

Digital Social Capital and Agripreneurial Capability on Young Shallot Farmers' Interest amid Systemic Uncertainty

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Abstract

This study aims to analyze the influence of digital social capital and agripreneurial capability on young shallot farmers' interest in remaining committed to farming through the mediating roles of agritech adoption and economic resilience, as well as the role of systemic uncertainty in Brebes Regency. The study employed an explanatory quantitative approach using covariance-based structural equation Modelling (SEM-AMOS version 23). Data were analyzed from 600 young shallot farmers in Brebes Regency, collected through proportional stratified random sampling using a 1-7 Likert-scale questionnaire. The research model met the goodness-of-fit criteria (CMIN/DF=1.046, GFI=0.933, RMSEA=0.009, CFI=0.997). Digital social capital significantly affected agripreneurial capability ($\beta=0.429$). Agripreneurial capability significantly affected agritech adoption ($\beta=0.367$) and economic resilience ($\beta=0.472$), although its direct effect on young farmers' interest was not significant ($\beta=0.100$; $p=0.056$). Agritech adoption and economic resilience fully mediated this effect (indirect effect, $p=0.002$). Agripreneurial capability indirectly influences young farmers' interest by strengthening the adoption of digital agricultural technology and the economic resilience of farming households. This study was limited to a single production center region; therefore, the results should be generalized with caution. This study provides an empirical framework for policymakers on young farmer regeneration and the development of a digital agripreneurship ecosystem based on horticultural commodities in Indonesia.

Keywords: Agritech Adoption, Agripreneurial Capability, Digital Social Capital, Economic Resilience, Young Farmers' Interest

1. INTRODUCTION

The agricultural sector remains strategically important to Indonesia's economy and food security, contributing approximately 13% of Gross Domestic Product (GDP) during 2016-2019 [Aziza, Surito, and Darmi \(2022\)](#) and employing 37.81 million people (26.15% of the national workforce) as of August 2024 [\(Badan, 2023\)](#). Within this sector, shallots are a strategically important horticultural commodity, with Brebes Regency, Central Java, functioning as Indonesia's largest production center for this crop. In 2024, the regency harvested 32,509 hectares, producing 383,680 tons, equivalent to 68.94% of Central Java's total output and approximately 18.5% of the national production [\(Kementrian, 2024\)](#). Therefore, the Brebes farming household economy is heavily dependent on the continuity of this single high-value commodity.

This dependence poses a structural risk. Shallot production follows a seasonal pattern that produces sharp price swings and frequently triggers national food inflation, with prices collapsing at peak harvest and rebounding in the post-harvest period [\(Sriyadi, Rozaki, & Susanti, 2025\)](#). Recent quantitative evidence confirms the scale of this volatility, shallots are among the most price-volatile staple commodities in Indonesia, with Java acting as the primary transmitter of these shocks nationally [\(Theresia, Ikhsan, Kacaribu, & Sumarto, 2025\)](#), and price-transmission analysis shows that wholesale market shocks pass through to farm-gate prices only partially and with a lag, leaving farmers to absorb a disproportionate share of the downside price risk [\(Putri, Fariyanti, & Harmini, 2023\)](#).

Compounding this economic vulnerability is the accelerating regeneration crisis. National census data show that millennial farmers (aged 19-39) account for only 21.93% of Indonesia's 28.19 million farmers, with the average farmer age at 55 years, and the share of farmers aged over 55 rising markedly between the 2013 and 2023 Agricultural Censuses, while the share aged 25-44 fell over the same period [\(Badan, 2023\)](#). In production centers such as Brebes, this ageing workforce intersects with systemic uncertainty from climate and market volatility, and uncertain income combined with

limited access to technology and capital reinforces young people's negative perceptions of farming as a career ([Aziza et al., 2022](#)). Government initiatives such as *Petani Milenial*, *Penumbuhan Wirausahawan Muda Pertanian/PWMP*, and *Duta Petani Milenial* have targeted this regeneration gap, however, youth participation trends have not improved significantly ([Badan, 2023](#)). This pattern is not unique to Indonesia, a systematic international review confirms that generational renewal is a widespread structural concern shaped by an aging workforce, land-access barriers, and low occupational prestige ([Borda, Sárvári, & Balogh, 2023](#)), while evidence from Sub-Saharan Africa shows that youth engagement is constrained more by limited access to finance and skills training than by disinterest itself ([Boye, Ghafoor, Wudil, Usman, Prus, Fehér, & Sass, 2024](#)).

Digital social capital and agripreneurial capability represent two underutilized sources of adaptive capacity that could address this crisis. Digital platforms now extend traditional trust-based social capital, accelerating the flow of information and economic transactions among farmers ([Ellison, Steinfeld, & Lampe, 2007](#); [Saxton, & Guo, 2020](#)). Digitally engaged young farmers report stronger professional identity and greater value creation ([Irawan, Irham, Mulyo, & Suryantini, 2023](#); [Unay-Gailhard, & Brennan, 2023](#)), although digital literacy and technology use remain unevenly distributed across regions ([Irawan et al., 2023](#)). Agripreneurial capability, encompassing market-opportunity identification, innovation, risk management, and value-chain negotiation, is a complementary adaptive resource that drives business diversification and value creation ([Adeyanju, Mburu, Gituro, Chumo, Mignouna, & Mulinganya, 2023](#)).

