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Led by IFPRI

IFPRI Discussion Paper 01947

Revised

November 2020

**Gender, Crop Diversification, and Nutrition in Irrigation Catchment
Areas in the Central Dry Zones in Myanmar**

Implications for Agricultural Development Support

Catherine Ragasa

Kristi Mahrt

Zin Wai Aung

Isabel Lambrecht

Jessica Scott

Development Strategy and Governance Division

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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AUTHORS

Catherine Ragasa (c.ragasa@cgiar.org) is a Senior Research Fellow in the Development Strategy and Governance Division of the International Food Policy Institute (IFPRI), Washington, DC.

Kristi Mahrt (k.mahrt@cgiar.org) is a Senior Research Analyst in IFPRI's Development Strategy and Governance Division, based in Colorado, USA.

Zin Wai Aung (zinwaiungyau@gmail.com) is a consultant for the World Bank and IFPRI, Myanmar.

Isabel Lambrecht (i.lambrecht@cgiar.org) is a Research Fellow in IFPRI's Development Strategy and Governance Division, Yangon, Myanmar.

Jessica Scott (Jessica.Scott@cgiar.org) is a Research Fellow in the WorldFish Myanmar Office, Yangon, Myanmar.

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Abstract

This report describes the baseline data collected from 1,835 men and women respondents in 998 households in two irrigation sites in the central dry zone in Myanmar to help diagnose, design, and test interventions to enhance the Myanmar Agricultural Development Support Project's impacts on gender equality and nutrition. Baseline data show large gender gaps, in which fewer women than men achieved adequacy in all 11 indicators of empowerment. Fifty-three percent of women versus 25 percent of men respondents were not empowered, and 45 percent of dual-adult households have gender gaps. The main contributors of disempowerment among women and men were high tolerance and acceptance of intimate partner violence against women and low membership in groups, especially influential groups. Other leading contributors to disempowerment for women were lack of access to and decisions on financial services, lack of work balance, and lack of intrahousehold harmony or respect among household members. More women and men in nonirrigation households did not achieve adequacy in access to and decisions on financial services than those in irrigation households. More men in nonirrigation households did not achieve adequacy in group and influential group membership than men in irrigation households. More women in nonirrigation households did not achieve adequacy in work balance than women in irrigation households. In both irrigation and nonirrigation households, although 95 percent of respondents owned smartphones, women were less likely than men to access Internet or social media through their phones. Thirty-nine percent of respondents received rice-related information and half received health-related information. Nine to 14 percent of respondents attended agriculture- or health-related training courses. Women were significantly less likely to receive agriculture and nutrition-related information and training than men. The dietary diversity score, a common indicator of diet quality and a good proxy for nutrition, is low in the sample. The individual dietary diversity score was 4.32, with no significant difference between women and men and no major differences between irrigation water users and other households. Dairy, nuts and seeds, eggs, vitamin-A-rich fruits and vegetables, and other fruits are not commonly or frequently consumed by a majority of respondents. Beans and dark leafy vegetables, which are relatively abundant in the study context, are consumed by only 38–48 percent of the respondents on a daily basis. Nutrition education highlighting dietary diversity can help the sample communities achieve better nutrition. Overall, most women and men in the sample communities employ good sanitation practices, but more people need to be sensitized on proper garbage disposal, drinking water treatment, and proper and more frequent handwashing.

Keywords: *irrigation, agricultural productivity, gender, nutrition, crop diversification*

Acknowledgments

We gratefully acknowledge funding from the Japan Scaling up Nutrition (SUN) Trust Fund and the CGIAR Research Program on Policies, Institutions, and Markets (PIM). We thank the Agricultural Development Support Project (ADSP) team for access to data and information on ADSP and facilitating the SUN study activities. We are particularly grateful to Indira Ekanayake, Mio Takada, and Anuja Kar at the World Bank Agriculture and Food Practice, Washington, DC; Dina Umali-Deininger, Practice Manager, Agriculture and Food Global Practice, East Asia and the Pacific; and U Bo Bo Kyaw (ADSP's Project Director), U Min Zaw Oo (ADSP's project manager), Sandar Tin Shwe (gender focal point), and Daw Moe Moe Lwin (National M&E Specialist) from the Irrigation and Water Utilization Management Department (IWUMD) at the Myanmar office. We are grateful to Nippon Koei for facilitation in the listing of WUGs, particularly U Nadi Nyarna and U Aung Moe Naing for their help during field visits and data collection. We would like to thank U Myo Naing, Assistant Director from IWUMD, Sagaing; U Myo Win, Assistant Engineer (AE) from Sinthe; and U Kyaw Soe Aung (AE) and U Min Zaw Myint (AE) from the North Yamar irrigation sites. Special thanks to Myanmar Survey Research (MSR), our partners in the survey implementation. We thank Futoshi Yamauchi for helping us in the early stages of the fundraising.

We are most grateful to the respondents, farmers, government officials, village leaders, food vendors, and service providers who shared their precious time to talk to us about their experiences and stories.

The opinions expressed here belong to the authors, and do not necessarily reflect those of the Japan SUN Trust Fund, World Bank, ADSP team, CGIAR, PIM, or IFPRI.

Acronyms

3DE	Three Domains of Empowerment index
ADSP	Agricultural Development Support Project
DALMS	Department of Agriculture Land Management and Statistics
DO	direct outlet
DY	distribution channel
GPI	Gender Parity Index
IPV	intimate partner violence
IWUMD	Irrigation and Water Utilization Management Department
MADB	Myanmar Agricultural Development Bank
MoALI	Ministry of Agriculture, Livestock and Irrigation
MS-NPAN	Multisectoral National Plan of Action for Nutrition
MSR	Myanmar Survey Research
NGO	nongovernmental organization
PAD	Project Appraisal Document
pp	percentage point
Pro-WEAI	project-level Women's Empowerment in Agriculture Index
SUN	Scaling Up Nutrition
SID	Simpson index of crop diversification
t/ha	tons per hectare
WEAI	Women's Empowerment in Agriculture Index
WUG	water user group

Contents

1. Introduction.....	1
2. Method.....	2
2.1. Study site.....	2
2.2. Data collection methods.....	5
2.2.1 Sampling strategy	5
2.2.2 Description of survey content.....	6
2.2.3 Enumerators' training and data collection	6
2.2.4 Ethics and compensation.....	7
2.3. Indicators.....	7
2.3.1 Gender equality and women's empowerment.....	7
2.3.2 Nutrition and health	8
2.3.3 Crop productivity, diversification, and commercialization	10
3. Results	10
3.1. Characteristics of the sample	10
3.2. Livelihood strategies	13
3.3. Crop diversification, productivity, and commercialization.....	14
3.4. Empowerment.....	18
3.5. Nutrition and health practices.....	24
3.6. Access to agricultural and nutrition-related services	29
3.6.1 Access to agricultural and nutrition-related information and training.....	29
3.6.2 Access to information and communications technology	33
3.6.3 Water user groups.....	34
4. Summary and Learning Outcomes for ADSP.....	34
4.1. Reducing the gender gap in knowledge access.....	35
4.2. Improving women's empowerment.....	35
4.3. Improving nutrition.....	36
4.4. Improving crop productivity, diversification, and commercialization	36
References	38

List of Tables

Table 1. Irrigated coverage areas (acres)	5
Table 2. Indicators used for nutrition exposure and knowledge	9
Table 3. Proportion (%) of sample households by household characteristics	11
Table 4. Proportion (%) of sample households not deprived in housing indicators	12
Table 5. Proportion (%) of sample respondents by individual characteristics	12
Table 6. Proportion (%) of parcels by type of document on land ownership	13
Table 7. Proportion (%) of sample households with livestock units	14
Table 8. Crops grown during post-monsoon season (2018–19)	15
Table 9. Crops grown during pre-monsoon season (2019)	15
Table 10. Crops grown during monsoon season (2019)	15
Table 11. Number of different crops grown by farming households	16
Table 12. Crop yield in biggest rice and nonrice parcels (kg/hectare)	17
Table 13. Estimated crop yields for all parcels cultivated	18
Table 14. Indicators of crop commercialization	18
Table 15. Pro-WEAI results	19
Table 16. Proportion (%) of survey respondents achieving adequacy in different empowerment domains, by gender	21
Table 17. Proportion (%) of survey respondents achieving adequacy in different empowerment domains, by household type and gender	22
Table 18. Proportion (%) of survey respondents by attitude about self-efficacy and gender norms	23
Table 19. Proportion (%) of survey respondents by leadership and engagement in the community	24
Table 20. Proportion (%) of survey respondents who answer nutrition questions positively or correctly ..	25
Table 21. Proportion (%) of survey respondents by proper handwashing practices	26
Table 22. Proportion (%) of sample households by water source and sanitation practices	28
Table 23. Proportion (%) of survey respondents consuming different essential food groups (24-hour food recall)	29
Table 24. Proportion (%) of survey respondents with access to agriculture- and nutrition-related information	30
Table 25. Proportion (%) of survey respondents by source of agriculture- and nutrition-related information	31
Table 26. Proportion (%) of agriculture- and nutrition-related training participants by training experiences	32
Table 27. Reasons for not following or adopting agriculture- or nutrition-related training lessons	32
Table 28. Proportion (%) of survey respondents by access to information and communication technologies	33
Table 29. Proportion (%) of survey respondents by WUG membership and experience	34

List of Figures

Figure 1. Map of Myanmar and location of the study sites	3
Figure 2. Map of the Sinthe and North Yamar irrigation sites	4
Figure 3. Sampling strategy for the SUN study	6
Figure 4. Domains and indicators of the Pro-WEAI	8
Figure 5. Contributors to disempowerment	20

1. Introduction

In May 2019, the Japanese Scaling Up Nutrition (SUN) Trust Fund, the Agricultural Development Support Project (ADSP), and the International Food Policy Research Institute (IFPRI) initiated a research project (called SUN study hereafter) that aims to diagnose, design, and test interventions to enhance gender equality and nutrition impacts within a sample of the ADSP coverage areas. ADSP (P147629) runs from 2015 to 2022 and aims to increase crop yields and cropping intensity in selected existing irrigation sites in Nay Pyi Taw, Bago East, Mandalay, and Sagaing regions. ADSP aims to improve irrigation infrastructure and provide technical support in irrigation governance and enhancing agricultural productivity and incomes of farmers. Starting in 2014, World Bank projects are encouraged to report on learning outcomes based on their nutrition and gender mainstreaming. The objective of the SUN study is to test delivery approaches to enhancing women's empowerment and the nutrition outcomes to feed into the learning agenda that can be used for future scale-up of ADSP project.

Agriculture is a potential pathway to improved nutrition, and the need for investments that boost agricultural production, keep prices low, and increase incomes is undisputable. Evidence of the nutritional effect of agricultural programs, however, is inconclusive; studies have shown that increased income does not necessarily lead to improved dietary diversity and nutrition (Ruel and Alderman 2013). Various studies also have indicated the critical role of women's empowerment in food and nutrition security (Cunningham et al. 2014; Kumar et al. 2018; Malapit et al. 2018; Ruel and Alderman 2013; Ruel et al. 2018).

