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Encouraging Factor for ICT Usage in Agriculture from Supplier View: A Case Study in Southern Region, Malaysia

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ABSTRACT

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Malaysia is leading the way in agriculture's information and communication technology (ICT) revolution, bringing innovation and efficiency. However, farmers may encounter several issues when using ICT due to higher costs, limited infrastructure, lack of technical scalability, literacy difficulties, compatibility issues, and change resistance. This study applied the technology acceptance model (TAM) to identify the development of ICT in Malaysia's agriculture industry and to examine the encouraging factors for farmers to adopt ICT from the suppliers' perspective so that ICT suppliers can develop solutions that match farmers' practical realities and constraints in their daily operations. Interviews were conducted with ten (10) ICT supplier companies and analysed using the Thematic Analysis model. There are four sub-themes revealed for ICT development in the agriculture industry: technology awareness, varieties of technologies, adoption of farmers' ICT usage, and product effectiveness. The next three sub-themes for ICT adoption factors among farmers are safety products, quality preference, and job opportunities. The study found that farmers with a high level of perceived ease of use (PEOU) and perceived usefulness (PU) of ICT will have a higher level of ICT usage. It is recommended that every new technology a supplier produces must undergo research and development, as it depends on farmers' demands and requirements.

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1. INTRODUCTION

The Information and Communications Technology (ICT) revolution has significantly changed Malaysia's agriculture industry. The government has been promoting using digital technologies to modernise and transform the sector, which is a crucial contributor to the country's economy. In each Malaysian plan, the ICT development programmes were significantly highlighted. In the Malaysia Budget 2021, the government allocated RM 1.2 billion for agriculture, including promoting technology and digital solutions. According to the 12th Malaysian Development Plan, the agriculture sector is expected to grow at 3.8% per year, contributing 7.0% to GDP (Dardak, 2022). The use of technology will accelerate the development and growth of this industry. The emphasis is on accelerating this industry's transformation into a contemporary, dynamic, and competitive sector backed by research, development, commercialisation, and innovation (Department of Prime Minister, 2021).

In Malaysia, (ICT) is used as an application for suppliers that can benefit their marketing of agricultural products. Also, ICT plays an essential role in this era of Industry 4.0 because the advancement of ICT, especially in mobile devices and internet connectivity, can help knowledge management in the agriculture sector (Ibrahim, Daud, & Hassan, 2020). The device will help market agricultural products by accessing updated and exact information to improve decision-making quality. Besides that, ICT can link suppliers to the market and provide them with current marketing information (Okello et al., 2020). After getting the report, the supplier can effectively decide on production and marketing. Due to ICT assistance in internal communication and information sharing with their business stakeholders, most suppliers have started to realise the utilisation of ICT in their everyday operations. ICT applications enhance a company's access to information, expertise, and capacity to grow its market and manage its operations better (Rozmi et al., 2020). Reducing manufacturing and labour costs may produce competitive products and improve business operations (Jaganathan et al., 2018).

ICT serves a significant role in the decision-support system for farmers. Farmers may stay informed about the latest developments in agriculture, weather, new crop types, and production and quality control techniques (Saidu et al., 2017; Pandey & Kumari, 2018). The government is promoting efforts to increase the use of ICT in agriculture. For example, in Malaysia Budget 2021, the government allocated 10 million ringgit in the form of matching grants up to 30 thousand ringgit to Pertubuhan Peladang Kawasan to implement the e-Satellite Farm Programme that can benefit more than 300 PPKs with a partnership of nearly 1 million farmers and planters (Bernama, 2020). In addition, Malaysia's Department of Agriculture created AgriMaths as part of its e-Agriculture Extension initiative to provide instantaneous access to government-run agricultural extension programmes from any location and at any time. MARDI also has developed several agriculture applications such as E-Ladang, MyPalmOil, SmartFarm, e-Fert, and AgroEcoSys that aimed at helping farmers improve their productivity and income. As a result, farmers could access pertinent information via ICT at any time, allowing them to work with development organisations and other farmers to increase agricultural productivity (Ramli et al., 2018; Abdullah and Samah, 2013). These claims that ICT offers timely information on what, when, where, why, and how to produce and sell agricultural products were supported by Kale et al. (2015).

