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Article

Extension Services and Household Food Security of Women Rice Farmers in the Delta Region of Myanmar

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Abstract: The study aimed to analyze women's households' farming practices towards household food security, particularly in six villages of the Ayeyarwaddy region. Data were collected from 126 randomized respondents. Descriptive analysis, Non-parametric Spearman's rank correlation coefficient and stepwise regression methods were applied to analyze the degree of association for extension services upon household food security. Results of the KII and FGD were used to further explain in survey. The respondents are mostly middle-aged women, married, natives of the study sites, and have achieved primary education with the average of five family members. Their earnings from farming are below the poverty threshold of Myanmar. The extension support organizations such as GOs, NGOs, INGOs, and private sectors support extension in this area and government as the primary support by providing and demonstrations. The result of food availability shows rice, fish, eggs, meats, vegetables, legumes are the usual food present in the homes of the respondents. All respondents mostly have rice, vegetables, and fish for a certain period of time in the food accessibility. When it comes to food utilization, most respondents cook their food except lime which they eat raw. In food stability, almost all respondents have enough food in their homes. Access to the extension services as to credit, market infrastructure, and transport accessibility proved to have huge effects on food security. Farm organizations also support food security. In view of all of these, the study recommended the adoption of extension strategies. These techniques are grounded on the respondents' farming practices and extension strategies identified.

Keywords: women households; access to extension services; food security

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1. Introduction

Agriculture is one of the most important sectors in the economy of Myanmar. In 2014-15, the agriculture sector contributed one-fifth of the GDP and total export earnings. Myanmar has more than 22 million hectares, of which more than 8% million hectares are devoted to rice (Shwe & Hlaing, 2011). Almost three-fourths of the farmers' income comes from rice farming (Larry, 2013). Besides Ayeyarwaddy, Bago, Mandalay, Yangon, and Sagaing regions are Myanmar's main paddy growing areas.

Ayeyarwaddy in the Delta region, which is rich in fisheries and the traditional rice bowl of the country. The main source of income is derived from farming in the Ayeyarwaddy region. Livestock and fisheries are the significant food sources and primary sources of income for farmers (Win et al., 2016). Ayeyarwaddy is the most climate-affected region. It loses an average of 11.4 percent of harvest annually to storms, floods, and pests, which is higher than the national average of 7.8 percent (United Nation Development Programme [UNDP], 2014). In 2008, Cyclone Nargis devastated much of the area of the Delta region (Win et al., 2016).

This study was a pioneering investigation on food security related to the farming practices of women households. Women's studies are still lacking in the Delta region. The linkage between women's role and food security is still weak due to the lack of agricultural technologies and extension support (ADB, 2016). No detailed studies were conducted in the Delta region, particularly on food security among the local people and specifically among women households. Moreover, there is no study or research about women in agricultural extension services related to food security. The study's general objective is to analyze the extension practices of female-headed households, and their households' food security in the Delta region of Myanmar. Specifically, the study aimed to:

1.1. Objectives

(1) Describe the socio-economic profile of the respondents.
(2) Discuss the agricultural extension services in the study townships, Delta region.
(3) Determine the factors that affect food security and analyze the relationship between extension services, and food security of female-headed households.
(4) Propose an extension framework.

2. Materials and Methods

2.1. Analytic Framework

The analytic framework developed for this research is presented in Figure 1. The framework lays out the various factors that were covered by this study. Therefore, the measurements of the food security status of households, and the four components of food security as identified by FAO served as the guide in the creation of the framework, and as such, was utilized by the researcher as a guide for data gathering and analysis. Following the literature review and the study's objectives, the researcher analyzed whether certain socio-economic factors, rice farming practices, and access to extension services influence the household food security of female-headed farmers. The socio-economic factors including age, household size, income, and farming practices are believed to be associated with the components of food security.

Women are actively engaging in farming activities, and their labor participation is necessary to attain food security. Therefore, access to extension is crucial and the given extension services allow people to improve food security.

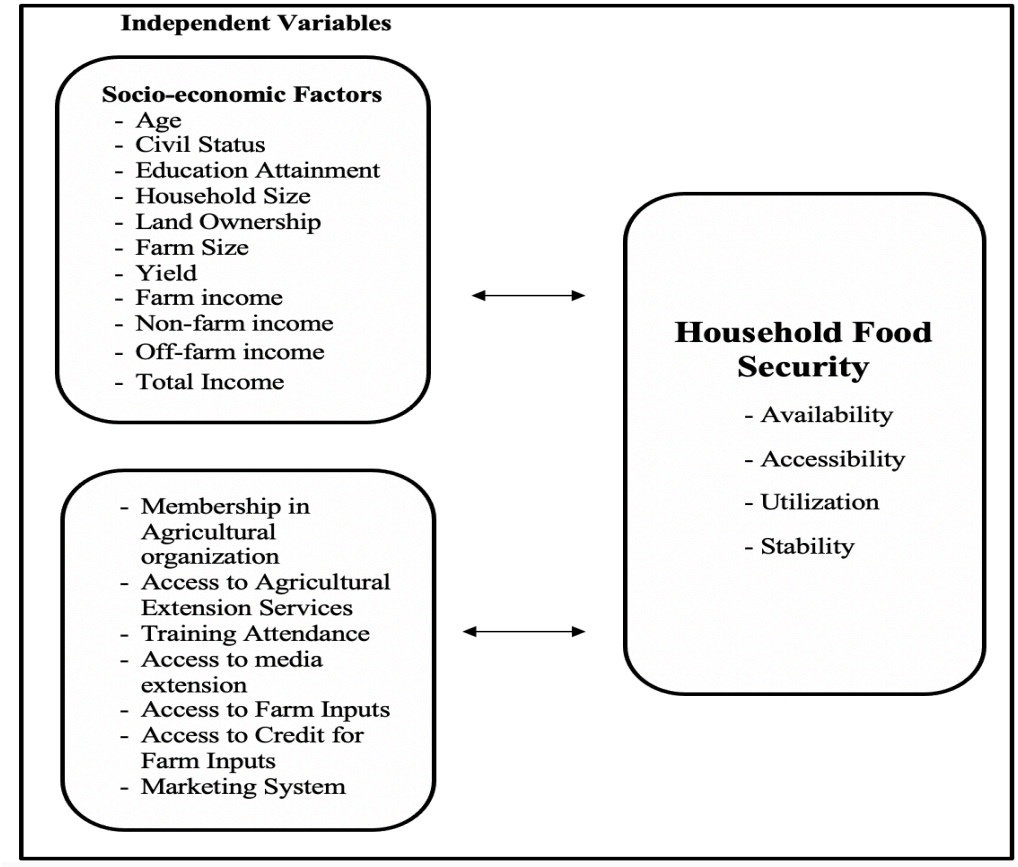
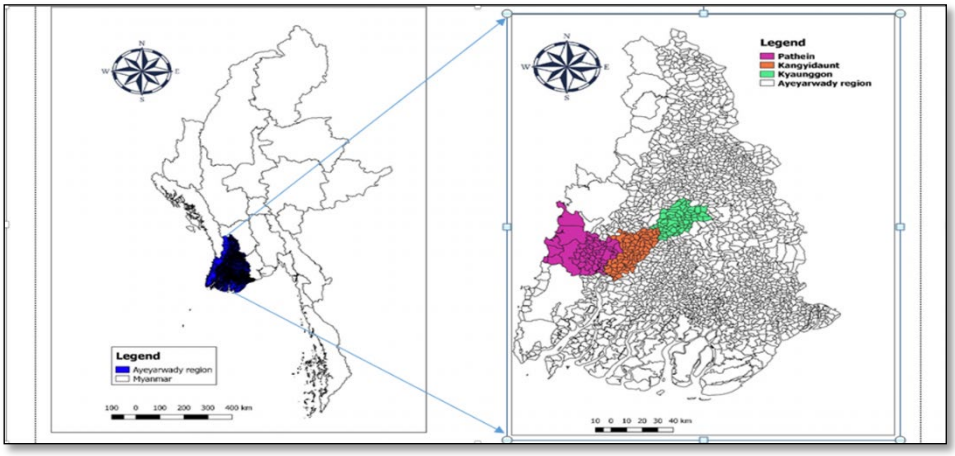


Figure 1. Analytic framework of the locale of the study.

