact in influencing farmers' technology adoption behaviour. Therefore, this study seeks to fill this gap by simultaneously assessing the role of various dimensions of social capital and agricultural extension services in shaping technology adoption among smallholder tea farmers.

3 Conceptual Framework and Hypotheses

This study is developed based on three main theoretical frameworks, namely Social Capital Theory, Diffusion of Innovation Theory, and Theory of Planned Behaviour. The combination of these three theories allows a more holistic understanding of how social, institutional and psychological factors influence smallholder farmers' decision to adopt agricultural technology.

3.1 Social Capital Theory

Social Capital Theory emphasize the importance of social relationship networks, trust, and shared norms in facilitating collective action and the exchange of resources (Grootaert and Van Bastelaer, 2002). In the context of agriculture, social capital helps farmers to obtain information, share experiences, and reduce uncertainties that are often related to the adoption of new technologies.

Social capital in this study is divided into three main dimensions. Bonding social capital refers to close relationships within the farming community, such as family ties, neighbours, and fellow villagers, which support cooperation and mutual support. Bridging social capital involves relationships across different communities or social groups, allowing farmers to be exposed to new ideas, practices and new technology. Linking social capital refers to the vertical relationship between farmers and formal institutions such as government agencies, financial institutions, and support organisations.

Previous studies show that bonding and bridging social capital often play an important role in speeding up the adoption of innovation through information sharing and social learning, while the effectiveness of linking social capital depends on how far these institutional relationships can provide practical support that is accessible and can be used (Hunecke *et al.*, 2017; Van Rijn *et al.*, 2012).

3.2 Diffusion of Innovation Theory

The Diffusion of Innovation Theory explains how an innovation is spread and taken up within a social system through communication channels over time (Rogers, 2003). According to this theory, social interaction and interpersonal communication play a major role in shaping farmers' perception of the advantages, suitability, and usability of new technology.

Among smallholder farmers, the process of diffusion of innovation often happens through observing fellow farmers, informal discussion, and shared experience. Therefore, a strong and open social network increases the likelihood of farmers accepting technology because risk and uncertainty can be reduced through learning from other people's experiences.

3.3 Theory of Planned Behaviour

The Theory of Planned Behaviour explains that an individual's behaviour is influenced by their attitude toward the behaviour, subjective norms, and the perceived control over the behaviour (Ajzen, 2002). In the context of agricultural technology adoption, farmers' attitude toward technology, social influence from peers and experts, as well as confidence in their own ability and available resources, will determine the adoption decision.

This theory complements Social Capital Theory and Diffusion of Innovation by emphasising the psychological dimension and individual perception, while at the same time strengthening the justification for using technology as an outcome variable in this research model.

3.4 Conceptual Framework of the Study

Based on the discussion of theory and review of the literature, a conceptual framework was developed to assess the influence of social capital and agricultural extension services on the adoption of technology among smallholder tea farmers. The research model includes six main constructs, namely bonding, bridging and linking social capital; agricultural extension services; technology acceptance; and farmers' sustainability.

This model assumes that a higher level of social connectedness and institutional support will increase the tendency of smallholder farmers to accept the recommended agricultural technology.

3.5 Research Hypothesis

Based on the proposed conceptual framework, the main hypotheses of this study are as follows:

H_1: Social capital bonds have a significant positive relationship with technology acceptance.

H_2: Social capital as a bridge has a significant positive relationship with technology adoption.
H_3: Social bridging capital has a significant positive relationship with technology acceptance.
H_4: Agricultural extension services have a significant positive relationship with technology adoption.

4 Methodology

4.1 Research Design

This study uses a quantitative approach with a cross-sectional survey design to assess the relationship between social capital, agricultural extension services, and technology adoption among the smallholder tea farmers in Sri Lanka. This design is suitable for collecting empirical data from respondents over a certain period of time and also allows testing the relationship between variables at the same time.

This study is explanatory in nature because it aims to identify and test the influence of social and institutional factors on technology adoption, in line with the conceptual framework and hypotheses that were developed.

4.2 Study Location

This study was carried out in the Mid-Country region of Sri Lanka, involving two main districts, which is Kandy and Badulla. Both of these districts represent about 95% of smallholder tea production in the Mid-Country area and were selected because of their importance to the country's tea industry (Tea Small Holdiing Authority, 2022). This area also reflects the socio-economic diversity and agricultural practices among smallholder tea farmers.

