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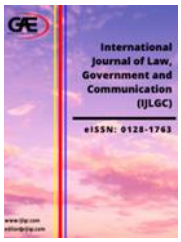

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GOVERNMENT SUPPORT TO ENCOURAGE THE USAGE OF ICT IN AGRICULTURE: PERSPECTIVE FROM GOVERNMENT OFFICERS IN THE NORTHERN REGION

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Abstract:

The agricultural sector in Malaysia is a crucial contributor to the country's economy. However, Malaysia has had one of the lowest agricultural productivity growth rates in recent years, trailing Indonesia, the Philippines, Vietnam, and Thailand. The industry is dominated by smallholders with an ageing farmer population, low levels of mechanisation, and a high dependence on labour, resulting in numerous inefficiencies and low productivity. This study explores government efforts to boost agricultural ICT adoption. assesses the effectiveness government's initiative and the obstacles it faces in promoting ICT in this industry. An in-person interview was conducted to collect perspectives and insights from eleven government officials from grades 27 to 52. The data was analysed using manual thematic analysis. The findings indicate that the ICT initiatives encompass a range of technological solutions and financial support. The efficiency, frequency, exposure, and variety of facilities are key performance indicators for evaluating the success of government initiatives. However, age, knowledge, cost, expertise, and inadequate network accessibility hinder ICT integration in agriculture. To address these challenges, it is imperative that all relevant stakeholders, including both governmental and private entities, collaborate to enhance the various tiers of information and communication technology

Keywords:

Agriculture Technology, Challenges, Effectiveness, Government Initiatives, ICT

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Introduction

Malaysia's agriculture industry contributes only 7.1 per cent to the national gross domestic product (GDP) provided employment opportunities to approximately 16 per cent of the Malaysian populace (DOSM,2022). Throughout history, the British planted extensive plantations and introduced new economic crops, but Malaysia's proportion of the global output of these products has slowly decreased over the last two decades. Since the early 1980s, Malaysian agriculture has seen several changes, with the growth of agriculture in rural areas concurrent with the development of land in the nation. To address the problem of food security, intensive agriculture is necessary to boost productivity, and ICTs can play a significant role in increasing agricultural production. Furthermore, the information and communications technology (ICT) revolution has substantial implications for social and economic growth, particularly in various disciplines and businesses. It is generally accepted that using ICT will benefit productivity and competitiveness in all industries, including agriculture. Therefore, ICTs are crucial in developing economic growth and agricultural productivity. Adopting digital technologies has helped modernise and transform the sector, making it more efficient, sustainable, and profitable. Malaysia Budget 2021 has proposed seven main initiatives for the agriculture sector, which is a crucial contributor to the country's economy, contributing 7.1 per cent to the gross domestic product in 2019 (Bernama, 2020). These initiatives aim to promote the use of technology, improve productivity, and enhance the agriculture sector's competitiveness (Malaysia Digital Economy Blueprint, 2021).

Moreover, the National Agrofood Policy 2021-2030 also aims to improve the agriculture sector's competitiveness by promoting modern technologies and innovative practices and enhancing the quality and safety of agricultural products. Several agricultural farms in Malaysia are currently utilising emerging technologies such as the Internet of Things (IoT), big data analytics (BDA), and artificial intelligence (AI). However, a report by the Economic Planning Unit revealed that from 2010 to 2015, the agriculture sector relied on unskilled and semi-skilled workers, showing how this industry's technology level was still relatively low (Abidin, 2018). In addition, Bank Negara Malaysia (2021) revealed that the domestic agrifood sector, in particular, faces lags in fully utilising the benefit of technological innovation. Therefore, this study aims to investigate the initiative and effectiveness of initiatives provided by the government to encourage ICT usage in the agriculture sector and to study the challenges faced by the government in promoting the usage of ICT in the agriculture sector.