The study was conducted in the six villages of three townships in the Delta region of Pathein District, Myanmar. The study villages are Kan Ni Phyar and Zayat Kwin in Pathein township, Ywa Thit Kone and Kwin Yar Kyi villages in Kangyidaut township, and Hlae Seik and Zayat Seik in Kyaunggon township. The Ayeyarwaddy region has an area of 35,140 km^2 and lies between 16°50″north and longitudes 95°10″ east. It has a population of 6,184,829 people. Delta region was chosen as Myanmar's rice bowl, and the villages selected are rice villages. After the devastation of

Cyclone Nargis in 2008, most farmers became landless, and men-headed farmers moved on to other regions for another livelihood and left their jobs with their wives. Therefore, the areas are the most appropriate sites for this study, considering 42% of the women labor force and impoverished communities that need help for food security. Figure 2 shows this study's research locale.



(a) Myanmar (b) Ayeyarwady region

Figure 2. Location of the Study Area.

3. Results

3.1. Data Collection and Analysis

A total of six villages from three townships was collected. The data was collected from 21 women farmers from each village and thus, the total number of women respondents were 126. Data gathering activities were conducted from November to December 2018. Key informant interview (KIIs) and focus group discussion (FGD) guides were developed based on the flow and content of the survey. Simple Linear Regression and Multiple Linear Regression were used to determine the relationship among the agricultural extension services, and women and their household food security. Non-parametric Spearman's rank correlation coefficient or Spearman's Rho was used to determine the relationship between the independent variables (extension services) and the dependent variables (food availability, food accessibility, food utilization, and food stability).

4. Discussion

4.1. Socio-demographic Profile of the Respondents

4.1.1. Age

Age of the respondents ranged from 23–65 years. The mean age is 45, and a third of the respondents were around mean 41–50 years (Table 1). According to Eisenstein (2020), farmers within 41–50 years are still productive and can devote their time and energy to farm development activities. This finding indicates that most respondents are at a good age to conduct farm activities.

4.1.2. Civil Status

Most of the respondents (76%) are married, while only 3% are separated (Table 1). Kao (2009) reported that women farmers are now actively engaged in supporting their families because they are busy at work or looking after their children and have no access to information. Thus, it is very important and urgent to help women farmers overcome their learning barriers. This finding agrees with the statement of Kao (2009) that most women are married and are actively engaged in farming.

Table 1. Socio-demographic profile of respondents.

	Frequency	Percentage
Age		
30 and below	9	7.11
31–40	37	29.43
41–50	39	31.08
51–60	31	24.60
61 and above	10	7.41
Range=	23–65	
Mean=	45	
St.Dev.=	10	
Civil Status		
Single	19	15.13
Married	95	75.46
Widower	8	6.31
Separated	4	3.22
Educational Attainment		
No Education	8	6.31
Primary School	58	46.02
Middle School	33	26.23
High School	15	12.01
College/University	7	5.51
No Response	5	4.09
Household Size		
Small (Equal or below mean)	77	61
Large (Above mean)	49	39
Range=	2–12	
Mean=	4	
St.Dev.=	2	

4.1.3. Educational Attainment

About 46% of the respondents had attended primary school education, while 6% had not attended formal schooling. Other 48% said they had other forms of education (Table 1). The findings indicated that half of the respondents had low education and literacy rates because they did not get the chance to learn through formal education. In this regard, Chanthavong (2012) reported that women in Asia are poorly educated because boys' schooling is customarily preferred since girls are trained to assist the mother in household chores and help earn income.

4.1.4. Household Size

More than 60% of the households are small household size, while others (39%) are large household size. As per Table 1, the average household size is 4. According to the 2014 Myanmar Population and Housing Census Thematic Report on Housing Conditions and Household Amenities, the average Myanmar national household size is 4.4 (United Nations Population Fund, 2017). Therefore, most of the respondents fall within Myanmar's national household size.

4.1.5. Income

The following discussion presents the average income and sources of the respondents. As per Table 2, most of their income comes from farm-related activities, other get from livestock raising, off-farm income and non-farm activities were noted.

Table 2. Total income sources of the respondents.

Source of Income ($)	Mean	Median	Mode	Std. Dev	Range
Farm income	4,756	3,051	2,101	5,444	23–43424
Off-farm income	842	630	5	940	2–3502
Non-farm income	1,873	420	70	5,501	1–28016
Total income	7,471				2–43424

Note: $1 = Kyats (K) 1427.77

The average farm income, off-farm income and non-farm income are K6,790,050 (4756 USD), K1,201,571 (842 USD) and K2,673,808 (1873 USD), respectively. Results also show that the minimum and maximum farm incomes are at K33,000 (23 USD) and K61,999,484 (43424 USD) and the total average gross income is $7,471. This finding agrees with Myanmar Living Conditions Survey (2017), which described that Myanmar farmers' total gross farm income per year is $4772 (Myanmar Living Conditions Survey, 2017 as cited by International Food Policy Research Institute (2022). Besides, this finding agrees with United States Agency for International Development (USAID, 2013)'s results, which described that Myanmar farmers' total gross income per year is $7984.

4.2. Access to Extension Services of the Respondents

Table 3 shows that 97% of the respondents get extension support from extension workers while the remaining percentage miss out on this aspect because their homes are not easy to visit.

Table 3. Access to individual extension method.

Variables	**Frequency** (n = 126)	Percentage
Visited by extension workers		
Yes	122	97.12
No	4	3.41
Times visited by extension workers		
Once a month	21	17.43
Twice a month	53	43.00
Thrice a month	13	11.21
Once in 2–3 months	2	2.46
1–6 times a year	20	16.09
Others	9	7.41
No Response	4	3.21

There are too many farmers to contact and visit their fields in the study region, therefore, there is not enough time to do so for the extension workers. Key informant interviews revealed that the extension workers support could not provide enough support for the whole study area due to the insufficient extension workers and farmers ratio. Thus, these problems became the top current extension problems and difficulties in this study. Traveling is also a problem since traveling to distant locations is time-consuming. Even the stringent regulations of Myanmar on extension support are also seen as an issue (Oo & Ando, 2012).

Table 4 shows the respondents' participation in extension programs and training in Table 5. About 52% of respondents reported having attended extension trainings, while 48% of respondents reported to have missed them. As to reasons for not attending, 62% reported they were not aware of these trainings while a good 30% said they have no time to join such.

Table 4. Attendance to group extension training.

Variables	**Frequency** (n = 126)	Percentage
Attendance a training or demonstration		
Yes	65	52.41
No	61	48.19
Reasons for not attendance		
Not aware	38	62.31
No time	18	30.12
Living very far from residence	5	8.00

The following topic deals with the type of trainings given by extension support groups (Table 5). It appears that 43% of the respondents get their extension training on rice production and vegetable production from the Department of Agriculture (DoA). About 44% of them likewise said that they have attended extension programs in relation to livestock also from the DoA. The respondents also got low support from cooperative development organizations except in terms of livestock production (33%). In contrast, NGOs have not extended any assistance on livestock production in this area just like the private organizations who provide no support in terms of vegetable production. The results of key informant interviews and focus group discussions agreed to reveal that the Government provided the greatest number of trainings than other organizations.

