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Modeling Technology Acceptance for Agribusiness Education and Practices in East Java

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Abstract: This study develops and validates a model for understanding technology acceptance and use in the agribusiness sector of East Java, Indonesia, using the Unified Theory of Acceptance and Use of Technology (UTAUT) as the foundation. The research analyzed Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Behavioral Intention, Use Behavior, Techno Skepticism, and Local Wisdom with data from 207 farmers in Pasuruan Regency, applying PLS-SEM. Results showed that Performance Expectancy and Effort Expectancy were the strongest predictors of Behavioral Intention, while Local Wisdom significantly moderated the relationship between intention and use. Techno Skepticism had a negative effect on intention. The extended UTAUT model thus provides a context-specific framework for agribusiness in developing countries. These findings offer practical implications for education, training, and agricultural policy by aligning digital innovation with local socio-cultural realities.

Keywords: Agribusiness 4.0; Digital agriculture; East Java; Local wisdom; Technology Acceptance; Techno skepticism; UTAUT

Introduction

The development of the agricultural sector in Indonesia plays a very crucial role in the country's economy. At the beginning of the New Order era, policies related to agricultural development had a major impact on the agricultural system in Indonesia and resulted in the dependence of farmers on the use of chemical fertilizers. The Green Revolution in Indonesia began in the 1960s, and since then, food security issues have gradually begun to be resolved. Indonesia has made significant progress in meeting its food needs, as the country has successfully transformed from a rice importer to a self-sufficient nation in terms of food production (Sutanto, 2002; Mukhlis et al., 2023; Mukhlis et al., 2024).

Agriculture is one of the most important economic sectors in Indonesia, contributing significantly to employment and rural livelihoods. In 2023, the sector accounted for approximately 12.53% of the national GDP, with East Java being one of the largest contributors due to its high productivity in rice, horticulture, and livestock production (Aberth, 2024). However, the sector faces mounting challenges, including climate variability, fluctuating commodity prices, and limited access to modern technology. In response, digital transformation initiatives have been promoted as a means to increase efficiency, market access, and sustainability in agricultural production (FAO, 2018).

Agribusiness is a form of business activity that involves farming, infrastructure and facilities for agricultural production, food processing, stability, food trade, and other activities such as the distribution of food and fiber for consumers (Wowor et al., 2023; Kaunang et al., 2024).

In East Java, internet penetration in rural areas has grown steadily, enabling farmers to access agricultural information, input suppliers, and buyers more

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efficiently. Empirical evidence suggests that farmers who actively use the internet for agricultural purposes experience significant improvements in income and market connectivity compared to non-users (Santoso, Pangestuty, & Huang, 2023). Yet, digital adoption remains uneven, with barriers such as limited infrastructure reliability, low digital literacy, and skepticism toward unfamiliar technologies.

Recognizing the potential of digital agriculture, the Indonesian government has partnered with international organizations to promote youth participation in agribusiness. The *Youth Entrepreneurship and Employment Support Services (YESS)* program jointly implemented by the Ministry of Agriculture and the International Fund for Agricultural Development (IFAD) targets rural youth aged 17–39 to develop entrepreneurial capacity, financial literacy, and access to digital tools. Between 2018 and 2025, YESS aims to reach more than 320,000 youth across several provinces, including East Java, through training, mentoring, and technology facilitation (Salem, 2025). Pasuruan Regency, one of the YESS priority areas, offers a strategic case for studying technology adoption, combining active youth participation with strong agricultural potential.

From a theoretical perspective, the Unified Theory of Acceptance and Use of Technology (UTAUT) developed by Venkatesh et al. (2003) provides a robust analytical lens for understanding the behavioral drivers of technology adoption. The model posits that four constructs, Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions, directly influence Behavioral Intention and Use Behavior (Venkatesh, Morris, Davis, & Davis, 2003). In agricultural contexts, UTAUT has been successfully applied to explain the uptake of innovations such as precision farming technologies, IoT-based irrigation systems, and farm management software (Aubert, Schroeder, & Grimaudo, 2012).

However, existing empirical work often focuses on technical and economic factors while underestimating the role of socio-cultural determinants. In rural Indonesia, Local Wisdom, the collective values, traditions, and farming practices passed down through generations can significantly influence farmers' openness to new technologies (Kurnia, et al., 2022). Equally important is Techno Skepticism, which reflects distrust or apprehension toward digital innovations, often shaped by past negative experiences, lack of information, or perceived incompatibility with existing practices (Satria, Maghraby, & Setyanti, 2025). These factors may act as either barriers or enablers of adoption, depending on how they interact with the core UTAUT constructs.