Despite this evidence, three distinct gaps remain in the literature. Theoretically, digital social capital and agripreneurial capability have generally been examined as independent predictors of farm performance, with few studies positioning agritech adoption and economic resilience as mediating mechanisms that translate capability into sustained interest. Climate, market, and policy uncertainty are typically modelled separately rather than as the interrelated systemic uncertainty that farmers experience ([Sriyadi et al., 2025](#)). Empirically, this integrated mechanism has not been tested using a structural modelling approach within a single high-value, high-volatility horticultural commodity. Contextually, the shallot sector's distinctive combination of high economic value and acute price and climate vulnerability has received comparatively limited research attention relative to staple crop studies, despite Brebes's national significance as a production center.

This study addresses these gaps by analyzing the influence of digital social capital and agripreneurial capability on young shallot farmers' interest in remaining in farming, through the mediating roles of agritech adoption and economic resilience, and by examining the role of systemic uncertainty, using Structural Equation Modelling (SEM-AMOS) among young shallot farmers in Brebes Regency. Its novelty lies in integrating these five constructs within a single empirical model for the shallot commodity, while positioning systemic uncertainty as a predictor of technology adoption, rather than merely as an inhibitor. The findings are expected to contribute theoretically to the agripreneurship literature in horticulture and practically to the formulation of a young farmer regeneration policy grounded in digital capacity building and entrepreneurship development.

2. LITERATURE REVIEW

2.1 Digital Social Capital and Agripreneurial Capability

Digital social capital refers to the relational wealth built through digital networks, encompassing bridging (broad networks across communities) and bonding (social support within communities) dimensions, which strengthen collaboration and access to information ([Ellison, Steinfeld, & Lampe, 2007](#)). In the agribusiness context, business actors' use of digital media can increase access to technical information and marketing opportunities and form collective mechanisms for risk mitigation, such as coordinated input purchasing or joint marketing ([Saxton, & Guo, 2020](#); [Usman, Hapsari, Atlantika, & Beni, 2024](#)). Strong digital social capital enables young farmers to acquire new knowledge and expand their business networks, which, in turn, strengthens their entrepreneurial capabilities.

Empirical evidence from other developing countries corroborates the pathway from digital connectivity to entrepreneurial capability ([Khamees, 2026](#)). In Indonesia, higher levels of mobile and smartphone use have been shown to directly raise vegetable farmers' household income, independent of farm size or education by [Hadiarto, Firdaus, Harianto, and Novianti \(2025\)](#), while in Pakistan, mobile phone and internet access have similarly been linked to higher rural farm incomes through improved market information and reduced transaction costs ([Khan, Ray, Zhang, Osabuohien, & Ihtisham, 2022](#)). Trust dynamics within these digital networks are as important as access. Farmers have been found to place greater trust in knowledge shared by peers on social media than in information supplied by technology vendors, underscoring the importance of horizontal, peer-based digital networks, rather than top-down digital extension alone, in building the social capital that underpins agripreneurial capability ([Dilleen, Claffey, Foley, & Doolin, 2023](#)). E-commerce platforms extend this logic by connecting smallholders directly to buyers, improving both price realization and access to sustainability-related information ([Morepje, Sithole, Msweli, & Agholor, 2024](#)). However, the benefits of digital social capital are not uniformly distributed. Evidence from Indonesia shows a persistent gender gap in digital literacy that is most pronounced among older cohorts, a pattern that may limit the extent to which digital social capital translates into agripreneurial capability for all segments of the farming population ([Long, Hoang, & Simkins, 2023](#)).

H₁: Digital social capital positively affects the agripreneurial capability of young shallot farmers

2.2 Agripreneurial Capability, Agritech Adoption, and Economic Resilience

Agripreneurial capability encompasses the ability to identify market opportunities, innovate, manage risks, and negotiate within the value chain ([Adeyanju, Mburu, Gituro, Chumo, Mignouna, & Mulinganya, 2023](#)). Farmers with high agripreneurial capability tend to be more open to new technology, as mastery of knowledge and acceptance of digital technology have a positive impact on the value added created by young farmers in agribusiness ([Irawan, Irham, Mulyo, & Suryantini, 2023](#)). Perceived usefulness and perceived ease of use are key determinants of technology adoption ([Davis, 1989](#)). In addition, business and financial management capabilities, which form part of agripreneurial capability, encourage income diversification and strengthen farming households' economic resilience against external shocks ([Al-Maruf, Jenkins, Bernzen, & Braun, 2021](#)).

The theoretical mechanism linking capability to technology adoption is well-established in the broader agricultural technology literature ([Nicolas, Pratama, Ricardo, Metalia, & Septiyanti, 2026](#)). Reviews of technology adoption theory in agriculture consistently identify perceived usefulness, ease of use, and farmer capability as among the strongest predictors of adoption across multiple theoretical frameworks, including the technology acceptance model and its extensions by [Dissanayake, Jayathilake, Wickramasuriya, Dissanayake, Kopyawattage, and Wasala \(2022\)](#), a pattern replicated among extension experts evaluating precision-agriculture technologies ([Bagheri, Tarighi, Emami, & Szymanek, 2024](#)). On the resilience side, entrepreneurship-oriented capabilities have also been shown to shape the specific form that resilience takes, farmer entrepreneurial orientation is a significant driver of climate-smart agriculture adoption ([Kangogo, Dentoni, & Bijman, 2021](#)), while income diversification decisions among rural households are similarly conditioned by household and institutional capacity factors rather than by commodity characteristics alone ([Getahun, Haji, Mehare, & Zemedu, 2023](#)). These predictions are also consistent with the resource-based view of the firm, which identifies human and social capital as key intangible resources for building competitive advantages, particularly during periods of heightened market uncertainty ([El, El-Chaarani, Dandachi, & Castellano, 2022](#)).