Literature Review

With the rise and development of digital technology in agriculture, much literature conducted studies on government support towards ICT application in the agriculture sector. For example, scholars Wang and Zhou (2020) confirm that government subsidies should be implemented at all levels, from companies to individuals. In this case, government subsidies could positively impact agriculture. Besides, the adoption and implementation of ICT, particularly in e-agriculture, are heavily influenced by environmental variables such as governmental intervention, public administration, and external pressure from rivals (Zhang et al, 2016; Kamarudin et al., 2019). With agricultural extension services, government initiatives have tried to help farmers overcome informational barriers to adopting new technologies. They analysed current ICT-based agriculture projects and classified them according to delivery mode and service type. Aker (2011) argues that it is crucial to identify potential design and implementation limits to such programmes. It wrapped off with some suggestions for doing in-field studies to determine how these programmes have affected farmers' education, adoption of technology, and standard of living.

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Similarly, Glendenning et al. (2010) looked into the many extension programmes in India and why farmers aren't using them effectively. The study concludes that collaboration and the exchange of expertise are becoming increasingly important in meeting the informational demands of India's marginal and smallholder farmers. For example, the Malaysian government allocated billions of ringgits to a computerised system that manages ploughing incentives for paddy farmers to reduce the issues of late payments, omissions and long preparation rate of claim reports Ibrahim et al. (2020) also point out that mobile apps such AgriMaths and 100 Tip Tanaman developed by DOA and MARDI have transformed extension services to become faster and easier for farmers to access. In addition, the government implemented various policies and programs to help farmers apply information and communication technology (ICT) in their agricultural practices. Kamarudin et al. (2019) stated that the allocations allocated for ICT in the Eighth Malaysia Plan and Ninth Malaysia Plan demonstrate that the Malaysian government places a significant emphasis on ICT development. It has been shown that this allocation for ICT development affects rural development. With ICT, problems such as the digital divide, poverty, and unemployment may be resolved. Moreover, Mazuki et al. (2020) found that, mobile and social network technologies should improve information exchange between small-scale fishermen and important shareholders. Government institutes, industries, and universities should help facilitate and diffuse such things into the daily use of fishing-related technologies by small-scale fishermen.

Many government agencies have explored the use of ICT in supporting agriculture production systems. It has proven to play an important role in transferring technology and sharing contemporary agriculture techniques with farmers. Yet, many of these farmers are not fully leveraging ICT's full potential. Several reasons hampered service utilisation, including failures to visit farmers, a lack of programme promotion, and farmer training. Linguistic and conventional obstacles to ensuring adequate ICT infrastructure in agricultural areas have been proven to impact the success of agribusiness adoption of ICT (Lokeswari, 2016). Relying on 100 micro survey data of farmers in Bihar, Anand et al. (2020) used index constraints to explore the challenges of farmers in adopting ICT. The results show that inadequate electricity was the biggest issue facing farmers, with a mean score of 2.84, followed by a slow internet connection (2.83), a lack of expertise (2.82), a lack of trust in using ICT tools (2.79), and a lack of training programs (2.71). The utilisation of ICT also may incur high costs. According to Samah (2009), farmers would desire IT applications that assist the operational elements of agriculture, such as real-time decision support over high-bandwidth wireless internet connections. However, Xie et al. (2021) found that few farmers reported that they were impoverished and could not afford to buy a television and Android mobile phone with various internet data pack costs and did not receive government assistance. Similarly, a study conducted by Dardak et al. (2022) reveals that most Malaysian farmers are small business owners who cannot afford to purchase new agricultural production methods, machinery, or automation equipment.

Farmers' age can also be a factor in their resistance to incorporating ICT into their farming methods. Elderly farmers may be less comfortable with technology and prefer conventional ways that they have employed for many years. They may also be less eager to undertake the additional learning and training necessary to use new technologies. Alam et al. (2010) and Sharon (2019) revealed that the average age of a Malaysian farmer is 50, making it difficult to incorporate or adopt new farming technology, mainly as rural youths migrate to urban centers in pursuit of employment and a modern lifestyle. Recent statistics presented by the Department of Statistics Malaysia 2020 supported this assertion, indicating that the agriculture sector employed approximately 1.25 million people, of whom 70 percent were classified as unskilled.

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As a result, many farmers are unfamiliar with the most recent technologies and lack confidence in their ability to employ them effectively.

The literature review is summarised in Table 1, presented below.

