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Service Quality, Ease of Use, and Trust in Agricultural Marketplace Adoption by Millennial Farmers**Cyndrika Rany Philipus, Melisa Maria Gosal, Sophia Claudia S. Tulenan, Ricardo Gianluigi Tindi.**Department of Management,
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Abstract. Digital marketplaces can expand farmers access to agricultural inputs, yet intended use depends on more than platform availability. This study examined the associations of Digital Service Quality, Perceived Ease of Use, and Trust with millennial farmers' Adoption Intention toward agricultural-input marketplaces in North Sulawesi, Indonesia. A quantitative cross-sectional survey was conducted in Minahasa, North Minahasa, and Tomohon. Respondents were farmers aged 19-39 years who actively managed farms and had accessed a marketplace to search for, compare, or purchase agricultural inputs within the previous six months; thus, Adoption Intention represented intended future or continued use among users with prior marketplace exposure. Purposive sampling with area-based quotas yielded 275 valid responses from 310 returned questionnaires. Data were analyzed using SPSS 26 and partial least squares structural equation modeling in SmartPLS 4.0.9 with 5,000 bootstrap subsamples. Digital Service Quality was positively associated with Trust ($\beta = 0.385, p < .001$) and Adoption Intention ($\beta = 0.214, p = .003$). Perceived Ease of Use was positively associated with Trust ($\beta = 0.412, p < .001$) and Adoption Intention ($\beta = 0.198, p = .012$). Trust showed the largest direct association with Adoption Intention ($\beta = 0.456, p < .001$). Significant indirect associations through Trust were also observed for Digital Service Quality ($\beta = 0.175, p < .001$) and Perceived Ease of Use ($\beta = 0.187, p < .001$). The findings indicate that Trust is an important mechanism within the tested marketplace-intention model. As practical implications rather than tested interventions, platform managers could combine usability improvements with reliable information, transaction security, seller verification, and mechanisms that strengthen confidence in product authenticity.

Keywords: Adoption intention; Agricultural e-commerce; Digital service quality; Perceived ease of use; Trust.

INTRODUCTION

Digital transformation is changing agriculture from a production-centered activity into a more connected system in which information, services, market coordination, and transactions increasingly depend on digital infrastructure. Recent reviews show that digital agriculture can improve access to information and markets, support decision making, and increase operational efficiency, while adoption remains uneven because of differences in connectivity,

digital literacy, affordability, technological knowledge, and perceived risk (Choruma et al., 2024; Dibbern et al., 2024; Manzoor et al., 2025). These conditions are particularly relevant in developing agricultural regions, where the value of digital innovation depends on its fit with farmers' routine production and purchasing decisions.

Farmer-level acceptance is therefore central to agricultural digitalization. Indonesian evidence links digital skills, supporting conditions, Perceived Ease of



Use, perceived usefulness, attitudes, and behavioral intention in technology adoption among small-scale farmers (Indriasari *et al.*, 2024). Among millennial farmers, digital motivation, knowledge, skills, and online participation are associated with adaptive capacity (Sasmita *et al.*, 2025), while horticultural farmers may still face barriers related to knowledge, experience, information access, infrastructure, and socio-cultural conditions (Adana *et al.*, 2026). Together, these findings indicate that both technology perceptions and the service environment surrounding a platform require attention.

Agricultural e-commerce is a relevant setting because online channels allow farmers to search prices and product specifications, compare sellers, and purchase seeds, fertilizers, pesticides, and farm equipment. Convenience differentiates farmers' attitudes toward online input purchasing (Schulze Schwering *et al.*, 2022), while effort expectancy, performance expectancy, social influence, environmental uncertainty, and other contextual factors are associated with farmers' behavioral intention toward digital platforms (Cimino *et al.*, 2024; Weng *et al.*, 2026). Nevertheless, agricultural social-commerce research remains concentrated on consumer purchase behavior, trust, engagement, and satisfaction, leaving farmers as buyers of production inputs comparatively underexplored (Lucila & Ching, 2025).

In an agricultural-input marketplace, Digital Service Quality and Perceived Ease of Use may be particularly relevant because farmers need clear information, reliable system performance, efficient interaction, and secure transactions. Evidence from digital-service and e-commerce settings links service quality with technology acceptance, trust, and purchase intention (Sharma *et al.*, 2024; Hanaysha *et al.*, 2025). A recent study involving millennial

farmers likewise supports examining Digital Service Quality, Perceived Ease of Use, Trust, and Adoption Intention within a single digital-service framework (Philipus *et al.*, 2026).