4.3 Population and Sampling

The study population consists of all small-scale tea growers registered under the Tea Smallholding Development Authority (TSHDA) in the districts of Kandy and Badulla. A multi-stage stratified random sampling technique was used to ensure respondent representativeness in terms of location and population size.

At the first stage, districts were selected based on their contribution to production. The second stage involved the random selection of divisions and villages, followed by selecting respondents from the official TSHDA list. A total of 452 respondents were successfully collected, which is more than the minimum sample requirement for PLS-SEM analysis and also meets the statistical recommendation for a model with multiple constructs (Hair *et al*., 2022).

4.4 Study and Variable Measurement Instruments

The data was collected using a structured questionnaire that was developed based on previous instruments that have already been validated. All items were measured using a five-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree).

The research instrument includes the following sections:

Social capital: Measured using 28 items covering the bonding, bridging and linking dimensions, adapted from Grootaert and Van Bastelae, (2002), Katungi *et al*. (2008), and Hunecke *et al*. (2017).

Agricultural extension services: Measured using 16 items based on the role of extension agents as a change catalyst, problem solver, resource linkers, and process helper (Rogers, 2003; Shah *et al*., 2013; Al-Zahrani *et al*., 2016).

Technology acceptance: Measured using 11 items based on the Theory of Planned Behavior which include attitude, subjective norms, and perceived behavioural control (Ajzen, 2002). The original questionnaire was translated into Sinhala using the translation and back translation methods to make sure the meaning is accurate and suitable for the local context.

4.5 Data Collection Procedures and Research Ethics

Data collection was carried out face-to-face with the help of extension officers and local community leaders. Before the data collection, ethical approval was obtained, and informed consent was given by all respondents. The respondents were informed that participation is voluntary and that the information provided is confidential and only used for academic purposes.

4.6 Data Analysis Methods

The data analysis was conducted using Partial Least Squares Structural Equation Modelling (PLS-SEM) through the SmartPLS 4 software. This method was chosen because it is suitable for prediction-oriented studies, complex models with many latent constructs, and data that does not necessarily follow a normal distribution (Hair *et al*., 2022).

The model evaluation involves two main stages. First, the measurement model was evaluated, including internal reliability (Composite Reliability above 0.70), convergent validity (AVE more than 0.50), multicollinearity (VIF below 5), and discriminant validity using the HTMT criterion (Henseler *et al*., 2015). Second, the structural model assessment uses a bootstrapping procedure to test the strength and significance of the relationship between constructs, including path coefficients (β), t-values, p-values and the coefficient of determination (R^2). This approach allows the testing of the research hypothesis in a systematic way and gives a strong empirical picture of the factors that influence the acceptance of technology.

5 Results

This section presents the respondent profiles, descriptive analysis of the main variables, and also the results from the evaluation of the measurement model and structural model using Partial Least Squares Structural Equation Modelling (PLS-SEM).

5.1 Respondent Profile

This study involved 452 smallholder tea farmers from the districts of Kandy and Badulla. The majority of respondents were male (65.7%), with an average age of 56.6 years, and 66.7% of them were aged over 50 years. All respondents are married, with an average household size of 3.92 persons. Most of the respondents are members of the Tea Smallholding Development Society (TSHDS).

In terms of experience, 43% of the respondents have more than 20 years of experience in tea planting. The level of education is mostly at the secondary level (GCE O/L). Most farms are small, less than one acre, and tea planting activities are carried out as a monoculture, as the main source of income. The average output was recorded at 241.39 kg per acre per month, reflecting a moderate level of productivity under cost and market constraints.

5.2 Descriptive Analysis of Study Variables

Overall, the mean scores for social capital, agricultural extension services, and technology adoption are at a moderate to high level.

Table 1. Overall Mean and Standard Deviation of Study Constructs

Construct	Number of Items	Mean	Standard Deviation
Bonding Social Capital	10	3.82	0.67
Bridging Social Capital	8	3.69	0.73
Linking Social Capital	10	3.64	0.69
Agricultural Extension Services	16	3.67	0.61
Technology Adoption	11	3.96	0.56

Note: Mean scores are based on a five-point Likert scale ranging from 1 = *Strongly disagree* to 5 = *Strongly agree*.