Table 1: Summary of Literature Review

Authors	Field of study	Country	Type of dimension	Key findings
Aker, 2011	Existing ICT-based agricultural extension programs are surveyed, and possible design and implementation issues are identified.	Developing countries	agriculture extension, ICT, program evaluation	Examines existing agricultural ICT programmes, categorising agricultural ICT programmes into mechanism (voice, text, internet, and mobile money transfers) and the sort of services supplied
Samah et al., 2009	The role of ICT in boosting the productivity of Malaysia's agro-based entrepreneurs	Malaysia	ICT usage, entrepreneur, ICT contribution	ICT's perceived impact to agro-based productivity is heavily influenced by age and electronic media usage.
Alam et al., 2010	Socioeconomic profile of farmers	Malaysia	farmers live hood, socioeconomic characteristics	The average age of all farmers is 52.9 years, with males being 52.9 years old and females being 53.5 years old.
Glendenning et al. 2010	Challenges and limitations of each agricultural extension strategy as endeavours to give farmers access to information pertinent to their farm enterprises	India	agriculture extension, knowledge, public-private partnership	Due to the difficulties of collaborating with the public sector, the private sector has few public-sector partnerships.
Lokeswari, 2016	Use of ICT among rural farmers	India	ICT, small-land owners, market access, agriculture	Failures to visit farmers, promote the service, and train farmers limited farmers' ICT potential. Agribusiness's embrace

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			market information	of ICT is hindered by language and cultural barriers.
Zhang et al., 2016	ICT-based information dissemination model and share expertise and experience in using developing ICT to reach farmers and farm communities	China	ICT service model, farmers, government intervention, public administration, government apps and websites.	Seven information model are used for agriculture information disseminations in China
Kamarudin et al., 2019	The significance of ICT implementation in rural communities, government efforts to improve ICT utilisation in the telecentre.	Malaysia	ICT, government, rural area	The significance of ICT implementation for rural communities, along with government efforts to improve ICT utilization, particularly in telecentres.
Sharon, 2019	Malaysia employs technology to support farmers	Malaysia	ICT, age, agriculture sector, farmers, profit	The average age of a Malaysian farmer is 50, making the incorporation or adoption of new farming technology difficult, particularly as rural youths migrate to urban centres in search of employment and a modern lifestyle. This can and will increase the volume outputs' pressure.
Anand et al., 2020	Farmer ICT access and use constraints	India	ICT, constraints to farmers, ICT tools, ICT use	The findings indicated that a significant proportion of farmers encountered challenges related to inadequate power supply, suboptimal internet connectivity, limited knowledge, and low confidence in utilizing information and communication technology (ICT) tools, and

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				insufficient access to training programs.
Ibrahim et al., 2020	ICT's knowledge management functions in agriculture	Malaysia	ICT, knowledge management, agriculture extension	DOA has launched two mobile apps, while MARDI produces 16 mobile apps containing information on crop and livestock
Mazuki et al., 2020	Fisheries technology for small-scale fishermen	Malaysia	small-scale fisherman, fisheries technology, ICT,rural development	Information exchange among small-scale fishermen and important shareholders should be improved through mobile and social network technologies, given that government institutes, industries, and universities should help facilitate and diffuse such things into small-scale fishermen's daily use of fishing-related technologies
Wang and Zhou, 2020	Assessing the impact of government subsidies on private R&D investment on new technology	China	government R&D subsidies, innovation, market environment	The type of subsidy used has a significant impact on the relationship between government subsidies and private R&D investment
Xie et al., 2021	Smallholder farmers involvement in digital agriculture	China	smallholder's farmers, digital agriculture	smallholders cannot afford large investments in digital agricultural technology
Dardak, 2022	Overview of the 11th Malaysian development (2016–2020) in the agriculture sector	Malaysia	Malaysia development plan, agriculture sector, food security	Due to low productivity brought on by reliance on physical labor rather than farming technology, the production growth of agro-food commodities is slower than it could be.