Trust warrants specific attention because agricultural-input transactions involve product-quality and economic risks. Farmers need confidence in the platform, sellers, product information, and transaction processes before relying on a digital service. Qualitative evidence indicates that trust in technology performance and in actors associated with digital agriculture can facilitate or constrain adoption (Yeo & Keske, 2024). At the same time, meta-analytic evidence suggests that the direct association between Perceived Ease of Use and farmers' behavioral intention can be weak or context dependent (Gouroubera *et al.*, 2026), supporting examination of Trust as an intervening mechanism rather than assuming that usability alone is sufficient.

A clear gap therefore remains at the intersection of agricultural e-commerce, service quality, and technology acceptance. Much of the digital-agriculture literature addresses general technologies, farm-management systems, or broad platform adoption rather than the acquisition of production inputs through marketplaces. Prior models also tend to emphasize usefulness, effort expectancy, facilitating conditions, social influence, and digital capability, whereas the joint associations of Digital Service Quality and Perceived Ease of Use with Adoption Intention through Trust are less developed in agricultural-input purchasing. Evidence focusing specifically on millennial farmers' agricultural-input marketplace Adoption Intention in North Sulawesi is also limited. The novelty of this study lies in integrating Digital Service Quality and Perceived Ease of Use in one model and positioning Trust as a statistical intervening mechanism connecting platform experience with Adoption Intention.



Accordingly, this study aims to explain the formation of millennial farmers' Adoption Intention toward agricultural-input marketplaces in North Sulawesi. Specifically, it examines the associations of Digital Service Quality and Perceived Ease of Use with Trust and Adoption Intention, the association of Trust with Adoption Intention, and the specific indirect associations of the two antecedents with Adoption Intention through Trust.

The hypotheses were specified as follows: H1, Digital Service Quality is positively associated with Trust; H2, Digital Service Quality is positively associated with Adoption Intention; H3, Perceived Ease of Use is positively associated with Trust; H4, Perceived Ease of Use is positively associated with Adoption Intention; H5, Trust is positively associated with Adoption Intention; H6a, Digital Service Quality has a significant positive indirect association with Adoption Intention through Trust; and H6b, Perceived Ease of Use has a significant positive indirect association with Adoption Intention through Trust.

MATERIAL AND METHODS

Study Area and Duration

This quantitative cross-sectional study was conducted in North Sulawesi, Indonesia, during a research project implemented from June to November 2026. The field survey took place from 1 July to 31 August 2026 after a pilot/pre-test conducted from 15 to 22 June 2026. Data collection covered Minahasa Regency, North Minahasa Regency, and Tomohon City. The selected localities were Tompaso and Kakas in Minahasa, Airmadidi and Kauditan in North Minahasa, and Rurukan and Kakaskasen in Tomohon. These locations were selected because they represent important horticultural production areas with concentrations of younger farmers and adequate access to digital infrastructure.

The principal production context included leafy vegetables, tomatoes, chili peppers, and maize. Smartphones connected through mobile 4G/LTE networks were the dominant mode of digital access documented for the study population.

Research Design, Population, and Eligibility

The unit of analysis was the individual farmer. For this study, the term millennial farmer was used as a study-specific operational label for farmers aged 19-39 years and is not intended as a universal generational boundary. The target population consisted of farmers within this operational age range who actively managed agricultural land in North Sulawesi, covering horticultural and food-crop activities. Respondents were required to be 19-39 years old, to have managed farming activities independently for at least one year, and to have searched for, compared, or purchased agricultural inputs through an online marketplace during the preceding six months. Respondents who were not decision makers in agricultural-input purchasing or who failed to complete the questionnaire were excluded.

An agricultural-input marketplace was defined as a digital aggregator, general e-commerce platform, or specialized agribusiness platform that facilitates transactions or product search for agricultural inputs. Examples documented in the study included Shopee, Tokopedia, and specialized agribusiness platforms. Covered products included seeds, organic or chemical fertilizers, pesticides, and light agricultural equipment. Prior online purchase was not mandatory; respondents qualified if they had used a platform to obtain price or product-specification information. Accordingly, Adoption Intention in this study refers to intended future or continued marketplace use among respondents with prior marketplace exposure rather than first-time platform



awareness. Screening confirmed age eligibility, active farm management, and prior marketplace access. Screening records identified 45 ineligible prospective participants: 20 were outside the operational age range and 25 had never accessed an agricultural-input marketplace.