We implement the empirical research in Myanmar, a country with huge agricultural potential but confronted by a high burden of malnutrition (MIID 2018; World Bank 2012). Myanmar performs worse in nutrition than most of its East Asian neighbors including those with lower income (World Bank 2012). The National Nutrition Center identified five undernutrition problems: protein energy malnutrition and high deficiencies in four micronutrients (iron, iodine, vitamin A, and vitamin B1), especially among women and children (MIID 2018). A study by Mahrt et al. (2019) shows that the country needs to look at the availability and affordability of nutritious foods and the role of nutrition education in addressing malnutrition.

In Myanmar, the Multisectoral National Plan of Action for Nutrition (MS-NPAN) has been developed and was approved in 2018. MS-NPA highlights women's lack of empowerment and poor knowledge and education as major underlying causes of malnutrition. Key indicators in the MSNPAN include (1) women's participation in household decision making, (2) life expectancy ratio of females to males, and (3) women's education attainment of at least secondary level. The SUN study aims to measure and directly contribute to improving the first indicator, and its longer-term goal is to contribute indirectly to improving indicators #2 and #3. This SUN study aims to contribute to key results and planned activities under MS-NPAN including (1) increased capacity of families to improve their practices, (2) improved knowledge of nutrition and health care of women and children, and (3) increased role and capacity of women and their groups in making decisions for health and nutrition issues in families as well as in social or community matters and issues, among others. The consultative processes related to MS-NPAN also generated suggestions to integrate the MS-NPAN activities into agricultural programming; this SUN study aims to help inform the future integration of nutrition into agricultural programs in Myanmar.

Some studies have documented the gender-based constraints in access to inputs, land, services, information, and participation in groups and community organizations, coupled with strong social norms and gender biases, that limit women's opportunities and productivity and increase their time burden. Such constraints and norms, in turn, affect their family's and children's nutrition and well-being (Akter et al. 2017; Faxon et al. 2015; MIID 2018; MS-NPAN 2018). Because of decades of military rule and oppression and a largely closed economy, Myanmar has mainly been deprived of research, including research on gender inequalities. Very little data are available from Myanmar, compared to other countries

(Akter et al. 2018; Lambrecht and Mahrt 2020). In recent years, several project reports or case studies have looked at gender issues, but few large-sample datasets and rigorous studies capture the status of gender-based constraints and empowerment in the culturally diverse areas of Myanmar. This paper aims to provide empirical evidence on the status of women's empowerment, gender equality, and nutrition using innovative and tested measurements and methods for data collection and analysis. In particular, this paper uses the survey-based tool to quantify women's and men's empowerment through the project-level Women's Empowerment in Agriculture Index (pro-WEAI) launched in 2018 by IFPRI and its partners. Moreover, this paper uses good practice guidance in measuring the Minimum Dietary Diversity for Women of Reproductive Age (MDD-W) score, which is a good proxy for micronutrient adequacy in a population of women of reproductive age. For comparison, we extend this indicator to men.

This paper provides the description of the baseline data collected under the SUN study. The specific research questions answered in this baseline study are as follows:

- What livelihood strategies do the sample households in the irrigation catchment areas adopt?
- What is the level of crop diversification, productivity, and commercialization among farmers in the focus irrigation catchment areas?
- What is the level of empowerment between women and men in the focus irrigation catchment areas?
- What are the sources of disempowerment among women and men in the study site?
- What is the level of nutrition knowledge and practice and diet quality in the study site?
- Are there differences in livelihoods, empowerment, and nutrition indicators between irrigation water users and other households?
- What are areas to improve women's and men's empowerment and nutrition indicators?

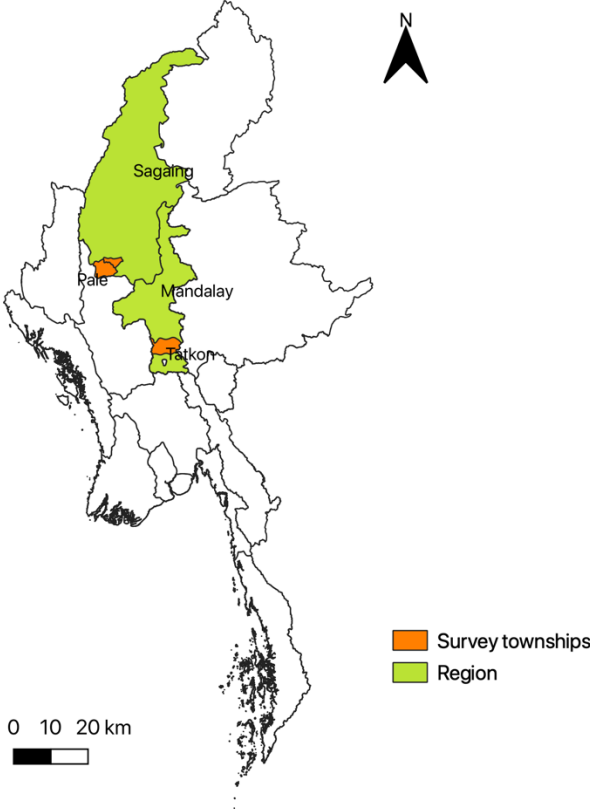
The rest of the report is structured as follows. Section 2 describes the sampling method for this baseline study. Section 3 presents the main findings. Section 4 summarizes the main findings and discusses their implications to the World Bank's ADSP and other similar projects.

2. Method

2.1. Study site

This study focuses on communities in the catchment areas of two irrigation sites, the Sinthe irrigation site in Tatkon township in Nay Pyi Taw region and the North Yamar irrigation site in Pale and Yinmarbin townships in Sagaing region (Figure 1). Both regions are in the central dry zones in Myanmar. These irrigation sites were the focus pilot sites of the ADSP by the time of the survey. Within these irrigation sites, three distribution channels (DYs) were the focus of ADSP in terms of its activities and were the focus of this baseline survey: DY2 in Sinthe site and DY5 and DY6 in North Yamar (Figure 2). These irrigation sites cover about 13,000 acres of irrigated area and are expected to increase coverage by 5,000 acres as a result of ADSP interventions (Table 1). North Yamar's main canal (ADSP's project area) has 10 DYs and one direct outlet (DO) covering 10,082 acres of irrigable area; the Sinthe irrigation site has five DYs and five DOs covering 7,761 acres as irrigable area (Table 1). According to data from the Department of Agriculture Land Management and Statistics (DALMS), in 2016–17 there were 5,769 farmers in 12 village tracts under the Sinthe irrigation scheme and 5,913 farmers in 16 village tracts under the Nother Yamar irrigation scheme.

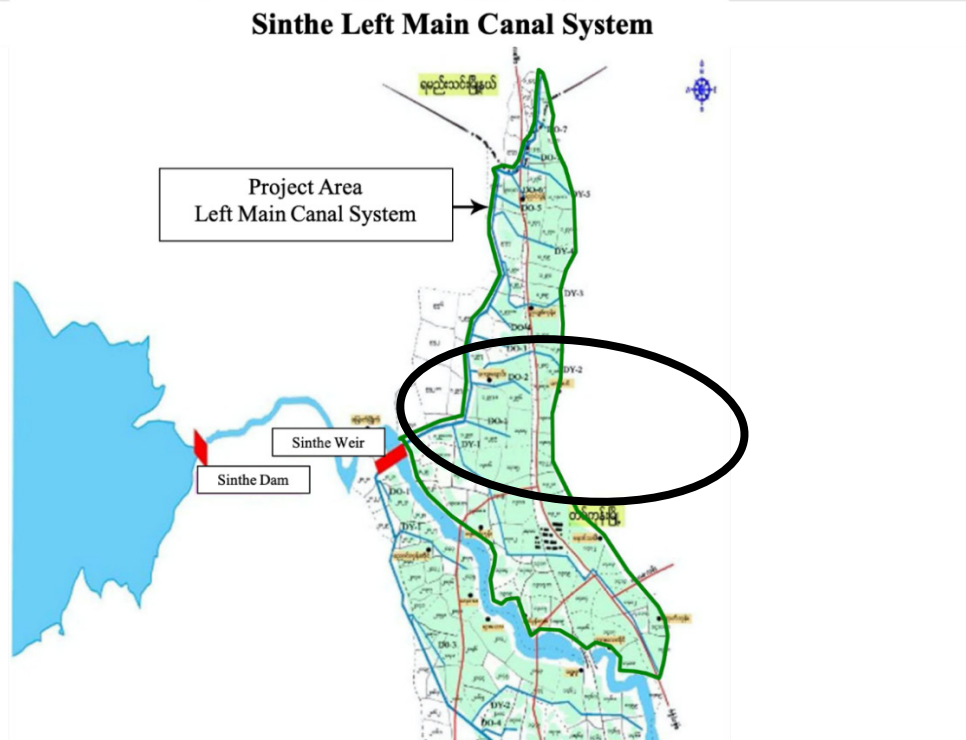
Figure 1. Map of Myanmar and location of the study sites



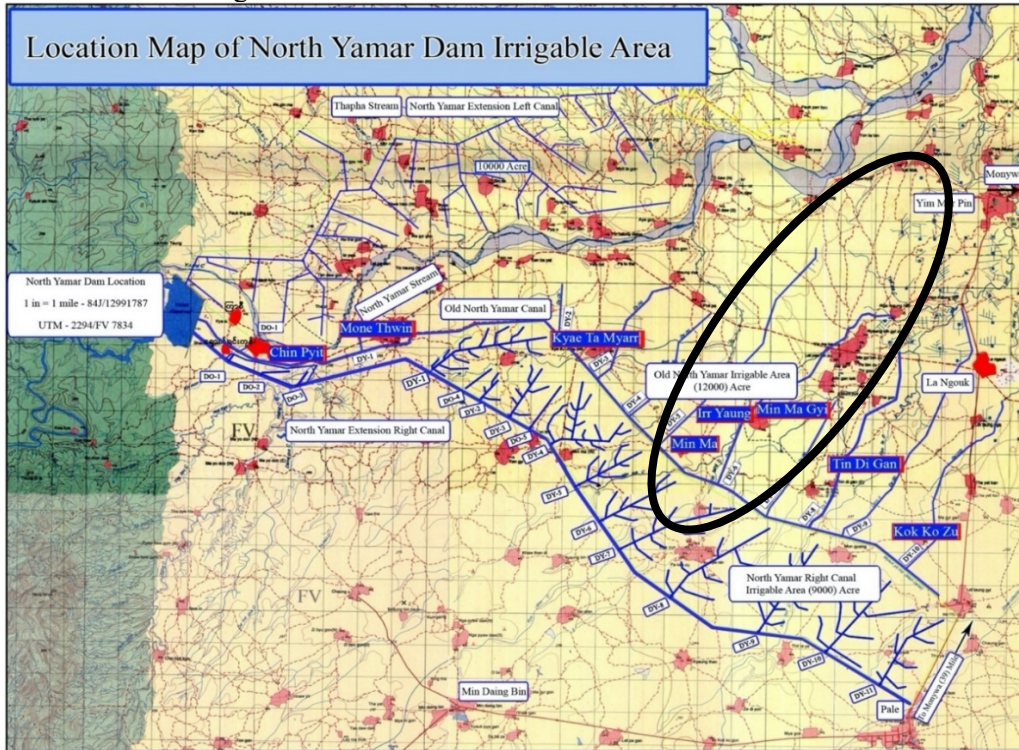
Source: IFPRI/World Bank/MSR (2020)

Figure 2. Map of the Sinthe and North Yamar irrigation sites

(a) Map of Sinthe irrigation site



(b) Map of North Yamar irrigation site



Source: ADSP documents: (a) IWUMD 2019a and (b) IWUMD 2019b; The coverage of the focus distribution canals (DYs) is indicated by the black ovals.