Methodology

This study used qualitative research methods, focusing on in dept field interviews, literature, and achieve research. The study area only considers government officers in northern Peninsular Malaysia, namely the Perlis, Kedah, Penang, and Perak. In choosing the sample of participants, the researcher used a purposive sampling method. This form of sampling is often used in qualitative research to discover and select information-rich instances to maximise the use of

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limited resources (Patton, 2015). In undertaking this study, the researcher chose to interview government officials from grade 27 to grade 52 because it is crucial to get information from the experts.

Furthermore, in Malaysia, a government officer between 27 and 52 is an educated person with at least the Malaysian High School Certificate or qualifications recognised as equivalent by the government, up to an expert in a particular field. There are eleven (11) participants were recruited to be interviewed because the minimum participant number of respondents is four (4) to get a clear picture of the issues faced (Maree,2015). The data collection took place from October 2022 until January 2023. Interviews with a semi-structured format were conducted with a series of questions adapted from the thorough review of existing literature and studies related to this research topic. The questions were mainly open-ended, with a small number of closed questions relating to information such as age, occupation and so on. Semi-structured interviews also allow individuals to respond to queries more on their terms than the standardised interview allows while providing a superior structure for comparative purposes (May 1997). Kumar (2005) argues that the discussion is the best method for researching complex and sensitive topics because the interviewer can prepare the participant for sensitive questions and explain complex ones in person. The researcher conducted the interviews and provided the participants with written questions in advance. In this setting, interviews may occur face-to-face or via many electronic media platforms, for example, telephone, email, social messaging apps and video conferencing. The data from the interview were analysed using thematic analysis. The benefit of using thematic analysis is that it will produce and present the data more effectively and more accurately reflect the reality of the data collection by using various instruments (e.g., observation, questionnaires, and interviews in one study) with participants in multiple environments (Miles and Huberman 1994; Creswell 2009; Hayes 1997). Moreover, according to Braun and Clarke (2006), the process of thematic analysis should involve coding, categorisation, and noting patterns to provide a relationship between the variables and factors and to produce a good and logical chain of evidence (Creswell 2009; Braun and Clarke 2006; Miles and Huberman 1994).

After collecting data from respondents, the researcher transcribed the information into digital text, coded and stored it in Microsoft Excel. The codes employed are keywords used to categorise or organise content and are regarded as an essential aspect of qualitative research. The data was then evaluated, classified, and arranged into themes and sub-themes that arose from the coding process. The concepts that emerged were given a code. The next step was to analyse the data by identifying recurring patterns and highlighting similarities and differences. The third stage was data verification, a method of testing the correctness of understanding by rechecking the transcripts and codes, allowing the researcher to confirm or change previously arrived at hypotheses.

Result and Discussion

Semi-Structured Interview Results

A total of 10 interview transcripts contained references to technology. The impact on the efficiency and productivity of agriculture has provided a benefit that will maximise the country's agricultural yields. Participants also explained the limitation that makes people less interested in implementing the usage of ICT in this field. Three broad themes emerged, including the initiative provided by the government, the effectiveness of the initiative conducted by the government and challenges faced by government agencies. Table 1 contains exemplar quotes categorised by theme.

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Table 1: Semi-structured Interview Illustrative Quotes by Themes

Theme	Illustrative Quotation	Category	Code
Theme 1: The initiative provided by the government to encourage ICT usage in the agriculture sector	"Computer, smartphone" "Smartphone, computer" "Smartphone" "Drone" "Drone, sensor" softtware, IoT, HOBO Data logger	Planning	Varieties of technology
	Skim tanam semula (MPOB)" "Program Entrepreneur Muda" "Agropreneur Muda" "Program Inkubator" "Aid in the form of input and grants" "In terms of inputs such as fertiliser from RISDA" "In the form of inputs such as pesticides and fertilisers." "Subsidy like a seed" "Grant subsidy" "Subsidy input" "Purchase machinery there is help in terms of paying half the price of the machine." "In terms of agricultural advisory services." "With the cost of ploughing wages." "Loan in the form of credit" "Collaboration financial institution like Agrobank" "In terms of loan"	Activities	Financial assistance
Theme 2: The effectiveness of initiatives conducted by the government to encourage ICT usage in the agriculture sector	"Very convenient, make it easier." "Very effectiveness and easier" "Very useful for helping the farmers in terms of skills, methods of use." "Simplify and shorten the process of agricultural cultivation."	Operation	Efficiency
	"From when we start planting until harvest." "From Growth, flowering and Harvesting" "In monitoring process." "During the research/cultivation process." "When there is the latest information" "When to develop knowledge input" "When to introduce farmers to new technology" "When the farmers have capital and all factor productions" "Depends on the need" "There is no specific time" "Should be used by agricultural development agents from now on to ensure that they are equal to, or more than the farmers being guided."	Activities	Frequency of use