Sampling Design and Sample-Size Determination

Purposive sampling was combined with area-based minimum quotas, with a target of at least 80 respondents from each selected regency or city. The quota strategy was used to ensure representation across the three study areas and should not be interpreted as proportional probability sampling. Potential participants were identified with the assistance of agricultural extension officers (Penyuluh Pertanian Lapangan) and leaders of young-farmer groups. Recruitment combined face-to-face contact at farms or village meeting facilities with distribution of a Google Forms link. The final structural analysis used the pooled eligible sample across Minahasa, North Minahasa, and Tomohon.

The proposal targeted 250-300 respondents. An a priori G*Power calculation established a minimum requirement of 119 observations for a structural model with three predictors of Adoption Intention, a medium effect size of $f^2 = 0.15$, $\alpha = .05$, and statistical power of .95. The planned sample was increased above this minimum to improve estimation stability. In total, 350 printed and digital questionnaires were distributed and 310 were returned. Data screening removed 35 returned questionnaires because of missing values or straight-lining response patterns, producing a final analytical sample of 275 respondents. The

45 ineligible prospective participants identified during eligibility screening are reported separately from the questionnaire distribution and return counts and are not included in the response-rate denominator.

Research Instrument and Measurement

Data were collected using a structured questionnaire containing 24 items across four latent constructs: Digital Service Quality (DSQ), Perceived Ease of Use (PEOU), Trust (TR), and Adoption Intention (AI). All constructs were specified as reflective. DSQ and PEOU were modeled as exogenous constructs, Trust as an intervening construct, and AI as the endogenous construct. Responses were recorded on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The instrument was developed through literature review and indicator adaptation. Content validation focused on construct relevance, contextual appropriateness, and clarity, followed by a pilot/pre-test conducted from 15 to 22 June 2026 to improve respondent comprehension before field administration.

The measurement domains are summarized in Table 1. DSQ captured information clarity, system reliability, service responsiveness, security, and ease of interaction. PEOU reflected ease of learning, ease of operation, and low effort required for platform use. Trust represented confidence in transaction security, platform reliability, and service credibility. AI captured intention to use, use again, or continue using agricultural-input marketplaces after prior marketplace exposure.

Table 1 presents the operational roles and measurement domains used for the four study constructs.

Table 1. Constructs, analytical roles, and measurement domains

Construct	Analytical role	Measurement domains	Specification
Digital Service Quality (DSQ)	Exogenous	Information clarity; system reliability; service responsiveness; security; ease of interaction	Reflective
Perceived Ease of Use (PEOU)	Exogenous	Ease of learning; ease of operation; low effort required	Reflective
Trust (TR)	Mediator	Transaction security; platform reliability; service credibility	Reflective
Adoption Intention (AI)	Endogenous	Intention to use, reuse, and continue marketplace use	Reflective

Note: The questionnaire comprised 24 items in total. Table 1 summarizes construct-level measurement domains rather than reproducing item-level wording.

The model therefore combines two exogenous platform perceptions with Trust as a mediating mechanism and Adoption Intention as the behavioral outcome.

Data Collection and Ethical Procedures

Data collection followed a staged process that included literature review and model finalization, indicator adaptation, pilot testing, coordination with local field contacts, respondent recruitment, questionnaire administration, completeness checks, coding, and tabulation. Printed and digital survey modes were used to improve reach across the selected locations. Participation was voluntary, and confidentiality of respondent identities was maintained. For printed administration, the study purpose and voluntary nature of participation were explained to prospective respondents before questionnaire completion. For digital administration, the same study information and an informed-consent statement were presented at the beginning of the form before respondents proceeded. Ancillary field notes and study documentation also recorded examples of platforms accessed, agricultural inputs sought, concerns raised about product authenticity and shipping, and local access conditions. These contextual observations were used descriptively in the Discussion and were not treated as quantified variables in the PLS-SEM.