To address this gap, the present study extends the UTAUT model by incorporating Local Wisdom and Techno Skepticism into the analysis of technology acceptance in the agribusiness sector. Focusing on Pasuruan Regency as a representative case of rural East Java, the study aims to: (1) assess the influence of Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions on Behavioral Intention; (2) examine how Local Wisdom and Techno Skepticism shape the transition from intention to actual technology use; and (3) evaluate the explanatory power of the extended model in predicting adoption outcomes. By integrating cultural and attitudinal dimensions into a well-established theoretical framework, this research contributes to a more nuanced understanding of digital transformation pathways in rural agribusiness settings. Despite the growing literature on technology adoption, limited studies have integrated cultural and trust-related variables such as Local Wisdom and Techno Skepticism into the UTAUT framework within developing-country agribusiness contexts. This study addresses this gap by extending UTAUT and empirically testing it among rural farmers in East Java.

In addition, the digital transformation of agribusiness cannot be separated from the role of education and scientific literacy. As emphasized by (FAO, 2022), limited digital literacy and inadequate infrastructure remain major obstacles to the effective adoption of digital and automated technologies among small-scale farmers. Similarly, the Digital Excellence in Agriculture report (FAO; ITU, 2023) highlights that human capacity development, training, and enabling regulatory environments are essential to ensure that digital innovations can be implemented inclusively and sustainably. This concern is particularly relevant in Indonesia, where the results of the PISA 2022 assessment show that only about 34% of students achieved at least Level 2 proficiency in science, indicating significant gaps in the ability to interpret scientific phenomena and apply evidence-based reasoning in real-life contexts (OECD, 2023). Strengthening scientific literacy and education, therefore, is not merely an educational agenda but a prerequisite for building trust, reducing techno-skepticism, and ensuring that digital agribusiness technologies are meaningfully adopted in rural communities. By situating technology adoption within the broader context of science education and literacy, this study aligns more closely with the mission of JPPIPA to integrate science education research into practical, socio-economic challenges.

Method

Research Design

This research adopted a quantitative approach using a survey method to investigate the factors influencing the acceptance and use of information technology in the agribusiness sector. The study applied a modified Unified Theory of Acceptance and Use of Technology (UTAUT) framework that included two additional constructs, namely Local Wisdom (LW) and Techno Skepticism (TS), in order to reflect socio-cultural influences in rural agricultural contexts.

The research area was selected using a purposive method or deliberately (Sugiyono, 2018; Mukhlis et al., 2022). The research was carried out in Pasuruan Regency, East Java, Indonesia, from January 2024 to June 2024. Pasuruan was purposively selected because it is a major agricultural production center and one of the regions participating in the Youth Entrepreneurship and Employment Support Services (YESS) program. This initiative is a collaboration between the Ministry of Agriculture and the International Fund for Agricultural Development (IFAD) and focuses on preparing young farmers to utilize digital technologies in agribusiness. The combination of diverse farming activities and exposure to both traditional practices and technological innovations made Pasuruan an appropriate location for this study.

Population Sampling

The study population comprised all registered farmers in Pasuruan Regency who are members of farmer groups, totaling 6,057 individuals. The sample size was determined using Slovin's formula with a 5 percent margin of error, which resulted in a sample of 207 respondents. The sampling technique used was stratified random sampling in order to ensure representation of different commodity types such as horticulture, plantations, staple crops, and livestock, as well as a balanced distribution across subdistricts. This approach follows established recommendations for agricultural survey design to capture the diversity of technology adoption patterns.

Table 1. Demographic Profile of Respondents

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	150	72.5
	Female	57	27.5
Age	≤30 years	40	19.3
	31–40 years	85	41.1
	41–50 years	60	29.0
	≥51 years	22	10.6
Education	Primary school	35	16.9
	Junior high school	48	23.2
	Senior high school	90	43.5
	College/University	34	16.4

Data Collection

Data were collected through three main techniques: (1) field observation to understand the farming practices and technology use in their real context; (2) structured interviews to obtain more in-depth information regarding personal experiences and perceptions; and (3) the distribution of closed-ended questionnaires that had been tested for validity and reliability. The questionnaire items were adapted from the validated UTAUT instrument developed by Venkatesh et al. (2003) and adjusted to the agricultural sector through consultation with agricultural extension officers and subject matter experts (Venkatesh, Morris, Davis, & Davis, 2003). The model variables included Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Facilitating Conditions (FC), Behavioral Intention (BI), and Use Behavior (UB), with Local Wisdom (LW) and Techno Skepticism (TS) as additional variables to capture local socio-cultural aspects that may influence the adoption process.