Despite the efforts for ICT development and the availability of these ICT services, the adoption and uptake of ICT in accessing the technical, market and financial information in Malaysia's agriculture sector remain moderate. According to Krone et al. (2016), ICT usage may require many costs. Most ICT tools like computers and drones involve a high value of money the farmers should invest in. Emeana et al. (2020) also found high illiteracy rates, inadequate

technological infrastructure, and a need for smartphone-based technologies cause only a tiny percentage of smallholder farmers in the developing world to take advantage of them. Poor internet and network coverage to support innovative technologies can limit these benefits and create barriers to success for farmers. For example, they may struggle to access information or connect with buyers and suppliers, limiting their ability to make informed decisions and improve their farms' profitability (Ayaz et al., 2019).

In addition, the mean age of a Malaysian agricultural worker is 50 years, posing challenges in the implementation and assimilation of innovative farming technologies, mainly due to the migration of rural youth to urban areas in pursuit of job opportunities and a contemporary way of life (Alam et al., 2010; Sharon, 2019). The agriculture community also prefers traditional farming methods over information and communication technology (ICT) in agricultural practices (Jose and Lokeswari, 2018). Recent statistics presented in the Department of Statistics Malaysia 2020 supported this fact where the agriculture sector employed approximately 1.25 million workers, of which around 70% were categorised as low-skilled workers. Additionally, many farmers are unfamiliar with the latest technologies and are not confident in their ability to use them effectively. Therefore, this study aims to identify the development of ICT in Malaysia's agriculture industry and examine the encouraging factors for adopting ICT among farmers from the supplier perspective. This explanation is vital to provide valuable insights to ICT suppliers into how ICT can be designed and implemented to meet the specific needs of farmers.

2. LITERATURE REVIEW

2.1 Encouraging Factors of ICT Usage

The Internet of Things (IoT) is an Internet-based dynamic global architecture that can rapidly grow worldwide and improve crop production to feed the growing population in the world. IoT technology is helping farmers monitor the agriculture process to enhance productivity in the agriculture industry. IoT can also inform suppliers about crops and soil health, crop storage conditions, and energy consumption. The suppliers can also use the IoT sensor in their transportation to provide data on crop health, which can be accessed using mobile phones or tablets as it is stored wirelessly on cloud-based systems or servers. Based on research, IoT can help avoid losses, increase productivity, and radically change agriculture management (Pillai & Sivathanu, 2020).

Age, education, IoT knowledge level, the area under cultivation, and farming experience are the elements that significantly impact. Several high-priority challenges, including poor supplier understanding of IoT usage, farmer ignorance of IoT advantages, and a lack of an extensive information system, impact farmers' adoption of IoT. IoT enables farmers to increase agricultural revenue and be well-based with business partners. In addition, IoT may allow farmers to employ current transport, storage, packaging, and processing methods more effectively. For sustainable development of agriculture and the national economy, emphasis on ICT and its use in agriculture is significant (Tonny, Palash, & Moniruzzaman, 2019).

Agriculture will benefit more from IoT monitoring and automation since it can replace humans and be done anywhere globally. By 2050, it is expected that IoT-enabled agriculture will improve food output by 70% and feed up to 9.6 billion people, with 525 million farms utilising 2 billion sensors. This forecast has increased interest in IoT-based agriculture and farming, which promises to provide real-time visibility of crop and soil health, utilised equipment, storage conditions, fertiliser usage, energy use, and animal behaviour. As a result, IoT is gaining

popularity as it provides information about the health of crops and soil, crop storage conditions, energy consumption, animal behaviour, fertilisers, and machinery utilised (Ahmed & De, 2018).

A computer-based information system called the Agriculture Information System (AIS) incorporates all the associated data that might be extremely helpful to farmers in managing information and making strategic decisions. The ICT tools facilitating farming activities include software and hardware for satellite systems, radio, television, mobile phones, computers, tablets, and networking. In addition, the internet and web-based applications are widely utilised for selling goods and services and sharing and distributing agricultural information (Ele et al., 2021).

2.2 The factor for the adoption of ICT

ICT adoption may organise data between clients and providers and improve decision-making. Additionally, it could make it easier for farmers and business owners to share information on supply and demand. ICT may also aid in timely decision-making, finding the best solutions, and developing adequate irrigation and water management systems to provide the highest possible yields. Its ability to deliver current management information as an ERP system enables quick corrective and preventative measures. In addition, ICT may provide a worldwide network of the agricultural sector, bringing together farmers, scientists/researchers, and administrators to work toward a shared objective and bolstering the growth of agricultural activity (Gatautis et al. 2015).