Table 1. Irrigated coverage areas (acres)

Scheme	Design Area	Irrigable area	Irrigated Area	Increased Irrigated Area*
North Yamar	12,292	10,082	5,962	4,120
Sinthe	10,005	7,761	6,846	915

Source: IWUMD's ADSP report. *expected increase in irrigated area as a result of ADSP interventions.

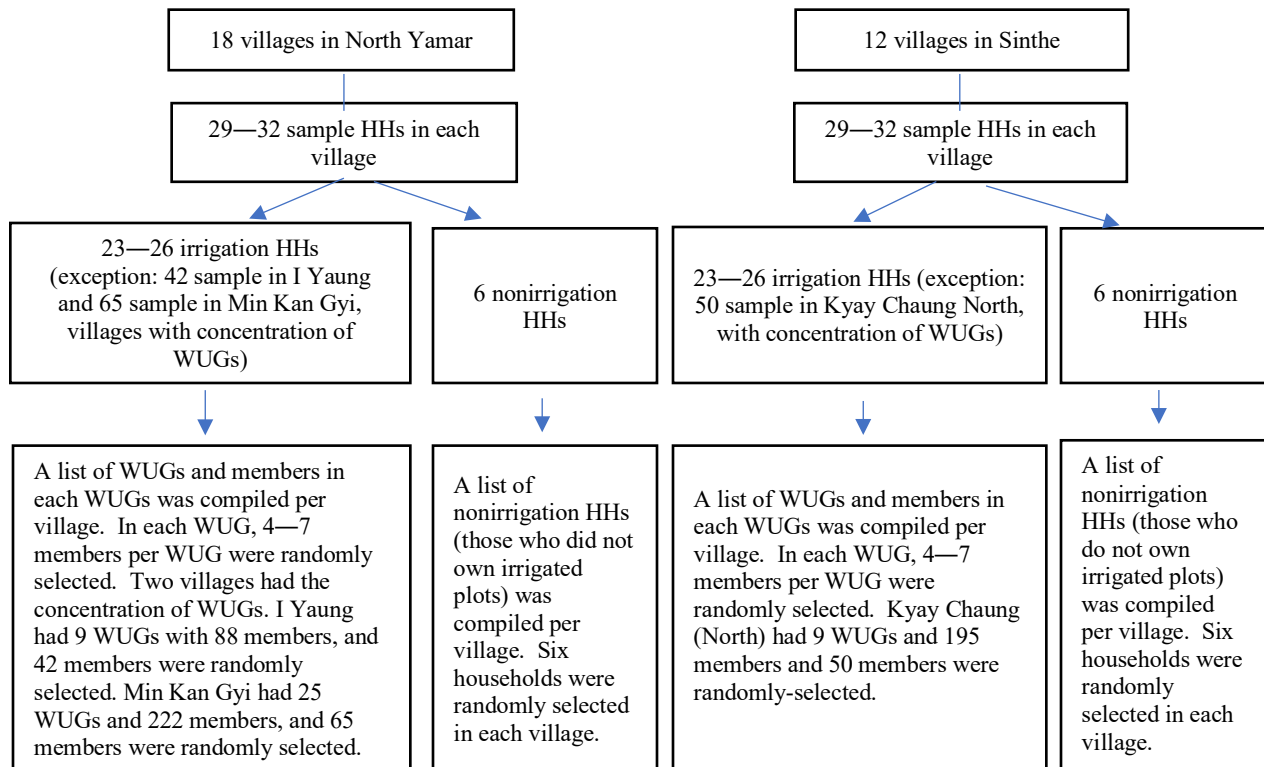
2.2. Data collection methods

A household survey was conducted in the study sites between November 2019 and February 2020. The household survey included both a household questionnaire and an individual questionnaire that was administered separately to a primary woman and a primary man decision maker within each household (usually the husband and wife). Scoping field work was undertaken from July 20 to August 4, 2019. A total of nine complementary community surveys and focus group discussions were conducted on September 9–28, 2019. A series of survey questionnaire pretests, particularly on women's empowerment modules, was conducted from October 22 to November 15, 2019, at the villages near the North Yamar and Sinthe irrigation sites.

2.2.1 Sampling strategy

The irrigation catchment areas are defined as the villages surrounding or engaged in farming in DY2 in the Sinthe irrigation site and DY5 and DY6 in the North Yamar irrigation site. These villages were identified by the irrigation officers, water user group facilitators, and village heads. Figure 3 shows the sampling strategy used for the household survey. A total of 12 villages in Sinthe and 18 villages in North Yamar were selected. In each village, full listing of households in the village was conducted by the survey team supervisors and 29–32 sample households were selected on the basis of stratified random sampling. The listing process was supported by village leaders, hundred household leaders and water user group members in each village. A list of water user group members were received from Nippon Koei organization facilitators and was confirmed and checked again by teams on arrival to each village. Households were stratified into three types. The first two types are the irrigation water users (called irrigation households hereafter), defined as those with at least one irrigated plot, disaggregated into (1) water users who have started forming water user groups (WUGs) under ADSP and (2) water users who are not yet part of a WUG. Because WUG formation has just started, we may not see differences in characteristics and activities between WUG and non-WUG members during baseline but expect to see some differences during the follow-up survey. The third type consists of other households with no irrigation plots, although some of them may have nonirrigated, upland plots used for crop cultivation (called other or nonirrigation households hereafter). The set-up of WUGs was concentrated in three villages. We oversampled these villages to ensure a sufficient sample of WUG members. In North Yamar site, I Yaung had 9 WUGs with 88 members, and 42 members were randomly selected. Min Kan Gyi had 25 WUGs and 222 members, and 65 members were randomly selected. Kyay Chaung (North) had nine WUGs and 195 members, and 50 members were randomly selected.

Figure 3. Sampling strategy for the SUN study



Source: Authors' compilation. HH=household; WUG=water user groups

The total sample is 998 households. This total consists of 340 households that have at least one member who is a member of a WUG (33 percent of the sample), 480 households that are irrigation water users but not yet members of WUGs (49 percent of the sample), and 180 other households with no irrigated plots (18 percent of the sample). The sample WUG members are roughly 40 percent of all the 840 WUG members identified in the two focus irrigation sites (Annex Table 1). The sample non-WUG irrigation users are roughly 23 percent in the focus villages; while sample nonirrigation-water-using households (other households) are roughly 6 percent in the focus villages. Overall, the sample households cover 16 percent of all households in the focus villages in the irrigation catchment areas.

2.2.2 Description of survey content

The survey consisted of both a household questionnaire and an individual questionnaire that was administered separately to the target woman and target man in the household. The household questionnaire contains basic information on household size and household members, land and crops cultivated, assets, and details on the value chains, including costs and labor. It was administered through a face-to-face interview with the most knowledgeable members or primary decision maker within the household and took, on average, one hour. The individual questionnaire contains information on the participation and experience in the ADSP program, other trainings and extension services, pro-WEAI modules, and gender attitudes. It was administered to the primary woman and man decision makers (interviewed separately) for about one hour each.

2.2.3 Enumerators' training and data collection

Myanmar Survey Research (MSR), which was selected through a competitive bidding process, implemented the household survey from November 2019 to February 2020. A total of 28 women and 20 men were trained to be enumerators for the household survey. Enumerator training was conducted in December and January 2019 by the IFPRI and WorldFish team and MSR. It included 10 days of

classroom-based work including practice and role play sections. The training covered project background information, ethics, obtaining informed consent, interviewing techniques, and detailed discussions of the questionnaires. A pilot survey was conducted in a nonsample area of Tatkon, Nay Pyi Taw, on December 24, 2019.

The survey was administered using tablets and a computer-assisted personal interviewing software called SurveyToGo (Dooblo) on which the interviewers were trained. As the data were collected, they were stored on a secure cloud-based server so that they were accessible to the research team for data checks.

2.2.4 Ethics and compensation

This study and all of its procedures were approved by IFPRI's Institutional Review Board as well as by the ADSP director and Irrigation and Water Utilization Management Department (IWUMD) under the Ministry of Agriculture, Livestock and Irrigation (MoALI) in Myanmar. The enumerators received training on research ethics, including the process for seeking informed consent. Prior to being interviewed, all participants provided oral informed consent. Consistent with standard practice, each household in the household survey was offered a package of coffee mix amounting to USD1.80 after the interview in appreciation for its time.

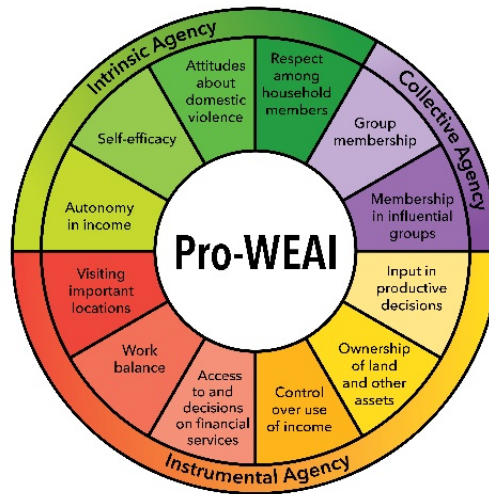
2.3. Indicators

We measured five sets of outcome indicators that pertain to (1) gender equality and women's empowerment, (2) nutrition, (3) crop productivity, (4) crop diversification, and (5) crop commercialization. We also measured demographic, socioeconomic, and other indicators that may affect the outcome indicators.

2.3.1 Gender equality and women's empowerment

We adopted the project-level Women's Empowerment in Agricultural Index (pro-WEAI), a survey-based tool to measure women's and men's empowerment and inclusion in agricultural development projects (Malapit et al. 2019). Unlike other empowerment measures (e.g., measures based on the Demographic and Health Surveys), which do not typically cover both men and women, pro-WEAI allows for direct comparison between women and men in the same household. The index consists of two subindices: the Three Domains of Empowerment index (3DE) and the Gender Parity Index (GPI). The 3DE aggregates women's and men's achievements across 12 equally weighted indicators that measure three types of agency: intrinsic, instrumental, and collective (Figure 4). Indicators of intrinsic agency are autonomy in income, self-efficacy, attitudes about intimate partner violence (IPV) against women, and respect among household members; indicators of instrumental agency are input in productive decisions, ownership of land and other assets, control over use of income, access to and decisions on financial services, freedom of movement and work balance; and indicators of collective agency are group membership and membership in influential groups. The GPI compares the achievements of women and men in the same household (for dual-adult households only).

Figure 4. Domains and indicators of the Pro-WEAI



Source: Malapit et al. 2019.

