Journal of Tropical Resources and Sustainable Science
Website : http://journal.umk.edu.my/index.php/jtrss/
eISSN : 2462-2389
Vol: 13, Issue 1, 2025, 89-94
DOI: 10.47253/jtrss.v13i1.1450

RESEARCH ARTICLE

Factors Influence the Acceptance of Smart Farming Technologies (SFTs) among Youth in Higher Learning Education in Malaysia

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ARTICLE HISTORY
Received : 18 October 2024
Accepted : 1 November 2024
Online : 30 June 2025

KEYWORDS
youth, smart farming technologies, knowledge, attitude, awareness

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ABSTRACT

Smart farming, a modern approach that integrates technology and innovation into agricultural practices, presents a compelling opportunity to attract young people to the agricultural sector. This approach has the potential to transform youth perceptions of agriculture, shifting it from a perceived outdated and unappealing career path to a viable and profitable option. Therefore, this research aims to determine the factors influencing the acceptability of Smart Farming Technologies (SFTs) among youth in selected public universities. The data were collected using a simple random sampling technique. The respondents involved in this study were undergraduate agriculture students (from second year and above) who studied at the UPM, UMK, UMT, UMS, and UiTM (Jasin). A total of 395 respondents were employed from the total population 2963 using the Raosoft Calculator. Data collection was conducted through Google Forms and has been analysed using SPSS version 27. Findings indicate that all factors exhibited strong positive correlations (>0.6) with the adoption of SFTs among youth. Attitude emerged as the most influential factor, followed by knowledge and awareness, demonstrating the highest standardized coefficient (0.406) and t-value (7.034). These results suggest that a positive attitude towards SFTs is a critical factor in influencing their acceptance among young people. This study emphasizes the crucial role of knowledge, attitude, and awareness in both promoting SFTs among youth and empowering them to facilitate the adoption of agricultural technology.

1. INTRODUCTION

Smart Farming Technologies (SFTs) have emerged as a transformative force in the agricultural sector by integrating information and communication technology (ICT) to enhance operational efficiency, facilitate data-driven decision-making, and promote sustainable practices. By utilizing tools such as drones, the Internet of Things (IoT), artificial intelligence (AI), and robotics, farmers can optimize their operations, increase yields, and minimize environmental impacts. This integration not only enhances profitability and productivity but also strengthens food security.

The implementation of SFTs offers various advantages to the agricultural industry. By lowering production costs in the long term and boosting farmer incomes, smart farming also improves economic viability of the agricultural sector. Resource-efficient practices save both time and money, while smart farming methods enhance output and optimize resource use. For instance, employing smartphones applications to monitor soil health and weather conditions enables farmers to determine the optimal timing and quantities for fertilizer and pesticide application (Musa & Basir, 2021).

Moreover, SFTs improve data accuracy by providing reliable weather forecasts, yield predictions, and disease maps, based on meteorological and climate data networks (Amiri-Zarandi *et al*., 2022). This enhanced data reliability mitigates risks and allows for targeted interventions to address challenges such as water stress, nutrient deficiencies, and early disease detection. The use of drones equipped with multispectral sensors can accurately survey fields, producing maps that identify issues like water stress and nutrient deficiencies, thus enabling timely and focused interventions to reduce crop losses (Zhang & Zhu, 2023). Additionally, smart farming practices minimize agriculture's ecological footprint by decreasing fertilizer and pesticide usage, subsequently lowering greenhouse gas emissions and mitigating leaching issues (Walter *et al*., 2017).

Despite these considerable advantages, a critical skills gap hinders the effective adoption and utilization of SFTs by farmers and producers (El Bilali *et al*., 2021; Liu *et al*., 2021). Addressing this gap and promoting sustainable growth in the

sector necessitates the active involvement of youth in agriculture. Youth, often more tech-savvy and receptive to innovation, are ideally positioned to lead the adoption of precision agriculture technologies, drone applications, and other advanced tools. Osabohien (2023) emphasized that improved access to technology and ICT can serve as a catalyst for enhancing youth participation in agriculture. An analysis by Nik Jaafar *et al.* (2021) indicated that Malaysia's internet usage reached 88.7% in 2020, with a significant youth demographic, as 85.9% of users fell within this age group. This suggests that initiatives aimed at fostering youth involvement in agriculture should prioritize technological advancements and infrastructure improvements to address the low youth participation in the sector, currently at only 15% (Izmir, 2021).

