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Article

Comparative Study of Agricultural Extension Methods Used by the Public and Private Sectors Before and During COVID-19 Pandemic in Myanmar: A Case Study

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Abstract: Agricultural extension plays a crucial role in the development of the agricultural sector and the dissemination of agricultural information. There are three extension methods, namely individual, group, and mass methods, that facilitate communication between extension workers and farmers. The study was conducted to examine the agricultural extension methods used by the public and private sectors before and during COVID-19 pandemic, and to investigate farmers' preference of agricultural extension methods used by the public and private sectors before and during COVID-19 pandemic in the Zeyarthiri township, Nay Pyi Taw Union Territory. A total of 60 respondents from three villages were interviewed using structured interview questionnaires for quantitative and qualitative data in July 2022. The demographic characteristics, agricultural extension methods received by farmers, and farmers' preference of agricultural extension methods by the public and private sectors were all collected. The descriptive analysis and paired sample t-test were used to compare agricultural extension methods used by both sectors. The Chi-square Friedman test was also conducted to analyze farmers' preference on extension methods with a 5-point Likert scale (1932) before and during the pandemic in SPSS. In terms of farmers' preference, they mostly liked farm and home visits under the individual method used by both sectors among other extension methods in this study area. It indicates that individuals can speak with extension staff members face-to-face during farm and home visits about anything they want to know. During COVID-19 pandemic, the farmers mostly preferred "TV" under the mass method. It means that TV is the best way, not only for COVID-19 restrictions but also for quick access to agricultural information during COVID-19 pandemic.

Keywords: agricultural extension methods; farmers' preference; public and private sectors; COVID-19 pandemic

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1. Introduction

Agriculture is the most important one and is also considered as the backbone economy in the developing countries including Myanmar. In Myanmar, the Ministry of Agriculture, Livestock, and Irrigation (MOALI) has been in charge of the country's agriculture industry since the times of colonization, despite the Ministry's name changing over time (Khaing, 2017). Since it was founded and continues to be so currently, the Agricultural Extension Department has been essential in increasing agricultural productivity ever. The development of a more effective system of agricultural extension relies on adaptable agricultural specialists who are most actively involved in both research demonstrations and the dissemination of the newly appropriate information and technologies to the recipients, such as farmers who live in rural villages, particularly in remote areas in Myanmar. Private and public agricultural extension plays a major role in the capacity building and fulfilling the goals of rural people. Their mission is to support farmers' learning and decision-making regarding improvements to their farming systems, including the use of new technologies, and the handling of issues like food security, poverty alleviation, environmental management, and product marketing.

The Ministry of Agriculture (MOA) set up the Department of Agriculture (DOA) in 1906 because agricultural extension in Myanmar has always received full government support. The MOA had a number of name changes to reflect the goals of the national policy until being restructured as the Ministry of Agriculture and Irrigation (MOAI) in 1996. Among the 14 institutions under MOAI in late 2006, Myanma Agriculture Service (MAS), Myanma Farm Enterprise (MFE), Myanma Jute Industries (MJI), Myanmar Cotton and Sericulture Enterprise (MCSE), Myanma Sugarcane Enterprise (MSE), etc., are primarily in charge of both the development of technologies and the distribution of suitable agro technologies to the farmers (Oo & Ando, 2012). The only government organization tasked with providing farmers' extension services is the Department of Agriculture (DOA), which is headed by a Director General. Production of seeds, education and training, and research and development (R&D) are its three main duties. The DOA is in charge of transferring the necessary technology through agricultural extension programs (Ponniah et al., 2008). From the perspective of the private sector, for example, different kinds of companies are also expanding their services, which are not limited to seed distributors, pesticide and fertilizer distributors, dealers of other crop management tools, etc., in other countries (Davis & Heemskerk, 2012) and also in Myanmar. The various roles of the private sector were performed as (i) input suppliers and dealers selling pesticides and farm implements; (ii) corporate sector (commercial crops plus farm implements); and (iii) community-based organizations. In addition to providing the technology, input suppliers can participate in agricultural innovations through their networks, share knowledge and perform activities, provide funding, and deliver information (United States Agency for International Development, 2019).

Agricultural extension plays a vital role in disseminating environmentally friendly technology packages, protecting the foundation of natural resources, and improving high-quality production. The extension agents have mostly discussions with rural people to understand more about their problems and to assist them in coming up with appropriate strategies. There are three extension methods, such as 1. individual methods, 2. group methods, and 3. mass methods, to extend knowledge and skills to rural people in the agricultural sector by drawing their attention towards them, arousing their interest, and helping them to have a successful experience of the new technologies and practices. In the individual methods, the extension agent meets the farmer at home or on the farm, explores topics of shared interest, and provides advice and information to them. This method is effective for tasks that each farmer or household can complete on their own or under complete control. Secondly, when using the group method, the agent meets with the group of farmers to conduct extension work. The agent thereby reaches a larger audience than the individual method. For example, group meetings, demonstrations, field days, and tours, etc. Thirdly, mass extension methods involve informing the public through the use of mass media, such as radio, television, newspapers, films, and posters. In general, mass media methods for disseminating agricultural information are helpful in quickly reaching a large audience (Irfan et al., 2006).