Through credit and other financial services, information and communication technology may significantly improve the effect and performance of agricultural output. As farmers, they can expand production, reach out to more prospective customers, and improve sales management efficiency. Additionally, it reduces direct and indirect costs, notably those associated with advertising, while enhancing corporate operations (Tonny, Palash, & Moniruzzaman, 2019). This might be accomplished by employing websites, which are more affordable than telephone operations, to provide farmers with the capacity to exchange information with other farmers and extension officials. Furthermore, farmers now have much time to access pertinent information through ICT, allowing them to collaborate with other farmers and development organisations to increase agricultural output. That timely knowledge on producing and marketing agricultural goods is available via ICT (Jaganathan, Ahmad, & Ishak, 2018). Additionally, market information systems based on ICT have a track record of enhancing rural livelihoods in emerging nations with middle-class populations.

Using ICT, entrepreneurs may get current and pertinent business information, allowing newer agricultural entrepreneurs to create networks and websites from anywhere. Similar problems are resolved by ICT, including traceability, process control, market information transparency, lower transaction costs, and identification and monitoring of customer demands. ICT has become a rising problem regarding traceability and trustworthiness concerning agricultural products like chicken flu and other connected illnesses. In addition, new ventures in agriculture and rural areas are being started, including e-commerce, real estate for satellite offices, rural tourism, and virtual collaboration of small farms (Ahmed & De, 2018). ICT may also aid in capacity building, gaining access to financing and markets, restructuring extension, and expanding interlinkages across development efforts. Furthermore, it was discovered that ERP serves various corporate operations, including order management, financial administration, warehouse management, production planning, sales, purchasing, and service delivery (Kamarudin et al., 2019).

2.3 Development of ICT

Tools for information and communication technology might be used in the agricultural sector to speed up development, which would likely result in a rise in the country's GDP. Through e-governance, knowledge management portals, e-kiosks, and common service centres at the local level, e-agriculture improves the lives of farmers and end users in sustainable development. The worldwide community may use it as a foundation to oversee the creation and validation of conceptual models and approaches and package and share them when tested. Using Geographic Information Systems (GIS), ICT educates farmers and craftspeople about correctly planning and managing natural resources. It is generally known that information technology (IT) plays a vital role in the advancement of e-agriculture and rural living. Through IT, farmers might obtain relevant information on agricultural inputs, crop production methods, agricultural processing, market assistance, agricultural financing, and management of farm businesses (Chibsa, 2020).

ICT plays a significant part in the farmers' decision-support system. Thanks to ICT, farmers may stay informed about the latest agricultural developments, weather, new crop types, and production and quality control techniques. The major difficulty facing policymakers in India is the lack of appropriate, effective, and targeted technology connected to the agro-climatic zone, farm size, soil type, and other factors for the farmers. For farmers to use and benefit from, information and communication technology may disseminate precise, accurate, and timely information. Farmers may better plan the crops they will grow and cultivate, harvest, post-harvest, and sell their produce using proper agricultural practices through a decision support system. Agriculture requires information based on factors such as agroclimatic areas, land holdings, crop types, technology used, market orientation, weather, etc. According to several investigations, most farmers considered the "question and answer service" the finest resource for receiving individualised answers to their unique agricultural difficulties (Singh et al., 2017).

2.4 Technology Acceptance Model (TAM) Theory

This study was based on the Technology Acceptance Model (TAM). From a conceptual standpoint, the Technology Acceptance Model (TAM) is an ideal tool for comprehending how technology functions. Perceived Usefulness (PU), perceived ease-of-use (PEOU), and attitudes toward using the system (ATU) are used to gauge user acceptability, which, according to Davis (1989), can reveal how well a system operates. Previous studies used the TAM model to investigate the adoption of ICT in agriculture among farmers and agricultural entrepreneurs (Zaremohzzabieh et al., 2015; Jain, 2023; Hendrawan et al., 2023). However, the adoption of ICT relies heavily on the owner's acceptance. If the owner does not recognise the utility of the technology or has a limited understanding of its potential, the owner will be hesitant to adopt it (Saariko et al., 2020). This study employs two TAM model variables: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). PU will refer to how farmers are more inclined to accept ICT if they believe it would help them run their businesses more efficiently. ICT suppliers may educate farmers on the advantages of ICT by showing them how these tools can increase their output, effectiveness, and profitability. PEOU will focus on how farmers are more inclined to use ICT if they believe it is simple. In addition, ICT suppliers may increase technology accessibility by offering user-friendly interfaces, clear instructions, and technical help.