Bonding social capital recorded an overall mean score of 3.82, showing a fairly strong level of trust, family support, and community cooperation that is quite solid. Bridging social capital recorded a mean score of 3.69, reflecting an open attitude towards learning and cooperation across communities, although cross-area networks are still limited in practical terms. For linking social capital, the overall mean score was 3.64, with high ratings given to advice from extension agents and relationships with the tea factory, but lower scores were seen in access towards financial institutions.

Agricultural extension services recorded an overall mean score of 3.67, with its role as a catalyst of change and process facilitator being rated more positively compared to its role as a source connector. For technology acceptance, the overall mean score is 3.96, showing a positive attitude towards the use of technology in tea cultivation. Detailed descriptive statistics for each measurement item are shown in Appendix A.

5.3 Measurement Model Evaluation

The results of the measurement model evaluation show that all constructs meet the criteria for reliability and validity. The Composite Reliability (CR) values for all constructs are above 0.70, while the Average Variance Extracted (AVE) is above 0.50, indicating a satisfactory level of convergent validity overall. The Variance Inflation Factor (VIF) values are below the level of 5, indicating there is no multicollinearity issue present. Discriminant validity was confirmed using the Heterotrait–Monotrait Ratio (HTMT) criteria, with all values below the recommended threshold.

5.4 Structural Model Assessment and Hypothesis Testing

The structural model evaluation was carried out using a bootstrapping procedure with 20,000 replications to estimate the path coefficients, t-values, and the significance level of relationships between constructs.

Fig. 1 shows the results of the PLS-SEM structural model, which indicates the relationship between social capital, agricultural extension services, and technology adoption, including the values of path coefficients (β) and coefficient of determination (R^2). As shown in Figure 1, the research model explains about 60.0% of the variation in technology acceptance ($R^2 = 0.600$), which indicates a strong level of explanatory clarity.

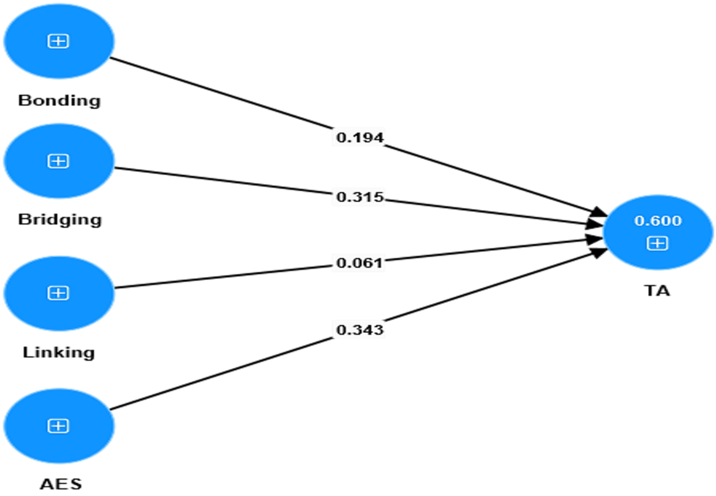

Fig. 1. PLS-SEM model structure for technology acceptance

The detailed results of the hypothesis tests are shown in Table 2.

Table 2. Path coefficients and hypothesis test results

Relationship	Std. Beta	Std. Deviation	Std. Error	t-value	p-value	Result
AES → TA	0.343	0.040	0.002	8.663	<0.001	Significant**
Bonding Social Capital → TA	0.194	0.050	0.002	3.901	<0.001	Significant**
Bridging Social Capital → TA	0.315	0.048	0.002	6.569	<0.001	Significant**
Linking Social Capital → TA	0.061	0.061	0.003	1.006	0.314	Not Significant

Notes: *$p < 0.05$, ** $p < 0.01$.
AES = Agricultural Extension Service; TA = Technology Adoption.

The path analysis shows that agricultural extension services have a positive and significant influence on technology adoption ($\beta = 0.343$, $t = 8.663$, $p < 0.01$). Bridging social capital also shows a positive and significant relationship ($\beta = 0.315$, $t = 6.569$, $p < 0.01$), followed by bonding social capital ($\beta = 0.194$, $t = 3.901$, $p < 0.01$), which indicates a weaker but still meaningful effect. In contrast, linking social capital does not show a significant relationship with technology adoption ($\beta = 0.061$, $t = 1.006$, $p > 0.05$). Therefore, hypotheses H1, H2, and H4 are supported, while hypothesis H3 are not supported.