In this study, we adopted similar adjustments to those adopted by the pro-WEAI development team based on lessons learned from other ongoing pro-WEAI efforts. The first adjustment to the pro-WEAI (described in Malapit et al. 2019) was to exclude one indicator—freedom of movement—from the 12 indicators of the pro-WEAI. The missing indicator, freedom of movement, is meant to capture whether individuals can freely choose to move about within their communities and to neighboring communities; this indicator is currently undergoing further validation by the WEAI team. This indicator was also excluded in other applications of pro-WEAI in Benin, Malawi and the Philippines (Heckert et al. 2020; Malapit et al. 2020; Ragasa et al. 2020). Freedom of movement was also not identified as an issue during the scoping field visits and community surveys for this SUN study. The second adjustment was to relax the definition of asset ownership: adequacy was earlier defined as owning land *and* any three other assets and is now defined as owning land *or* any three other assets. The third adjustment was to streamline the self-efficacy indicator, from using eight statements to using three statements because of redundancies in the earlier eight statements encountered during the field team’s training and pretest. The fourth adjustment was to expand the list the list of livelihoods covered in the inputs to production decisions, so they include not just agriculture-related activities. The heavy focus on agriculture activities has been the main criticism of the WEAI methodology (Malapit et al. 2019). The fifth adjustment was to simplify the calculation of autonomy in income. Annex Table 2 provides the definitions and adequacy cut-offs for each indicator.

2.3.2 Nutrition and health

The study used the following indicators of nutrition and health. First, we computed a composite index and 12 indicators representing the exposure to knowledge and good practices on nutrition mainly based on the LEARN modules (LEARN 2015). The 12 indicators are binary variables based on survey responses (yes or no; agree or disagree) to a set of 12 questions or statements based on the LEARN modules (Table 2). Second, we asked respondents about their handwashing practices, sanitation facilities and practices, and water source. On the latter two indicators, we calculated both including and excluding water collection time (not deprived if water collection usually takes <30 minutes) and whether sanitation facility is not shared with other households. Other sanitation practices asked about were garbage disposal, drinking water treatment, and whether animals enter food preparation areas.

Table 2. Indicators used for nutrition exposure and knowledge

LEARN themes	12 indicators
Nutrition Basics	Agreed with “Men play an important role in making sure a family is well-nourished.”
	Chose a plate showing a healthy and nutritious diet (1/2 energy-giving food, 1/6 body-building food and 1/3 protective food according to LEARN’s nutrition guideline).
	Have heard that the most important time for good nutrition in a child’s life is from when a woman becomes pregnant until a child’s second birthday.
Family Nutrition	Agreed with “Like meat, fish, and eggs, legumes are also a body-building food.”
	Chose “Fathers support a pregnant or breastfeeding woman by helping her with chores, making sure she gets plenty of rest, or making sure she eats a variety of healthy foods.”
	Disagreed with “Breastfeeding women should avoid eating all kinds of beans, legumes, vegetables, fruits, eggs and meats because those foods could be harmful for the health of the mother and child.”
Access to Nutritious Foods	Disagreed with “Rice porridge (tamingazi) is the only solid food that children aged six months to two years old need to be healthy.”
	Agreed with “Families should avoid spending money on food which is not nutritious.”
	Disagreed with “Foods gathered from the wild are not as healthy as foods that are bought.”
Food Preparation	Have heard that a home garden with good production methods can contribute significantly to household nutrition security.
	Agreed with “We must take great care to ensure that the food preparation environment and the eating place are kept clean to protect our families from disease.”
	Have heard that washing vegetables before they are cut and using a lid when boiling vegetables are practices that can make prepared food more nutritious.

Source: LEARN 2015.

Third, the MDD-W indicator for the women and men respondents was calculated. Dietary diversity is a commonly used indicator for diet quality and an international accepted proxy for nutrition. Martin-Prével et al. (2015) establish an MDD-W threshold of 5 out of 10 food groups, which at the population level is associated with greater micronutrient adequacy of among women of reproductive age. In this study, we asked each respondent to list the food eaten the day before the interview (24-hour food recall, from the time of waking up to before going to sleep). This study follows the good practice guidelines in FAO and FHI360 (2016) in designing and conducting MDD-W. We used a list of 10 food groups as in FAO and FHI360 (2016) and adapted in the Myanmar context:

- Grains, white roots and tubers, and plantains
- Pulses (beans, peas, and lentils)
- Nuts and seeds
- Dairy
- Meat, poultry, and fish
- Eggs
- Dark green leafy vegetables
- Other vitamin A-rich fruits and vegetables
- Other vegetables
- Other fruits

Foods providing at least 60 retinol activity equivalents (RAEs) per 100 grams are considered sources of vitamin A (FAO and FHI360 2016). Examples given to respondents during the survey are any vegetables or roots that are orange colored inside, such as pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside, or any fruits that are dark yellow or orange inside, such as ripe mango, ripe papaya, muskmelon, or ripe, deep yellow-fleshed or orange-fleshed bananas.

2.3.3 Crop productivity, diversification, and commercialization

Crop productivity is measured as the harvested crop in kilogram per acre of cultivated land per cropping season. Crop productivity is measured in terms of the biggest rice and non-rice parcels and on total harvest reported for the last 12 months divided by the corresponding total cultivated areas. Cropping intensity is defined as the sum of crop areas planted in wet, winter and dry seasons divided by the net area equipped by irrigation and drainage, in percent (World Bank 2015, page 45). Crop diversification is measured in two ways: (1) the number of different crops grown in the same parcels and across all parcels and (2) the Simpson's Diversity Index, $SID_i = 1 - \sum_{j=1}^{J_i} c_{ij}^2$, where c_{ij} is the share of the household's total cropland area that is planted with crop j , $j = 1, \dots, J_i$. SID that is equal or closer to 0 means limited diversification and complete specialization; SID that is equal or closer to 1 means diversification. Crop commercialization is measured as the proportion of total harvest sold.

3. Results

3.1. Characteristics of the sample

This section describes the sample respondents and households. The communities are pretty homogenous. Almost all respondents are Burmese, with only four respondents who belonged to Shan, Kayin, or Mon ethnicities. All respondents practiced Buddhism.

The average household size was 4.22 (Table 3). Eighty-eight percent of the sample households had both female and male adults (dual-adult households) and 12 percent had female adults only (no male adults). Most households were composed of a married couple, one or two of their parents or older members, and either no children or one child. Irrigation households had generally bigger household size than nonirrigation households. Despite cultural similarities, many differences in socioeconomic indicators between irrigation and nonirrigation households were observed.

Table 3. Proportion (%) of sample households by household characteristics

Indicator	All	Irrigation HH	Other HH	Difference (I- O)	
Household size	4.22 (1.72)	4.35 (1.72)	3.65 (1.60)	0.70	***
Number of children (0–2)	0.05 (0.23)	0.04 (0.21)	0.08 (0.29)	–0.03	
Number of children (2–8)	0.19 (0.42)	0.18 (0.41)	0.23 (0.47)	–0.05	
Number of children 8–18	0.26 (0.49)	0.26 (0.47)	0.30 (0.55)	–0.04	
Land owned or operated (acre)	6.94 (6.87)	8.31 (6.77)	0.68 (2.29)	7.63	***
% of households with wage/salary employment	39.88	32.76	72.22	–39.46	***
Amount of wages/salaries (MMK 000/year)	329.57 (757.27)	278.61 (759.39)	561.16 (704.41)	–282.55	***
% of household with nonfarm enterprises	20.84	19.93	25.00	–5.07	
Net income from nonfarm enterprises (MMK 000/year)	289.91 (4,803.17)	340.60 (5,127.61)	59.58 (2,903.17)	281.01	
% of households receiving remittances	29.76	28.00	37.78	–9.78	*
Amount of cash remittances (MMK 000/year)	2,895.14 (11,940.68)	2,664.06 (8,525.77)	3,945.28 (21,471.47)	–1,281.22	
% of households receiving transfers	9.52	10.76	3.89	6.87	***
Amount of cash transfer (MMK 000/year)	192.85 (1,125.21)	218.97 (1,214.46)	74.16 (550.36)	144.82	*
N	998	818	180		

Source: IFPRI/World Bank/MSR 2020.

Note: Statistically different at * 10%, ** 5%, *** 1% level of significance based on Wald test. MMK1,444 = USD1 (exchange rate in January 31, 2020, end of survey).

Most households (89 percent of irrigation households and 73 percent of nonirrigation households) had access to electricity (Table 4). Most households also had sufficient rooms and dwelling size and did not experience crowding, an indicator of household welfare (UN 2007). Few households, however, had improved cooking fuel or improved housing materials. Fewer other households than irrigation households had improved cooking fuel or improved housing materials. Overall, irrigation households are not deprived in 59 percent of housing indicators compared 46 percent of nonirrigation households.

Table 4. Proportion (%) of sample households not deprived in housing indicators

	All Households	Irrigation HH	Other HH	Difference (I-O)	
Average household share of indicators that are not deprived	57	59	46	13	***
Household has fewer than 4 members per room	73	74	71	3	
Household uses an improved cooking fuel	46	49	30	19	***
Household has access to electricity	86	89	73	16	***
Household has improved housing materials	21	24	11	13	***
Number of sample households	991	812	179		

Source: IFPRI/World Bank/MSR (2020). Note: Statistically different at * 10%, ** 5%, *** 1% level of significance. UN-Habitat defines crowding, and therefore deprivation, when there are more than three people per room (UN 2007). Crowding indicator excludes kitchens, toilets, corridors, balconies, and rooms used only for business. Improved cooking fuels include electricity, liquified petroleum gas, or biogas. Improved housing is a house that is not a hut and does not have natural or rudimentary floors, walls, or roof.

In terms of individual respondents, the average age was 51 (Table 5). Ninety-two percent belonged to dual-adult households and 8 percent belonged to female-adult-only households. There was low level of education in the study site, with 46 percent of respondents having no formal schooling or only a few years in primary school. Only 11 percent of respondents were high school graduates or higher. Sample women had significantly lower educational attainment and literacy than men. Eighty-four percent of the respondents were married, 9 percent were single, and 7 percent were widow/divorced/separated.

Table 5. Proportion (%) of sample respondents by individual characteristics

Indicators		All	Men	Women	Difference (M-W)	
Household type	Dual-adult household	92	100	86	14	***
	Female-adult-only household	8	0	14	-14	***
Highest education	No education	46	40	50	-10	***
	Primary	43	45	41	5	**
	High school	11	14	9	5	***
Literacy status	Cannot read/write	4	1	7	-6	***
	Can read/write, but not fluent	20	17	22	-5	***
	Fluent	76	82	71	11	***
Marital status	Single	9	7	12	-5	***
	Married	84	90	78	12	***
	Widow/Divorced/Separated	7	3	10	-7	***
Participation in farming	Does not participate in farming	22	13	29	-16	***
	Participates in farming	78	87	71	16	***
Main occupation	Farming own land	67	82	54	28	***
	Agricultural labor	6	6	5	1	
	Nonfarm employment or own enterprise	9	9	10	-1	
	Homemaker	18	3	31	-28	***
Age (number of years)		51	53	50	2	***
Number of respondents		1,853	855	998		

Source: IFPRI/World Bank/MSR 2020. Note: Statistically different at * 10%, ** 5%, *** 1% level of significance.

3.2. Livelihood strategies

Most sample respondents (81 percent of men and 71 percent of women) were engaged in farming activities (Table 5). Qualitative interviews and focus group discussions revealed that farming was seen as “family activity” in which the husband, wife, and other adult household members help out with farming activities. Farming was reported as the main occupation by 82 percent of men respondents and 54 percent of women respondents.