Statistical Analysis

Descriptive analysis was conducted using SPSS version 26. The hypothesized relationships among the four latent constructs were estimated using partial least squares structural equation modeling (PLS-SEM) in SmartPLS version 4.0.9. PLS-SEM was used to estimate the specified direct paths and specific indirect pathways through Trust. The present manuscript reports only the structural-path and indirect-effect statistics documented for the study and does not use unreported diagnostics to support its conclusions.

All constructs were treated as reflective. The PLS algorithm used the path-weighting scheme, a maximum of 300 iterations, and a stop criterion of 10^{-7} . Structural relationships were summarized using standardized path coefficients (β), t statistics, and two-tailed p -values.

Hypothesis testing used a two-tailed significance level of $\alpha = .05$ and 5,000 bootstrap subsamples. Specific indirect associations were estimated for DSQ $\rightarrow$ Trust $\rightarrow$ AI and PEOU $\rightarrow$ Trust $\rightarrow$ AI. Because the Results section reports β , t , p , and specific indirect coefficients, the analytical description and Table 2 are restricted to these reported procedures and outputs.

Table 2. Reported PLS-SEM settings for structural-path and mediation testing

Assessment component	Setting / statistic	Reported value / rule
PLS algorithm	Path-weighting scheme	Maximum 300 iterations; stop criterion 10^{-7}
Direct-path testing	Standardized β , t , p	Two-tailed $\alpha = .05$



Assessment component	Setting / statistic	Reported value / rule
Bootstrapping	Resampling	5,000 bootstrap subsamples
Mediation	Specific indirect associations	DSQ → TR → AI; PEOU → TR → AI

These settings correspond directly to the structural-path and mediation statistics reported in the Results section.

Research Workflow

Figure 1 summarizes the research workflow from conceptual development and instrument preparation through field recruitment, data screening, PLS-SEM estimation, and interpretation.

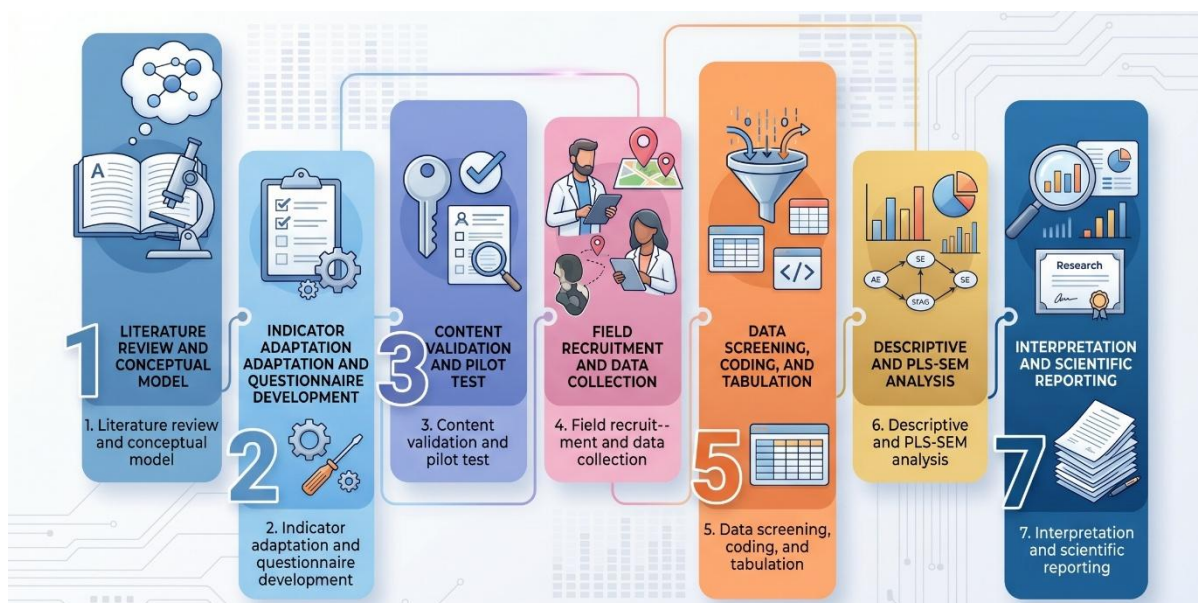


Figure 1. Research workflow from conceptual development to statistical analysis

RESULTS AND DISCUSSION

Results

Analytical Sample

The survey process yielded a final analytical sample of 275 respondents. Of 350 printed and digital questionnaires distributed, 310 were returned, corresponding to a response rate of 88.6%. Thirty-five returned questionnaires were excluded during data-quality screening because of missing values or straight-lining response patterns. Eligibility screening separately identified 45 ineligible prospective participants, comprising 20 individuals outside the operational age range and 25 who had never accessed an agricultural-input marketplace. These screening exclusions are reported separately from the 350-questionnaire distribution denominator.