In Myanmar, the Ministry of Health and Sports (MOHS) announced the isolation and precautions due to the COVID-19 pandemic for the people starting in March 2020. Therefore, it creates limitations like travel restrictions and a prohibition on public meetings and gatherings that make it challenging for farmers to access agricultural extension services. On the other hand, the agricultural extension personnel frequently lack the mobility to interact with the farmers and supply them with agricultural advice (Talukder et al., 2021). Farmers were faced with a barrier to selling their agricultural products after their harvest from the field, so their income was lower during the pandemic than before. Furthermore, rural families relied on their migratory children; the remittances from the tributaries have been steadily decreasing; and there was a scarcity of labor at the time of sowing (International Food Policy Research Institute, 2021). It is suspected that improper use of teaching methods is making extension services less effective (Umeh et al., 2018). Moreover, the efficiency of extension teaching methods is also influenced by the lack of contact between extension staffs and farmers. (Khan & Akram, 2012). That's why, agriculture and its related sectors must be powerful because they are directly tied to society's most fundamental needs during COVID-19 pandemic. The situation will get worse if the agricultural sector is not resilient enough to handle this pandemic.

Based on the above circumstances, there is a need to prepare for the development of the agricultural sector and its related activities when the outbreak of COVID-19 pandemic stops. Thus, this study focused on the comparative study of agricultural extension methods accessed by farmers that are used among both sectors in the area of Nay Pyi Taw Union Territory. This research was conducted with two objectives, as below:

(i) To examine the agricultural extension methods used by the public and private sectors before and during COVID-19 pandemic.

(ii) To investigate farmers' preference for agricultural extension methods used by the public and private sectors before and during COVID-19 pandemic.

2. Research Methodology

2.1. Study Area

Nay Pyi Taw is the administrative capital of Myanmar, where all ministries are located. There are eight townships in Nay Pyi Taw such as Ottarathiri, Dekkinathiri, Zeyarthiri, Poppathiri, Zabuthiri, Pyinmana, Tatkone, and Lewe. Among them, Zeyarthiri Township (see Figure 1) was chosen as a sample area to evaluate agricultural extension methods used by both sectors because there is the existence of Yezin Agricultural University (YAU), the Department of Agriculture (DOA), the Department of Agricultural Research (DAR), the Agricultural Extension and Rural Development Training Center (AERDTC), and Knowledge centers (KC), which would provide access to agricultural extension activities and improved agricultural technologies. As described in Table 1, there are seven knowledge centers in this township such as 1) Khit Aye, 2) Sipin Tharyar, 3) Kyauk Chat, 4) Aung Zay Ya, 5) Nyaung Pin Gyi Su, 6) Seinzabin, and 7) Kyun Yaung.

Table 1. List of knowledge centers (KC) in Zeyarthiri Township.

No.	Knowledge centers (KC)	Number of Farmers
1	Khit Aye	747
2	Sipin Tharyar	1100
3	Kyauk Chat	1103
4	Aung Zay Ya	545
5	Nyaung Pin Gyi Su	675
6	Seinzabin	816
7	Kyun Yaung	1166
	Total	6152

Source: DOA, personal communication (2022).

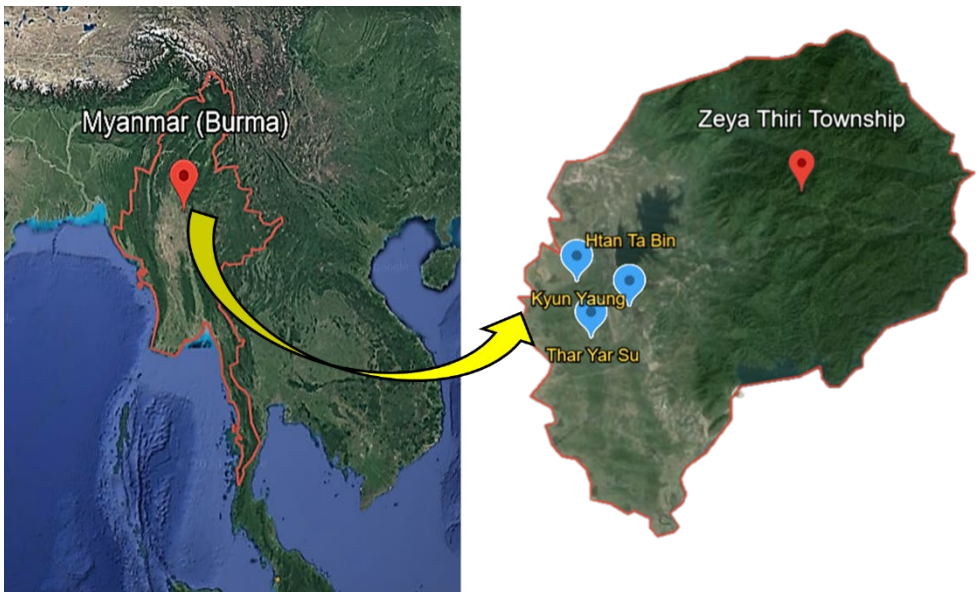

Figure 1. Location of study area.
Source: Google Earth.