Table 5. Type of trainings and training providers.

Training Provider	**Rice Production (n = 65)**		**Vegetable Production (n = 7)**		**Livestock (n = 9)**	
	f	**%**	**f**	**%**	**f**	**%**
Government Organizations						
Department of Agriculture	28	43.02	3	43.17	4	44.41
Cooperative Department	1	2.41	0	0	3	33.00
Saemaul Undong	18	28.16	1	14.00	1	11.15
Non-government Organizations						
Non-government	3	5.32	2	29.38	0	0
Private sector	19	29.44	0	0	1	11.08
No Response	8	12.31	1	14.42	0	0
Average number of times attended the training	2 times		2 times		2 times	
Training Satisfaction						
Slightly satisfied	1	2.08	0	0	0	0
Moderately satisfied	13	20.31	2	29.31	4	44.31
Highly satisfied	42	65.41	2	29.31	3	33.41
No Response	9	14.31	3	43.16	2	22.39

It was also found that all respondents have, on average, twice attended these trainings. In fact, 65% of the respondents were highly satisfied when it comes to these rice production workshops while 29% and 33% of them, respectively, were also much pleased with the extension trainings given to them.

The next part discussed the respondents' access to media extension in terms of rice varieties, inputs, and marketing strategies. As per Table 6, 33% of the respondents get rice variety information from television. About 32% said they get rice variety knowledge from radio while 14% and 18% of them get input and marketing information also from this media. Aside from the findings of FGD, the respondents' access to media extension includes the radio and television. Note that, the respondents receive low to zero information from their co-farmers, extension workers, farm journals, and other farmer channels.

Table 6. Access to media extension.

Access to Media	Rice Varieties (n = 126)		Inputs (n = 126)		Marketing (n = 126)	
	f	%	f	%	f	%
Source of Information						
Television	42	33.12	21	17.14	20	16.31
Radio	40	32.45	18	14.33	22	18.15
Leaflets	27	21.26	12	10.27	6	5.48
Farmer channel	6	5.31	3	2.49	2	2.27
Newspaper	4	3.49	1	1.36	0	0
Farm journal	2	2.32	3	2.44	1	1.14
Sources of Interpersonal Information						
Extension worker	2	2	0	0	0	0
Co-farmer	1	1.14	1	1.14	0	0
None/Not aware	33	26.07	82	65.31	87	69.46
Printed materials that have read by respondents						
Brochure	45	36.04	22	18.00	20	16.14
Leaflets	8	6.45	1	1.14	2	2.08
Newspaper	6	5.12	0	0	1	1.47
Farm journal	0	0	1	1.14	0	0
Others	2	2.39	0	0	0	0

Data also showed that brochure is the top printed material that respondents read to know more about rice varieties (36%), inputs (18%) and marketing (16%). In the case of Myanmar, Livelihoods & Food Security Trust Fund (LIFT, 2015a) reported that the Ministry of Agriculture, Livestock and Irrigation (MOALI) is undertaking farmers' education activities through the mass media (e.g., newspaper, radio, television, and channels), distribution of education pamphlets, leaflets and brochures individual and group training and visits by extension workers.

The results revealed that the respondents receive two loans per year (Table 7). The same data also states that 45% of them borrowed money to pay farm inputs while 2% said they loaned to repay their previous loans. It also appears that 77% of the respondents applied for second loans in order to pay off other farm-related expenses. About 6% of them, also admitted that they did so to repay their first loans. The data shows that respondents get credit from many sources such as agricultural banks, the Cooperative Department, Saemaul Undong, private money lenders, group savings, non-institutional sources, relatives and others within loan 1 and loan 2. In this study, agricultural banks and cooperatives and Saemaul Undong are government organizations. To be precise, 67% of them get their first loans from agricultural banks while 47% of them get from the cooperative department. The average loan amount of the respondents for the first loan is $444 while the average amount for the second is $341. The results of FGD revealed that access to credit can support the farm operation costs and the farmers from the study area need to get more amount of loans for other farm-related expenses.

Table 7. Details of credit support.

Details of Credit	Loan 1 (n = 117)		Loan 2 (n = 17)	
	F	%	F	%
Purpose of Loan				
Payment for farm inputs	53	45.16	8	47.13
Other farm-related expense	46	39.45	13	77.41
Payment for farm labor	31	27.31	3	18.47
Loan payment	2	2.27	1	6.36
No Response	4	3.18	0	0
Provider of Loan				
Governmental Organizations				
Agricultural Bank	78	67.00	2	12.37
Cooperative Department	23	20.12	8	47.41
Non-governmental Organizations				
Saemaul Undong[a]	16	14.45	4	24.39
Non-institutional sources	2	2.36	0	0
Private Organizations				
Private money lenders	9	8.49	1	6.15
Group savings in the village	4	3.27	0	0
Others	4	3.27	1	6.36
Relatives	1	1.07	0	0
No Response	0	0	1	6.36
Amount of Loan				
Average amount (in K)	$444		$341	
Std. Deviation	$752		$282	
Lowest loan	$70		$105	
Highest loan	$5603		$1051	

Note: [a] (The Saemaul Undong (SMU) program was initiated and run in Myanmar since 2012. Although the project period is over the SMU villages continue their villages development by themselves.)

LIFT (2015a) reported most farmers do not necessarily borrow money from government, agricultural development companies, traders, and middlemen because they assume that their interest rates are high but they do. Information on loans from government banks such as the Myanmar Agriculture and Development Bank (MADB) is disseminated through village leaders.

As the respondents cultivated mainly rice and the second was growing other crops, the raising livestock was found to be very rare in the study area. They mostly sell out their crops and livestock to local assemblers. In fact, 56% of them trade their rice to local assemblers. About 75% of them are sent their vegetables to the local assemblers. However, 63% of respondents sell poultry directly to the public market (Table 8). These data are agreed with the report of Livelihoods & Food Security Trust Fund (LIFT, 2015b), that each district in the Delta region has a local market center where the local commodities produced were sold.

Table 8. Market support.

Market Support	Commodity							
	Rice (n = 126)		Vegetables (n = 12)		Livestock (n = 9)		Poultry (n = 8)	
	F	%	F	%	F	%	F	%
Market Outlet								
Local assembler	71	56.00	9	75.31	7	78.19	2	25.14
Retailer	17	14.52	0	0	0	0	1	13.36
Middleman	29	23.16	1	8.23	0	0	0	0
Public market	0	0	0	0	2	22.36	5	63.31
Others	1	1.13	2	17.18	0	0	0	0
No Response	8	6.36	0	0	0	0	0	0
Ave. distance of market from farm	11 km		6 km		No Response		2 km	
Marketing Problems								
Low price	38	30.43	3	25.21	1	11	0	0
Transport cost	3	2.27	0	0	0	0	0	0
Postharvest losses	2	2.27	1	8.27	0	0	0	0
None	83	66.00	8	67.31	8	89.14	8	100

Transportation to these local markets, appear to also affect the smooth delivery of products. According to the rice farmers, the distance between the field and the market could be as far as 11km while vegetable growers said that theirs is at an average of 6km. LIFT (2015a) recommended that the significant distance from the field of the farmers should be given a solution especially when farmers have to travel that long in order to sell their crops, and get the necessary supplies for their next cropping. Aside from transportation, another market-related problem is the selling of rice way below its normal price (30%). The discussions of focus group members (FGD) revealed that their crops get low price in the market. LIFT (2015a) described that the market system in Ayeyarwaddy Delta as a "dendritic market system" or a hierarchy of streets in a branching out pattern. For this, much infrastructure support from the government was necessary.