The retained sample exceeded the a priori minimum of 119 observations and remained within the planned range of 250-300 respondents.

Table 3. Eligibility screening, survey response, and analytical sample

Survey stage	n / value
Prospective participants excluded during eligibility screening (reported separately)	45
Questionnaires distributed	350
Questionnaires returned	310
Response rate based on distributed and returned questionnaires	88.6%
Returned questionnaires removed during data-quality screening	35
Final analytical sample	275

The response rate is calculated from the 350 questionnaires distributed and 310 returned; the separate eligibility-screening count is not included in that denominator.

Structural Model and Hypothesis Testing

The structural relationships among Digital Service Quality, Perceived Ease of Use, Trust, and Adoption Intention are summarized in Table 4. All five direct paths were positive and statistically significant at the 5% level. Digital Service Quality was positively associated with Trust ($\beta = 0.385$, $t = 4.821$, $p < .001$) and Adoption Intention ($\beta = 0.214$, $t = 2.934$, $p = .003$). Perceived Ease of Use was positively associated with Trust ($\beta = 0.412$, $t = 5.105$, $p < .001$) and Adoption Intention ($\beta = 0.198$, $t = 2.512$, $p = .012$). Trust showed the largest direct association with Adoption Intention ($\beta = 0.456$, $t = 6.230$, $p < .001$).

The specific indirect associations were also positive and statistically significant. The indirect association between Digital Service Quality and Adoption Intention through Trust was $\beta = 0.175$ ($t = 3.621$, $p < .001$), while the corresponding indirect association for Perceived Ease of Use was $\beta = 0.187$ ($t = 3.819$, $p < .001$). Because the corresponding direct paths also remained positive and significant, the coefficient pattern is consistent with partial statistical mediation within the specified cross-sectional model. Figure 2 compares the magnitudes of the reported direct and indirect standardized coefficients.

The hypothesis-test statistics are presented in Table 4.

Table 4. Structural-model and mediation results

Hypothesis	Structural relationship	β	t	p	Decision
H1	DSQ to Trust	0.385	4.821	< .001	Supported
H2	DSQ to Adoption Intention	0.214	2.934	.003	Supported
H3	PEOU to Trust	0.412	5.105	< .001	Supported
H4	PEOU to Adoption Intention	0.198	2.512	.012	Supported
H5	Trust to Adoption Intention	0.456	6.230	< .001	Supported
H6a	DSQ through Trust to Adoption Intention	0.175	3.621	< .001	Supported
H6b	PEOU through Trust to Adoption Intention	0.187	3.819	< .001	Supported

Note: DSQ = Digital Service Quality; PEOU = Perceived Ease of Use; TR = Trust; AI = Adoption Intention; β = standardized path coefficient. All p-values are two-tailed.

The coefficient pattern places Trust centrally within the specified model: it had the largest direct association with Adoption Intention, while both

antecedents also showed significant indirect associations with Adoption Intention through Trust.