2.2. Data Collection

The field survey was carried out in three villages of Zeyarthiri township, Nay Pyi Taw in July 2022. The structured questionnaire was revised based on the information collected from the pilot survey. Thus, the primary data was collected with the help of a pre-tested interview schedule and a well-structured questionnaire, whereas secondary data (list of knowledge centers) was collected from the Department of Agriculture (DOA), Zeyarthiri township. The township was purposively selected with the factors described in the study area. There were three villages such as Kyun Yaung, Htan Ta Bin, and Thar Yar Su randomly selected from two village tracts (Kyun Yaung and Ma U Taw) in Zeyarthiri township.

The total sample size was collected sixty sample respondents of farmers which were randomly selected with twenty sample respondents from each selected village. The questionnaire of respondents was conducted to collect the following information: demographic characteristics, agricultural extension methods used by both sectors (see Table 2) with the conceptual framework (as in Figure 2), and also farmers' preference for extension methods that are used by both sectors.

2.3. Data Analysis

Both qualitative and quantitative data were first input into Microsoft Excel after being collected from a total sample size via an interview schedule. Microsoft Excel was also used to calculate the descriptive analysis and paired sample t-test. Descriptive statistics like mean, percentage, frequency, and standard deviation were used to describe demographic characteristics, and a paired sample t-test was used to evaluate both two different situations, like before and during the pandemic and two different sectors within the same sample of respondents. Thus, a paired sample t-test was chosen to compare agricultural extension methods offered by both sectors (public and private) before and during this pandemic. The analytical techniques were used for the Chi-square Friedman test by SPSS (Statistical Package for Social Science Software) version 25.0. The Chi-square Friedman test was conducted to analyze farmers' preference on extension methods before and during COVID-19 pandemic.

2.3.1. T-Test for 1st Objective

The following formula was used to answer the aim of the research, namely the first objective which was to know agricultural extension methods before and during COVID-19 pandemic. This formula used in this study was the Paired sample t-test as below (Mayesty et al., 2022) :

$$t = \frac{\overline{D}}{SD / \sqrt{N}} \tag{1}$$

To get the average difference in measurement 1 and 2, use as below:

$$\overline{D} = \frac{\sum_1^n = 1^{d_i}}{n} \tag{2}$$

To get the value of the deviation and standard deviation, use as below:

$$SD = \frac{\sqrt{\sum_{i=1}^{n} (d_i - d)^2}}{n-1} \tag{3}$$

where,

t = value "t" count
$\overline{\mathbf{D}}$ = Average difference in measurement 1 and 2
SD = Standard deviation of the difference in measurement of 1 and 2
N = Number of samples
d_i = difference of each pair
d = Mean

2.3.2. Chi-square Friedman Test for 2nd Objective

The analysis of farmers' preference ranking was calculated by the Friedman's test (Fr.) It can be demonstrated that the statistic Fr. is distributed approximately as chi-square ($\chi 2$) with d.f.= k-1 when the number of rows and/or columns is big (Abeyasekera, 2001).

$$\chi^2 = \sum^{k} \frac{(O_i - E_i)^2}{E_i} \tag{4}$$

where,

$\boldsymbol{\chi^2}$ = chi-square
$\mathbf{O_i}$ = observed frequency;
$\boldsymbol{E_i}$ = expected frequency;
$\boldsymbol{\Sigma}$ = summation sign; and
k = category of observation. (Adie et al., 2021)

The response options ranged from strongly agree = 5, agree = 4, neutral = 3, disagree = 2, and strongly disagree = 1. This type of Likert scale was used to analyze 2nd objective.

Table 2. Agricultural Extension Methods Used by Public and Private Sectors.

Methods	Types	References
Individual	1. Farm & home visit, 2. Office calls, 3. Phone contacts, 4. Visiting Knowledge Center (KC)	Oakley and Garforth (1985); Buyinza et al. (2009); Khan and Akram (2012).
Group	1. Demonstration, field tour & field visit, 2. Group discussion	
Mass	1. Radio, 2. TV, 3. Pamphlet, 4. Poster, 5. Mobile phone, 6. Facebook, 7. Call center	Irfan et al. (2006); Christopher et al. (2013); Surudhi et al. (2017).