Table 9 presents the methods by which the respondents transport their crop, this being an aspect of infrastructure support. Note that respondents transport their crops and livestock by motorcycle, trucks, and others in the study area. On that aspect, data shows that 70% of the respondents transported their crops and livestock from the farm to the market by trucks while the rest transported them by other means.

Table 9. Infrastructure support.

Details	Crops (n = 85)					
	Truck		Motorcycle		Others	
	F	%	F	%	F	%
Means of transportation from farm to market	59	69.12	3	4.38	28	33.28
Ownership						
Owned	12	20.45	2	67.17	4	14.38
Borrowed	0	0	0	0	2	7.39
Rented	41	70.44	0	0	17	61.39
No Response	6	10.13	1	33.37	5	18.47
Total	59	100	3	100	28	100
If rented, arrangement for payment						
Per trip	29	71.21	0	0	8	47.46
Contracted price	3	7.53	0	0	0	0
Others	0	0	0	0	1	6.36
No Response	9	22.46	0	0	8	47.08
Total	41	100	0	0	17	100

The results show that 67% of the respondents have their own motorcycles while only 20% have their own trucks. To be precise, 70% of the respondents rent trucks called "Gon-daung" when

they want to sell their fresh produce to the market. A little below this percentage (61%) also rents out Bullock-carts. It is noted that from FGD, the group members described that the renting cost of Gon-daung is relatively high in the study villages.

Table 10 shows the aspects pertaining to support received by farmer-members. The results show full active participation of the respondents in farmers, women, and religious organizations.

Table 10. Membership in organization.

Market Support	Type of Organization									
	Farmer's Organization (n = 30)		Women's Organization (n = 3)		Religious Organization (n = 1)		Social Organization (n = 37)		Others [a] (n = 11)	
	f	%	g	%	g	%	f	%	f	%
Status of Membership										
Active	30	100	3	100	1	100	35	95.48	3	27.31
Inactive	0	0	0	0	0	0	1	3.39	4	36.07
No Response	0	0	0	0	0	0	1	3.39	4	36.07
Position in the Organization										
Member	30	100	3	100	1	100	34	92.43	6	55.19
Officer	0	0	0	0	0	0	1	3.39	0	0
No Response	0	0	0	0	0	0	2	5.36	5	46.27

Note: [a]Others include Pyae Mahar, Cooperative Department, and Company

Almost (95%) are also active members of social organizations, however, some who do not actively participate due to busy life and schedule. All respondents are bonafide members of various farmers', women's, and religious organizations while only 92% are members of social organizations. About 55% of them are also members of other groups. It was found that agricultural banks, cooperatives, and Saemaul Undong coordinate with the village tracts in order to provide credits, loans, farm inputs and others to the farmers in the study area. Women households were found to actively participate in these organizations. According to the key informant leaders' interviews, the women-headed farmers are active participants in the organizations and they are also good members. LIFT (2015b) recommended that GOs, NGOs, and the private organizations share about the knowledge of agricultural technology, farm diversification, and home economics through village leaders, information distributors, or village meetings to the villagers.

4.3. Food Security of the Respondents

4.3.1. Food Availability

Food availability is measured by the presence of food inside the farmers' houses. Fruits, vegetables, legumes, dairy products, meat, and cereals are included within the houses as the food availability measurements. Boles et al. (2014) reported that food availability is measured through the presence of food inside homes. Most of them keep only 1 to 2 kinds of food and have fruits (59%), vegetables (50%) and meat (90%). Based on the data, the respondents have abundant food supply of different kinds of vegetables (46%) while they only have 1 to 2 kinds of dairy products (see in Table 11).

Table 11. Total food availability of the respondents.

Variety	1 to 2		3 or more		None		Total	
	F (n=126)	%	F (n=126)	%	F (n=126)	%	F (n=126)	%
Fruits	74	58.73	14	11.11	38	30.16	126	100
Vegetables	63	50.00	58	46.03	5	3.97	126	100
Frozen vegetables	6	4.76	1	0.79	119	94.44	126	100
Legumes	60	47.62	1	0.79	65	51.59	126	100
Dairy products	16	12.70	0	0	110	87.30	126	100
Meat products	114	90.47	12	9.82	0	0	126	100
Cereal products	51	40.47	3	2.38	72	57.14	126	100

As the respondents are rural, most do not have refrigerator and they do not keep frozen vegetables (94%). This finding agrees with the report of Gearhart (2013), that the households are used to keeping only 1 to 2 kinds of food in every food item such as fruits, vegetables, legumes, dairy products, meat, cereal.

4.3.2. Food Access

The Household Dietary Diversity Indicator Guide of the United States Agency International Development (USAID) was used as a tool to determine whether farmers had access to various food products. Under this endorsed by USAID in 2006, the respondents' food attitudes and behaviors were collected using the previous 24-hours as a reference period (24-hour recall). The food access data of respondents were collected based on the 12 main food items in the food box during the 24-hour period (Swindale & Bilinsky, 2006). The average food consumption of the respondents is 6 within the ranges 2 to 12. The individual results based on the 12 main food items were divided by the number of total respondents (126) then multiplied by 100. First, the Household Dietary Diversity Score (HDDS) variable was calculated for each household. The value of this variable ranged from 0 to 12.

HDDS (0-12)	Total number of food groups consumed by members of the household. Values for A through L will be either "0" or "1". Sum (A + B + C + D + E + F + G + H + I + J + K + L)

Second, the average HDDS indicator was calculated for the sample population using the following:

$$Average\ HDDS\ (\%) = \frac{Number\ of\ Households\ with\ B, D\ or\ F\ =\ 1+2+3}{Total\ number\ of\ households} \times 100$$

All respondents ate rice because it is the main food of the country. It is followed by vegetables at 91% (Table 12). RoUM in Myanmar Census of Agriculture in 2010 stated that the top food item of Myanmar households is cereal and the second is vegetables (Christoplos, 2010).

Table 12. Food access of households.

Food Items	Frequency (n = 126)	Percentage
A. Cereals	126	100
B. Root and tubers	40	32.23
C. Vegetables	114	91.16
D. Fruits	73	58.47
E. Meat, poultry, offal	54	43.39
F. Eggs	39	31.26
G. Fish and seafood	81	64.00
H. Pulses/legumes/nuts	27	21.37
I. Milk and milk products	9	7.09
J. Oil/fats	24	19.21
K. Sugar/honey	34	27.49
L. Miscellaneous	47	37.23
Average HDDS	6	
Minimum HDDS	2	
Maximum HDDS	12	

According to the data, the respondents had the minimum consumption food of household dietary diversity scores is 2 and the maximum HDDS is 12 while the average HDDS is 6. This means the respondents, on the average, had 6 food items while they had the minimum had 2 food items and the maximum food items 12 for 24 hours. According to Walker and Fisher (1997), a person should eat 20–30 different types of foods every day and the dietary adequacy levels are described based on food variety consumption: > 30 food items is very good; 25–29 food items is good; 20–24 food items is fair; < 20 food items is poor; and < 10 food items is very poor. This finding falls in very poor dietary adequacy level and the average food access of them are very low level.

4.3.3. Food Utilization

Total food utilization results show that the respondents mostly cooked their food before eating such as rice (84%), fish (85%), pork (100%), eggs (50%), roselle (49%), water spinach (58%), tomato (68%), cauliflower (92%), lettuce (91%), and banana (100%). They eat lettuce raw in salads and banana in the fruit category. Fried water spinach, on the other hand, is their top choice in the food section as per Table 13.