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	"There is no specific time because every time needs technology"		
	"Exposure at an earlier age" "Wider exposure to ICT" "Give more knowledge about the function of ICT" "When there is knowledge about agricultural ICT" "When giving an initial approach to students in the use of technology in agriculture" "Syllabus in agricultural technology must be introduced"	Limitation	Exposure
	"With the availability of financial resources, skills, and sufficient facility resources" "From the application of agriculture activities"	Activities	Variety of facilities
Theme 3: The challenges faced by government agencies in promoting the usage of ICT in the agriculture sector	"Does not have much impact for the old farmers because they do not know how to conduct the technology" "Lack of support from old citizen farmers to using ICT" "Old farmers more like to manage the farm manually rather use the technology" "In rural area there are lot of farmers in their late 60s" "Farmers in old citizen lack knowledge about ICT because they are more comfortable used manually" "Factor of age where young generation less interested in agriculture." "Age is one of the factors of ICT is not effectiveness for young generation"	Limitation	Age
	Lack of interest" "No knowledge about ICT" "Lack of exposure to the importance of ICT in agriculture"	Limitation	Knowledge
	"Cost of ICT is not cheap" "Cost in farming is not only for ICT usage" "Cost maintenance is also a big challenge" "Heavy investment"	Limitation	Cost
	" Do not have skill and expertise in using ICT" "Do not get support from experts"	Limitation	Expertise
	"Rural areas with less internet coverage are among the challenges" "The coverage network also needs to be expanded even more for the most basic plagues" "Internet access is not widespread	Limitation	Rural areas/ Coverage Areas

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"If the coverage is bad, information to be conveyed to farmers is difficult and limited"
"It is difficult for the technology transfer process to be conducted smoothly."

Theme 1: The Initiative Provided By The Government To Encourage ICT Usage In The Agriculture Sector

Varieties of technology

Several participants referred to the varieties of technology provided as government initiatives to encourage the usage of ICT technology in agriculture. For example, there are many digital agriculture channels, such as government websites, mobile applications, and e-commerce platforms developed by the government for smallholder farmers and agropreneur. They were making it easy for farmers and government officials to access all data. Based on the study by Al-Hassan et al. (2013) and Ramli et al. (2019), numerous websites, e-commerce software, and new technologies are used in Malaysia to offer rural regions pertinent agricultural information. Among these, AgriMaths, MARDI Fertigasi, MARDIMy on Farm, e-Agro, and various government websites enable Malaysian farmers, field officers, policy-makers, and the government to interact and obtain essential and helpful agricultural information.

Moreover, most farmers have their own general ICT tools, such as smartphones, laptops, and PCs, and they utilise all the ICT devices to access information through ICT channels. Based on the interview, six out of eleven respondents agreed that the variety of technology devices is one of the factors in encouraging farmers to use ICT in their field. Some respondents also said drones, IoT, and HOBO data loggers are the most used devices in agriculture.

Financial assistance

Participants also commented that using financial assistance from the government will reduce the burden on farmers to use ICT in their farming. Most respondents mentioned that financial aid would be given in terms of inputs, subsidies, and grants. For example, more than 300 PPKs and a partnership of nearly 1 million farmers and planters can benefit from the e-Satellite Farm Programme, which received 10 million ringgits in matching grants of up to RM30,000 from the government in Malaysia's Budget 2021 (Bernama, 2020). These findings align with a study by Benard et al. (2018) that many information and communications technology (ICT) instruments should have their prices subsidised by the government so that more fish farmers can afford and utilise them to acquire and share agricultural information.