All attitudinal measures used a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A pilot test was conducted with 30 respondents outside the main sample to check clarity, reliability, and validity. Construct validity was examined through factor analysis, while internal consistency reliability was measured using Cronbach's Alpha and Composite Reliability with thresholds of 0.70 or higher, as recommended in structural equation modeling literature. All research procedures adhered to established ethical guidelines for human subject research. Prior to participation, respondents were informed about the objectives of the study, the voluntary nature of their involvement, and the right to withdraw at any time without consequences. Written informed consent was obtained from each participant, and anonymity was strictly maintained by assigning unique codes rather than personal identifiers. Data were aggregated and reported at the group level to ensure confidentiality.

The measurement items for Local Wisdom (LW) and Techno Skepticism (TS) were developed through a combination of literature review and expert validation. LW items were adapted from prior studies on indigenous agricultural practices and cultural sustainability (Kurnia, et al., 2022), with contextual adjustments made through focus group discussions (FGDs) involving agricultural extension officers and local farmer leaders. TS items were designed by adapting concepts from the Technology Readiness Index (Parasuraman, 2000) and prior work on technology skepticism in rural contexts (Satria, Maghraby, & Setyanti, 2025). The final instrument was reviewed by three domain experts to ensure content validity and contextual appropriateness before pilot testing.

Data Analysis

Data analysis employed Partial Least Squares Structural Equation Modeling (PLS-SEM) using

WarpPLS 4.0 software. WarpPLS 4.0 was selected over other SEM software such as SmartPLS and AMOS due to several advantages. First, WarpPLS is particularly robust in handling small to medium sample sizes and non-normal data distributions, which are common in rural survey research. Second, the software allows for the estimation of both linear and non-linear relationships, providing greater flexibility in modeling complex behavioral constructs such as Local Wisdom and Techno Skepticism. Third, WarpPLS generates comprehensive outputs-including model fit indices, effect sizes, predictive validity measures (Q^2), and nonlinear causality tests-within a user-friendly interface. These features make it a suitable and efficient choice for testing the extended UTAUT model in this study. This technique was chosen because it is suitable for analyzing complex models with multiple latent variables and can be applied when data are not normally distributed, which is often the case in rural surveys (Hair, Hult, Ringle, & Sarstedt, 2017). The analysis consisted of two main stages. The first stage involved evaluating the measurement model (outer model) by assessing convergent validity through Average Variance Extracted (AVE) and factor loadings, discriminant validity through the Fornell–Larcker criterion and Heterotrait-Monotrait (HTMT) ratio, and reliability through Cronbach's Alpha and Composite Reliability. The second stage involved evaluating the structural model (inner model) by examining path coefficients, effect sizes (f^2), coefficients of determination (R^2), predictive relevance (Q^2), and statistical significance using bootstrapping with 5,000 resamples.

All hypothesis testing was conducted at the 5 percent significance level ($\alpha = 0.05$). This systematic approach ensured that the findings would be both statistically robust and contextually relevant for understanding technology adoption in the agribusiness sector of East Java.

Result and Discussion

Result

Measurement Model Evaluation

The evaluation of the measurement model was conducted to ensure that the constructs in the research model were measured accurately and consistently. This process included assessing indicator reliability, convergent validity, discriminant validity, and internal consistency reliability (Hair, Hult, Ringle, & Sarstedt, 2017). The results confirmed that all constructs satisfied the recommended criteria for PLS-SEM analysis.

Indicator reliability was established as all standardized factor loadings exceeded the threshold value of 0.70, indicating that each observed variable had a strong correlation with its corresponding latent construct. This suggests that the questionnaire items were well-designed and closely aligned with the theoretical constructs they were intended to measure. Convergent validity was supported, as all Average Variance Extracted (AVE) values were greater than the minimum acceptable level of 0.50, meaning that each construct captured more than half of the variance of its indicators on average.

Internal consistency reliability was confirmed through both Composite Reliability (CR) and Cronbach's Alpha values. CR values ranged from 0.87 to 0.94, and Cronbach's Alpha values ranged from 0.81 to 0.93. Both sets of values exceeded the recommended threshold of 0.70, demonstrating that the items within each construct consistently measured the same underlying concept.