The average agricultural land owned or operated by the sample households within 12 months prior to the survey was 6.94 acres, ranging from 0.15 to 45 acres (Table 3). Among irrigation households, the average agricultural land owned or operated was 8.31 acres. Twenty-one percent of the nonirrigation households owned and cultivated some land in nonirrigated areas (upland areas). Among the nonirrigation households, the average land owned and operated was 0.68 acres. In terms of the type of documents for land ownership, 92 percent of households had some kind of legal documents (Table 6). Eighty-nine percent held a Form 7 (also called land use certificate), which gives farmers the legitimacy to sell or transfer their land or use their land as collateral for accessing credit.

Table 6. Proportion (%) of parcels by type of document on land ownership

Document type	All parcels	Lowland	Upland
Form 7	88.96	91.95	77.06
None	7.91	5.65	16.87
Contract	1.67	1.27	3.24
Form 105/U paing	1.07	0.94	1.62
Tax receipt	0.34	0.13	1.21
Don't know	0.05	0.06	0.00
Number of parcels	3,841	3,082	741

Source: IFPRI/World Bank/MSR 2020.

Aside from the farming, households in the irrigation catchment areas rely on other sources of income, including wage or salary employment, nonfarm enterprises, and remittances. Forty percent of sample households were engaged in wage or salary employment (Table 3). Thirty-three percent of irrigation households and 72 percent of nonirrigation households were engaged in wage or salary employment. The communities are roughly 4–5 kilometers or 20–30 minutes by motorbike away from the nearest town center, where household members work in wage or salary employment. Twenty-one percent of households had nonfarm enterprises they were managing or were engaged in. Twenty percent of irrigation households and 25 percent of nonirrigation households were engaged in nonfarm enterprises. The most common of these nonfarm enterprises were trading, dry good shops, and crafts or artisan activities.

Men respondents more often reported farming as their main occupation as compared to women respondents (82 versus 54 percent) (Table 5). Nearly a third of female respondents (31 percent) but only 3 percent of male respondents reported homemaker (not engaged in any farm or nonfarm employment or enterprise) as main their employment. There is no difference in the proportion of women and men respondents reporting farm and nonfarm employment and own nonfarm enterprises as their main occupation: 5–6 percent of men and women respondents reported agricultural labor as their main occupation, and 9–10 percent of men and women respondents reported nonfarm employment or own enterprises as their main occupation (Table 5).

Among irrigation households, the vast majority (93 percent) had farming as the main occupation of men respondents. Sixty-five percent of the wives also had farming as their main occupation, while 28 percent

were homemakers and the remaining 7 percent had other main jobs (mainly small household nonfarm enterprise). Half of the women in irrigation households were engaged and helped out in farming.

Among the nonirrigation households, 26 percent of men respondents had nonirrigation upland acreage and had farming as their main occupation, whereas 26 percent of them worked as daily farm labor. Among the women respondents, 13 percent had farming as their main occupation, 25 percent worked as farm labor, and the majority of them are homemakers.

The study reveals some migration from the study sites. Thirty percent of households had some relatives working in other places and were receiving remittances from these relatives. Twenty-eight percent of irrigation households and 38 percent of nonirrigation households received remittances. Some households also received transfers (cash or in-kind) from government or nongovernmental organizations (NGOs). Eleven percent of irrigation households and four percent of nonirrigation households received transfers (Table 3).

Livestock raising is not common in the study sites, except for draft animals (Table 7). Many farmers do not raise or own any more animals than are necessary to complete farming tasks. To many farmers, it is considered bad karma to breed animals if they end up at the slaughterhouse, which is similar to the observations in the study in other townships in Central Myanmar by Proximity Designs and Studio D Radiodurans (2019).

Table 7. Proportion (%) of sample households with livestock units

Livestock	% of households owning	For those households owning, figures are the livestock units			
		Mean	SD	Mix	Max
Cow/oxen/buffalo (draft animals)	48.5	2.3	0.9	1.0	8.0
Cow/oxen/buffalo (nondraft animals)	26.3	2.3	1.5	1.0	17.0
Chicken	22.3	12.6	11.6	1.0	60.0
Pig	11.2	1.8	1.0	1.0	8.0
Duck	0.8	5.5	4.0	1.0	12.0
Goat	0.1	6.0	na	6.0	6.0

Source: IFPRI/World Bank/MSR 2020. SD=standard deviation. na=not applicable

3.3. Crop diversification, productivity, and commercialization

This section describes the production, cropping patterns, and commercialization of households that cultivated some crops in any of the growing seasons during the 12 months prior to the survey. Of the total agricultural land owned and operated reported by the sample households, 52 percent was cultivated during the post-monsoon season (October 2018 to mid-February 2019) (Table 8), 25 percent during the pre-monsoon season (mid-February to mid-May 2019) (Table 9), and 83 percent during the monsoon season (mid-June to late October 2019) (Table 10). During the 2018–19 post-monsoon season, chickpeas were the dominant crop, accounting for 78 percent of the cropland. During the 2019 pre-monsoon season, sesame and paddy were the main crops grown accounting for 47 percent and 43 percent of total acreage, respectively. During the 2019 monsoon season, paddy dominated the cropland area.

Table 8. Crops grown during post-monsoon season (2018–19)

Crops	Land area (acres)	Percent
Chickpeas	2,806.52	77.72
Wheat	304.76	8.44
Sunflower	119.81	3.32
Green gram	62.94	1.74
Sesame	60.28	1.67
Groundnut	55.58	1.54
Onion	43.64	1.21
Paddy	39.75	1.10
Soybean	24.50	0.68
Tomatoes	15.75	0.44
Shwe Yinn Mar bean	15.25	0.42
Chili peppers	14.50	0.40
Labab bean	14.15	0.39
Other	33.86	0.94
Total	3,611.285	100

Source: IFPRI/World Bank/MSR 2020.

Table 9. Crops grown during pre-monsoon season (2019)

Crops grown in pre-monsoon	Land area (acres)	Percent
Sesame	792.82	47.18
Paddy	725.13	43.15
Green gram	67.60	4.02
Tomatoes	27.29	1.62
Chili pepper	13.75	0.82
Groundnut	13.25	0.79
Other	40.51	2.41
Total	1,680.35	100

Source: IFPRI/World Bank/MSR 2020.

Table 10. Crops grown during monsoon season (2019)

Crops	Land area (acres)	Percent
Paddy	5,214.44	89.06
Sesame	275.73	4.71
Green gram	74.00	1.26
Chickpeas	47.20	0.81
Chili pepper	47.15	0.81
Cotton	43.65	0.75
Sunflower	42.70	0.73
Groundnut	36.90	0.63
Maize	25.05	0.43
Other	48.10	0.82
Total	5,854.92	100

Source: IFPRI/World Bank/MSR 2020.

Cropping systems are quite diverse with different crops being grown across seasons (Table 11). Most farming households planted two or three different crops in the same parcel across different seasons, although monocropping (i.e., one crop per parcel of land) was practiced in 98 percent of all parcels in 2019. The average Simpson index of crop diversification (SID) was 0.457, which indicate relatively diverse cropping system across seasons. Fourteen percent of households with land cultivated only one

crop per year (thus SID=0), about of households had SID less than 0.5, and the others had SID of at least 0.5.

Table 11. Number of different crops grown by farming households

Number of different crops in same parcel	Number of parcels	% of parcels	Number of farming households	% of households
1	1,220	33.97	75	9.04
2	1,927	53.66	472	56.87
3	377	10.5	218	26.27
4	40	1.11	40	4.82
5	15	0.42	13	1.57
6	8	0.22	8	0.96
8	2	0.06	2	0.24
9	1	0.03	1	0.12
10	1	0.03	1	0.12
Total	3,591	100	818	100

Source: IFPRI/World Bank/MSR 2020.

Crop intensity, measured as the sum of crop areas planted in wet, winter and dry seasons divided by the net area equipped by irrigation and drainage, was 1.4 in 2019. Fifty-four percent of irrigation HHs cultivated only for one cropping season (i.e., rainy or monsoon season), whereas the rest of the irrigation HHs cultivated two or three cropping seasons. On average, of the total 14.2 acres of gross area planted by an irrigation household, 8.1 acres was irrigated, which was about 57 percent. During post-monsoon season, 8 percent of cultivated parcels of the sample irrigation households were irrigated; monsoon season, 76 percent; and pre-monsoon, 71 percent.

In terms of productivity, we asked for the quantity of harvest for each farming household in its biggest rice plot and biggest nonrice plot. Table 12 shows the harvested quantity in kilograms per hectare of land harvested for paddy and the most common crops grown per season. The average paddy yield during monsoon was 3.2 tons per hectare (t/ha); the average paddy yield during pre-monsoon season was 3.6 t/ha. The average yield of green gram was 0.6 t/ha. These averages were all comparable to the baseline estimates in the ADSP Project Appraisal Document (PAD) (World Bank 2015). The average yield of sesame was 0.23—0.27 t/ha, which was closer to a bad year harvest (0.11 t/ha) than a good year harvest (0.65 t/ha) described in Oo (2018). The figures in Table 12 also show wide variability in the crop yields and low levels achieved many farmers. These indicate the need to understand why there is wide variability and low yields achieved by many farmers in order to devise strategies to reduce this variability and improve the yields of many farmers with currently low levels.

Table 12. Crop yield in biggest rice and nonrice parcels (kg/hectare)

Crop (season)	Number of farmers	Mean	SD	Min	Max
Paddy (pre-monsoon)	239	3,564.36	1,454.14	430.37	9,296.09
Paddy (monsoon)	794	3,219.85	1,363.62	77.47	9,113.81
Paddy (post-monsoon)	15	3,291.75	1,336.54	1,187.83	6,197.39
Sesame (pre-monsoon)	169	402.13	297.71	20.18	2,196.76
Sesame (monsoon)	65	267.27	195.97	5.41	888.75
Sesame (post-monsoon)	22	231.36	209.60	7.57	665.95
Green gram (pre-monsoon)	33	624.08	331.46	23.09	1,292.85
Green gram (monsoon)	31	614.42	430.62	10.10	2,017.53
Chickpeas (post-monsoon)	358	860.58	818.00	51.56	9,805.24
Wheat (post-monsoon)	21	1,432.49	1,062.53	593.05	4,542.78
Sunflower (post-monsoon)	24	413.97	341.10	8.96	1,398.31

Source: IFPRI/World Bank/MSR 2020. SD=standard deviation.

We also asked respondents roughly how much they harvested per crop across all parcels instead of the biggest parcel as in Table 12. Rice production was 2.9 t/ha across all parcels (Table 13), which was slightly lower than the biggest rice parcel mentioned above. Chickpea production was 0.68 t/ha, which was also lower than the biggest chickpea parcel above. The biggest difference was with sesame—production was at 23 kg/ha across all parcels compared to more than 200 kg/ha in the biggest parcel. Being described as “the gambling crop” (*Laung-ka-sar-thee-nan*), sesame’s yields are volatile and sensitive to weather changes. Therefore, sesame farming is considered risky. Compared to rice, agronomic researchers and policymakers have paid little attention to sesame and provided scant support to grow markets or promote value-added investments (Proximity Designs and Studio D Radiodurans 2019). Nonetheless, sesame is the second largest staple crop grown in Myanmar, both in terms of acreage and its estimated 500,000 farmers (Proximity Designs and Studio D Radiodurans 2019). While some product is directed for domestic consumption as oil and snacks, the country is now the sixth-largest exporter in the global market, with nearby China, South Korea, and Japan being the primary destination for 76 percent of overall product (Proximity Designs and Studio D Radiodurans 2019). More attention can be given to sesame.