Table 13. Utilization of food.

Food Items	Method of Preparation					
	Cooked		Fried		Raw	
	F	%	F	%	F	%
Starch						
Rice	87	84.02	0	0	0	0
Sea-food						
Fish	67	85.41	0	0	0	0
Meat						
Pork	27	100	0	0	0	0
Eggs	20	50.23	0	0	0	0
Vegetables						
Roselle	19	49.16	0	0	0	0
Water Spinach	0	0	19	58.16	0	0
Tomato	13	68.07	0	0	0	0
Salad						
Cauliflower	0	0	12	92.41	0	0
Lettuce	0	0	0	0	10	91.34
Fruit						
Banana	0	0	0	0	52	100

4.3.4. Food Stability

The questionnaire used was adapted from USDA Household Dietary Diversity and Households Hunger scales was used to represent household food stability (Bickel et al., 2000).

$$\text{HHS} = \frac{\text{Survey-weighted sample of households with household hunger score} > 1}{\text{Survey-weighted sample of households in the FFP project implementation area}} \times 100$$

HHS categories

a. little to no hunger in the household (0–1)

b. moderate hunger in the household (2–3)

c. severe hunger in the household (4–6).

To summarize the data, the Household Hunger Scale (HHS) was calculated by using Food for Peace (FFP) indicators of USAID (2015). In this case, HHS score was calculated using this formula.

According to the results, 99% of the respondents fell in the moderate hungers scores while at least 1% of the respondents had little to no hunger in the households (Table 14).

Table 14. Household hunger scale (HHS) of the respondents.

Statement	Frequency (n = 126)	Percentage
1	2	1.28
2	106	84.31
3	18	15.46

This finding is similar with Deitchler et al. (2011) who reported that moderate household hunger scale is higher than other household hunger scales. Minn and Oo (2017) reported that poor diet quality has contributed to high levels of stunting and malnutrition along with high levels of anemia, iodine and vitamin A deficiency is found in Myanmar people and children in Ayeyarwady region.

4.4. Relationships

4.4.1. Relationship between Extension Services and Food Security

Table 15 shows the correlations between extension services and food security. According to the results of food availability, the training attendance (rs = 0.267, p = 0.001) has high significant correlation and the number of training programs (rs = 0.024, p = 0.176), rice production training satisfaction (rs = 0.205, p = 0.011), number of vegetable production training (rs = 0.148, p = 0.049), and be accompanied by training (rs = 0.184, p = 0.019) have significant correlations.

In terms of food access, the number of vegetable production (rs = 0.221, p = 0.006), and the training satisfaction on livestock (rs = 0.212, p = 0.009) have high significant correlations while training attendance (rs = 0.189, p = 0.017), number of training program (rs = 0.158, p = 0.039), number of rice production training (rs = 0.188, p = 0.018), rice production satisfaction (rs = 0.192, p = 0.016), training satisfaction of vegetable production (rs = 0.193, p = 0.015), number of livestock (rs = 0.204, p = 0.011), be accompanied by training (rs = 0.175, p = 0.025), have significant correlations.

Likewise, the number of vegetable production (rs = 0.275, p = 0.001), vegetable production satisfaction (rs = 0.239, p = 0.003), number of livestock training (rs = 0.210, p = 0.009), and livestock satisfaction (rs = 0.221, p = 0.007) have high significant correlations while number of rice production training (rs = 0.165, p = 0.032), rice production training satisfaction (rs = 0.190, p = 0.017), and have significant correlations with food utilization.

According to food stability, six variables: number of training programs (rs = 0.301, p = 0.000), number of rice production training (rs = 0.224, p = 0.006), and number of vegetable production training (rs = 0.309, p = 0.000), vegetable production training satisfaction (rs = 0.258, p = 0.002), number of livestock training (rs = 0.519, p = 0.000), livestock training satisfaction (rs = 0.519, p = 0.000) have high significant correlations while the rest: training attendance (rs = 0.198, p = 0.013), rice production training satisfaction (rs = 0.196, p = 0.014), and be accompanied by a training program (rs = 0.175, p = 0.025) have significant correlations with food stability. The key informant leaders revealed that the training sessions are effective support for farmers in agriculture and the respondents need to provide training related to food security.

Table 15. Correlation between extension services & food security

Extension Services	FAV	FAC	FU	FS
Visited by Extension Workers	0.068^{ns}	−0.029^{ns}	0.070^{ns}	−0.039^{ns}
	0.226	0.371	0.217	0.330
Attendance of training	0.267**	0.189*	0.129^{ns}	0.198*
	0.001	0.017	0.075	0.013
Number of training programs	0.176*	0.158*	0.117^{ns}	0.301**
	0.024	0.039	0.096	0.000
Number of rice production training	0.137^{ns}	0.188*	0.165*	0.224**
	0.063	0.018	0.032	0.006
Rice production training satisfaction	0.205*	0.192*	0.190*	0.196*
	0.011	0.016	0.017	0.014
Number of vegetable production training	0.148*	0.221**	0.275**	0.309**
	0.049	0.006	0.001	0.000
Vegetable production training satisfaction	0.108^{ns}	0.193*	0.239**	0.258**
	0.113	0.015	0.003	0.002
Number of livestock training	0.079^{ns}	0.204*	0.210**	0.519**
	0.191	0.011	0.009	0.000
Livestock training stratification	0.088^{ns}	0.212**	0.221**	0.519**
	0.163	0.009	0.007	0.000
Be accompanied by training	0.184*	0.175*	−0.134^{ns}	0.175*
	0.019	0.025	0.067	0.025

Note:
* Significant at P < 0.05
**Highly significant at P < 0.01
- No significant correlation

Legend:
FAV: Food Availability
FAC: Food Accessibility
FU: Food Utilization
FS: Food Stability

Overall, visiting of extension workers in this study seems not related with food security but respondents' attendance in training and their inputted satisfaction levels in relation to these trainings are positively related with food security. The respondents can improve their knowledge related with food security and they can keep their households to be food safety and security by attending the trainings. This finding agrees with the report of the Salesain Missions (2014) which found that agriculture trainings educate farmers to know the modern techniques in agriculture and livestock farming in order to improve food security and increase income potential.

4.4.2. Relationship between Market Infrastructure and Food Security

Table 16 shows the correlations between market infrastructure and food availability, access, utilization, and stability, as a whole. There is no relationship between market infrastructure and food availability. Crops transported by other means (rs = 0.202, p = 0.012), and livestock by motorcycle (rs = 0.155, p = 0.042) have significant correlations while livestock by truck (rs = −0.153, p = 0.043) have negative significant correlation with food access.

Likewise, the three significant correlated variables of food utilization are crops transported by other means (rs = 0.182, p = 0.021), livestock by truck (rs = 0.167, p = 0.031) and livestock by motorcycle (rs = 0.157, p = 0.040) in market infrastructure.

According to food stability, crops transported by other means (rs = 0.245, p = 0.003) has high significant correlation while the crops transported by motorcycle (rs = 0.149, p = 0.048) and livestock by motorcycle (rs = 0.153, p = 0.044) have significant correlations with food stability in terms of market infrastructure.

Table 16. Correlation between market infrastructure & food security.