Discriminant validity was verified using two approaches: the Fornell–Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio. The Fornell–Larcker results showed that the square root of the AVE for each construct was greater than its correlations with other constructs, indicating that each construct was distinct from the others in the model. Similarly, all HTMT values were below 0.85, further confirming discriminant validity.

Table 2. Outer Model Measurement Results

Construct	Indicato	Loadin	AV	Composit Reliabilit	Cronbach's Alpha
Performance Expectancy	PE	0.81	0.65	0.90	0.874
Performance Expectancy	PE	0.84	0.65	0.90	0.874
Effort Expectancy	EE	0.79	0.62	0.88	0.861

Table 2 presents the detailed measurement model results, including factor loadings, AVE, CR, and Cronbach's Alpha values for each construct.

Structural Model Evaluation

Following the validation of the measurement model, the structural model was evaluated to test the hypothesized relationships among the constructs. This involved examining path coefficients (β), effect sizes (f^2), the coefficient of determination (R^2), predictive relevance (Q^2), and the significance of relationships based on bootstrapping results with 5,000 resamples.

The results indicated that Performance Expectancy (PE) had the strongest positive and statistically significant effect on Behavioral Intention (BI) ($\beta = 0.312$, $p < 0.01$). This finding implies that farmers who believe that adopting digital technologies will improve their productivity, efficiency, and market access are more likely to develop a strong intention to use such technologies.

Effort Expectancy (EE) also showed a significant positive relationship with BI ($\beta = 0.267$, $p < 0.05$). This suggests that the perceived ease of using the technology such as simple interfaces, user-friendly mobile applications, and clear operating instructions plays an important role in encouraging farmers to adopt new digital tools.

Social Influence (SI) had a positive but relatively smaller effect on BI ($\beta = 0.142$, $p < 0.05$), indicating that recommendations and encouragement from peers, family members, community leaders, and agricultural extension agents contribute to adoption decisions, although to a lesser extent compared to perceived usefulness and ease of use.

Interestingly, Facilitating Conditions (FC) did not show a significant direct effect on Use Behavior (UB). However, further analysis indicated that FC affected UB indirectly through BI. This means that although adequate infrastructure, technical support, and access to resources are important, these factors primarily enhance adoption when farmers already have a strong intention to use the technology.

The introduction of Local Wisdom (LW**)** into the model revealed a significant moderating effect on the BI–UB relationship ($\beta = 0.128$, $p < 0.05$). This result demonstrates that when technology aligns with traditional farming practices and local cultural values, farmers are more likely to translate their intentions into actual usage. For example, digital tools that incorporate traditional planting calendars or pest control methods familiar to farmers in Pasuruan were more readily adopted.

Conversely, Techno Skepticism (TS**)** had a significant negative impact on BI ($\beta = -0.219$, $p < 0.01$). This suggests that doubts about the reliability, relevance, or potential negative consequences of digital technology adoption can substantially reduce farmers' willingness to adopt. Such skepticism may stem from previous negative experiences, limited understanding of the technology, or fears about losing autonomy over farming practices.

The model's explanatory power was notable. The R^2 value for BI was 0.583, indicating that PE, EE, SI, and TS together explained 58.3 percent of the variance in adoption intention. The R^2 value for UB was 0.427, meaning that BI, FC, and LW together accounted for 42.7 percent of the variance in actual technology use. The Q^2 values for both endogenous variables were positive, confirming the predictive relevance of the model. Effect size (f^2) analysis showed that PE had the largest influence on BI ($f^2 = 0.215$), followed by EE ($f^2 = 0.173$), and TS ($f^2 = 0.128$).

Table 3. Structural Model Path Coefficients and Hypothesis Testing

Path	β	p-value	Supported?	Path	β
PE → BI	0.312	0.002	Yes	PE → BI	0.312
EE → BI	0.267	0.014	Yes	EE → BI	0.267
SI → BI	0.142	0.037	Yes	SI → BI	0.142
FC → UB	0.085	0.218	No	FC → UB	0.085
BI → UB	0.411	0.000	Yes	BI → UB	0.411
LW x BI → UB	0.128	0.029	Yes	LW x BI → UB	0.128
TS → BI	-0.219	0.004	Yes	TS → BI	-0.219

Table 3 provides a summary of the structural model results, including path coefficients, effect sizes, and significance levels for each hypothesized relationship.