6 Discussion

This study provides a clearer empirical understanding of the factors that influence technology acceptance among smallholder tea growers in Sri Lanka. Overall, the findings of the study show that technology adoption is significantly influenced by agricultural extension services and two dimensions of social capital, namely bonding and bridging, while linking social capital does not show a significant influence. This pattern of findings emphasises that technology acceptance is not only a technical issue, but also strongly depends on social support and the effectiveness of institutional mechanisms at the grassroots level.

The positive and significant influence of agricultural extension services on technology adoption confirms the important role of extension agents as a catalyst for change in the smallholder sector. This finding is in line with previous studies, which highlight that agricultural extension acts as the main channel for knowledge transfer, capacity building, and the reduction of uncertainty related to agricultural innovations (Feder *et al.*, 2004b; Pretty, 2003). In the context of this study, the strength of extension services lies in their role as a process helper and facilitator, helping farmers understand and implement technology gradually. This shows that a practical and continuous development approach is more effective compared to delivering information only once.

The research findings also show that bridging social capital has a stronger influence compared to bonding social capital towards technology acceptance. Cross-community relationships allow smallholder farmers to be exposed to new ideas, innovative practices, and the experiences of other farmers, which at the same time speed up the process of social learning. This finding supports the view that exposure to external networks increases the likelihood of innovation adoption by reducing perceived risk and expanding the range of information options (Quinn *et al.*, 2020; Van Rijn *et al.*, 2012). In the tea sector, where traditional practices are still dominant, interaction with outside communities plays an important role in challenging existing norms and encouraging behaviour change.

Bonding social capital also shows a significant positive relationship with technology acceptance, although with a more moderate effect. Close relationships in the community, family support, and shared trust help create an environment that is conducive to information sharing and practical assistance. This finding is in line with previous literature, which emphasises that internal social support can increase farmers' confidence to try new technology, especially within risky environments (Hunecke *et al.*, 2017). However, the lower impact compared to bridging shows that internal support alone is not sufficient without exposure to external knowledge and practices.

On the other hand, the absence of a significant relationship between linking social capital and technology acceptance is an important finding and is highly contextual in nature. Although smallholders have formal relationships with institutions such as government agencies, tea factories and financial institutions, these relationships do not always translate into support that is practical and easy to access. Constraints such as limited access to credit, a high ratio of extension agents to farmers, and NGO involvement that is temporary and project-based may explain why linking social capital does not function effectively in encouraging technology adoption. This finding shows that the mere existence of institutional relationships is not sufficient without a well-functioning support mechanism.

This discussion also needs to be seen in the context of the decline of productivity among smallholder tea growers in Sri Lanka over the recent decades. Although the level of knowledge and attitudes toward technology is positive, the gap between awareness and actual implementation is still quite obvious. This shows that barriers to technology adoption are more closely linked to structural and socio-economic factors rather than a simple lack of information alone. Therefore, strategies to improve productivity should focus on strengthening social networks and the effectiveness of institutional support, and not only on the development of new technology.

Overall, the findings of this study stress that technology acceptance among small tea smallholders is the result of a complex interaction between social support, exposure to outside networks, and the effectiveness of extension services. A development approach that integrates social and institutional factors at the same time is important to ensure that the technology introduced is truly accepted and implemented in a sustainable way.

7 Conclusion

This study gives strong empirical evidence on the role of social capital and agricultural extension services in influencing technology adoption among smallholder tea farmers in Sri Lanka. Overall, the study findings show that agricultural extension services, bonding social capital, and bridging social capital have a significant positive influence on the adoption of technology. On the other hand, linking social capital did not show a significant relationship, suggesting that formal ties with institutions have not yet been effectively translated into practical support that helps technology adoption decisions.

This finding emphasises that technology adoption among smallholder farmers does not depend only on the availability of innovation or the level of farmers' knowledge, but is also strongly influenced by the strength of social networks and the effectiveness of institutional support at the grassroots level. Close relationships within the community and networks across communities help reduce uncertainty, improve social learning, and build farmers' confidence to adopt new technologies. At the same time, extension services that function well play an important role in translating technical knowledge into agricultural practices that can be implemented by farmers.