Market Infrastructure	FAV	FAC	FU	FS
Crops transported by truck	0.045^{ns}	−0.011^{ns}	0.34^{ns}	−0.070^{ns}
	0.310	0.450	0.352	0.217
Crops transported by motorcycle	0.014^{ns}	0.013^{ns}	0.42^{ns}	0.149*
	0.439	0.443	0.319	0.048
Crops transported by others	0.127^{ns}	0.202*	0.182*	0.245**
	0.079	0.012	0.021	0.003
Livestock transported by truck	0.069^{ns}	−0.153*	0.167*	0.049^{ns}
	0.221	0.043	0.031	0.294
Livestock transported by motorcycle	0.124^{ns}	0.155*	0.157*	0.153*
	0.083	0.042	0.040	0.044
Livestock transported by others	0.013^{ns}	0.073^{ns}	0.053^{ns}	0.104ns
	0.442	0.208	0.276	0.123

Note:
* Significant at P < 0.05
**Highly significant at P < 0.01
No significant correlation

Legend:
FAV: Food Availability
FAC: Food Accessibility
FU: Food Utilization
FS: Food Stability

Overall, this implies that infrastructure is also related with food security. Crops transported by other means and livestock transported by motorcycle are mostly correlated with FAC, FU and FS. Food availability is not related with market infrastructure. This finding coincides with statement of Hebebrand and Wedding (2010) which said that the role of trade and trade market expansion play important roles in (a) enhancing food security and highlight expanding market information; (b) improving post-harvest market infrastructure; and (c) creating a positive investment climate conducive for agribusiness growth.

4.4.3. Relationship between Membership Organizations and Food Security

The correlations between the membership organizations and food availability, access, utilization, and stability in Table 17. Among the variables on membership organizations, number of organization (r_s = 0.416, p = 0.000), membership organization (r_s = 0.368, p = 0.000), status of membership (r_s = 0.368, p = 0.000), social organization (r_s = 0.341, p = 0.000), others (r_s = 0.212, p = 0.008) showed highly significant correlations while only farm organization (r_s = 0.203, p = 0.011) illustrated significant correlation with food availability.

Table 17. Correlation between membership organizations & food security.

Extension Services	FAV	FAC	FU	FS
Membership Organization	0.368**	0.139^{ns}	0.111^{ns}	0.225**
	0.000	0.061	0.109	0.006
Status of membership	0.368**	0.139^{ns}	0.111^{ns}	0.225**
	0.000	0.061	0.109	0.006
Number of organizations	0.416**	0.135^{ns}	0.110^{ns}	0.220**
	0.000	0.065	0.111	0.007
Farm organization	0.203*	0.241**	0.182*	0.403**
	0.011	0.003	0.021	0.000
Social organization	0.341**	0.024^{ns}	0.024^{ns}	−0.087^{ns}
	0.000	0.397	0.393	0.166
Women organization	−0.141^{ns}	−0.127^{ns}	−0.082^{ns}	−0.068^{ns}
	0.058	0.078	0.180	0.224
Religious Organization	−0.98^{ns}	−0.92^{ns}	−0.073^{ns}	0.120^{ns}
	0.138	0.153	0.209	0.090
Others	0.212**	−0.02^{ns}	−0.028^{ns}	0.02^{ns}
	0.008	0.3876	0.377	0.490

Note:
* Significant at P < 0.05
**Highly significant at P < 0.01
- No significant correlation

Legend:
FAV: Food Availability
FAC: Food Accessibility
FU: Food Utilization
FS: Food Stability

Meanwhile, only farm organization is highly significantly (rs = 0.241, p = 0.003) correlated with food access and significantly correlated (rs = 0.182, p = 0.021) with food utilization in terms of market infrastructure. In food stability, membership organization (rs = 0.225, p = 0.006), status of membership (rs = 0.225, p = 0.006), number of organization (rs = 0.220, p = 0.007), farm organization (rs = 0.403, p = 0.000) have higher significantly correlations in terms of membership organizations.

To sum it up, almost all respondents are members of most organizations with some being leaders even. Among the organizations, farm organization is the most correlated with food security. For this finding, the sustainable development report of the United Nations (UN, 2013) finds application. According to that report, cooperative organizations of GOs and INGOs encourage the growth of agricultural cooperatives by easing the farmers' access to affordable financing options, appropriate risk management instruments, sustainable production techniques, decision-making forums, nutrition-related programs and policies, and other agricultural resources geared towards ensuring food security. They also encourage investment in rural infrastructure which is necessary to penetrate world trades, participation of women in economic activities.

4.4.4. Relationship between Income and Food Security

Results show the significant (P < 0.05) and highly significant (P < 0.01) correlations between income (including farm income, off-farm income, non-farm income, and household income) and food availability, access, utilization, and stability (Table 18).

Among the variables on income, farm income (rs = −0.244, p = 0.003), household income (rs = −0.211, p = 0.009) are negatively correlations while non-farm income (rs = 0.143, p = 0.055) is positively correlated with FAC.

Table 18. Correlation between total income and food security.

Income	FAV	FAC	FU	FS
Farming income	−0.137 ^{ns}	−0.244**	−0.176*	−0.278**
	0.063	0.003	0.024	0.001
Off-farm income	0.018^{ns}	0.089 ^{ns}	0.072 ^{ns}	−0.095^{ns}
	0.420	0.160	0.212	0.144
Non-farm income	0.002 ^{ns}	0.143*	0.139 ^{ns}	0.057 ^{ns}
	0.492	0.055	0.060	0.262
Household income	−0.129 ^{ns}	−0.211**	−0.134 ^{ns}	−0.307**
	0.075	0.009	0.068	0.000
Note:			Legend:	
* Significant at P < 0.05			FAV: Food Availability	
**Highly significant at P < 0.01			FAC: Food Accessibility	
- No significant correlation			FU: Food Utilization	
			FS: Food Stability	

In food utilization, only farm income (rs = −0.176, p = −0.024) is negatively correlated variable. Meanwhile, farm-income (rs = −0.278, p = 0.001) and non-farm income (rs = −0.307, p = 0.000,) are negatively correlated with FS.

Overall, farming income and household income were not saved for the costs of FAC, and FS. In detail, farm income was not saved for FAC, FU and FS. Increasing non-farm income were effect on for food consumption (FAC) while their income is not related to food availability. This finding is agreed with the reports of Chang and Mishra (2008) and Qureshi et al. (2015), increasing non-farm income could enable greater investments in agriculture leading to higher income and non-farm income could improve food security even for the households which cannot invest back in agriculture through inter-temporal food consumption smoothing or by ameliorating food shortage risks in case of unexpected crop failures. Besides, this finding is also similar with Silvestri (2015) and Gassner et al. (2019) statements, that household income is negatively effect on food security.

4.5. Multiple Regression Analysis

The statistical findings of Spearman's rho correlation were enabled not only for establishing the relationship between women households' farming practices, extension services and food security in the study area but also in making the possible predictions for the multiple regression analysis. Stepwise regression method was used to further streamline the predictors (women households' farming practices) of food security in order to guide the researcher in formulating the recommended appropriate extension strategies to achieve food security. The predictors are the women households' farming practices and extension services that have strong significance with food security. Those predictors that have p-values less than the significance level of 0.05 and less than highly significant level 0.01 have statistically significant impacts.

The multiple regression analysis results in Table 19 reflects that lowland rice manual transplanting (p = 0.028), rainfed rice manual transplanting (p = 0.012), use of mechanical in pest management (P = 0.007), no transportation in rice post-harvest operations (p = 0.001), transportation to milled market in labor pattern during summer (p = 0.011) of women households' farming practices; and farmers' organization in membership (p = 0.028) of extension services, will have the highest impact on household food accessibility. Not taking these sex predictors altogether will not have the expected high impact on improving household food security in the study area. In essence, it points out that among the farming practices of women households and their access to extension services, these six will have the highest impact on household food security in this area.