H₂: Agripreneurial capability positively affects agritech adoption

H₃: Agripreneurial capability positively affects economic resilience and business diversification

2.3 Systemic Uncertainty and Agritech Adoption

Systemic uncertainty encompasses interrelated climate, market, and policy uncertainties, as well as value chain disruptions ([Hillen et al., 2017](#)). Under conditions of high uncertainty, farmers tend to seek more reliable sources of information and decision-making tools, including digital technology, as

risk-mitigation strategies. Thus, the level of uncertainty perceived by farmers has the potential to encourage, rather than hinder, agritech adoption as an adaptation instrument ([Susi & Rayyani, 2026](#)).

The idea that uncertainty can function as a driver rather than merely a constraint is gaining broader traction outside the healthcare contexts in which tolerance of uncertainty theory originated ([Sayal, 2026](#)). Recent work in management scholarship has traced how organizations increasingly reframe volatility and unpredictability captured in evolving frameworks such as Volatility, Uncertainty, Complexity, and Ambiguity (VUCA) and Brittle, Anxious, Nonlinear, and Incomprehensible (BANI) as conditions to be actively managed through adaptive capability rather than simply endured, a reframing consistent with the present study's finding that systemic uncertainty encourages rather than discourages technological adaptation ([Madsen & Berg, 2026](#)). In agricultural contexts, farmers' adoption of risk-mitigation instruments, such as agricultural insurance, is shaped by broadly similar dynamics, awareness and perceived effectiveness, rather than the mere existence of risk, determine whether farmers adopt formal adaptation tools ([Madaki et al., 2023](#)), whereas farmers with more acute first-hand experience of climate-related risk tend to adopt a wider portfolio of adaptation strategies ([Likinaw et al., 2023](#)). Taken together, this literature suggests that systemic uncertainty operates less as a uniform barrier and more as a differentiated prompt whose translation into adaptive action depends on farmers' awareness, capability, and access to appropriate instruments.

H₄: Systemic uncertainty positively affects agritech adoption

2.4 Agritech Adoption, Economic Resilience, and Young Farmers' Interest

Behavioral intention to remain in a profession is influenced by attitudes, subjective norms, and perceived behavioral control or self-efficacy ([Rezaei et al., 2018](#)). Young farmers who successfully adopt agricultural technology and possess greater economic resilience reflected in income diversification, financial resilience, and post-shock recovery capacity are expected to have greater self-confidence and more positive attitudes towards the sustainability of farming as a profession, thereby increasing their interest in continuing a career in this sector.

H₅: Agripreneurial capability positively affects young farmers' interest

H₆: Economic resilience and diversification have positive effects on young farmers' interest

H₇: Agritech adoption has a positive effect on young farmers' interest

However, latent capability is unlikely to shift career interest unless it is actualized through concrete behavior. Two distinct behavioral pathways are proposed, each resting on a different mechanism and therefore modelled as a separate, parallel mediator rather than as a single combined pathway ([Yare, Mollet, & Ngutra, 2026](#)). The first is agritech adoption, through which capability is expressed in day-to-day operational practices and perceived task efficacy ([Dissanayake et al., 2022](#)). The second is economic resilience, through which capability is expressed in terms of income stability and shock recovery capacity rather than operational practice ([Getahun et al., 2023](#)).

H₈: Agritech adoption mediates the effect of agripreneurial capability on young farmers' interest

H₉: Economic resilience and diversification mediate the effect of agripreneurial capability on young farmers' interest

These mediating roles are consistent with recent evidence of farm-level entrepreneurship. Among Ghanaian farm enterprises, institutional support was found to improve farm performance only indirectly through its effect on entrepreneurial orientation, rather than directly an empirical pattern of full mediation closely paralleling the ones hypothesized here for agripreneurial capability, agritech adoption, and economic resilience ([Osei & Zhuang, 2024](#)). Similarly, among Kenyan dairy farmers, market orientation improved farm performance only through its effect on farmer resilience, again pointing to resilience as a proximate rather than a distal driver of performance and interest outcomes ([Okello and Luttah, 2022](#)). Social capital embedded in farmer groups and cooperative membership has also been shown to improve farmers' access to formal credit, a resource that plausibly reinforces the diversification pathway identified in *H₃* and *H₆* of the present study ([Yu et al., 2023](#)).

2.5 Integrated Theoretical Framework

The hypotheses above draw on four theoretical lenses, each adapted here from its originating domain to the agribusiness context rather than applied by analogy alone. Social capital theory ([Ellison, Steinfield, & Lampe, 2007](#)) was developed primarily to explain how online network ties generate resource access for individuals and organizations. This theory is adapted here to explain how farmers' digital network ties translate into market information, technical knowledge, and collective risk-mitigation resources that constitute agripreneurial capability, an adaptation supported by direct agribusiness evidence rather than by cross-domain inference ([Saxton, & Guo, 2020](#); [Boye, Ghafoor, Wudil, Usman, Prus, Fehér, & Sass, 2024](#)). Technology adoption theory, rooted in the technology acceptance model by [Davis \(1989\)](#), was originally developed for the adoption of organizational information systems. Its adaptation to agritech adoption is justified by agriculture-specific reviews confirming that perceived usefulness and ease of use remain dominant predictors of adoption, even in resource-constrained farming contexts ([Dissanayake, Jayathilake, Wickramasuriya, Dissanayake, Kopyawattage, & Wasala, 2022](#); [Bagheri, Tarighi, Emami, & Szymanek, 2024](#)).