Theme 2: The Effectiveness Of Initiatives Conducted By The Government To Encourage ICT Usage In The Agriculture Sector.

Effectiveness

After the interview, the effectiveness factor is one of the government initiatives in promoting ICT usage in the agricultural sector. Four out of eleven agreed that farmers basically would influence to use the technology after they know how effective the usage of ICT to the field. ICT is very convenient, makes it more accessible, and shortens the agricultural process, which is the most stated by the respondents. According to Santiteerakul (2020), farmer corporations should have access to an easy-to-use technological application or platform that assists farmers in making decisions, marketing their products, and administering sales as crop prices decline.

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Increasing the use of ICT at the farmer level can improve farmers' access to timely and pertinent information and facilitate the exchange of digital data (Pandey and Kumari, 2018).

Frequency

Four out of eleven participants noted that the utilisation and implementation of ICT are not time-bound, as it is required continually. Farmers, for example, utilised their mobile devices frequently and accessed the internet through them, as they had access to this feature on their mobile devices. They use their mobile devices often and access the internet, as it has become a ubiquitous necessity for individuals to stay connected with one another. The simplicity of mobile technology requires no technical expertise to operate, thus allowing farmers to conveniently access financial and extension-advisory services, including weather updates, market information, and agricultural guidance. Remote sensing technology, one of the enabling ICT technologies, is also available within the industry. However, it is offered mainly to researchers and agribusinesses for research reasons only. Another four participants commented that they intend to use ICT products and services frequently in their agricultural work, starting from planting until harvesting. This study shows that frequent usage has been found as a positive attitude toward ICT (Dixon, 2009). It is indicated that the frequency of ICT use is a factor in the effectiveness of initiatives conducted by the government to encourage ICT usage in the agriculture sector.

Exposure

Exposed at an earlier age, more comprehensive information on ICT usage in agriculture and introduced in the syllabus about agricultural technology are an example of the respondent's answers. The findings are consistent with the previous study conducted by Tiraieyari et al. (2013), which revealed that over 50% of the agriculture extension agents in Malaysia, who are the intended beneficiaries of e-learning implementation, are aged below 35 years. Looi and Kamarulzaman (2015) suggest that younger generations exhibit a higher propensity to embrace technological advancements. Furthermore, another two additional participants recognised that the broader exposure of current agricultural knowledge and technology from governmental organisations to their intended audience, including farmers, agricultural entrepreneurs, practitioners, and researchers, is facilitated through agricultural extension initiatives. This statement is significant because participation in ICT classes, seminars, and workshops can significantly improve ICT use and enhance exposure to the significance of ICT for fishermen (Omar et al., 2011).

Variety of Facilities

Based on the interview, the result shows a variety of facilities that affect the effectiveness of initiatives by the government to encourage ICT usage in agriculture. Respondents stated that the availability of financial resources, skills, and sufficient facility resources also from the application of agriculture activities. For example, the Malaysian government introduced telecenters such as Mini Rural Transformation Center, 1Malaysia Internet Centers, Public Access Internet Centers, Community Technology Centers, and Community Multimedia Centers as tools to provide potential benefits of ICTs to the rural community (Malek and Tahir, 2017). Moreover, basic amenities and facilities such as 24-hour electricity and free wireless broadband are also explicitly provided to FELDA (Malek et al. 2012). In addition, the Selangor government was also offering 100 laptops and 50 tablets to farmers who earn RM 2000 and below per month (Azni, 2022). A previous study from Gokhe (2020) stated specific facilities and resources are needed for the learning environment when ICT is employed. Basic infrastructure such as electrical wiring, Internet connectivity, lighting, air conditioning, and space are examples of facilities. In addition, technologies such as computers with peripherals,

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video equipment, and specialist instruments like digital microscopes are examples of resources. Additional resources also come in the form of numerous software programmes and more conventional tools like books, films, and audiotapes (Gokhe, 2020).

Theme 3: The Challenges Faced By Government Agencies In Promoting The Usage Of ICT In The Agriculture Sector.