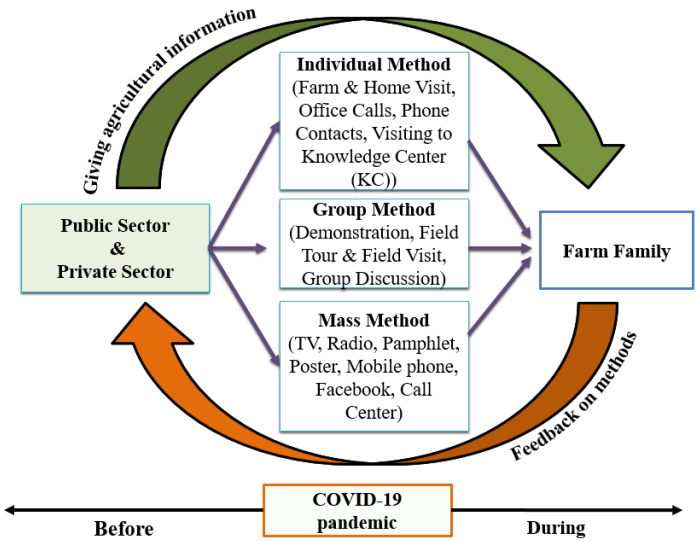

Figure 2. Conceptual framework of the research.
Source: Authors (2022).
Note: Methods adopted from various literature.

3. Results and Discussion

3.1. Demographic Characteristics of Sample Farmers

3.1.1. Age

The age of respondents was categorized into three groups: young, middle, and old (shown in Table 3), and their mean age was 50 years, within the range of 21–78 years. The results revealed that most of the respondents are in the middle age group (66.7%), which is between 38 and 63 years old. This was followed by the young age group (18.3%) under 38 years and the old age group (15%) with 64 years and above, respectively. The average age finding is similar to the finding of Thar et al. (2021) in Nay Pyi Taw, Myanmar, where the average age is also 50 years.

3.1.2. Educational Status

The level of education in sample respondents was articulated under these options: graduate, high school, middle school, primary school, monastic education, and illiterate (see Table 3). The result showed that significantly 46.7 percent obtained middle school education. Secondly, 26.7 percent and 18.3 percent attained primary and high school education. Then, it is remarkable that only about 5 percent are monastic education among sample respondents. Moreover, 1.7 percent similarly obtained the ability to read and write, and the graduate level. The level of education can affect the ability to receive knowledge, use new agricultural technologies, and utilize modern ICT (information and communications technology) tools. According to the results, farmers can access agricultural information using ICT tools because their education level is highest at the middle school level. Win and Htwe (2020)found that farmers who possess middle education was the highest percentage (40%) therefore, farmers were able to accept both appropriate agricultural information and appropriate technologies to improve their agricultural productions.

3.1.3. Asset of ICT Tools

Information and Communication Technology (ICT) assets are important to receive agricultural information and technology. In this study, the data were collected on the respondents and what kinds of ICT tools they possessed. The assets of respondents on ICT tools include televisions, radios, mobile phones, and laptops (see Table 3). The percentage of respondents who own mobile phones and TVs were 98% and 95% respectively. Only 6.7% of them had laptops, whereas nearly 25% had radios. Thar et al. (2021) reported that the assets of mobile phones had the highest percentage (71%) in Zeyarthiri, Tatkone, and Taungoo townships in Myanmar. Additionally, she found that although farmers in the study area own a high percentage of mobile phones, internet usage is relatively low (38%). Then, Ferris et al. (2008) also found that 86% of farmers had access to a mobile phone, which helped them build connections with others, particularly extension specialists. And then, Abbas et al. (2003) claimed that the mass extension method (presence of TV, radio, etc.) is a crucial source in getting reliable new agricultural technologies for rural communities in Asian countries.

Table 3. Demographic Characteristics of Sample Farmers (n=60).

Variables	Respondents	
	Frequency	Percentage (%)
Age (yrs)		
Young group (≤ 38)	11	18.3
Middle group (38 – 63)	40	66.7
Old group (≥ 64)	9	15.0
Mean	50	
Std. Dev.	13	
Educational Status		
Able to read and write	1	1.7
Monastic Education	3	5.0
Primary School	16	26.7
Middle School	28	46.7
High School	11	18.3
Graduate	1	1.7
Assets of ICT tools		
TV	57	95
Radio	15	25
Mobile phone	59	98.3
Laptop	4	6.7

Source: Field survey (2022).

3.1.4. Farming Experience

The respondents were additionally asked about their individual farming experiences, and their answers were grouped according to how many years of experience they had. The results are shown in Figure 3. In accordance with the results, 25.0% of respondents had 11–20 years of farming experience. 21.7% had between 21 and 30 years as well as between 31 and 40 years of farming experience. Only 18.3% of respondents, or those who had experience below 10 years. Khan and Akram (2012) found that 11–20 years of farming experience was the highest percentage (44%) which is similar to this finding. Although it is described as 11–20 years of farming experience, their farmers were experts in their farming activities because they possessed traditional experience from their ancestors in Pakistan.