Consequently, Malaysia must cultivate a strong agricultural community rooted in active youth participation. Beyond ensuring the sustainability of Malaysian agriculture, investing in this sector presents a vital opportunity to address pressing socioeconomic issues such as poverty, unemployment, and income disparity. The integration of modern farming techniques, increased access to financial resources, technological advancements, and attractive incentives can collectively drive youth engagement in agriculture. By embracing technological innovation and leveraging the energy of its youth, Malaysia can effectively confront the challenges posed by an ageing workforce and knowledge gaps, ultimately establishing a competitive and sustainable agricultural sector for the future.

This study selects agriculture students as respondents due to their foundational understanding of agricultural practices and familiarity with SFTs. This criterion enables a more informed assessment of their perceptions, as these students have been exposed to essential knowledge and skills through their coursework. The focus on agriculture students aligns with the study's objective to examine the acceptability of SFTs among youth in higher education learning in Malaysia. Specifically, the objectives are to (i) evaluate the levels of knowledge, attitude, awareness, and acceptance of SFTs; (ii) analyze the relationships between knowledge, attitude, and awareness in relation to SFTs acceptance; and (iii) identify the strongest factor influencing SFTs acceptance among this demographic.

2. MATERIALS AND METHODS

In this research, the total population comprises 2963 undergraduate students enrolled in agriculture programs at five universities. Given the time and expense associated with recruiting respondents, determining an appropriate sample size is essential to ensure efficient resource use (Sequeira *et al*., 2019). The sample size was calculated using the Raosoft sample size calculator, which factors in desired confidence levels, margins of error, and population size for accurate estimation (Amagsila *et al*., 2022). Based on these parameters, the ideal sample size was determined by inputting the total population of 2963 students.

From this population, a sample of 395 undergraduate agriculture student, from the second year onward, was selected across Universiti Putra Malaysia (UPM), Universiti Malaysia Kelantan (UMK), Universiti Malaysia Terengganu (UMT), Universiti Malaysia Sabah (UMS), and Universiti Teknologi MARA Jasin (UiTM Jasin) in Malaysia.

Data collection utilized a quantitative approach through a self-administered questionnaire distributed via Google Forms. A pilot test was conducted prior to the main survey to assess the validity of the questions, aiming to identify any potential issues and improve the questionnaire's clarity and effectiveness in gathering accurate data. The pilot test results indicated that all variables had a reliability score above 0.7.

The final questionnaire was developed and adapted from prior research (Azraai, 2023) and consists of six sections (A, B, C, D, E, and F). Sections A and B feature closed-ended questions addressing the respondents' demographic information and their understanding of SFTs. Specifically, Section A includes four questions on demographics such as age, gender, university, and current year of study. Section B has two questions addressing the concept of SFTs.

Sections C through F employed a 5-point Likert scale (1=strongly disagree to 5=strongly agree), enabling respondents to indicate their level of agreement. Each of these sections contains ten questions. Section C assesses knowledge about SFTs, Section D examines attitude, including perception and interest in SFTs, Section E looks at awareness and exposure to SFTs, and Section F evaluates the acceptance of SFTs in agricultural practices.

Self-administered questionnaires were distributed to respondents through online platforms like WhatsApp and email to gather data. The researcher coordinated with student representatives and university contacts to facilitate the study, after which the Google Form link was shared. The collected data were analyzed using SPSS version 27. Information was exported from Google Forms into IBM SPSS for analysis.

Descriptive statistics were employed to examine the relationship between individual variables and the outcome of interest, specifically assessing how the independent variables-knowledge, attitude, and awareness-influence the dependent variable, which is the youth acceptability of smart farming technology, which was the first objective. The analysis classified these variables into three levels: low, moderate, and high. To categorize responses collected on a 5-point Likert scale, the following steps were followed: (1) defining the range, with a maximum value of 5 and minimum value of 1; (2) calculating the

interval size using the formula Interval Size = (Max - Min)/Number of groups = (5-1)/3 =1.34; and (3) establishing levels, as shown in Table 1.

Table 1: Indicator values of each level.

Level	Mean
High	3.67 - 5.00
Moderate	2.34 - 3.66
Low	1.00 – 2.33

Pearson's correlation analysis was then used to investigate the relationship between two variables—one dependent and one independent—addressing the second objective by examining how attitude, knowledge, and awareness related to the acceptability of SFTs among youth. Finally, multiple linear regression analysis was utilized to meet the third objective, to identify the most significant factors affecting youth acceptance of SFTs.