Table 13. Estimated crop yields for all parcels cultivated

Indicators	Mean	SD	Min	Max
<i>Rice</i>				
Quantity harvested (kg)	8,927.5	7,585.4	177.7	66,880.0
Land cultivated (ha)	3.0	2.2	0.2	14.2
Production (kg/ha)	2,972.3	1,060.9	206.6	7,512.0
<i>Chickpea</i>				
Quantity harvested (kg)	1,688.8	1,322.9	93.9	9,390.0
Land cultivated (ha)	2.8	2.1	0.2	14.1
Production (kg/ha)	681.0	389.0	128.9	3,609.4
<i>Sesame</i>				
Quantity harvested (kg)	28.7	78.3	1.5	1,225.0
Land cultivated (ha)	1.7	1.6	0.2	13.6
Production (kg/ha)	23.3	94.8	0.9	1,513.5

Source: IFPRI/World Bank/MSR 2020. SD=standard deviation.

Most producing households sell their harvest (Table 14). For example, 72 percent of households that grew rice in the last 12 months have sold their harvest. On average, a farmer sold about 28 percent of the total harvested rice. For chickpeas, a farmer sold about 59 percent of total harvest on average. For sesame, a farmer sold about 51 percent of total harvest on average.

Table 14. Indicators of crop commercialization

Crop	Number of farming households growing this crop	% of households growing this crop	% of producing households selling	% of harvest sold			
				Mean	SD	Min	Max
Paddy	812	99	72	28	27	0	100
Chickpeas	375	46	94	59	32	0	100
Sesame	264	32	73	51	40	0	100
Green gram	86	11	97	85	26	0	100
Sunflower	80	10	19	11	27	0	100
Groundnut	78	10	79	50	33	0	100
Wheat	56	7	96	76	27	0	100

Source: IFPRI/World Bank/MSR 2020. SD=standard deviation.

3.4. Empowerment

The pro-WEAI includes 11 indicators measured across three domains of empowerment (Table 15). The overall proportion of respondents achieving empowerment, as defined by the 72 percent threshold (adequacy in 8 out of 11 indicators), was low for both women and men. Only 47 percent of women and 75 percent of men achieved empowerment. Fifty-three percent of women and 25 percent of men were not empowered. Among women, fewer women in dual-adult households achieved adequacy than women in women-adult-only households in almost all indicators, except attitude about IPV and respect among household members (Annex Figure 2).

Another component of the pro-WEAI is the GPI, which reflects women's achievements relative to men in the same household. Only 55 percent of all dual-adult households achieved gender parity (and 45 percent

have gender disparity in empowerment). The average empowerment gap, or the average percentage difference in empowerment between men and women in households that did not achieve gender parity, was 0.21. Both the 3DE score and the GPI score are used to calculate the pro-WEAI score, which is 0.78 for the total sample.

Table 15. Pro-WEAI results

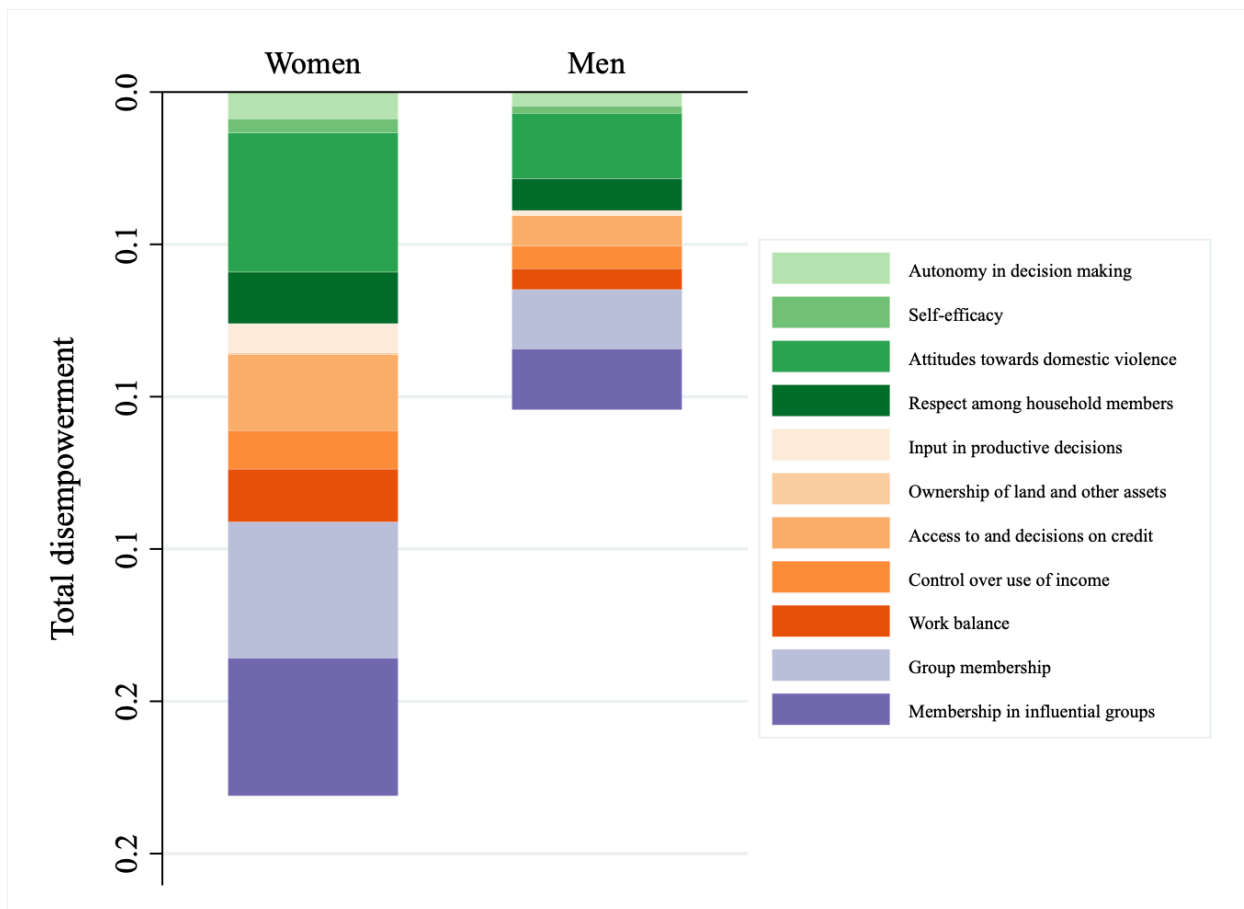
Indicator	Women	Men
Number of observations	929	848
3DE score	0.77	0.9
Disempowerment score (1 – 3DE)	0.23	0.1
% achieving empowerment	47	75
% not achieving empowerment	53	25
Mean 3DE score for not yet empowered	0.56	0.59
Mean disempowerment score (1 – 3DE)	0.44	0.41
Gender Parity Index (GPI)	0.90	
Number of dual-adult households	848	
% achieving gender parity	55	
% not achieving gender parity	45	
Average empowerment gap	0.21	
Pro-WEAI score	0.78	

Source: IFPRI/World Bank/MSR 2020.

Figure 5 shows the absolute contributions of each of the 11 indicators to disempowerment. Inadequacy in attitudes about IPV and lack of participation on groups and in influential groups are the top contributors to disempowerment for women and men. These inadequacies were significantly worse for women. Most women and men had high tolerance and acceptance of IPV against women. Only 8 percent of women and 19 percent of men believed that husbands are not justified in hitting their wives regardless of circumstances, based on responses to six scenarios, similar to the Myanmar Demographic and Health Survey, narrated to the respondents. More details are in Annex Figures 1 and 2.

Lack of membership in groups, especially in influential groups, was the second top contributor for women and men (Figure 5). Other leading contributors to disempowerment for women were lack of access to and decisions on financial services, lack of work balance, and lack of intrahousehold harmony or respect among household members.

Figure 5. Contributors to disempowerment



Source: IFPRI/World Bank/MSR 2020. The bars and components show disempowerment score or lack of adequacy in the dimensions of empowerment.

Table 16 shows the proportion of women and men respondents achieving adequacies in 11 pro-WEAI indicators. In all indicators except control over use of income, autonomy in income, and ownership of land and other assets, fewer women achieved adequacies. The largest differences in adequacies between women and men were in indicators of collective agency, particularly group membership (34 percentage points [pp], with men more likely to achieve adequacy) and membership in influential groups (33 pp difference). The next-largest differences in adequacies between women and men were in indicators of instrument agency, in particular, access to and decisions on financial services (13 pp difference). The difference between men and women in inputs to productive decisions is also relatively large (9 pp difference). Among the intrinsic agency indicators, attitudes about IPV against women show the largest difference in adequacy between women and men (11 pp difference, with men more likely to achieve adequacy). Women were more tolerant and accepting than men of IPV against women.

Table 16. Proportion (%) of survey respondents achieving adequacy in different empowerment domains, by gender

	Women	Men	Gender gap
Autonomy in income	89	91	2
Self-efficacy	94	96	2*
Attitudes about intimate partner violence against women	8	19	11***
Respect among household members	74	79	5**
Input in productive decisions	89	98	9***
Ownership of land and other assets	99	100	0
Access to and decisions on financial services	66	80	13***
Control over use of income	84	83	-2
Work balance	72	80	8***
Group membership	32	67	34***
Membership in influential groups	31	64	33***
<i>N</i>	929	848	

Source: IFPRI/World Bank/MSR 2020. Statistically different at *** 1%, ** 5%, and * 10% level of significance. More details can be found in Annex Tables 3 through 8 and Annex Figures 1 and 2.

Women and men in irrigation and nonirrigation households were generally similar in terms of empowerment and main contributors of empowerment (Table 17), with a few exceptions. First, tolerance and acceptance of IPV are worse among both women and men in other households than in irrigation households. Second, access to and decisions on financial services was much worse for both women and men in other households than in irrigation households. This difference results from the availability of credit from the Myanmar Agricultural Development Bank (MADB) given to rice farmers but not available to other households. Third, work balance was worse for women in the other households than for women in irrigation households, and the same for men in both the irrigation and other households. Work balance for women in both irrigation and other households was worse than for men in these households. Fourth, there was no difference in group membership between women in irrigation and in other households, whereas group membership of men in other households was much lower than of men in irrigation households.