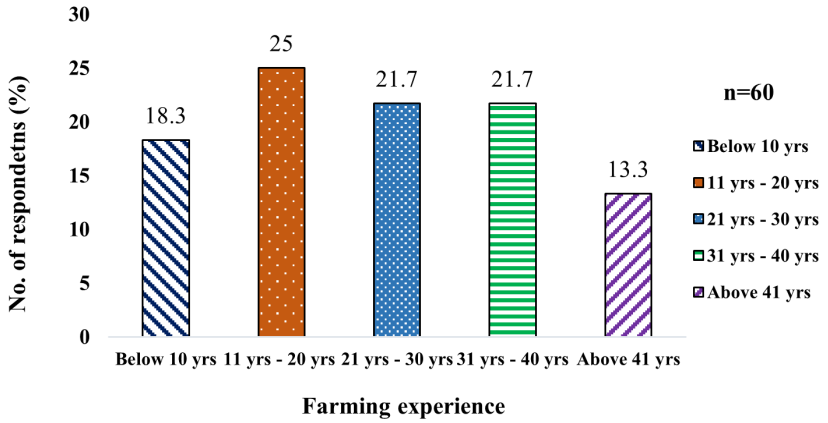

Figure 3. Farming experience of respondents in the study area.
Source: Field survey (2022).

3.2. Access to Field Visit from Public and Private Sectors Before and During COVID-19 Pandemic

According to the public sector, respondents answered "visit" (63.3%) and "no visit" (36.7%) in the same amount both before and during COVID-19 pandemic. The conditions of the field visits to the farmers in this sector remain unchanged. In the private sector, 86.7% of farmers answered "visit", and 13.3% of farmers answered "no visit" before COVID-19 pandemic. Next, 60% of farmers answered "visit", and 40% of farmers answered "no visit" in the private sector during the pandemic. Thus, there have been slightly significant changes in the conditions of field visits by the private sector to the farmers (see Table 4 & 5).

As in Table 4, there was a high significance in two sectors before COVID-19 period. It can be assumed that both sectors have no barriers to disseminate their agricultural information but there was no significant in during COVID-19 between both sectors. Thus, there was an alternative calculation to know whether each sector was significant or not in these two periods as shown in Table 5. As a result, the role of the private sector was more distinct than that of the public sector both before and during COVID-19. In Pakistan, Talib et al. (2017) found that private extension services were more effective than public extension services in most aspects.

Table 4. Differences Between Public and Private Sectors in Accessing Field Visits Before and During COVID-19 Pandemic (n=60).

Categories	Before				During			
	Public		Private		Public		Private	
	F	%	F	%	F	%	F	%
No Visit	22	36.7	8	13.3	22	36.7	24	40.0
Visit	38	63.3	52	86.7	38	63.3	36	60.0
t-value	−2.96**				0.31^{ns}			

Source: Field survey (2022).
Note: F=frequency. t-value, ns, and ** represent not significant, significant at 5%.

Table 5. Differences Between Before and During COVID-19 Pandemic in Accessing Field Visits of Each Sector (n=60).

Categories	Public				Private			
	Before		During		Before		During	
	F	%	F	%	F	%	F	%
No Visit	22	36.7	22	36.7	8	13.3	24	40.0
Visit	38	63.3	38	63.3	52	86.7	36	60.0
t-value	0.00^{ns}				4.63**			

Source: Field survey (2022).
Note: F=frequency. t-value, ns, and ** represent not significant, significant at 5%.

Moreover, the frequency of visits per month in the public sector and the private sector most occurred at least once before and during COVID-19 pandemic in comparison with how many visits to the farmers (see Table 6). Before Covid-19, the comparison of visit percent in both sectors are nearly the same to receive agricultural information. Moreover, the percentage of once and twice visits is not quite different during COVID-19. But significantly, the private sector had thrice visits per month, with 11.1% compared to the public sector during COVID-19 with no respondents in the public sector.

Based on this finding, farmers rarely received information from the public sector during the pandemic because a respective extension agent per area can only provide services to them at a fortnightly interval in a month. In these conditions, the private sector is visited more frequently than the public sector because the agents of the private sector are getting more incentives than agents of the public sector, like supporting vehicles and daily allowances in Myanmar. And then, there have been many different organizations, like Myanma Awba, Farm Link, Wisara, etc., in the private sector that have visited the study areas, even though there are few departments like DOA in the public sector. Therefore, Abbas et al. (2021a) reported that several private sector extension organizations (FMC, Jaffer Brother, Arysta Life Science, Bayer Crops, etc.) are present to provide agricultural services to the local farming community. That's why, they frequently contacted the field of farmers or their home one after one in Pakistan.

Table 6. Frequency of Visit Per Month from The Public and Private Sectors Before and During COVID-19 Pandemic.

Visit/Month	Before				During			
	Public (n=38)		Private (n=52)		Public (n=38)		Private (n=36)	
	F	%	F	%	F	%	F	%
Once	21	55.3	23	44.2	33	86.8	27	75.0
Twice	12	31.6	22	42.3	5	13.2	5	13.9
Thrice	5	13.1	7	13.5	0	0.0	4	11.1

Source: Field survey (2022).
Note: F=frequency. * n based on no. of visit from Table 4 and 5.