3. RESULTS AND DISCUSSION

3.1 Demographic Profiles of Respondents

Table 2 presents the frequency distribution of the socio-demographic variables included in this study: age, gender, university affiliation, and current year of study. The sample was primarily composed of individuals aged 22–25 years (70.6%), followed by 18–21-year-olds (24.1%). Meanwhile, only 4.8% of the respondents are between 26–-30 years and the remaining 0.5% of the respondents' age are 30 years old and above. Female respondents outnumbered males, constituting 59.2% of the sample compared to 40.8% of males. The distribution revealed a plurality of respondents from UPM (32.7%), followed by UMT (17.7%), UMK (17.7%), UMS (16.7%), and UiTM Jasin (14.0%). Third-year students comprised the largest group (39.7%), followed 55 closely by fourth-year students (39.7%). Second-year respondents formed a smaller portion of the sample (28.1%).

Table 2: Socio-demographic Profile (n=395).

Variable	Frequencies	Percentage (%)
Age		
18-21	95	24.1
22-25	279	70.6
26-30	19	4.8
30 and above	2	0.5
Gender		
Male	161	40.8
Female	234	59.2
University		
UPM	129	32.7
UMK	70	17.7
UMT	75	19.0
UiTM Jasin	55	14.0
UMS	66	16.7
Current year of study		
Second year	111	28.1
Third year	157	39.7
Fourth year	127	32.2

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3.2 Level of knowledge, attitude and awareness towards the acceptance of SFTs among youth

Table 3 presents the levels of knowledge, attitude, and awareness regarding the acceptance of SFTs among youth at selected public universities. Attitude demonstrated the highest frequency of high levels, with 373 out of 395 respondents (94.4%). The mean score for attitude was 4.52 (SD = 0.51), indicating a high level (categorized as 3.67 to 5.00). For knowledge, the mean score was 4.35 (SD = 0.53), with 90.6% of respondents rated at a high level, 8.9% at a moderate level, and 0.5% at a low level. Awareness also showed a significant percentage, with 86.8% of respondents indicating high levels, while only 0.3% were rated at a low level.

Table 3: Level of Factors Influence the Acceptance of SFTs among Youth (n=395)

Factor	Level	Frequency	Percentage (%)	Mean	SD
Knowledge	Low (1.00–2.33)	2	0.5	4.35	0.53
	Moderate (2.34–3.66)	35	8.9		
	High (3.67-5.00)	358	90.6		
Attitude	Low (1.00–2.33)	0	0.0	4.52	0.51
	Moderate (2.34–3.66)	22	5.6		
	High (3.67-5.00)	373	94.4		
Awareness	Low (1.00–2.33)	1	0.3	4.28	0.59
	Moderate (2.34–3.66)	51	12.9		
	High (3.67-5.00)	343	86.8		

Regarding the acceptance of SFTs among youth in selected public universities, as presented in Table 4, the overall mean score is 4.65, with a standard deviation of 0.47. Table 4 also indicates that a significant majority (95.9%) of youth have a high level of acceptance, while 4.1% demonstrate a moderate level, and none exhibit a low level of acceptance.

Table 4. Level of Acceptance of SFTs among Youth (n=395)

	Level	Frequency	Percentage (%)	Mean	SD
Level of Acceptance of SFTs among Youth	Low (1.00–2.33)	0	0.0	4.65	0.47
	Moderate (2.34–3.66)	16	4.1		
	High (3.67-5.00)	**379**	**95.9**		

3.3 Relationships between knowledge, attitude and awareness towards the acceptance of SFTs among youth

Table 5 shows that all three variables had statistically significant positive correlations with acceptance ($p < 0.01$, 2-tailed), consistent with findings from earlier studies (Chuang, Wang, & Liou, 2020; Harisudin et al., 2023; Kwakye et al., 2021; Mburu, 2022; Waseem et al., 2020).

Table 5: Relationships between Knowledge, Attitude and Awareness towards the Acceptance of SFTs among youth

	Acceptance (Y)	Knowledge (X1)	Attitude (X2)	Awareness (X3)
Acceptance (Y)	1			
Knowledge (X1)	0.642**	1		
Attitude (X2)	0.685**	0.723**	1	
Awareness (X3)	0.635**	0.780**	0.770**	1

3.4 Strongest independent variables influencing the acceptance of SFTs among youth

As indicated in Table 6, all three predictors were statistically significant, with p-values below 0.05 for each variable. Attitude emerged as the most influential factor affecting the acceptance of SFTs, with standardized coefficients for attitude (0.406) being higher than those for knowledge (0.246) and awareness (0.130). Taheri *et al.* (2022) also support this relationship, showing a statistically significant impact of attitude on the intention to adopt wireless sensor networks (WSNs) as an example.

The t-value for attitude (7.034) is higher than those for knowledge (4.176) and awareness (2.044), indicating that the relationship between attitude and SFTs acceptance is statistically stronger compared to the relationships between knowledge, awareness, and acceptance. This is consistent with the Technology Acceptance Model (TAM), which emphasizes the crucial role of attitude in mediating the relationship between perceived ease of use, perceived usefulness, and adoption intention (Jimenez et al., 2021).