As indicated by their regression coefficients, the respondents will get food security by reducing their use of mechanical apparatuses in pest management (β = −0.208), reducing of non-transportation of rice in post-harvest operations (β = −0.256), reducing/avoiding the summer labor pattern including transportation to market can increase crop production (β = −0.199). Results also revealed that manual transplanting in lowland rice (β = 0.174), and rainfed rice (β = 0.209), could increase crop production and farmers' organizations (β = 0.174), support for increased production.

Table 19. Regression analysis of women households' farming practices and extension services for households' food accessibility.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	6.942	0.259		26.815	0.000**
Lowland rice manual transplanting	1.124	0.506	0.174	2.221	0.028*
Rainfed rice manual transplanting	1.482	0.581	0.209	2.552	0.012*
Mechanical apparatuses in Pest-management	−2.706	0.992	−0.208	−2.727	0.007**
Non-transportation of rice in post-harvest operations	−1.858	0.553	−0.256	−3.361	0.001**
Transporting to Milled Market in summer labor pattern	−0.713	0.274	−0.199	−2.599	0.011*
Farmers' Organizations in membership	1.124	0.506	0.174	2.221	0.028*

Note: Dependent Variable: Food Accessibility
Significant*

The results imply that by avoiding mechanical apparatuses in pest management, preventing non-transportation of rice in post-harvest operations, reducing the summer labor pattern including from transportation of crops to milled market, respondents are seen to increase their crop production and their food security. Hebebrand and Wedding (2010) said that the role of trade market and transportation is to enhance food security, expand market information, improve post-harvest market infrastructure, and growth the agribusiness. But one of the findings is inconsistent with the finding of Pan et al. (2018) ,it is that using of mechanical in pest control is more effective for crops production and food security.

Specifically, manual transplanting in lowland and rainfed and membership and participation in farmers' organizations are highly encouraged. It appears that there is a higher chance for the respondents to attain their desired rice yields if they follow these farming practices and extension services. This interpretation agrees with the notion that participation in agricultural extension programmes positively affects the welfare of farmers' organizations through improvement in farm productivity, income, improved agricultural technologies, improved crop production and adoption of fertilizer (Danso-Abbeam et al., 2018).

Table 20 shows the results of multiple regression analysis on the farming practices of women households such as lowland rice broadcasting ($p = 0.005$), no rice transportation ($p = 0.017$) and rice transportation by bullock-cart in post-harvest operations ($p = 0.006$), crops transportation by other means to the market in terms of market infrastructure ($p = 0.045$), number of live-stocks training ($p = 0.002$), and livestock training satisfaction ($p = 0.000$) are extension services which were all found to have highest impacts on household food utilization. The analyzed data implies that farming practices and extension services are equal to the variables related to food utilization. This means that not all predictors will have high impact on improving household food security in the villages of the study sites. Rather, it only shows that these predictors will have the highest impact on household food security in the study area.

Table 20. Regression analysis of women households' farming practices and extension services for households' food utilization.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	5.446	0.215		25.320	0.000**
Lowland rice broadcasting	−0.736	0.259	−0.214	−2.839	0.005*
Non-transportation of rice during post-harvest operations due to combine-harvester harvesting	−0.887	0.368	−0.181	−2.412	0.017*
Rice transportation by bullock-cart in post-harvest operations	2.399	0.854	0.213	2.810	0.006*
Crops transported by others in market infrastructure	0.648	0.319	0.157	2.029	0.045*
Number of live-stocks training	−1.539	0.487	−0.460	−3.161	0.002**
Livestock training satisfaction	1.869	0.425	0.644	4.394	0.000**

Note: Dependent Variable: Food Security
*Significant**

According to the regression coefficients, lowland rice broadcasting (β = −0.214), no rice transportation in post-harvest operations (β = −0.181), and a number of livestock training (β = −0.460) will not increase crop production and not support food security. Meanwhile, rice transported by bullock-cart (β = 0.213 and crops transportation by others in market infrastructure (β = 0.157) will increase post-harvest losses and crops production. The respondents' satisfaction level for livestock training (β = 0.644) will increase food security. This coincides with the finding of Pan et al. (2018) stating that agriculture training improved farming operations and increased high yields production and food security. There seems also no contention that agricultural extension programmes which include farmers' capacity building of good agricultural practices, skill development regarding the use of improved farm technologies, exposure to general farm management practices and many input and output markets have been the fundamental principles underlying delivery of agricultural extension services. Needless to say, all of these are geared towards improvement in productivity, reduction of poverty and enhancement of food security (Danso-Abbeam et al., 2018 as cited in Ghana Statistical Service, 2010).

Overall, the respondents are projected to achieve food security if they avoid lowland rice broadcasting, use combine-harvester to reduce transportation in rice post-harvest operations, and minimize number of livestock training. On the other hand, transportation of rice with bullock-cart in post-harvest operations and transportation of good by other means in terms of market infrastructure as well as satisfactory livestock training will increase chances of achieving food security.

According to the multiple regression analysis results, rainfed rice broadcasting (p = 0.024), both using pre-emergence and post-emergence herbicide in weed management (p = 0.000), time of pest control in ripening stage (p = 0.016) are the farming practices which have the highest significant correlations with household food stability. Likewise, crop transportation by motorcycle (p = 0.026), crop transported by other means as per market infrastructure (p = 0.012), livestock training satisfaction (p = 0.000) as part of extension services also appear to have the highest significant correlations with household food stability (Table 21).

Table 21. Regression analysis of women households' farming practices and extension services for households' food in stability.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	5.446	0.215		25.320	0.000**
Rainfed rice broadcasting	−0.475	0.208	−0.147	−2.289	0.024*
Both using pre-emergence and post-emergence herbicide in weed management	1.315	0.360	0.233	3.654	0.000**
Time of pest control in ripening stage	−1.607	0.660	−0.156	−2.434	0.016*
Crops transported by motorcycle in market infrastructure	1.226	0.543	0.145	2.259	0.026*
Crop transported by others in market infrastructure	0.523	0.204	0.168	2.561	0.012*
Livestock training satisfaction	1.269	0.142	0.582	8.918	0.000**

Note: Dependent Variable: Food Security
*Significant**

This means that not all the predictors identified will have a high impact on improving household food security in the study villages and that only these predictors mentioned will have the highest impact on household food security in these villages.

These regression coefficients indicate that avoiding rainfed rice broadcasting (β = −0.147) and reducing pest control in ripening stage (β = −0.156) could increase crop production. Using both pre-emergence and post-emergence herbicide (β = 0.233) for weed management, crop transportation by motorcycle (β = 0.145) and by other means (β = 0.168) under market infrastructure could also increase crops production. Besides, the satisfaction level of the respondents in livestock training (β = 0.582) also appears to encourage food security. Pan et al. (2018) have recommended that usage inputs such as pesticides, fertilizer, etc., and proper and sufficient farming practices information provide farmers to improve their livelihood, thereby encouraging higher yield production and therefore ultimately achieving food security. Therefore, extension services could have immense benefits on building good agricultural practices which in turn could lead to increased incomes and overall improved food security status of the community and region.

Avoiding rainfed rice broadcasting and pest control during the ripening stage could increase on the crop production. Meanwhile, using both pre and post-emergence herbicide in weed management, crops transportation by motorcycle and other means in terms of market infrastructure will increase the crops production of the respondents. Additionally, their satisfaction on livestock training will support and increase food security. All of these suggested farming practices and extension services are seen to attain the respondents' desired rice yields.