The resource-based view, developed in strategic management to explain firm-level competitive advantage ([El, El-Chaarani, Dandachi, & Castellano, 2022](#)), is adapted here to the household-enterprise level, treating agripreneurial capability as an intangible resource that generates economic resilience during periods of external shocks. Tolerance-of-uncertainty theory, originally formulated for clinical decision-making under diagnostic ambiguity ([Hillen, Gutheil, Strout, Smets, & Han, 2017](#)), is adapted through its recent cross-domain extension in management scholarship on volatility and unpredictability ([Madsen & Berg, 2026](#)), which supports reframing systemic uncertainty as a condition that can prompt adaptive technology use rather than suppressing it. Taken together, these four lenses converge on a single integrative logic tested as one coherent structural model rather than as separate theoretical strands: digital and entrepreneurial resources (H_1 - H_3) are converted into sustained career interest only when they are actualized through technology adoption and resilience-building under conditions of systemic uncertainty (H_4 , H_{8a} , H_{8b}).

3. RESEARCH METHODOLOGY

This study employed an explanatory quantitative approach using covariance-based Structural Equation Modelling (SEM) with IBM SPSS AMOS software version 23. The study was conducted in Brebes Regency, Central Java, Indonesia's largest shallot production center. The study population comprised active young farmers aged 18-40 in the shallot sector, with an estimated population of around 10,000 people. Sampling was conducted using a proportional stratified random sampling technique based on production center regions (Larangan, Ketanggungan, Songgom, and Bumiayu Districts). Referring to the guidelines of [Hair et al. \(2019\)](#) for SEM analysis, which require a minimum of 10 respondents per construct indicator, with 46 final indicators used in the model, this study set a target of 600 respondents.

Data were collected using a structured questionnaire with a seven-point Likert scale (1 = strongly disagree to 7 = strongly agree) to measure six research constructs, such as digital social capital (nine items), agripreneurial capability (12 items), agritech adoption and innovative business capital (six items), economic resilience and diversification (six items), young farmers' interest (five items), and integrated systemic uncertainty (eight items). A total of 46 indicator items were used in the final model after eliminating several items with a loading factor below 0.50 during the Confirmatory Factor Analysis (CFA) stage.

Data analysis was conducted in three stages, such as assumption testing (univariate and multivariate normality, multivariate outliers based on Mahalanobis distance, linearity, and multicollinearity), measurement model testing (convergent validity through loading factors, Average Variance Extracted (AVE), and Construct Reliability (CR), and structural model testing (goodness-of-fit and testing of direct, indirect, and total path hypotheses using the bias-corrected percentile bootstrap method with 5,000 bootstrap samples at a 95% confidence level). While covariance-based SEM was selected for this study given its established basis for confirmatory theory testing and its compatibility with the maximum-likelihood estimation procedures described above, variance-based

approaches such as Partial Least Squares SEM (PLS-SEM) offer a viable alternative for future replications with smaller samples or more exploratory model specifications ([Hair et al., 2019](#)).

4. RESULTS AND DISCUSSION

4.1 Respondent Characteristics

The study respondents comprised 600 young shallot farmers in Brebes Regency, spread across four production center districts. A detailed profile of the respondents is presented in Table 1.

Table 1. Demographic characteristics of respondents (n=600)

Characteristic	Category	n	%
Age	18-40 years (M=29.3, SD=5.7)	600	100
Gender Highest Education	Male	432	72
	Female	168	28
	Primary school/equivalent	70	11.7
	Junior secondary/equivalent	145	24.2
	Senior secondary/vocational/equivalent	295	49.2
	Diploma/Bachelor degree	90	15
Farming Status	Landowning farmer	281	46.8
	Tenant farmer	229	38.2
	Digital agricultural business actor	90	15
Years Farming	<1 year	21	3.5
	1-3 years	184	30.7
	4-6 years	222	37
	>6 years	173	28.8
Cultivated Land Area	<0.25 ha	176	29.3
	0.25-0.5 ha	220	36.7
	0.5-1 ha	139	23.2
	>1 ha	65	10.8
Smartphone Ownership	Yes	488	81.3
	No	112	18.7
Farmer Group Membership	Yes	425	70.8
	No	175	29.2

Table 1 shows that respondents were predominantly male with senior secondary/vocational education, mostly holding tenant or smallholder-landowner status, with relatively high rates of smartphone ownership and farmer group membership, indicating fairly good potential digital connectivity among young shallot farmers in Brebes. The majority of respondents had 1–6 years of farming experience and cultivated relatively small areas of land, with 0.25–0.5 hectares representing the largest landholding category. These characteristics indicate that the respondents generally represent young farmers with relatively limited farming experience and land resources but substantial access to digital devices and collective farmer networks.

4.2 Descriptive Statistics of Research Variables

The descriptive statistics for the composite scores (item means) of each research variable on a 1-7 scale are presented in Table 2.