Table 6. Multiple Linear Regression Analysis for the Acceptance of Youth towards SFTs

	Unstandardized Coefficients		**Standardized Coefficients**		
Model	B	Std Error	Beta	y	Sig
(Constant)	1.561	0.155		10.068	0.001
Knowledge	0.216	0.052	0.246	4.176	0.001**
Attitude	0.379	0.054	0.406	7.034	0.001**
Awareness	0.102	0.050	0.130	2.044	0.042**

**. Correlation is significant at the level of $p < 0.05$

These findings, underscoring the importance of attitude, align with previous research on technology acceptance. Studies like Chuang et al. (2020) and Kamrath et al. (2018) suggest a similar reciprocal link between perceived usefulness and ease of use, where a positive attitude from past experiences boosts user confidence and enhances perceived ease of use. Similarly, Yoon et al. (2018) found that young farmers' attitudes towards technology positively influenced their perceptions of the IoT's utility, which in turn affected their acceptance of the technology.

The model summarizing the factors influencing youth acceptance of SFTs is presented in Table 7. The total relationship between the significant predictors and youth acceptance ($R = 0.720$) indicates a strong correlation. The adjusted R^2 value is approximately 0.515, meaning that 52% of the variance in youth acceptance of SFTs is explained by the predictors in the model.

Table 7. Model Summary[b] of the Determinant of Youth Acceptance of SFTs

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.720[a]	0.519	0.515	0.328

a. Predictors: (Constant), Awareness, Attitude, Knowledge
b. Dependent variable: Youth Acceptance of SFTs

The findings demonstrate that knowledge, attitude and awareness all have statistically significant and positive correlations with previous research (Chuang, Wang, & Liou, 2020; Harisudin et al., 2023; Kwakye et al., 2021; Mburu, 2022; Waseem et al., 2020). These strong correlations emphasize the importance of increasing knowledge, fostering positive attitudes, and raising awareness to increase the acceptance rate of SFTs among youth. This highlights the need for educational initiatives that go beyond information dissemination, aiming to build positive perceptions and awareness about SFTs.

Among the three factors, attitude was the most influential factor in SFTs acceptance, as evidenced by both the standardized coefficients and t-values. This suggests youth with a more favourable attitude toward SFTs are more inclined to accept them, which aligns with the Technology Acceptance Model (TAM). According to TAM, attitude serves as a mediator between perceived ease of use, perceived usefulness, and the intention to adopt technology (Jimenez et al., 2021). The higher t-value for attitude indicates its more significant role compared to knowledge and awareness, highlighting the need to focus on shaping attitudes to effectively promote SFTs.

These findings align with previous studies that explore the link between user perceptions and technology adoption. For instance, research by Chuang et al. (2020) and Kamrath et al. (2018) identified a reciprocal relationship between perceived usefulness, ease of use, and attitude. This suggests that positive experiences with technology boost user confidence and enhance perceptions of ease of use, which in turn, strengthens acceptance of new technologies. Similarly, Yoon et al. (2018) showed that young farmers' favourable attitudes towards technology positively influenced their perceptions of the IoT's usefulness, which impacted their willingness to adopt the technology. These results reinforce the importance of cultivating positive attitudes towards SFTs as a main factor for driving their acceptance among youth.

The model summary indicates that the predictors in this study account for 52% of the variance in youth acceptance of SFTs (adjusted R2 = 0.515). This substantial proportion suggests that knowledge, attitude, and awareness are key determinants of SFTs acceptance, although there may be other unexplored factors contributing to the remaining variance. Therefore, the modern, tech-driven nature of smart farming appeals to younger generations, who are generally more tech-savvy and this might become a high-tech career choice that resonates with young people.

4. CONCLUSION

In summary, the findings of this study show the main role of attitude in shaping youth acceptance of SFTs, alongside the importance of knowledge and awareness. These results suggest that efforts to promote SFTs should focus on developing positive attitudes through targeted campaigns and educational initiatives that engage youth and resonate with their values and experiences. By addressing these factors, stakeholders might significantly enhance the acceptance and adoption of SFTs among youth, contributing to the advancement of sustainable agriculture and improved food security in the digital era. By incorporating these technologies, farming activities transforms this sector into a forward-looking, profitable, and environmentally sustainable that appeals to young people, offering opportunities for growth, income, and meaningful impact to the agriculture sector in Malaysia.

ACKNOWLEDGEMENT

The authors wish to thank Universiti Putra Malaysia (UPM) for providing the Research Grant (GP-IPM/2023/9769800) to conduct this research.

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