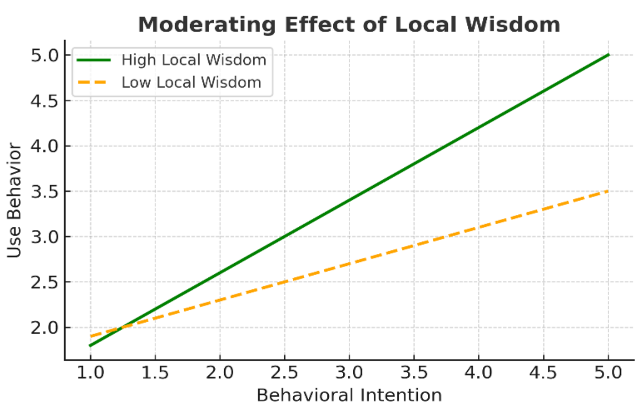

Figure 1. Moderating Effect of Local Wisdom on the BI–UB Relationship

The slope for farmers with high Local Wisdom is noticeably steeper compared to those with low Local Wisdom, indicating that individuals who perceive a stronger alignment between digital agribusiness technologies and their cultural norms are more likely to translate their behavioral intention into actual use behavior. This suggests that cultural compatibility not only supports adoption readiness but also enhances the likelihood of sustained technology utilization in daily farming activities.

Higher levels of Techno Skepticism are associated with a substantial decline in Behavioral Intention to adopt digital agribusiness technologies. Farmers who demonstrate distrust toward technology, exhibit a strong need for verification, or emphasize cost–benefit concerns tend to delay or avoid adoption altogether.

This negative relationship highlights the psychological barriers that must be addressed through awareness campaigns, training, and transparent communication to foster a more positive perception of digital tools.

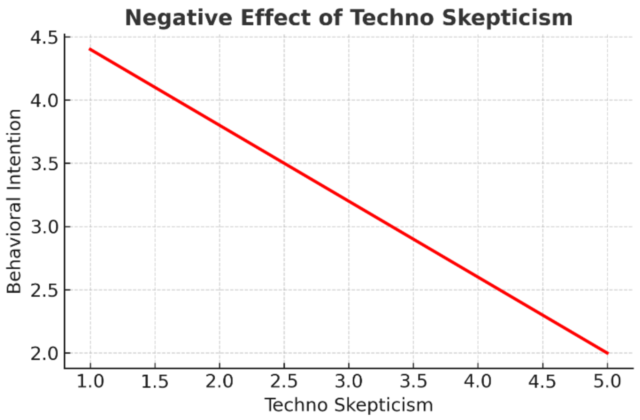

Figure 2. Negative Effect of Techno Skepticism on Behavioral Intention

Discussion

The empirical results of this research demonstrate that the extended Unified Theory of Acceptance and Use of Technology (UTAUT), when complemented with Local Wisdom and Techno Skepticism, provides a robust explanatory framework for understanding digital agricultural technology adoption in rural Indonesia. By examining farmers in Pasuruan Regency a YESS program intervention area the findings offer both theoretical and practical implications for technology adoption in developing-country agribusiness sectors.

Performance Expectancy (PE) emerged as the strongest determinant of Behavioral Intention, confirming that perceived usefulness is central to adoption decisions. In Pasuruan, farmers valued tools such as weather forecast apps, price updates, and pest-disease diagnostics for their direct impact on productivity. This aligns with UTAUT-based studies in precision farming, but extends the evidence by situating usefulness within a developing-country agribusiness context (Aubert, Schroeder, & Grimaudo, 2012). Importantly, this suggests that training programs and extension services should prioritize demonstrating tangible productivity gains to strengthen adoption intentions

Effort Expectancy (EE) also had a substantial effect on Behavioral Intention, indicating that ease of learning and operation is critical for adoption. Farmers preferred applications with clear interfaces, minimal technical jargon, and visual guidance, especially in Javanese or Bahasa Indonesia. This reinforces earlier findings on user-friendly design (Satria, Maghraby, & Setyanti, 2025), while also highlighting the importance of incorporating digital literacy and localized training methods into agricultural extension and vocational curricula.

The role of **Social Influence (SI)**, while statistically smaller, cannot be underestimated in collectivist agricultural communities. In Pasuruan, endorsements from farmer group leaders, agricultural extension agents, and respected peers carried significant weight in encouraging trial use of digital tools.

Contrary to some prior studies, **Facilitating Conditions (FC)** did not have a significant direct effect on Use Behavior. This suggests that access to devices, internet connectivity, and institutional support while necessary do not guarantee actual use unless coupled with strong behavioral intentions. In practical terms, this implies that infrastructure investments must be complemented by capacity-building and motivational interventions. Similar findings were reported by Manda et al. (2020) in sub-Saharan Africa, where digital infrastructure alone failed to translate into active usage without localized training and incentive mechanisms.