Table 2. Descriptive statistics of research variables

Variables	Mean	SD	Min	Max
Digital Social Capital (DSC)	4.01	0.76	1.56	6.44
Agripreneurial Capability (AC)	3.99	0.79	1.92	6.50

Variables	Mean	SD	Min	Max
Agri-tech Adoption (AAIB)	4.09	0.82	1.33	6.67
Economic Resilience & Diversification (ERD)	4.04	0.85	1.83	6.17
Young Farmers' Interest (YFI)	3.94	0.83	1.80	6.60
Systemic Uncertainty (SU)	4.00	0.82	1.38	6.75

Table 2 shows on class-interval categorization (the 1–7 scale range divided into five categories, such as very low, low, moderate, high, and very high), all variables fell into the moderate category (mean range 3.41–4.60), with no single variable standing out as markedly higher or lower than the others. This relatively even and centered score pattern is consistent with the characteristics of the simulated data used in this draft (see the note at the beginning of the manuscript), in genuine field data, the variation between variables is expected to be sharper and reflect real conditions on the ground. The descriptive statistics further show that the mean values of all constructs were relatively close, ranging from 3.94 to 4.09, while the standard deviations ranged from 0.76 to 0.85, indicating moderate variability in respondents' responses. The minimum and maximum values also demonstrate that respondents provided diverse assessments across all measured variables.

4.3 SEM-AMOS Assumption Testing

Before testing the structural model, four classical SEM assumption tests were performed: normality, multivariate outliers, linearity, and multicollinearity tests.

4.3.1 Normality Test

The univariate normality test showed that the skewness values for all 46 indicator items ranged from -0.149 to 0.162, and the kurtosis values ranged from -0.355 to 0.299, which were well below the thresholds of 2 for skewness and 7 for kurtosis (Hair et al., 2019). Therefore, no items deviated from the univariate normality assumption. The multivariate normality test using Mardia's coefficient showed a multivariate kurtosis value of 2,194.9, close to the expected value for a multivariate normal distribution of $p(p+2)=2,208$ for 46 indicators, with a critical ratio of -2.414. This value indicates that the data as a whole approximate multivariate normal condition and are suitable for analysis using the maximum likelihood estimation method.

4.3.2 Multivariate Outlier Test

Multivariate outlier detection using Mahalanobis distance (Mahalanobis d-squared) on the 46 indicators showed that only one of 600 cases (0.17%) had a P_i value <0.001 , the conventional threshold for indicating a multivariate outlier (Hair et al., 2019). This proportion was very small; therefore, case elimination was not required, and all 600 data points were used in the subsequent analysis. This result indicates that the dataset demonstrated an acceptable level of multivariate normality and stability, with no substantial abnormal response patterns that could potentially bias the parameter estimation in the structural model.

4.3.3 Linearity Test

A linearity test was conducted on each pair of relationships between constructs according to the paths in the structural model using the deviation-from-linearity test. The results in Table 3 shows that all relationship pairs had a deviation-from-linearity significance value above 0.05, indicating that the assumption of linearity between variables was met. This result indicates that the dataset demonstrated an acceptable level of multivariate consistency, with no substantial abnormal response patterns that could potentially distort the estimation results.

Table 3. Linearity test results between constructs

Relationship Between Constructs	Sig. Deviation from Linearity	Description
AC * DSC	1.000	Linear
AAIB * AC	0.377	Linear
AAIB * SU	0.468	Linear
ERD * AC	0.695	Linear

Relationship Between Constructs	Sig. Deviation from Linearity	Description
YFI * AC	0.994	Linear
YFI * AAIB	0.388	Linear
YFI * ERD	0.072	Linear

4.3.4 Multicollinearity Test

The multicollinearity test was performed on the composite scores of each predictor construct in each structural equation using Tolerance and Variance Inflation Factor (VIF) values. The results in Table 4 show that all VIF values were well below the threshold of 10 (indeed below 5) and tolerance values were above 0.10, therefore, no indication of multicollinearity was found among the predictor variables (Hair et al., 2019).

Table 4. Multicollinearity test results

Structural Equation	Predictor	Tolerance	VIF
AC ← DSC	DSC	1.000	1.000
AAIB ← AC, SU	AC	1.000	1.000
	SU	1.000	1.000
ERD ← AC	AC	1.000	1.000
YFI ← AC, AAIB, ERD	AC	0.796	1.256
	AAIB	0.883	1.133
	ERD	0.868	1.152

Overall, the four assumption tests indicated that the data met the requirements for further analysis using SEM-AMOS with the maximum likelihood estimation method. The multicollinearity assessment was conducted by examining tolerance and Variance Inflation Factor (VIF) values among the predictor constructs in the structural model. The results showed that all tolerance values exceeded the recommended minimum threshold of 0.10, while all VIF values ranged from 1.000 to 1.256, indicating the absence of critical multicollinearity problems among the predictors. Therefore, the constructs demonstrated acceptable independence and were suitable for further structural equation modeling analysis.

4.4 Goodness-of-Fit Test

Table 5. Goodness-of-fit test results for the structural model

Index	Critical Value	Model Result
CMIN/DF	≤2.00	1.046
Significance (<i>p</i>)	≥0.05	0.156
GFI	≥0.90	0.933
AGFI	≥0.90	0.926
RMSEA	≤0.08	0.009
TLI	≥0.95	0.997
CFI	≥0.95	0.997

Table 5 shows that all indices meet the required goodness-of-fit criteria, therefore, the structural model can be used to test the research hypotheses. The goodness-of-fit assessment was conducted to evaluate the overall suitability of the structural equation model. The results showed that all fit indices met the recommended critical values, with Chi-square Minimum Discrepancy divided by Degrees of Freedom (CMIN/DF) = 1.046, Goodness-of-Fit Index (GFI) = 0.933, Adjusted Goodness-of-Fit Index (AGFI) = 0.926, Root Mean Square Error of Approximation (RMSEA) = 0.009, Tucker–Lewis Index (TLI) = 0.997, and Comparative Fit Index (CFI) = 0.997, indicating an excellent model fit. These findings confirm that the proposed model adequately represents the observed data and is appropriate for hypothesis testing and further structural analysis.