3.3. Comparison of Extension Methods Offered by Public Sector Between Before and During COVID-19 Pandemic

The respondents received different extension methods namely individual, group, and mass methods as shown in Table 7. Based on these group methods (excluding no visit data), 50.0% of respondents received information through the group method, followed by the individual method (36.8%) and the mass method (13.2%) before COVID-19. In normal conditions, farmers were mostly involved in results demonstrations and group discussions in their local villages, which are held by the public sector. Therefore, the group method in comparison had the highest percentage before COVID because farmers could discuss their problems, seek solutions to their farming issues with each other, and also be attracted to community development toward sustainability. Buyinza et al. (2009) stated that most of the farmers in Uganda preferred group methods for disseminating their agroforestry technologies because this method enabled farmers to help each other and motivated them for self-development and empowerment.

On the contrary, 47.4% of respondents received agricultural techniques through the mass method, followed by the individual method (44.7%) and the group method (7.9%) during COVID-19. The mass method among extension methods was potential for the farmers during the pandemic. Therefore, mass methods were especially effective in transmitting agricultural technologies to farmers through communication channels like farmer channels, social media, etc. possessed by the public sector when situations faced not only a limited number of extension staff members but also disasters, pandemics, and other crises. In this case, the percentage of individual methods was also as high as the mass method because farmers used telephone calls during this pandemic to maintain the rules and regulations.

But there is no significant difference in the extension methods used by the public sector before and during COVID-19 pandemic as the result of the t-value. Shanabhoga et al. (2017) described that when there are fewer extension staff members available, telephone calls are a more effective way for the extension personnel in public extension to communicate in normal circumstances. According to Mayesty et al. (2022), the result found a significant difference in extension methods by public sectors during COVID-19 pandemic in Indonesia. This is demonstrated by the way in which extension workers and their target groups hold discussions via social media and other channels among mass methods. There is no specific time to discuss with the extension agent, and they can use it anywhere and anytime when there are several government restrictions

that have led to a lack of direct communication. Moreover, the mass method, as opposed to the group method, which is frequently used by extension agents will significantly increase farmers' adoption of new technologies and agro-information in Nigeria (Umeh et al., 2018).

3.4. Comparison of Extension Methods Offered by Private Sector Between Before and During COVID-19 Pandemic

According to the private sector (also excluding no visit data), 75% of respondents received information through the group method, followed by the individual method (15.4%) and the mass method (9.6%) before the pandemic. On the other hand, 50% of respondents received information through the mass method, followed by the individual method (36.1%) and group method (13.9%) during the pandemic. There is a highly significant difference among extension methods used by the private sector for the dissemination of agricultural information before and during COVID-19 pandemic in the result of t-value (see Table 7).

Also, the results were the same case with the public sector before and during COVID-19. The group method before COVID-19 was also effective by the private sector because there has more cost-effective in delivering any agricultural information and it could reach medium large number of people in a short period. Abbas et al. (2021a) reported that the private sector paid more attention and used the group method better because it was cost-effective and time-saving. Especially, it tends towards profit-making by reaching a large number of farmers to use their products in Pakistan.

Table 7. Comparison of Extension Methods Offered by Public and Private Sectors Between Before and During COVID-19 Pandemic (n=60).

Categories	Public		Private	
	Before (n=38)	During (n=38)	Before (n=52)	During (n=36)
Individual	14 (36.8)	17 (44.7)	8 (15.4)	13 (36.1)
Group	19 (50.0)	3 (7.9)	39 (75.0)	5 (13.9)
Mass	5 (13.2)	18 (47.4)	5 (9.6)	18 (50.0)
t-value	**−0.78 ns**		**2.56****	

Source: Field survey (2022).
Note: (1) Figures in the parentheses represent percentage.
(2) t-value, ns, and ** represent not significant, significant at 5%.

On the other hand, the mass method was also essential in disseminating information for extension agents and target populations when there is a decrease in individual and group methods due to governmental policies to minimize crowded conditions during COVID-19. Also, Abbas et al., (2021b) stated that this method was cost-effective but it was partially helpful which had to be considered in changing the behavior of farmers. On the other side, they could not sell their products to the farmers compared to other teaching methods because they were more interested in their benefits according to their principles.

3.5. Farmers' Preference on Extension Methods Before COVID-19 Pandemic

According to the results of the score (see Table 8 & 9), most of the farmers preferred (i) farm and home visit (4.18, individual method), (ii) demonstration, field tour, and field visit (4.12, group method), (iii) group discussion (4.05, group method) and (iv) TV (3.92, mass method), etc. in this study area. Under individual and group methods, they directly acquired agricultural knowledge as well as cutting-edge technologies through face-to-face interactions. They also discussed the difficulties and roadblocks they faced in farming and what they needed from the public sector. The Friedman test was used to determine whether significant differences existed among the extension methods preferred by the respondents. The Friedman test ($\chi^2 = 167.69$; $p<0.05$) was significant, which meant that significant differences existed.

Okwu and Daudu (2011) reported that crop farmers preferred individual teaching methods (farm and home visit, office calls, and telephone calls) in Benue State of Nigeria because they valued direct communication with extension agents alongside fellow farmers. As the same results of Shaibu et al. (2023), the group method interaction within a group is intended to share ideas, feelings, and actions related to the topic being discussed (adoption of suggested cowpea production techniques) in their cowpea farmers.