This study contributes to the literature by integrating multiple dimensions of social capital and extension services into a single analytical framework, thereby enriching the understanding of social and institutional factors that shape technology adoption in the smallholder tea sector. From a practical perspective, the findings of this study show that efforts to improve productivity and sustainability in the tea sector need to focus on strengthening farmers' social networks and improving the effectiveness of the extension system, rather than focusing only on the development of new technology.

8 Implications for Policy and Practice

The findings of this study have important implications for policy formulation and the implementation of development programmes in the smallholder tea sector in Sri Lanka. Since the adoption of technology is significantly influenced by bonding and bridging social capital as well as agricultural extension services, policy approaches should focus on strengthening social and institutional factors at the same time.

From a policy perspective, efforts to strengthen social capital among smallholder farming communities need to be given higher priority. Community-based organisations such as Tea Smallholding Development Societies (TSHDS) have a strong potential to function not only as channels for distributing inputs and collecting produce, but also as a shared learning platform, experience sharing, and trust building within the community. More systematic allocation of resources and institutional support to this organisation can help strengthen internal cooperation and improve the collective capacity for smallholder growers.

In addition, the findings of the study emphasise the importance of bridging social capital, which shows that cross-community relationships and exposure to outside networks play an important role in encouraging the acceptance of technology. Therefore, agricultural policy needs to encourage programs that make it easier for interaction between smallholder farmer communities, such as farm visits, peer mentor programs, and cross-regional learning platforms. This approach has the potential to speed up the spread of innovation through social learning and by observing the success of other farmers.

From the implementation perspective, agricultural extension services need to be strengthened not only in terms of the number of agents, but also in the quality of interaction and how suitable the approach is. Continuous training for extension agents in communication aspects, community engagement, and support based on local needs is important to make sure the recommended technology can be implemented in a practical way. A participatory and process-oriented extension approach was found to be more effective in building farmers' confidence towards new technology.

The absence of a significant influence of linking social capital shows the need to re-evaluate the existing institutional support mechanism. The formal relationship between smallholders and institutions such as government agencies, financial institutions, and support organisations needs to be translated into support that is easier to access and more relevant, especially in terms of financing, specialised training, and access to markets. Better coordination between related institutions is also important to reduce overlap of programs and improve the effectiveness of the intervention.

Overall, the implication of this study shows that increasing technology acceptance and the sustainability of the smallholder tea sector requires a more holistic development approach. Policies and practices need to move beyond a focus only on technology by placing more emphasis on building social networks, strengthening intermediary institutions, and delivering support that truly meets the needs of smallholder farmers.

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Appendix A
Descriptive Statistics of Measurement Items

This appendix presents the descriptive statistics (mean and standard deviation) for all measurement items used in the study. All items were measured using a five-point Likert scale ranging from 1 = *Strongly disagree* to 5 = *Strongly agree*.

A1. Bonding Social Capital

Item Code	Statement	Mean	SD
BSC1	I feel a strong sense of trust and mutual support among small tea farmers in my community.	3.83	1.03
BSC2	I have a close network of small tea farmers I can depend on in times of need.	3.47	1.26
BSC3	I feel comfortable sharing personal information and experiences with other small tea farmers in my community.	3.85	1.03
BSC4	Tea farmers in my community frequently exchange favours or assistance with each other.	3.46	1.24
BSC5	A group of small farmers in my community often come together for social gatherings or events.	3.65	1.11
BSC6	Participating in community activities allows me to develop new skills and knowledge.	4.09	0.94
BSC7	I feel a sense of importance among close people.	4.00	0.85
BSC8	I wish to share agricultural equipment/ tools with neighbouring farmers.	3.99	1.04
BSC9	I am satisfied with my family members' support regarding my tea cultivation.	4.07	1.07
BSC10	Tea farmers in my community have a shared understanding and common goals.	3.86	0.97