3. METHODOLOGY

A qualitative approach was chosen as the research method for this study. The study area considers ICT suppliers in the southern region of Peninsular Malaysia only, namely the states

of Melaka, Selangor, Johor and Negeri Sembilan, because most ICT suppliers are located in the south part of Malaysia, particularly in Johor and Selangor (Ken Research Analysis, 2018). The researcher used purposive sampling to select the sample of participants. This type of sampling is primarily strategic and demands trying to align sampling objectives with research questions (Bryman, 2004). Interviews were conducted with ten (10) ICT supplier companies that supplied ICT goods to the farmers, such as software, drones, and precision farming, based on the participants for the inclusion criteria. The respondents that have been interviewed are ten (10) respondents because the minimum number of respondents is four (4) to get a clear picture of the issues faced (Maree,2015). The data was collected between October 2022 and January 2023. The researcher conducted the interviews and provided written queries in advance to the participants. Within this context, interviews are conducted through direct personal interaction and various electronic media platforms, for example, telephone, email, social messaging apps and video conferencing. The interview data was analysed using thematic analysis in Microsoft Excel. Braun and Clarke (2006) propose that thematic analysis should encompass coding, categorisation, and identification of patterns to establish connections between variables and factors, ultimately yielding a robust and coherent chain of evidence (Creswell 2009; Braun and Clarke 2006; Miles and Huberman 1994). Thematic analysis enhances the effectiveness and accuracy of data presentation, ensuring a more realistic reflection of data collection. This is achieved through the utilisation of diverse instruments (such as observation, questionnaires, and interviews) in a single study involving participants in multiple environments (Miles and Huberman 1994; Creswell 2009; Hayes 1997). The process begins with codes utilised as keywords employed for categorising and organising content, and they are considered a fundamental component of qualitative research. The data was subsequently assessed, categorised, and organised into overarching and subordinate concepts from the coding procedure. The notions that arose were assigned a code. Later, the data was subjected to analysis through the identification of repeating patterns and the highlighting of similarities and contrasts. In the last stage, data verification was conducted to assess comprehension accuracy by reviewing the transcripts and codes. This process enabled the researcher to validate or modify previously formulated assumptions.

4. RESULT AND DISCUSSION

The data were extracted and analysed according to the study's main objectives: 1) To research ICT development in agriculture. 2) To identify encouraging factors for farmers to use ICT. According to the participants, ICT has reportedly been employed extensively in agriculture because farmers are essential to applying ICT in agriculture. Crop yields in the nation will be boosted to their most significant potential due to the favourable impact on agricultural productivity and efficiency. However, participants also discussed the barriers preventing others from utilising ICT in this industry. These constraints were found because of the awareness problem. According to the research, formal education, such as that provided in colleges and universities, is essential for disseminating agricultural information and motivating students to pursue professions.

Table 1: Codes, categories, and theme

Codes, Categories and Themes		
Codes	**Category**	**Theme**
Technologies Awareness, Varieties of technologies	Operation	Development of the ICT agriculture industry
Adoption of ICT usage to farmers, effectiveness of products	Planning	
Safety Products	Safety	Encouraging factors for the adoption of ICT among farmers
Job Opportunities, Quality Preference	Opportunity	

Two broad topics were created to manage the subject of the study. The first topic developed was in response to the research question: What ICT device kinds positively influence the agriculture sector? How might applying technologies-based ICT in the agriculture industry affect the future? The researcher developed all goals after carefully reviewing the participant's interviews.

4.1 Theme 1: Development of the ICT agriculture industry

From Table 2, participants were unanimous that technology has made farmers spend less on their energy and time, especially by using drones and ICT improving production. Below is the selected narrative :

"Drones are used to save farmers from spending energy and time." - Respondent 1,8,9

"Digitalise the data to improve the efficiency of production." Respondent 1,7

According to Ayaz et al. (2019), Fixed-wing drones are recommended when a significant region must be covered because of their long-range flying capability and, most importantly, because they are accident-tolerant. In addition, multi-rotor drones are increasingly popular since they are more straightforward to set up, take off faster, and land vertically. Compared to fixed wings, multi-rotors offer several benefits since they are simpler to operate, don't need to anticipate the wind ahead of time and fly more precisely. Besides that, in the Technology Acceptance Model (TAM), the result is under the category of Perceived use (PEOU) because by using drones, the farmers can save energy and time. Also, it can help farmers prevent the risk of chemical spraying.