Table 8. Farmers' preference on all extension methods before COVID-19 pandemic (n=60).

Extension methods	SD	D	N	A	SA
Individual methods					
Farm & home visit	0 (0.0)	1 (1.7)	7 (11.7)	32 (53.3)	20 (33.3)
Office calls	10 (16.7)	29 (48.3)	8 (13.3)	13 (21.7)	0 (0.0)
Phone contacts	1 (1.7)	15 (25.0)	14 (23.3)	27 (45.0)	3 (5.0)
Visiting knowledge centers	1 (1.7)	7 (11.7)	7 (11.7)	36 (60.0)	9 (15.0)
Group methods					
Demonstration, field tour & field visit	0 (0.0)	4 (6.7)	4 (6.7)	33 (55.0)	19 (31.7)
Group discussion	0 (0.0)	3 (5.0)	5 (8.3)	38 (63.3)	14 (23.3)
Mass methods					
Radio	1 (1.7)	11 (18.3)	19 (31.7)	25 (41.7)	4 (6.7)
TV	0 (0.0)	7 (11.7)	6 (10.0)	32 (53.3)	15 (25.0)
Pamphlet	0 (0.0)	4 (6.7)	12 (20.0)	32 (53.3)	12 (20.0)
Poster	0 (0.0)	4 (6.7)	18 (30.0)	27 (45.0)	11 (18.3)
Mobile phone	1 (1.7)	13 (21.7)	14 (23.3)	25 (41.7)	7 (11.7)
Facebook	1 (1.7)	14 (23.3)	12 (20.0)	27 (45.0)	6 (10.0)
Call center	4 (6.7)	16 (26.7)	13 (21.7)	25 (41.7)	2 (3.3)

Source: Field survey (2022).
Note: (1) Figures in the parentheses represent percentage.
(2) SD=strongly disagree, D=disagree, N=neutral, A=agree, SA=strongly agree.

Table 9. Mean and Mean Rank of Farmers' Preference on Extension Methods Before COVID-19 Pandemic (n=60).

Extension methods	Types	Mean	Mean Rank
Farm & home visit	I	4.18	8.92
Demonstration, field tour & field visit	G	4.12	8.85
Group discussion	G	4.05	8.58
TV	M	3.92	8.23
Pamphlet	M	3.87	7.92
Visiting knowledge centers	I	3.75	7.50
Poster	M	3.75	7.29
Facebook	M	3.38	6.43
Mobile phone	M	3.40	6.36
Phone contacts	I	3.267	5.9
Radio	M	3.33	5.88
Call Center	M	3.08	5.48
Office calls	I	2.4	3.68
χ^2			**167.69****

Source: Field survey (2022).
Note: (1) I (individual method), G (group method), M (mass method)
(2) χ^2 value, ** represent significant at 5%. ** = highly accessible.

3.6. Farmers' Preference on Extension Methods During COVID-19 Pandemic

During the COVID-19 pandemic, farmers also strongly preferred TV among the mass extension methods (as shown in Table 10 & 11). According to the results of mean value, farmers preferred TV (4.07, mass method), followed by pamphlets (3.83, mass method), posters (3.78, mass method), mobile phones (3.65, mass method), and phone contacts (3.65, individual method), etc. as their mostly preferred extension methods during COVID-19 pandemic. The Friedman test was used to determine whether significant differences existed among the extension methods preferred by the respondents. The Friedman test (χ^2 = 152.67; $p<0.05$) was significant, which meant that significant differences existed. Nowadays, almost everyone owns a television (TV) in Myanmar.

Therefore, they can rely on TV while it broadcasts agricultural information for farmers. It is a very effective way for the farmers who are living in remote areas to cope with sudden restrictions like this pandemic. TVs have the ability to disseminate information to large audiences efficiently and effectively.

Chhachhar et al. (2012) showed that a large number of respondents believed that television is a useful medium for educating the public about agriculture in the study of Sindh, Pakistan. As a result, the government ought to make effective use of television, particularly its educational programming, to provide the public with important and relevant information. Here, non-governmental organizations and television networks could be extremely helpful to the government in enabling and supporting the realization of this goal.

Syiem and Raj (2015) also reported that TV had the second-highest percentage in the state of Meghalaya, North-East India, which is similar to these findings. Their farmers used ICT tools, especially television (TV), to learn the scientific method of transplanting followed by post-harvest management, in contrast to other agricultural technology. These technologies are frequently shown on the Kissan TV channel of Doordarshan Kendra Shillong (Meghalaya) because they are location-specific and focused on the needs of the state's farmers.

Table 10. Farmers' Preference on All Extension Methods During COVID-19 Pandemic (n=60).