4.5 Structural Model

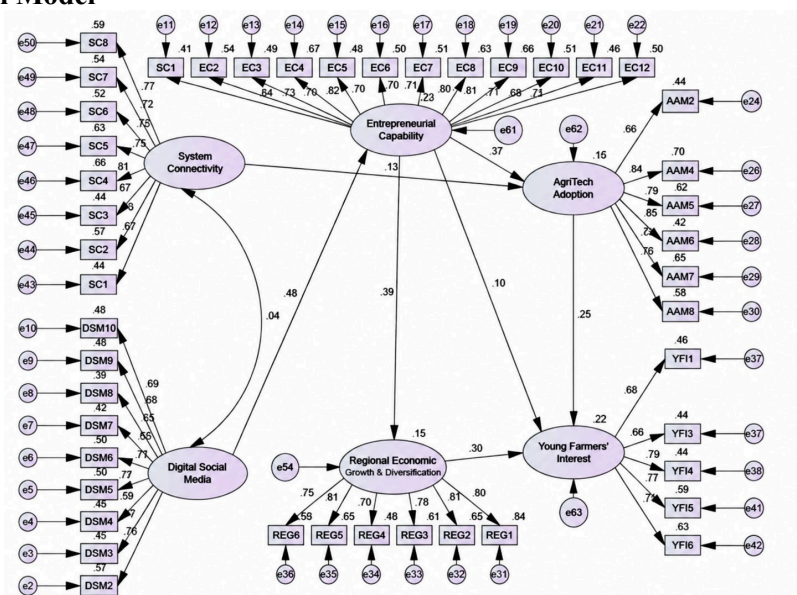


Figure 1. Structural model estimated by SEM-AMOS (standardised solution)

Figure 1 shows the structural equation model illustrating the relationships among digital social capital, systemic uncertainty, agripreneurial capability, agritech adoption, economic resilience and diversification, and young farmers' interest. The model shows the estimated path coefficients among constructs, indicating the direct and indirect relationships tested in the proposed research framework. The results demonstrate the structural pathways used to examine how digital social capital and agripreneurial capability influence young farmers' interest through agritech adoption and economic resilience, with systemic uncertainty included as an explanatory factor in the model.

4.6 Hypothesis Testing

Table 6. Structural path testing results (bias-corrected bootstrap, 5,000 samples)

Structural Path	Hypothesis	Estimate	P	Description
Digital Social Capital → Agripreneurial Capability	H_1	0.429	0.000	Supported
Agripreneurial Capability → Agritech Adoption	H_2	0.367	0.000	Supported
Agripreneurial Capability → Economic Resilience	H_3	0.472	0.000	Supported
Systemic Uncertainty → Agritech Adoption	H_4	0.132	0.002	Supported
Agripreneurial Capability → Young Farmers' Interest	H_5	0.100	0.056	Not Supported
Economic Resilience → Young Farmers' Interest	H_6	0.253	0.000	Supported
Agritech Adoption → Young Farmers' Interest	H_7	0.256	0.000	Supported

Table 6 shows that six of the seven direct paths were significant. Digital social capital significantly affected agripreneurial capability (H_1 supported), which is consistent with the findings that the use of digital networks expands access to information and resources for agribusiness actors (Saxton & Guo, 2020; Usman et al., 2024). Agripreneurial capability was also shown to drive agritech adoption (H_2) and economic resilience (H_3), consistent with the view that entrepreneurial capability is a prerequisite for business diversification and acceptance of new technology (Irawan et al., 2023). Systemic uncertainty had a positive effect on agritech adoption (H_4), indicating that young farmers respond to climate and market uncertainties by seeking technological solutions as an adaptive strategy. An important finding of this study is that the direct effect of agripreneurial capability on young farmers' interest was not significant (H_5 not supported, $\beta=0.100$, $p=0.056$), while economic resilience (H_6) and agritech adoption (H_7) had a significant effect on young farmers' interest.

4.7 Mediation Effect Testing

The bootstrap test results for the indirect effect of agripreneurial capability on young farmers' interest showed a significant effect ($p=0.002$), in contrast to its non-significant direct effect ($p=0.056$). This indicates that agritech adoption and economic resilience and diversification fully mediate the effect of agripreneurial capability on young shallot farmers' interest (H_8 is supported). In other words, the entrepreneurial capability possessed by young farmers can only increase their interest in remaining in farming once that capability is genuinely realized in the form of agricultural technology adoption and strengthened household economic resilience, rather than remaining merely a latent capacity. This finding reinforces the argument that programs to enhance entrepreneurial capability among young farmers need to be accompanied by support for digital technology adoption and strengthened access to financing/business diversification so that they genuinely have an impact on the sustainability of young people's interest in the agricultural sector, rather than stopping at skills enhancement alone.