Three (3) respondents quoted similar reasons for the code of various technologies. For example, sensors may measure the soil's pH level and verify the earth's maturity. Below is the selected narrative:

"Integrated with Sensor, validation of soil matured sensor, use to collect data."- Respondent 2,

"Smart crop system to evaluate pH level on the soil."- Respondent 4

"Use drones to spray pesticides" – Respondent 7

Electrochemical sensors measure important soil parameters, such as pH (Ali et al., 2020). These sensors may readily replace traditional chemical soil analyses, which are typically expensive and time-consuming. Therefore, the result under the TAM model can be categorised as

perceived of use (PEOU) because using a variety of technologies, such as sensors, can allow the farmers to be used to get information on crop conditions.

For the subtheme of adopting ICT usage to farmers, six (6) respondents acknowledge that farmers are frequently wary of new technology, especially if they are unsure of how it operates or the advantages it may offer. The narrative is as follows.

"Distributed the benefit of the drone"- Respondents 1, 4, 8

"Introduce to the farmer, let the farmer understand the benefit of technology." - Respondent 10

"Giving a new mindset to the new generation that agriculture can improvise career growth skill." Respondent 5,6

Therefore, providing practical demonstrations and training sessions may be an excellent method to assist farmers in comprehending the benefits of technology. Furthermore, Onwude et al. (2020) assert that farmers may utilise ICT to use better the current transport, storage, packaging, and processing methods. Therefore, it is essential to emphasise the role that technology and innovation play in contemporary agriculture and the chances for development and progress that this generates to change how the next generation thinks about the possibility of professional advancement. The result of the TAM model for adopting ICT usage to the farmers is user acceptance because the farmers should accept that ICT can benefit them and improve crop quality.

Three (3) participants referred to the effectiveness of product factors influencing ICT development in the agriculture industry. The narratives are as follows:

"Drone can cover three times more effectively than using manpower." – Respondent 3

"More than 50% of management improved."-Respondent 4

"Using manpower for spraying can get more time use if using the drones can make the time spend less"- Respondent 9

Drones may occasionally be more advantageous than manual labour in some circumstances. According to Ayaz et al. (2019), fast, low-cost, real-time, and large-scale surveillance supported with an accurate data acquisition and transmission facility is crucial for agriculture production. The product's effectiveness can be perceived as usefulness in the TAM model because the farmers believe using drones would increase their productivity and can cover multiple times the workforce's productivity.

Table 2: Respondent's Answer for Objective 1

Respondent	Interview Transcript	Category	Code	TAM Model
R1, R8, R9, R10	"Drones are used to save farmer spend energy and time." "Drones made farmers away from spraying risk which at paddy crop, the farmer less wearing PPE for their safety."	Operation	Technology Awareness	Perceived of Use (PEOU)

R1, R7	"Digitalise the data to improve the efficiency of production."	Operation	Technology Awareness	Perceived of Use (PEOU)
R2, R4, R7	"Integrated with Sensor, validation of soil matured sensor, use to collect data." "Smart crop system to evaluate pH level on soil." "Use the drones to spray pesticides."	Operation	Varieties of technologies	Perceived of Use (PEOU)
R1, R4, R8, R10	"Distributed the benefit of the drone." "Introduce to the farmer, let the farmer understand the benefit of technology."	Planning	Adoption of ICT usage to the farmer	User Acceptance
R5, R6	"Giving a new mindset to the new generation that agriculture can improvise career growth skill."			
R3, R4, R9	"Drone can cover three times more effectively than using manpower." "More than 50% of Management improved." "Using Manpower for spraying can get more time use if using the drones can make the time spend less."	Planning	Effectiveness of product	Perceived Usefulness

4.2 Theme 2: Encouraging factors for the adoption of ICT among farmers

Table 3.3 uses the thematic analysis method to identify the themes. For the subtheme of safety products, three (3) respondents agreed that the technology could significantly enhance food safety by offering creative solutions to identify and increase food items' safety. The narrative is as follows:

"Using drones is safer because farmers wear less PPE during spraying."- Respondent 1

"Technology also can make improvise food safety."- Respondent 2,3,8

The technology could significantly enhance food safety by offering creative solutions that can identify and increase the safety of food items (Suhaila et al., 2020). According to the Food and Agriculture Organization (FAO), ICT traceability in livestock helps guarantee that animal diseases are better monitored and managed, easing regional and global commerce. For example, the internet-based electronic service TraceNet makes obtaining certification to export organic goods from India easier. It gathers, saves, reports, and tracks quality assurance data forwards and backwards (Forster et al., 2013). The result of the TAM model for safety products is perceived as ease of use because, with the help of technologies, the farmers can enhance the quality of life, such as human health, safety, and welfare.