4.6 Agricultural Extension Framework

From the results of the statistical analysis, the following framework is proposed. It reflects the need for food security to be acknowledged and included in the extension system (Figure 3).

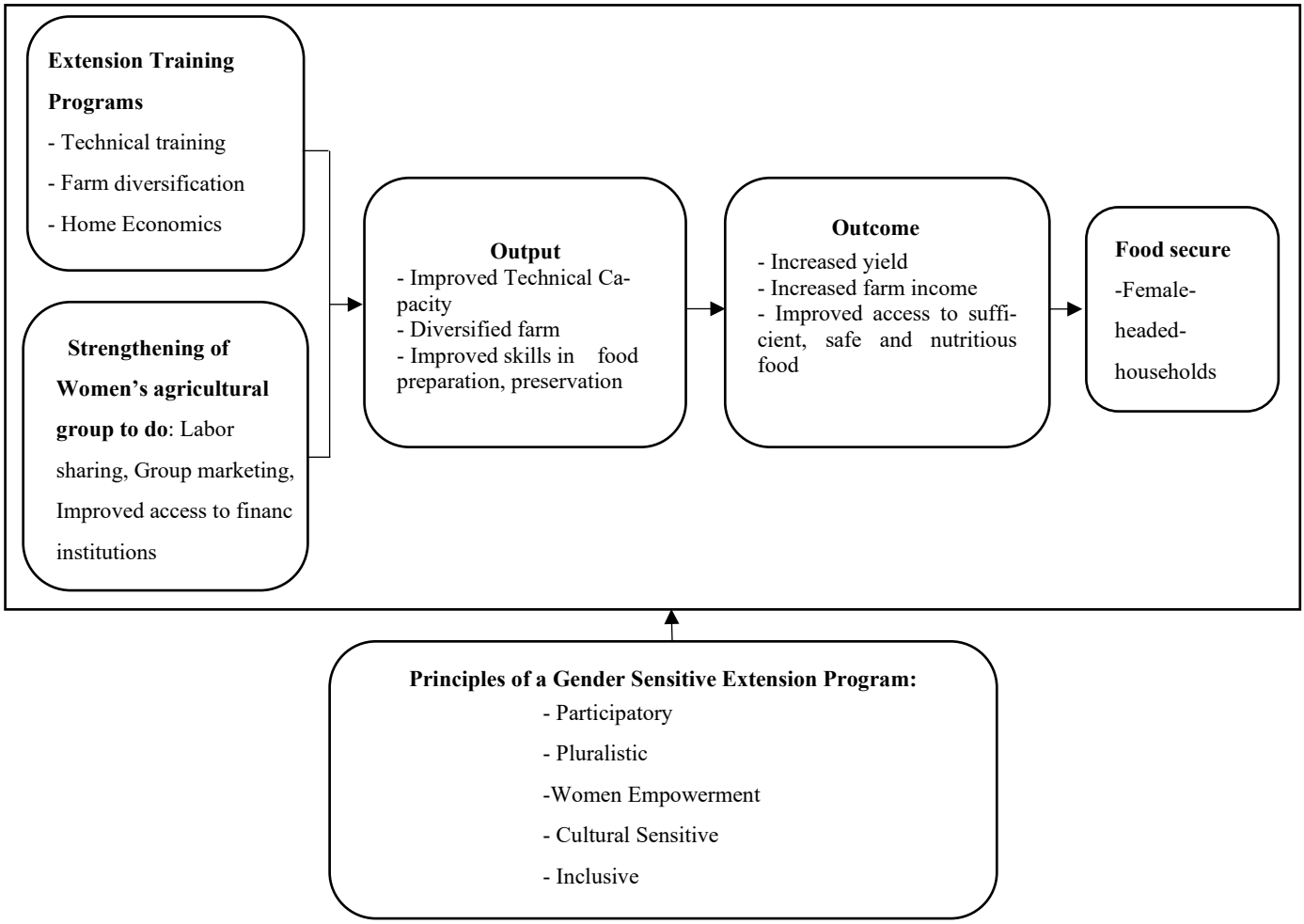


Figure 3. Proposed extension framework for women farmers.

Effective extension services and active role of women in leading farming practices are crucial in planning and implementing food security programs. The proposed extension strategies are anchored on the opportunities and challenges in the extension delivery system given the uniqueness of women farmers as revealed in the study. Through the proposed strategies, it is expected that the women farmers would be able to improve farming practice, increase self-reliance, and develop in food security.

Overall, the proposed extension framework responds to the weaknesses of the current extension system in the study area as earlier mentioned. Some of the weak points identified are insufficiency of funds, inappropriateness of technologies, low participation of women, and poor food security knowledge. Aside from identifying the weak points of the proposed extension framework, it also maximizes the strengths of the current extension system and identifies opportunities such as networks and linkages especially those in relation to women.

5. Conclusions

The average age of respondents is 45 within the range 23–65 and a large number of them have finished primary school education and the average household size is 4. The average monsoon land size is 3.2 ha while the average summer land size is 4 ha. Summer fields have higher land acres than monsoon fields because some monsoon fields are not used due to water-lodging. Most of them were farm owners whose primary source of income was derived from rice farming. Although broadcasting was the common method used, manual transplanting was seen to be more effective in terms of food security. A large number of them used post-emergence herbicide but using both pre and post-emergence herbicide appeared to be more effective for food security. Spraying was also employed but it turned out to be negatively related to food security. Likewise, irrigation which was

also commonly used, was negatively related to food security but dependence on rain was seen positively related to crop production. This has implications for irrigation facilities which currently may not be reaching many farmers who remain dependent on rain for water needs of their crops.

The respondents access the extension support from GOs, NGOs, INGOs and private sectors. GOs is the main source of extension support. According to the GOs, the agricultural extension systems, technologies, and operations of extension staff cannot fulfill its goal of catering to all the farmers' needs from the earlier extension period up to today. Besides this, connections and linkages with other services supporting professionals, technicians, and farmers at the field level are very weak thus knowledge and information developed at higher levels fail to trickle down to the grassroot levels.

The respondents did not fully access the extension support from GOs, NGOs, INGOs and the private sectors, however, GOs are found as the main source of extension support in the study area. According to the GOs, the agricultural extension systems, technologies, and operations of extension staff cannot fulfill its goal of catering to all the farmers' needs from the earlier extension period up to today. The connections and linkages with other services supporting professionals, technicians, and farmers at the field level are very weak thus knowledge and information developed at higher levels fail to trickle down to the grassroot levels.

Due to this, NGOs, INGOs, and other private sector step in to perform and provide education about technological improvement for rural livelihood, food security, and organization improvements. However, women households are still have poor access to extension services in this study region. Access to resources including trainings, market, credit, farm inputs and infrastructure support, are also related to food security. Among them, crops transported by other means and livestock transported by motorcycle are mostly correlated with FAC, FU and FS. Almost all respondents are members of most organizations with some being leaders even while only farm organization is the most correlated with food security in this study.

Surprisingly, most respondents think themselves that their households are food secure in the study area. Based on the data, they have not reached the optimum security level and they are only in the modest level of food security. In sum, the study sites in the strictest term are access to full extension support and sufficiently food security at this point thereby still posing possible risks of hunger or malnutrition upon the people in these villages.

5.1. Recommendations

The households' food security can be improved by ensuring access of female-headed households to extension training programs in topics such as technical training, farm diversification and home economics. Given the labor dependence of the households, it is likewise recommended that strengthening of women's agricultural organizations be implemented to ensure that they receive support in labor sharing, group marketing and assistance in accessing financial institutions. The proposed extension framework for female headed households is recommended to facilitate access to extension and support services and improvement of food security situation.

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