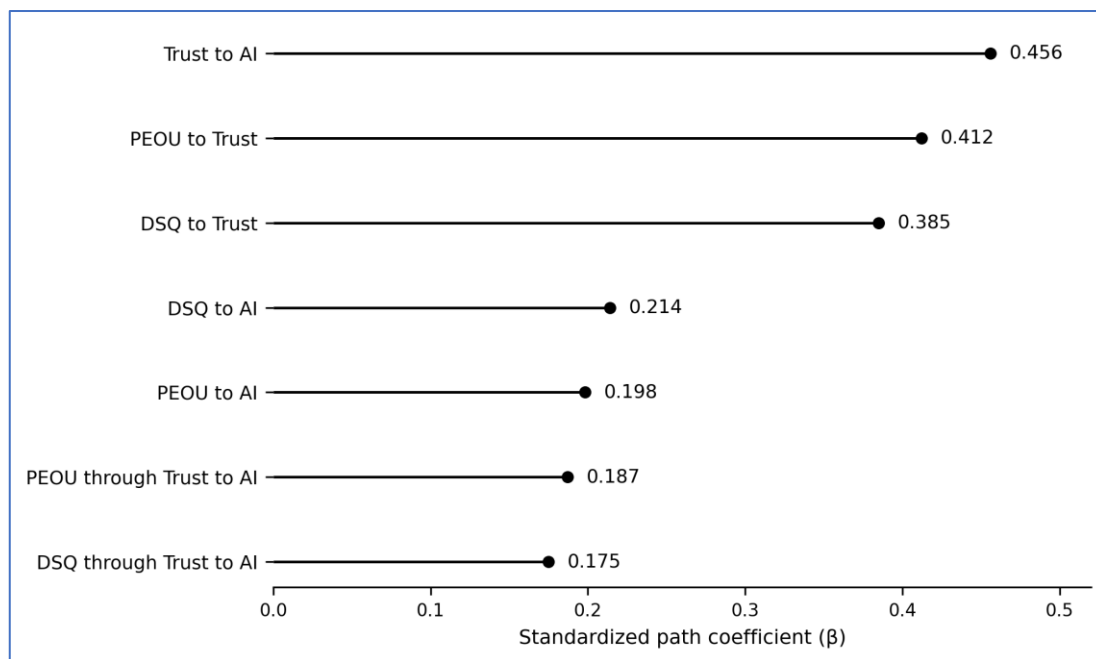


Figure 2. Direct and indirect standardized path coefficients in the agricultural-input marketplace Adoption Intention model. DSQ = Digital Service Quality; PEOU = Perceived Ease of Use; TR = Trust; AI = Adoption Intention.

Figure 2 displays both direct and indirect standardized coefficients; the direct TR-to-AI path was the largest coefficient reported in the model.

Discussion

The positive association between Digital Service Quality and Trust indicates that higher perceived service quality coincided with greater Trust in agricultural-input marketplaces among the surveyed farmers. This pattern is consistent with e-commerce evidence linking perceived service quality with trust and purchase intention (Hanaysha et al., 2025) and with broader digital-service research connecting service quality with technology acceptance (Sharma et al., 2024). It also extends the pattern reported by Philipus et al. (2026) in another digital-service context involving millennial farmers. In agricultural-input transactions, clear information, reliable platform functions, responsive service, and transaction security may help explain why more favorable service evaluations were associated with greater Trust.

Digital Service Quality was also positively associated with Adoption Intention. Although this direct coefficient was smaller than the Trust-to-Adoption Intention coefficient, the result indicates that farmers' evaluations of the service experience were related to their intended future or continued marketplace use. This interpretation is compatible with studies showing that farmers evaluate digital platforms not only in terms of technological benefits but also in relation to operational convenience and the surrounding service ecosystem (Cimino et al., 2024; Schulze Schwering et al., 2022). Because the design is cross-sectional, this association should not be interpreted as evidence that service quality causes subsequent adoption.

Perceived Ease of Use was positively associated with both Trust and Adoption Intention. The PEOU-to-Trust coefficient was slightly larger than the DSQ-to-Trust coefficient, indicating that respondents who perceived a platform as easier to learn and operate also tended to report greater Trust. Indonesian evidence

similarly identifies Perceived Ease of Use as part of the farmer technology-acceptance process (Indriasari *et al.*, 2024). The direct PEOU-to-Adoption Intention association should nevertheless be interpreted as context specific because meta-analytic evidence suggests that this relationship can be weak or inconsistent across studies (Gouroubera *et al.*, 2026). In the present cross-sectional model, usability and Trust therefore appear to be complementary correlates of intended marketplace use.

Trust showed the largest direct association with Adoption Intention among the paths reported in the model. This finding is substantively relevant because online purchases of fertilizers, pesticides, seeds, and agricultural equipment involve product-quality and transaction risks that may affect farm production. Yeo and Keske (2024) similarly emphasize the importance of trust in technology performance and in actors associated with digital agriculture. The present pattern also aligns with e-commerce research in which Trust statistically intervenes between service-related perceptions and purchase intention (Hanaysha *et al.*, 2025). In this study, Trust represents respondents' confidence that the marketplace can support dependable transactions involving economically important inputs.