Age

Respondents stated that age is a challenge for government agencies to encourage ICT usage in the agriculture sector. Three out of eleven respondents said ageing people the adaption to ICT is low, and there is less interest in the young generation towards the agriculture sector. Many rural youths have moved to urban areas due to the prospect of employment and a more modern way of life. This causes more inadequate adaptation of ICT usage in the agriculture sector, leading to challenges government agencies face in encouraging ICT usage in the agriculture sector. To be added, younger individuals have more access to ICT than older people (Ali et al., 2016). According to age categories in a different survey, the percentages of respondents who said they used ICT were 60 per cent, 21.2 per cent, and 12.8 per cent for young, middle-aged, and older people, respectively. Farmers between the ages of 25 and 40 have better labor output. The younger generation is more receptive to ICT because they are more engaged, educated, and eager to learn new ideas and technology. However, the under-use of information and communication technologies (ICTs) has restricted the flow of information on agricultural output among adolescents since the latest news is not effectively digitised via online sources. In addition, a lack of skill in using ICT tools relates to the fact that older farmers do not know how to obtain information from mobile devices. Most of them could not know how to access various web and agricultural apps. As a result, they are more comfortable with the traditional farming method and less aware of the potential benefits of ICT.

Knowledge

Following the interview, respondents stated that farmers' lack of knowledge and interest are also hurdles to ICT implementation. Farmers with limited education could not comprehend information due to illiteracy and language barriers, as most of the information received was in English. The study is also consistent with Dhaka and Chayal (2010); Nallusamy (2015). Participants also reported that rural farmers are less exposed to ICT. The result is in line with the prior research made by Ali et al. (2020) that pointed out that most of the farmers were only visited by the extension staff on an annual or bi-annual basis. To be added, Abdullah & Samah (2013) also found that the most significant barriers to technology adoption include farmers' poor levels of education and technological perception, disorganisation, geographical factors, a lack of resources, and funding and instructional capacity. To be motivated to learn new technologies, farmers also need to have a particular degree of education and be well-versed in rice cultivation.

Cost

Seven out of eleven respondents said costs are the most challenging factor to encourage ICT usage in agriculture. The interview resulted that cost is the barrier because many farmers are from rural areas. In addition, the cost associated with procuring technologies and high startup cost hinders their implementation. Furthermore, most farmers operate as small-scale entrepreneurs and face financial constraints that prevent them from acquiring advanced technologies, such as machinery, automation devices, or innovative agricultural production systems. For example, incorporating water or pesticides into robotic planters necessitates the inclusion of additional weight, thereby requiring a distinct hardware design that incurs elevated

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production expenses for scaling up the device. After that, technical difficulties and equipment malfunctioning can result in high costs for repairing specialised equipment (Ku, 2022). The research made by Popescu et al. (2017) indicates that a significant proportion of farmers, precisely 81%, have identified equipment cost as the primary obstacle to implementing intelligent farming technologies. Furthermore, the study reveals that 14% of farmers have adopted such technologies.

Expertise

Concerning expertise, three out of eleven people claimed that old agro-based entrepreneurs and farmers lack proper skills and expertise in using ICT. This assertion is corroborated by the research conducted by Kabir (2015). Typically, elderly individuals possess more agricultural expertise and tend to lack enthusiasm toward altering their current circumstances. Nevertheless, individuals with limited farming experience but a daring disposition are inclined towards adopting novel practices and exhibit a genuine desire to acquire new knowledge. In addition, the respondents also said that several farmers have stated that they do not receive complete technical support from the experts. According to Arshad (2020), although extension officers serve as the primary interface between agriculture and disseminating contemporary technology to farmers, insufficient financial incentives and inadequate training opportunities currently impede their efficacy.

Furthermore, technology transfer from government research institutions is relatively minimal. According to a Ministry of Science, Technology, and Innovation report, Malaysia's technology transfer rate is between 8% and 9%. In other words, only eight to nine innovations out of 100 developed by public research organisations are fully transmitted or embraced by farmers, breeders, and entrepreneurs.