Table 17. Proportion (%) of survey respondents achieving adequacy in different empowerment domains, by household type and gender

	Irrigation HH			Other Households			Irrigation type gap	
	Women	Men	Gender gap	Women	Men	Gender gap	Women (IHH vs. OHH)	Men (IHH vs. OHH)
Autonomy in income	89	91	2	89	87	-2	1	5*
Self-efficacy	95	96	1	91	96	5	4*	-0
Attitudes about intimate partner violence against women	9	20	11***	4	13	9***	5**	7*
Respect among household members	75	79	4**	70	76	7	5	3
Input in productive decisions	90	98	9***	87	97	10***	2	1
Ownership of land and other assets	99	100	0	100	100	0	-1	-0
Access to and decisions on financial services	69	85	16***	50	46	-4	19***	39***
Control over use of income	84	82	-2	89	89	-0	-6*	-7**
Work balance	74	80	7***	66	81	15***	7*	-1
Group membership	32	70	38***	33	47	14**	-1	23***
Membership in influential groups	31	68	37***	32	44	12**	-1	24***
<i>N</i>	781	721		148	127			

Source: IFPRI/World Bank/MSR 2020. Note: Statistically different at *** 1%, ** 5%, and * 10% level of significance. HH=household; IHH=irrigation HH; OHH=other HH

Table 18 shows strong sense of self-efficacy among both women and men respondents. Almost all respondents strongly agreed or agreed with statements indicating self-efficacy (#1–3). A majority of respondents also agreed or strongly agreed with statements in favor of gender equality. For example, almost all women and men respondents strongly agreed with the statements that women should be encouraged and supported to be leaders or entrepreneurs. Similarly, nearly all women and men respondents strongly agreed that husbands should help wives with household chores like cooking and taking care of children. Disagreement did arise about whether women can own land or assets or have their names in the title. This disagreement mirrors the strong culture in Myanmar that land and assets should be in the name of the head, which is often the man in the household. For gender sensitization, these gender norms on equality in land and asset ownership could be emphasized.

Table 18. Proportion (%) of survey respondents by attitude about self-efficacy and gender norms

Statements about self-efficacy and gender attitudes	Men					Women				
	SD	D	N	A	SA	SD	D	N	A	SA
1. I will be able to achieve most of the goals that I have set for myself.	0	1	1	7	91	1	1	1	10	86
2. Compared to other people, I can do most tasks very well.	1	2	0	9	88	2	2	1	12	84
3. Even when things are tough, I don't easily give up.	1	0	1	6	91	1	2	0	11	86
4. I am motivated to do my work better than I have done in the past.	0	0	0	5	95	1	0	0	8	91
5. I make important contributions to my community.	1	1	1	9	88	2	2	1	13	82
6. Women should be encouraged and supported to be leaders in the community, groups, or organizations.	3	2	2	8	85	3	0	1	9	87
7. Women should be encouraged and supported as entrepreneurs or as owners and managers of farms or businesses.	1	0	1	8	90	1	1	1	9	88
8. Husbands should help wives with household chores like cooking and taking care of children.	1	0	0	7	92	1	1	1	10	88
9. Women can own land or household assets or have their names in the title.	23	9	3	9	56	14	6	3	11	66

Source: IFPRI/World Bank/MSR 2020. Respondents were read the following statements and were asking to say whether they SD=strongly disagree, D=disagree, N=neither agree or disagree, A=agree, or SA=strongly agree on each of those statements.

Table 19 shows the level of engagement of respondents in community affairs and their level of comfort about speaking in public. Nineteen percent of men and 46 percent of women said they were not comfortable speaking in public. Moreover, a majority of women and men did not feel they had influence in what was happening in the community. Fifty-four percent of men and 67 percent of women felt they could not change anything in the community if they really wanted to. Building self-confidence, negotiation skills, and leadership skills should therefore also be emphasized during sensitization efforts, especially for women.

Table 19. Proportion (%) of survey respondents by leadership and engagement in the community

	Men	Women
<i>Suppose you are asked to attend a meeting in the community, do you dare to speak up to help decide on community affairs (e.g., discussions on infrastructure development, community festivals, etc.)?</i>		
No, not at all comfortable	19	46
Yes, but with difficulty	20	15
Yes, comfortably	59	38
Not applicable	1	1
<i>Do you feel you can change anything in the community if you really wanted to?</i>		
No, not at all	33	49
Yes, but with a great deal of difficult	21	18
Yes, but with a little difficulty	22	15
Yes, fairly easily	11	9
Yes, very easily	13	9

Source: IFPRI/World Bank/MSR 2020.

3.5. Nutrition and health practices

This section describes respondents' scores on (1) nutrition knowledge and exposure; (2) health practices, including handwashing practices, and hygiene and sanitation practices; and (3) dietary diversity.

Community health services in the study sites are available. Each village has its own community health center, with at least two community health officers. Almost all young children (6–59 months) in the sample households were vaccinated and received vitamins and deworming medicine, mainly from the community health centers.

We asked selected questions indicating knowledge, exposure, and practice related to the four main themes of LEARN: nutrition basics, family nutrition, access to nutritious foods, and food preparation (LEARN 2015). Table 20 shows the percentage of respondents who answered correctly according to the good nutrition-related practices in each of these themes. Higher figures mean better nutrition exposure and knowledge. Women and men respondents scored high on three themes—food preparation, access to nutritious foods, and nutrition basics—but scored very low in family nutrition. The themes that the majority of respondents got wrong, therefore indicating weak nutrition knowledge, are the following:

- Rice porridge (tamingazi) is NOT the only solid food that children aged six months to years old need to be healthy. Children six months to two years old need diverse foods, such as egg, soft meat, fish, fruits, and vegetables, to be healthy.
- Breastfeeding women should eat beans, legumes, vegetables, fruits, eggs, and meats because diverse foods are good for the health of the mother and child.
- Many vegetables and fruits gathered from the wild can be as healthy as foods that are bought.
- Fathers should support pregnant or breastfeeding women by
 - Helping women with chores,
 - Making sure women get plenty of rest, and
 - Making sure women eat a variety of healthy foods.
- Washing vegetables before they are cut and using a lid when boiling vegetables are practices that can make prepared food more nutritious.
- One must eat a greater proportion of body-building and protective food than what is usually eaten. The LEARN module has a specific quantity/proportion recommendation for healthy and nutritious diet (1/2 energy-giving food, 1/6 body-building food, and 1/3 protective food).

Table 20. Proportion (%) of survey respondents who answer nutrition questions positively or correctly

	Variable	All	Men	Women	Difference
Index: share of LEARN chapter questions answered correctly/positively	Composite index	68	68	68	0
	Sub-index on Nutrition Basics	77	77	78	-1
	Sub-index on Family Nutrition	28	28	28	0
	Sub-index on Access to Nutritious Foods	80	82	79	3 ***
	Sub-index on Food Preparation	89	87	91	-4 ***
Nutrition Basics	Agreed with “Men play an important role in making sure a family is well-nourished.”	94	96	92	4 ***
	Chose a plate showing a healthy and nutritious diet (1/2 energy-giving food, 1/6 body-building food, and 1/3 protective food according to LEARN's nutrition guideline).	47	48	45	3
	Have heard that the most important time for good nutrition in a child's life is from when a woman becomes pregnant until a child's second birthday.	72	67	77	-10 ***
	Agree with “Like meat, fish, and eggs, legumes are also a body-building food.”	97	96	97	-1
Family Nutrition	Chose “Fathers support a pregnant or breastfeeding woman by helping her with chores, making sure she gets plenty of rest, or making sure she eats a variety of healthy foods.”	51	52	51	1
	Disagreed with “Breastfeeding women should avoid eating all kinds of beans, legumes, vegetables, fruits, eggs and meats because those foods could be harmful for the health of the mother and child.” /a	33	33	33	0
	Disagreed with “Rice porridge (tamingazi) is the only solid food that children aged six months to two years old need to be healthy.” /a	3	3	2	1
Access to Nutritious Foods	Agreed with “Families should avoid spending money on food which is not nutritious.”	85	85	86	-1
	Disagreed with “Foods gathered from the wild are not as healthy as foods that are bought.” /a	61	66	57	9 ***
	Have heard that a home garden with good production methods can contribute significantly to household nutrition security.	95	95	95	0

	Variable	All	Men	Women	Difference
Food preparation	Agreed with “We must take great care to ensure that the food preparation environment and the eating place are kept clean to protect our families from disease.”	100	100	100	0
	Have heard that washing vegetables before they are cut and using a lid when boiling vegetables are practices that can make prepared food more nutritious.	78	74	81	-7 ***
Number of respondents		1,853	855	998	

Source: IFPRI/World Bank/MSR 2020. Positive answers include agreeing with or having heard a nutrition message or disagreeing with a false statement ^(a). The source of nutrition messages is LEARN (2015).

In general, a high proportion of women and men respondents practiced frequent handwashing in the number of scenarios presented to them (Table 21). The survey found no difference in handwashing practices between irrigation and nonirrigation households but did find differences in handwashing practices between women and men. Fewer men than women practiced good handwashing practices with water and soap than. Targeting men with health and nutrition messaging can help in this regard. Moreover, the frequency of handwashing, particularly after handling animals, and with the use of both water and soap, can be further improved.

Table 21. Proportion (%) of survey respondents by proper handwashing practices

Indicator	All	Men	Women	Difference	
Indicators	Not deprived if sometimes/always wash in all scenarios and use water	91	87	95	-8 **
	Not deprived if sometimes/always wash in all scenarios and use water & soap	85	79	91	-12 ***
	Not deprived if always wash in all scenarios and use water	75	67	82	-15 ***
	Not deprived if always wash in all scenarios and use water & soap	71	62	80	-17 ***
Scenarios	Washes hands after defecation and urination	96	94	97	-3 ***
	Washes hands before preparing meals	98	98	98	0
	Washes hands before eating	98	98	99	-1
	Washes hands after eating	99	99	99	-1 **
	Washes hands after handling animals	87	82	92	-10 ***
	Number of respondents		1,694	796	898

Source: IFPRI/World Bank/MSR 2020. Note: Scenarios: 100 = always, 50 = sometimes/often, 0 = never/rarely

Most households had an improved water source (Table 22). Past water, sanitation, and health projects had built boreholes and tubewells in the communities. Other households had their own boreholes or tubewells. Most households also had an improved sanitation facility not shared with other households, although 16 percent of irrigation households and 27 percent of nonirrigation households share a sanitation facility with other households or use an unimproved sanitation facility. Overall, the majority of households in the focus communities have improved water sources, handwashing areas, and improved sanitation; and they practiced good handwashing and other hygiene and sanitation practices. The areas that need further improvement and to be included in health and nutrition messaging are (1) treating drinking water, for example by boiling; (2) proper garbage disposal, for example not burning garbage or throwing it into rivers, streets, or open spaces; and (3) ensuring that no domestic animals enter the kitchen or food preparation areas (Table 22).

Table 22. Proportion (%) of sample households by water source and sanitation practices

Indicators	All Households	Irrigation HH	Other HH	Difference (I-O)
<i>Improved water source</i>				
Household uses an improved water source and water collection time is less than 30 minutes	91	91	91	0
Household uses an improved water source and water collection time is greater than 30 minutes	7	7	8	-1
Household uses an unimproved water source	2	2	1	0
<i>Improved sanitation facility</i>				
Household uses an improved sanitation facility that is not shared with other households	82	84	73	11 **
Household uses an improved sanitation facility that is shared with other households	17	15	24	-9 **
Household uses an unimproved sanitation facility	1	1	3	-2
<i>Other health and sanitation indicators</i>				
Household has a handwashing area with soap and water	86	86	87	0
Garbage is not burned or thrown into rivers, streets, or open places	20	20	23	-4
Farm animals do not enter the kitchen preparation area	95	96	92	4 **
Domestic animals do not enter the kitchen preparation area	87	87	87	1
Drinking water is treated	28	28	28	0
Number of sample households	998	818	180	

Source: IFPRI/World Bank/MSR 2020. Note: Water source pertains to cooking water. Improved water sources include piped water, boreholes or tubewells, protected dug wells, protected springs, rainwater, and packaged or delivered water. Improved sanitation facilities include flush toilets, ventilated improved pit latrines, composting toilets, and pit latrines with slabs. Water treatment methods include boiling, chemical treatment, filtration, and solar disinfection. HH=households.