Three (3) respondents quoted the factor of ICT adoption among farmers as a quality preference for the code of quality preference. The narrative is as follows:

"Farmers using estimation to estimate the plant need but using AI technology can give the accurate solution." – Respondent 4, 6

"With technology, the farmer can focus on improving quality rather than increasing production quantity." – Respondent 10

Because Artificial Intelligence (AI) has developed predictive models that can forecast future outcomes based on previous data, AI technology can offer precise answers. In addition, these models may be trained to see trends and produce accurate predictions, giving businesses helpful information to guide decision-making. For example, ICT-based decision support systems assist farmers in choosing suitable crops to plant and grow, harvest, post-harvest, and sell their food to improve yields (USAID, 2013). Quality preference is perceived useful under the result of the TAM model because the farmers believe that using technologies such as decision support system can improve their decision-making on enhancing the quality and giving accurate solutions.

Three (3) respondents agree that job opportunities among farmers are the following factor of ICT adoption. Below is the selected narrative:

"With technology also can open job opportunities for all generations of age."- Respondent 7,9,10

Provide young people with the opportunity to gain practical agricultural experience through internships, job shadowing, and other initiatives. By doing so, one may develop their talents, gain valuable experience, and better grasp the opportunities available in agriculture. For example, automation, a technology product, can replace certain occupations while opening new career options for those with technical training and experience in data analysis, programming, and robotics. The result under the TAM model of job opportunity is user acceptance because the farmers should accept that adapting the technologies used in the agriculture sector can bring new job opportunities to programming, data analysis, and engineering.

Table 3: Respondent's Answer for Objective 2

Respondent	Interview Transcript	Category	Code	TAM Model
C1	"Using drones is safer because farmers wear less PPE during spraying."	Safety	Safety Product	Perceived of Use (PEOU)
C2, C3, C8	"Technology also improves food safety."			
C4, C6, C10	"Farmers using estimation to estimate the plant need, but AI technology can give the accurate solution." "With technology, the farmer can focus on improving quality rather than increasing production quantity."	Opportunity	Quality Preference	Perceived Usefulness (U)
C7, C9, C10	"Technology also can open job opportunities for all generations of age."	Opportunity	Job Opportunity	User Acceptance

This can further be enhanced by using an IoT web host application that allows the users to connect to the proposed system remotely if there is internet connectivity. This shows the great potential of the IoT-based platform to control the proposed approach over the internet regardless of any range limitations.

5. CONCLUSION

In summary, Information and Communication Technology (ICT) should be utilised in all sectors of the economy, particularly in agriculture. Even if the study's findings and analysis show that farmers in the agriculture sector use ICT to a limited extent, the government is crucial in boosting agricultural output in keeping with the goal of economic growth as food consumption rises yearly. Although Malaysia's ICT development is not very advanced, ICT suppliers may use the available technology to produce a strong Return On Investment (ROI). Any new technology must first undergo research and development since it depends on the demands and needs of farmers. Governments can allot funds for research and development in agricultural technology, which can aid in the creation of more individualised and cost-effective ICT solutions for farmers. Governments can also facilitate partnerships between public and private institutions, promoting cooperation between ICT providers and agricultural organisations to create tailored solutions for farmers. Farmers also should be made aware of the many ways in which ICT can improve their livelihoods through awareness campaigns. These initiatives need to be made publically accessible and feature tangible achievements. All farmers will employ these technologies if they think they are essential for their crops. ICT is necessary for farmers' products since it has cost and efficiency advantages. ICT-based crop monitoring will considerably aid farmers' ability to labour less. They will refer to the system and sensor to take any action and render the appropriate decision depending on crop circumstances. In future studies, a quantitative methodology may be employed to investigate prevailing patterns of success among farmers using ICT tools specially designed for them. The findings of this study have practical implications for ICT suppliers, as they can utilise the results to develop ICT tools specifically tailored to meet the distinct needs of farmers. ICT suppliers are expected to create these tools within the agricultural sector.

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AUTHORS CONTRIBUTION

NAI is responsible for the preparation of the article and the supervision of the entire research process. MAB plays a significant role in academic research literature review and methodology sections. MIH is responsible for overseeing the data collection process and conducting data analysis. MAB and MIH collaboratively brainstormed the discussion section with the assistance of NAI.

CONFLICT OF INTEREST

The authors declare there is no conflict of interest.

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