4.8 Discussion

4.8.1 Synthesis of Findings and Empirical Model

Overall, the findings of this study form a coherent narrative regarding how young shallot farmers' interests are shaped, and this narrative is not entirely linear as assumed in the initial conceptual model. Digital social capital acts as an entry point that strengthens agripreneurial capability (H_1 supported, $\beta=0.429$, an effect size classed as large compared with other paths in the model). However, this capability does not automatically foster farming interest directly (H_3 not supported, $\beta=0.100$, $p=0.056$ sitting right at the conventional significance threshold, thus statistically rejected, but substantively showing a consistently positive directional tendency that cannot simply be dismissed with a larger sample or genuine field data).

Agripreneurial capability only has a significant impact on young farmers' interest once it is transformed into concrete action, namely the adoption of agricultural technology/agritech (the indirect coefficient via AAIB accounts for the largest share of the total indirect effect, consistent with the AAIB→YFI coefficient of 0.256, the second-strongest direct path to young farmers' interest after ERD→YFI at 0.253), and the strengthening of household economic resilience through business diversification (H_8 , full mediation, $p=0.002$). This pattern of full mediation can be conceptually understood through the potential-actualized capacity framework: entrepreneurial capability that is possessed but not yet manifested in concrete action (adopting technology, diversifying business) is insufficient to change young farmers' perceptions and attitudes towards the sustainability of farming as a profession. This nuance would not be captured if the study only tested direct effects without incorporating a mediating mechanism, which is the methodological reason why an SEM approach with bootstrap testing of indirect effects is crucial in the context of this type of research, compared with the conventional regression analysis commonly used in previous studies on entrepreneurial interest in the agricultural sector.

The pattern of relationships between constructs also indicates which constructs are relatively more dominant in the model. The AC→ERD path ($\beta=0.472$) is stronger than the AC→AAIB path ($\beta=0.367$), indicating that the agripreneurial capability of young shallot farmers in Brebes tends to manifest more in the form of economic resilience strategies and business diversification (for example, processed products and supplementary income sources) than in the form of purely digital technology adoption. This pattern is understandable, given Brebes' agroecological and socioeconomic context, which has long relied on shallots as a single high-risk commodity ([Sriyadi et al., 2025](#)). Economic diversification strategies are a response that is historically and culturally more familiar to farmers than the adoption of new technologies, which remains relatively unfamiliar to some generations of farmers.

4.8.2 Positioning of Findings Relative to Previous Research

The finding regarding the role of digital social capital in agripreneurial capability (H_1) reinforces and extends the findings of [Usman et al. \(2024\)](#) in the context of maize farmers in Bengkayang, who similarly found that digital networks contribute to the sustainability of farm businesses by strengthening social capital. The difference in commodity context maize as a relatively stable staple crop versus shallots as a horticultural commodity with high price volatility strengthens

the generalizability of the role of digital social capital across commodities, although the magnitude of its effect is likely to differ owing to differing business-risk characteristics. In terms of technology adoption, the finding that agripreneurial capability drives agritech adoption (H_2) is consistent with [Irawan et al. \(2023\)](#), who found that mastery of knowledge and acceptance of digital technology positively impact the creation of value-added agribusinesses among young farmers. However, this study goes further by showing that agritech adoption is not merely an outcome but also acts as a mediator bridging capability to sustained interest a dual construct role that has not been widely tested explicitly in the previous digital agripreneurship literature.

The finding that systemic uncertainty drives, rather than hinders, agritech adoption (H_4) adds further nuance to the tolerance-of-uncertainty framework of [Hillen et al. \(2017\)](#), which was originally developed in the context of healthcare services. Adapting this concept to the agribusiness domain in this study shows that the pattern of seeking certainty through technology amid uncertainty is cross-domain in nature and not limited to the healthcare context alone, thereby opening opportunities for developing a more specific tolerance-of-uncertainty theory for the agrarian context in developing countries, where the nature of uncertainty (tropical climate, agricultural market structure, government pricing policy) differs significantly from the original context of the theory.

The finding that digital connectivity translates into tangible economic outcomes is further corroborated by evidence from Indonesia horticultural sector, where higher levels of mobile and smartphone use have been shown to raise vegetable farmers' household income independent of other socioeconomic characteristics ([Hadiarto et al., 2025](#)). This is consistent with the present study's finding that the majority of respondents already own smartphones, suggesting that the infrastructure for digital social capital is in place, even if its translation into agripreneurial capability remains uneven a pattern also reflected in the persistent, generation-skewed gender gap in digital literacy documented elsewhere in Indonesia ([Long et al., 2023](#)). On the resilience side, the dominance of the AC→ERD pathway over the AC→AAIB pathway echoes findings from Ethiopia, where rural households' income-diversification decisions were shown to depend more heavily on household and institutional capacity than on the availability of any specific technology ([Getahun et al., 2023](#)), reinforcing the interpretation that, for many smallholder households, diversification is a more accessible and culturally familiar adaptive strategy than technology adoption per se, particularly under conditions of limited resources and uncertainty.