The significant specific indirect coefficients indicate that Trust functioned as a statistical intervening mechanism within the tested model. Higher Digital Service Quality and Perceived Ease of Use were each associated with greater Trust, which in turn was associated with higher Adoption Intention. These indirect relationships help explain why intended marketplace use should not be interpreted solely in terms of interface ease and support an integrated perspective combining service-quality and technology-acceptance logic (Philipus *et al.*, 2026; Sharma *et al.*, 2024). Given the cross-sectional design, these indirect

coefficients describe modeled associations and do not establish temporal or causal mediation.

Ancillary field notes and study documentation provide contextual observations that help interpret the centrality of Trust. Shopee and Tokopedia were among the platforms mentioned by respondents, and examples of products sought included pesticides and superior horticultural seed varieties. The documentation also recorded concerns about counterfeit products, particularly chemical fertilizers and liquid pesticides, as well as shipping costs to more remote areas. Because these contextual observations were not formally quantified as survey outcomes, they are presented descriptively rather than as frequency-based results. Their content is nevertheless consistent with broader evidence that reliability, security, infrastructure, and perceived risk remain relevant barriers in digital agriculture (Dibbern *et al.*, 2024; Manzoor *et al.*, 2025) and with barriers identified among Indonesian horticultural farmers (Adana *et al.*, 2026).

Field documentation also noted that hilly topography can increase the effort and transport cost required to reach physical agricultural-input shops, suggesting a practical rationale for online access when delivery costs are manageable. Digital channels may also expand access to brands or seed varieties that are unavailable locally. For millennial farmers, these potential advantages are compatible with evidence linking digital motivation and skills with adaptive capacity (Sasmita *et al.*, 2025). However, the present study did not test specific platform interventions. Seller verification, clearer product information, transaction protection, agricultural-product authentication, and stronger review-screening mechanisms should therefore be interpreted as practical options suggested by the findings rather than as measures whose effectiveness was demonstrated by this survey.



The findings have theoretical and practical implications. Theoretically, the model indicates that Digital Service Quality and Perceived Ease of Use are associated with Adoption Intention both directly and indirectly through Trust, extending agricultural technology-adoption research toward the service and transaction characteristics of e-commerce. This is relevant because recent reviews emphasize that agricultural social-commerce research remains dominated by consumer-centered topics (Lucila & Ching, 2025), while digital-agriculture adoption reflects multidimensional and context-dependent influences (Choruma *et al.*, 2024; Manzoor *et al.*, 2025). Practically, marketplace providers serving farmers could consider combining interface simplicity with reliable information, responsive service, secure transactions, and seller-verification mechanisms. These recommendations are implications derived from the observed associations and contextual observations, not interventions evaluated in the present design.

The results should be interpreted within the study design. The cross-sectional survey measures Adoption Intention rather than verified longitudinal marketplace use and does not establish causal direction. Purposive sampling with area-based minimum quotas also limits population-level generalization, and the structural analysis used the pooled sample rather than locality-specific estimates. In addition, this manuscript reports the structural-path and indirect-effect statistics documented for the study and does not interpret unreported measurement-model or out-of-sample predictive diagnostics. Future research could validate the model across additional districts or provinces, compare commodity groups, incorporate contextual variables such as perceived risk, platform support, social influence, and facilitating conditions, and use longitudinal or repeated-measures designs to examine

whether Adoption Intention develops into sustained marketplace use over time.

CONCLUSION

Digital Service Quality, Perceived Ease of Use, and Trust were significantly associated with millennial farmers' Adoption Intention toward agricultural-input marketplaces in North Sulawesi. Digital Service Quality and Perceived Ease of Use each showed positive direct associations with Trust and Adoption Intention, while Trust had the largest direct association with Adoption Intention among the reported paths. Significant indirect associations through Trust were also observed for both antecedents, indicating that Trust is an important statistical intervening mechanism within the tested model. These findings should be interpreted as cross-sectional associations rather than causal effects. In practical terms, marketplace providers could consider combining accessible interfaces with reliable product information, secure transactions, responsive digital services, seller-verification mechanisms, and measures that strengthen confidence in product authenticity. These recommendations are implications of the observed associations and contextual observations, not interventions tested by the study. The study contributes to agribusiness e-commerce and technology-adoption research by positioning Trust within a model linking service quality and perceived usability with marketplace Adoption Intention among millennial farmers. Future research can test the model in broader geographic settings and examine whether Adoption Intention translates into sustained marketplace use over time.

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