A2. Bridging Social Capital

Item Code	Statement	Mean	SD

BRSC1	I have connections and interactions with tea farmers from different communities or regions.	2.45	1.42
BRSC2	I actively seek opportunities to collaborate with tea farmers from diverse backgrounds.	3.39	1.23
BRSC3	I am open to learning from tea farmers with different perspectives and experiences.	4.24	0.92
BRSC4	I dialogue and exchange knowledge with tea farmers with different farming practices.	4.20	0.88
BRSC5	I actively seek partnerships with tea farmers from other communities to share resources and expertise.	3.76	1.12
BRSC6	I am willing to contribute my skills and knowledge to collaborative projects involving tea farmers from diverse backgrounds.	4.02	1.00
BRSC7	I participate in events or forums that bring together tea farmers from various areas.	3.28	1.29
BRSC8	Building connections with tea farmers from different regions or communities is essential for the industry's growth.	4.16	0.90

A3. Linking Social Capital

Item Code	Statement	Mean	SD
LSC1	I communicate well and interact with other small tea farmers in my community.	3.56	1.22
LSC2	I always trust the government/ extension agents and their advice.	4.12	0.93
LSC3	I feel connected to the local tea farming associations or cooperatives.	3.55	1.20
LSC4	I have a good relationship with tea factories and leaf collectors.	4.04	1.00
LSC5	I have a good relationship with banks or microfinance institutes for getting agricultural loans.	2.66	1.36
LSC6	There is a sense of unity and cooperation among small tea farmers in my community.	3.94	0.97
LSC7	I have access to valuable resources and information through my network of small tea farmers.	3.57	1.13
LSC8	Smallholder tea farmers in my community actively collaborate on shared issues and challenges.	3.53	1.09
LSC9	Tea farmers in my community work together to promote the collective interests of the tea farming industry.	3.47	1.08
LSC10	I feel a sense of belonging and identity as part of the small tea farming community.	3.94	0.98

A4.Agricultural Extension Services

Item Code	Statement	Mean	SD
Change of Catalyst			
AES1	Technical knowledge is empowering the tea smallholder community.	4.04	0.99
AES2	Your extension agent has a positive attitude toward the work and organisation of development agencies.	3.81	1.04
AES3	Your extension agent encourages you to adopt new technologies.	3.61	1.14
AES4	Your extension agent points out the advantages of using new technologies.	3.60	1.14
Problem Solver			
AES5	Your extension agent has extensive knowledge and experience related to work and social life matters.	3.77	1.11
AES6	Your extension agents will always be a reference source for the tea smallholder community.	3.56	1.20
AES7	Your extension agent encourages you to try agricultural innovation despite facing high risks.	3.34	1.29
AES8	Your extension worker discusses your problem and helps with solutions whenever you request	3.70	1.14
Resource Linker			
AES9	Your extension agent has a vast network of contacts with agricultural agencies.	3.61	1.08
AES10	Your extension agent exhibits friendly behaviour during the development and technology transfer process.	3.70	1.10
AES11	Your extension agents help you get agricultural loans.	3.00	1.37
AES12	Connecting tea farmers for resource sharing	3.58	1.19
Process Helper			
AES13	Your extension agent has the qualities of a diligent and dedicated mentor.	3.72	1.16
AES14	Your extension agent is confident in the capabilities demonstrated by the tea smallholder community.	3.77	1.02
AES15	Your extension agent always encourages the tea smallholder community to achieve the highest innovation progress.	3.88	1.03
AES16	Your extension agent has a high level of patience when developing agriculture.	4.00	0.94

A5. Technology Adoption

No.	Statement	Mean	SD
Attitude			
TA1	Using recommended technologies produces high-quality tea.	4.47	0.65
TA2	Adopting new technology improves yield and productivity.	3.82	0.76
TA3	Technology-based farming is more beneficial than traditional methods.	4.18	0.78
TA4	I am optimistic about the benefits of technological advances in tea cultivation.	4.04	0.84
Subjective Norms			
TA5	Experts' opinions influence my decision to adopt technologies.	3.89	0.94
TA6	I seek advice from farmers who have successfully adopted technologies.	3.92	0.99
TA7	My peers and family support my decision to adopt technology.	3.74	1.13
Perceived Behavioural Control			
TA8	I have the necessary resources, skills, and knowledge to adopt and implement recommended technologies in my tea cultivation effectively.	3.72	1.02
TA9	I believe that I have control over the process of integrating recommended technologies into my tea cultivation practices.	3.82	0.95
TA10	With the proper training, I can overcome challenges in using new technology for tea farming.	4.18	0.90
TA11	My previous experiences with technology make me confident in adopting new technological advancements in tea farming.	3.93	0.90