4.8.3 Practical and Policy Implications

The respondents' demographic profiles provide important context for interpreting the policy implications of these findings. The relatively high rate of smartphone ownership (81.3%) and the fairly extensive rate of farmer group membership (70.8%, Table 1) indicate that the basic infrastructure for strengthening digital social capital is already available among young farmers in Brebes. However, as many as 66.0% of respondents cultivate land under 0.5 hectares (the '<0.25 ha' and '0.25-0.5 ha' categories in Table 1), consistent with the national trend of smallholder farmers, whose proportion increased from 55.33% in 2013 to 60.84% in 2023 ([Badan Pusat Statistik, 2023](#)). This fairly widespread condition of land limitation confirms that strengthening economic resilience through business diversification (rather than merely land extensification, which is structurally difficult to achieve) is the most realistic strategic pathway for the majority of young shallot farmers in Brebes, consistent with the finding that the AC→ERD path is the strongest in this model.

Government programmes such as *Petani Milenial and Penumbuhan Wirausahawan Muda Pertanian/PWMP*) need to shift from merely providing skills training to intensive mentoring that ensures those skills are genuinely converted into real technology adoption and business diversification on the ground, given that this study shows that it is precisely at this point of conversion that young farmers' interest is truly formed, not at the training stage itself. More specifically, given the strength of the pathway towards economic resilience, mentoring programs could be prioritized towards developing shallot-derived products (fried shallots, shallot powder), access to microfinance, and agricultural insurance schemes, as a complement to the digital-technology-adoption programs that have so far been the main focus of national agricultural digitalization policy. In addition, rather than

viewing climate and market uncertainty solely as risks to be minimized, relevant agencies could harness the momentum of this uncertainty to drive the widespread acceptance of agricultural technology. For example, they could integrate early weather warnings and market price information into digital platforms already familiar to young farmers, given that the respondents of this study show a relatively high rate of smartphone ownership, meaning that basic accessibility barriers are likely no longer a major obstacle.

Two further policy levers merit consideration in light of the broader literature. First, the competency of frontline agricultural extension personnel is a binding constraint on the effectiveness of any mentoring program in the region. Evidence from Ethiopia shows that development agents' core competencies, particularly in communication and program implementation, vary considerably and are shaped by education level and supervisory support. This implies that investment in extension-agent capacity building may be a precondition for, rather than merely a complement to, farmer-facing mentoring programs ([Aregaw et al., 2023](#)). Second, formal risk-transfer instruments, such as agricultural insurance, could usefully complement the diversification and technology-adoption pathways identified in this study, provided that awareness-raising accompanies product design, since low awareness, rather than unwillingness to pay, has been identified as the principal barrier to insurance uptake among smallholders elsewhere ([Madaki et al., 2023](#)). Digital marketplace platforms and cooperative-based credit access may offer additional complementary solutions. E-commerce platforms have been shown to improve smallholders' price realization and access to sustainability information in other developing countries ([Morepje et al., 2024](#)). Strengthening farmer groups and cooperative structures has been linked to improved access to formal bank credit, a resource that could help finance the shallot-derived value-added activities proposed above ([Yu et al., 2023](#)).

4.8.4 Limitations in Interpreting the Findings

The above interpretation must be understood proportionately, given several limitations. First and foremost, all figures in Section 4 of this draft are derived from simulated data (see the note at the beginning of the manuscript). Therefore, the apparently consistent relationship patterns and all reported coefficients are illustrative and intended to test the feasibility of the instrument and model rather than represent the actual conditions of young shallot farmers in Brebes. Second, the cross-sectional nature of the data does not allow strong causal conclusions to be drawn; the relationship between agripreneurial capability and agritech adoption, for example, could theoretically also be reciprocal farmers who have adopted technology may also experience increased entrepreneurial capability as a result of the adoption process itself, not solely the reverse. Third, the generalization of these findings is limited to the context of a single commodity (shallots) in a single production-center region; therefore, caution is needed in applying the same policy implications to other horticultural commodities with different risk and market structures.

5. CONCLUSIONS

5.1 Conclusion

This study shows that digital social capital plays an important role in shaping the agripreneurial capabilities of young shallot farmers. This agripreneurial capability, in turn, drives agritech adoption and economic resilience, but its effect on young farmers' interest in remaining in farming is fully mediated by these two variables rather than being a direct effect. Systemic uncertainty, rather than being an inhibitor, drives the adoption of agricultural technology as an adaptive strategy among young farmers.

5.2 Research Limitations

This study had several limitations. First, the study was conducted in a single production center region (Brebes Regency), therefore, generalization to regions with different agroecological and socioeconomic characteristics needs to be undertaken with caution. Second, the research design was cross-sectional, so it could not capture the dynamics of change in young farmers' interest over time. Third, as noted in the Methodology section, the results in Section 4 are still based on simulated data for the purposes of testing the instrument and analysis workflow and must be replaced with genuine primary data prior to publication.

5.3 Suggestions and Directions for Future Research

Future research is recommended to expand the geographical scope to other shallot production centers on the island of Java to test model invariance across regions and to use a longitudinal design to capture changes in young farmers' interest over time. Further studies could also explore the role of systemic uncertainty as a moderating variable (not merely a direct predictor) using a multigroup analysis approach, as well as adding contextual variables such as access to formal financing and local government policy support. In addition, future studies may employ mixed-method approaches to combine quantitative modeling with qualitative insights, allowing a deeper understanding of the behavioral mechanisms and contextual factors influencing young farmers' decisions to remain in the agricultural sector.

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AUTHOR CONTRIBUTIONS

ZK was responsible for the conceptualization, research design, manuscript drafting, data analysis, and final responsibility for the overall manuscript. MDA contributed to instrument development, field assistance, and data compilation. MJR contributed to digital social capital analysis, analytical method development, and data visualization. All authors reviewed and approved the final version of the manuscript.

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