Extension methods	SD	D	N	A	SA
Individual methods					
Farm & home visit	12(20.0)	17 (28.3)	12 (20.0)	16 (26.7)	3 (5.0)
Office calls	9 (15.0)	27 (45.0)	15 (25.0)	9 (15.0)	0 (0.0)
Phone contacts	0 (0.0)	6 (10.0)	18 (30.0)	27 (45.0)	9 (15.0)
Visiting knowledge centers	3 (5.0)	16 (26.7)	22 (36.7)	18 (30.0)	1 (1.7)
Group methods					
Demonstration, field tour & field visit	1(1.7)	14(23.3)	14(23.3)	18(30.0)	13(21.7)
Group discussion	8(13.3)	15(25.0)	16(26.7)	19(31.7)	2(3.3)
Mass methods					
Radio	2 (3.3)	7 (11.7)	25 (41.7)	24 (40.0)	2 (3.3)
TV	0 (0.0)	4 (6.7)	6 (10.0)	32 (53.3)	18 (30.0)
Pamphlet	0 (0.0)	4 (6.7)	14 (23.3)	30 (50.0)	12 (20.0)
Poster	0 (0.0)	4 (6.7)	17 (28.3)	27 (45.0)	12 (20.0)
Mobile phone	2 (3.3)	6 (10.0)	12 (20.0)	31 (51.7)	9 (15.0)
Facebook	2 (3.3)	9 (15.0)	17 (28.3)	24 (40.0)	8 (13.3)
Call center	2 (3.3)	12 (20.0)	18 (30.0)	27 (45.0)	1 (1.7)

Source: Field survey (2022).
Note: Figures in the parentheses represent percentage. SD=strongly disagree, D=disagree, N=neutral, A=agree, SA=strongly agree.

Table 11. Mean and Mean Rank of Farmers' Preference on Extension Methods During COVID-19 Pandemic (n=60).

Extension methods	Types	Mean	Mean Rank
TV	M	4.07	9.44
Pamphlet	M	3.83	8.49
Poster	M	3.78	8.29
Mobile phone	M	3.65	7.92
Phone contacts	I	3.65	7.88
Demonstration, field tour & field visit	G	3.47	7.42
Facebook	M	3.45	7.13
Call Center	M	3.22	6.66
Radio	M	3.28	6.63
Group discussion	G	2.87	5.82
Visiting knowledge centers	I	2.97	5.68
Farm & home visit	I	2.68	5.38
Office calls	I	2.4	4.28
χ^2		**152.67****	

Source: Field survey (2022).
Note: (1) I (individual method), G (group method), M (mass method).
(2) χ^2 value, ** represent significant at 5%. ** = highly accessible.

4. Conclusions

Farmers with middle school level and above can access agricultural information using ICT tools and digital extension programs under the mass method. In Myanmar's education system, English is taught grammatically from Grade 5 to 8 at the middle school level. Because of an understanding of English, it facilitates these tools and makes it easy to learn to use them. As most of the respondents are middle-aged, they can become more familiar with ICT if they are given systematic training to use ICT tools because the mass method involves the use of ICT to increase the rate of adoption of required information by a large number of farmers (Umeh et al., 2018). Farmers possess the highest percentage of mobile phones. Mobile phones created many advantages for the smallholder farmers aside from its unique characteristics of being handy, customized content delivery, and convenience. But mobile phones still have weaknesses such as a lack of familiarity with ICT equipment, a high cost of data, and the fact that not every house is equipped with Wi-Fi. Farmers possess the second highest percentage of TV (non-interpersonal), and it is an old ICT that farmers have been familiar with for a long time and is an easy-to-use tool.

The conditions of field visits from the view of both sectors before and during COVID-19 pandemic, although there are no changes from the public sector to farmers because employees in government sectors have to go to the office on a rotating basis during the lockdown period, highly significant changes were found from the private sector. In the comparison of extension methods offered by both the public and private sectors before and during COVID-19 pandemic, the group extension method was the most widely used method before the pandemic, and although the method of mass extension was less used before the pandemic, it is widely used during the pandemic.

According to farmers' preferences, farmers mostly preferred farm and home visits, demonstrations, field tours, and field visits among individual and group extension methods before COVID-19 because they could discuss individually and had more opportunities with face-to-face discussion about their difficulties and problems encountered in their farming practices. In contrast, farmers preferred TV and pamphlets among the mass extension methods during COVID-19 pandemic. TV plays a significant role in educating farmers about the usage of various pesticides and fertilizers, market information, innovative agricultural techniques, and expert advice. It is the best way, not only for COVID-19 restrictions but also for quick access to agricultural information during COVID-19 pandemic.

Especially since there is the name "Farmer Channel" in the television system under the public sector of Myanmar, it has been released about the agricultural information for the farmers that was started many years ago. TV channels that provide farmers with agricultural formation should develop creative edutainment programs. If TV is one of the extension methods that can help Myanmar's farmers both during restricted situations and receiving electricity regularly, digital extension programs should be improved and also provided to extension personnel in order to disseminate agricultural information through mass extension methods. However, due to the language barrier among farmers, agricultural information should be broadcast on TV channels so that nearly

all farmers can understand it. Therefore, farmers' digital literacy should also be taken into consideration in extension programs.

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