The inclusion of **Local Wisdom** as a moderating factor proved to be a novel and meaningful extension to UTAUT. Farmers were more likely to adopt technologies that complemented traditional practices, such as the *pranoto mongso* planting calendar, customary pest control, and community-based trading systems. This supports Kurnia et al. (2022), who showed that culturally adaptive innovations diffuse more rapidly, but extends the discussion by underscoring the role of cultural compatibility in sustaining use. Embedding such local values into extension materials and educational curricula can make digital agribusiness initiatives more acceptable and sustainable in rural communities.

Conversely, **Techno Skepticism** emerged as a significant barrier to adoption, with farmers expressing concerns about dependence on external platforms, long-term costs, and potential data misuse. Similar patterns have been observed in technology readiness studies, where discomfort and insecurity hinder adoption (Parasuraman, 2000). Unlike in high-income contexts where skepticism often relates to privacy concerns, in rural East Java it was closely tied to economic vulnerability and lack of reliable information. Addressing such skepticism through transparent communication, participatory training, and community-based demonstrations could build trust and facilitate more inclusive adoption.

In sum, the findings indicate that successful digital agricultural transformation in rural settings requires more than technical innovation it demands socio-cultural alignment, trust-building, and user-centered design. By integrating cultural compatibility and addressing skepticism, policymakers and technology developers can significantly increase adoption rates and sustain long-term engagement.

These findings underscore the importance of integrating science education and training into digital agribusiness strategies. Extension programs should not only provide technical skills but also enhance scientific literacy, enabling farmers to critically interpret agricultural data and apply innovations responsibly. Vocational and higher education curricula can incorporate modules on digital agriculture that respect local wisdom while addressing techno-skepticism. Such educational approaches will ensure that adoption is not only technologically feasible but also socially and culturally embedded, thereby increasing the likelihood of sustainable impact

These findings also carry important implications for science and agribusiness education. The significant roles of Performance Expectancy and Effort Expectancy suggest that training programs and extension services should emphasize not only the practical benefits of digital tools but also their ease of use. Integrating digital agriculture modules into vocational curricula and higher education can enhance farmers' scientific literacy and digital competence, reducing barriers to adoption. Furthermore, addressing techno-skepticism through transparent communication and culturally grounded demonstrations aligns with extension education strategies that build trust and bridge the gap between traditional practices and modern innovations. By embedding Local Wisdom into educational materials, policymakers and educators can design interventions that are not only technically relevant but also socially and culturally resonant, thereby fostering sustainable adoption of digital agribusiness technologies.

Conclusion

This study developed and empirically tested an extended Unified Theory of Acceptance and Use of Technology (UTAUT) model to explain the adoption of digital technologies in the agribusiness sector of Pasuruan Regency, East Java. The results confirm that Performance Expectancy, Effort Expectancy, and Social Influence significantly influence Behavioral Intention, while Facilitating Conditions did not directly affect Use Behavior. The inclusion of Local Wisdom and Techno Skepticism provided novel insights: Local Wisdom strengthened the link between intention and use, whereas Techno Skepticism reduced adoption intentions.

Beyond theoretical contributions, the findings hold important implications for science education and literacy. Training programs and extension education should not only deliver technical knowledge of digital tools but also cultivate scientific reasoning skills, enabling farmers to interpret data such as weather forecasts, soil diagnostics, and market trends. Embedding local wisdom into training modules, such as incorporating the *pranoto mongso* planting calendar into digital platforms, can make educational interventions culturally relevant and easier to adopt. Similarly, addressing techno-skepticism through transparent demonstrations, participatory learning, and inclusion of digital agriculture content in vocational and university curricula can bridge the gap between tradition and innovation.

In sum, the study highlights that successful adoption of digital agribusiness technologies requires not only functional and cultural alignment but also deliberate integration of science education and literacy strategies. By linking digital innovation with education and cultural context, policymakers, educators, and technology developers can design interventions that are both effective and sustainable in rural communities.

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Author Contributions
F.P.A.: Developing ideas, analyzing, writing, reviewing, responding to reviewers' comments; A.F., M.B., I.G.S.: analyzing data, overseeing data collection, reviewing scripts, and writing.

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Conflicts of Interest
The authors declare no conflict of interest.

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