Coverage

Four participants concurred that network coverage is inadequate for small producers to implement ICT because it has not been expanded. According to the respondents, rural areas have the lowest and most inconsistent internet coverage. Despite the Prime Minister's ambitions to revolutionise high-tech agriculture, which has shifted mainly towards digital agriculture, poor internet connectivity and insufficient progress impede efforts to transform agriculture in rural areas.

Four participants agreed that network coverage is not expanded, and it is not good enough for the small farmers to implement the ICT. The respondents also said that rural areas are the most with less and unstable internet coverage. Despite the Prime Minister's aspirations to revolutionise high-tech agriculture, which has shifted mainly towards digital agriculture, inadequate internet connectivity and insufficient progress impede efforts to transform agriculture in rural regions. According to Abdultalib (2020), certain areas of developed villages or suburbs continue to experience inadequate internet access in terms of speed, coverage distance, and access stability. The disruption may pose challenges for the local community to implement smart agriculture practises, mainly those utilising Internet of Things (IoT) technology, known for its high efficiency and ease of use, and can yield significant benefits. This study is also in line with the findings of Dhaka and Chayal (2010), Navinkumar (2018), and Anand (2020).

Conclusion and Recommendations

This research contributed to the existing literature on the use of ICT in agriculture. It included a qualitative investigation of the government's support for increasing the use of ICT from the

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viewpoint of the government perspective. Using a thematic analysis, the primary purpose of this research is to identify the initiatives, effectiveness, and challenges that government face in encouraging the use of ICT in agriculture. The findings of the interview analysis highlight that farmers were provided with a range of amenities and monetary support to promote their adoption of ICT. Through ample exposure and a diverse range of resources afforded by the government, individuals are likely to develop greater confidence and incorporate information and ICT more frequently into their routine agricultural practice. Notwithstanding, the degree of acceptance and integration of contemporary technologies in the agricultural sector continues to be modest. Furthermore, the agricultural industry in Northern Malaysia encounters various obstacles, such as inadequate proficiency in digital skills, a growing population of elderly farmers, insufficient technical expertise, elevated deployment expenses, and bad internet connectivity, particularly in rural regions, which hinders the adoption of contemporary technologies. Addressing these five fundamental shortcomings could lead to the indirect mitigation or elimination of other issues through organic market expansion. Providing high-quality inputs and adequate training in modern agricultural methods by the government could potentially enhance agricultural productivity, increasing farmers' income and reducing operational challenges. In the immediate future, it is suggested that the government allocate funding towards the research and cooperative associations of select farmers. These entities would be tasked with regulating the distribution of inputs, guiding the marketing of exported outputs, and facilitating the sharing of knowledge, all to increase agricultural productivity at both the regional and national levels. The mitigation of the current agricultural crisis does not necessarily require the resolution of all existing issues. The government can be considered the pivotal entity, serving as the primary stakeholder that underpins all of the fundamental issues of the agricultural crisis. Enhancing its function, the government has the potential to establish a conducive atmosphere that results in a significantly more significant advantage for all other stakeholders in the agriculture industry of Northeast Malaysia. Private enterprises and non-governmental organisations must increase their participation in addressing the agricultural crisis. Providing direct or indirect financial support to a farmers' cooperative association or offering specialised training and technology at a reduced cost would significantly benefit farmers.

In due course, with the amelioration of the agriculture crisis, farmers will gain additional knowledge and expertise and subsequently adopt modern agri-business technologies and innovations, thereby enhancing their productivity through effectively utilising these tools. The augmentation of farming productivity can trigger positive outcomes such as heightened strategic planning, knowledge acquisition, and other related benefits. It is recommended that forthcoming researchers incorporate interviews with private sector representatives as a means of contrasting perspectives. Researchers may opt to utilise innovative techniques to conduct their study and apply a novel methodology to compare their research outcomes with those of others, thereby facilitating fellow researchers' work. Finally, it is recommended that researchers conduct a comparative analysis of ASEAN member states to enhance the novelty of future research and gain insights into other nations. However, it is also possible to compare the utilisation of Information and Communication Technology (ICT) in agriculture in developing countries. Consequently, they will be capable of obtaining superior information that could impact the study's conclusions.

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