The MDD-W indicator, a commonly used indicator of diet quality and a good proxy for nutrition, is low at 4.71 out of 10 (Table 23), which falls below the MDD-W of threshold of 5. No significant difference was found in dietary diversity between women and men. More women than men ate nuts and seeds, vitamin A-rich fruits and vegetables, and other fruits on a daily basis. Women and men in irrigation households had higher dietary diversity scores than those in nonirrigation households. More women and men in irrigation households ate nuts and seeds, meat and fish, and vitamin A-rich fruits and vegetables on a daily basis than those in nonirrigation households.

We looked closely at consumption of dairy, a good source of calcium; however, in the study area (as in the whole of Myanmar), only 1 percent of sample individual adults consume dairy on a daily basis (Table 23). Promoting more dairy consumption in the study area would be difficult for several reasons:

1. Lactose intolerance is common in much of Asia and could also be an issue in Myanmar. Although young children can often tolerate dairy, lactose intolerance is common in adulthood.
2. Much of the dairy that is available is not especially helpful. Sweetened condensed and evaporated milk brands are commonly available but can contain palm oil and sugar, which are both health

hazards. Quite a few drinks with dairy are available, but they contain a low percentage of dairy and/or a high percentage of sugar. Nondairy creamer is readily available but contains no calcium.

3. In the study by Mahrt et al. (2019) on the cost of the recommended diet, the authors found that consuming the recommended amount of dairy (about 1 cup) would cost approximately 20 percent of the total cost of a healthy diet—similar to the cost of staples and the cheapest meat/egg/fish sources. Meeting this cost would require a major adjustment in spending habits.
4. A more realistic approach to improving calcium intake given existing consumption patterns, particularly given the short time frame, might be to promote the consumption of small fish with head and bones as well as dark leafy greens. Small fish eaten whole, dried fish, and fish-based products are good alternatives, culturally appropriate, and of high bioavailability (like milk).

Table 23. Proportion (%) of survey respondents consuming different essential food groups (24-hour food recall)

Food Groups	All	Men	Women	Diff. (M–W)	Irrig. HH	Other HH	Diff. (I–O)
Grains & roots	100	100	100	0	100	100	0
Beans	52	52	52	–1	52	51	1
Nuts/seeds	17	15	18	–3 *	18	13	5 **
Dairy	1	1	1	0	1	1	0
Meat & fish	78	79	78	1	79	73	6 **
Egg	25	25	25	0	26	23	3
Dark leafy vegetable	63	64	61	3	63	62	1
Vitamin A-rich fruits and vegetables	25	22	27	–5 **	26	20	6 **
Other vegetable	87	87	88	–1	87	87	0
Other fruits	23	21	24	–4 *	23	23	–1
<i>Dietary diversity score</i>							
<i>Average</i>	4.71	4.65	4.75	–0.10	4.74	4.54	0.20 **
<i>Standard deviation</i>	1.32	1.32	1.32		1.31	1.35	
Number of respondents	1,852	855	997		1,543	309	

Source: IFPRI/World Bank/MSR 2020. Statistically different at ** 5%, and * 10% level of significance. Number of observations: 1704 females and males. Men=men; W=women; Diff=difference; Irrig=Irrigation; HH=households.

Along with low dairy consumption, the survey found that nuts and seeds, eggs, vitamin A-rich fruits and vegetables, and other fruits are not consumed on a daily basis by three-quarters of the respondents (Table 23). Even beans and dark leafy vegetables, which are relatively abundant in the study context, are consumed by only 52–62 percent of the respondents on a daily basis. Consumption of these food groups should be emphasized during nutrition education.

3.6. Access to agricultural and nutrition-related services

3.6.1 Access to agricultural and nutrition-related information and training

About a third of respondents received information on farming rice and other crops, and about half received information on nutrition, health, or sanitation (Table 24). Fourteen percent of men and women respondents had attended training on rice farming, and 11 percent had attended training on irrigation management. Men were more likely than women to receive agriculture and nutrition-related information and training—31 percent of women versus 49 percent of men received agricultural information and 9 percent of women versus 20 percent of men attended agricultural training.

Table 24. Proportion (%) of survey respondents with access to agriculture- and nutrition-related information

Indicator		All	Men	Women	Difference	
Received information from any source	Rice	39	49	31	18	***
	Non-rice	33	41	27	14	***
	Nutrition, health and sanitation	48	51	46	5	**
Participated in training	Rice	14	20	8	13	***
	Irrigation management	11	18	6	13	***
	Crop diversification	9	13	5	8	***
	Nutrition, health, and sanitation	11	11	11	0	
	Other training	1	1	1	0	
N		1,853	855	998		

Source: IFPRI/World Bank/MSR 2020. Note: Statistically different at **** 1%, ** 5%, and * 10% level of significance. Other training includes general education and village development, among others.

The main sources of information on farming rice and other crops were another farmer or a neighbor, reported by 43–48 percent of the men and women respondents (Table 25). Other main sources were agricultural seminars or trainings, TV, and input companies, reported by 13–25 percent of the respondents. Other sources were township agriculture offices, radio messaging, the Internet or social media, extension workers, and brokers or agents, reported by 3–10 percent of the respondents. Women were less likely than men to receive agriculture-related information from all sources, except from other farmers/neighbors and brokers/agents. The largest gaps were in receiving information from township agriculture offices, Internet/social media, radio, TV, and agricultural trainings.

Table 25. Proportion (%) of survey respondents by source of agriculture- and nutrition-related information

Source	Information on rice farming					Information on other crops					Information on nutrition and health				
	All	M	W	Diff		All	M	W	Diff		All	M	W	Diff	
Radio	9	11	6	6	**	8	9	7	2		12	15	9	6	***
TV	23	25	21	3		19	21	16	5	**	35	39	31	9	***
Another farmer or neighbor	43	37	50	-12	***	48	42	56	-15	***	21	16	24	-8	***
Agri seminar or training	25	28	22	5	*	23	24	22	1		3	2	3	-1	
Company (e.g., input dealer)	16	17	16	1		13	14	11	2		0	0	0	0	***
Phone/SMS	2	1	2	0		2	2	2	0		2	2	1	1	
Internet/Social media	4	5	3	2	*	5	8	2	6	***	6	8	4	5	**
Extension workers	4	4	4	1		3	4	2	2		39	35	43	-7	***
Township agriculture office	10	13	5	8	***	7	10	3	7	***	0	0	0	0	
NGO	0	0	0	0		0	0	0	0		1	0	1	-1	**
Other source ^{/a}	5	3	8	-4	***	4	3	6	-2		10	10	9	1	
Acted upon the information/advice (0/1)	89	89	88	0		86	87	86	1		94	94	95	-1	
N	726	418	308	110		617	347	270			896	437	459		

Source: IFPRI/World Bank/MSR 2020. Note: Statistically different at ** 5%, and * 10% level of significance. ^{/a} Other sources of information on rice and other crop farming were mainly brokers or agents; other sources of nutrition and health information were from health talk/Department of Health. N=number of observations

The main sources of nutrition-related information were extension workers and TV, reported by 35–39 percent of men and women respondents. The second main source was another farmer or neighbor, reported by 21 percent of respondents. The other main sources were radio messaging; health talks, particularly those with the Department of Health; and Internet or social media. Women were more likely than men to receive nutrition-related information from another farmer or neighbor and extension workers. Men were more likely to receive nutrition-related information from radio, TV, and Internet or social media.

Most respondents said they followed or acted upon the information received (Table 25). This finding is consistent with responses on training lessons being followed and adopted by more than 90 percent of training participants (Table 26). Of those not following received advice, the most common reasons were that (1) the information was not relevant to their farming, enterprise, or growing season; (2) they did not trust the information; (3) they did not understand the information; and (4) they did not have enough resources and spare time to implement training lessons (Table 27). Only about half of training participants, however, said they had learned something new from the training attended. Most respondents who attended training shared the information received with their spouse or other household members (Table 26).

Table 26. Proportion (%) of agriculture- and nutrition-related training participants by training experiences

Indicator	Number of training participants	% of training participants
<i>Shared the training information within household (0/1)</i>		
Rice	252	91
Irrigation management	210	90
Crop diversification	163	94
Nutrition, health, and sanitation	206	95
Other training	23	83
<i>Had learned something new (0/1)</i>		
Rice	379	51
Irrigation management	321	46
Crop diversification	256	46
Nutrition, health, and sanitation	284	50
Other training	23	74
<i>Had adopted or acted upon the training lessons</i>		
Rice	194	92
Irrigation management	148	96
Crop diversification	117	90
Nutrition, health, and sanitation	141	96
Other training	17	82
<i>Had plans to apply training lessons in the future</i>		
Rice	194	96
Irrigation management	148	97
Crop diversification	117	97
Nutrition, health, and sanitation	141	99
Other training	17	100

Source: IFPRI/World Bank/MSR 2020. Note: All indicators are binary variables (0/1), and the figures are % of total respondents.

Table 27. Reasons for not following or adopting agriculture- or nutrition-related training lessons

Reasons	Rice	Other crops	Health/sanitation
Not relevant to my farm or business	30	38	2
Planning to implement in the future	13	9	19
Not relevant to the growing season	11	10	1
Did not trust information	1	8	3
Did not understand information	8	9	15
Did not have adequate resources to implement the advice	6	5	0
No spare time	4	3	4
Received improper seeds	1	0	0
Weak market (no buyers)	0	1	0

Source: IFPRI/World Bank/MSR 2020. Figures are number of respondents.

3.6.2 Access to information and communications technology

Almost all respondents owned a smartphone and had access to a cell phone network (Table 28). Only a quarter, however, reported having tried to access the Internet via cell phone. Sixty-six percent of respondents had heard of agricultural information available through Internet or phone. Twenty-two percent participated on social media, particularly Facebook. Women respondents had significantly less access to these technologies than men respondents did. The largest gaps were in accessing the Internet via cell phone, social media participation, and having heard of agricultural information available through Internet or phone.

Table 28. Proportion (%) of survey respondents by access to information and communication technologies

Indicators		All	Men	Women	Difference	
Had access to this cell phone network (0/1)	MPT	83.32	87.84	79.46	8.38	***
	Ooredoo	84.19	88.30	80.66	7.64	***
	Telenor	84.73	89.47	80.66	8.81	***
	Mytel	78.58	82.92	74.85	8.07	***
Had tried to access Internet via cell phone (0/1)		24.61	34.74	15.93	18.80	***
Participated on social media (0/1)		22.88	32.40	14.73	17.67	***
	Facebook	21.91	31.11	14.03	17.08	***
	Other social media	5.61	8.30	3.31	5.00	***
	YouTube	0.22	0.47	0.00	0.47	*
	Instagram	0.05	0.00	0.10	-0.10	
	Viber	5.34	7.84	3.21	4.63	***
Had heard about agricultural information access through phone or internet (0/1)		66.00	75.67	57.72	17.96	***
Had heard of this app (0/1)	Greenway	22.67	26.20	19.64	6.56	***
	Ooredoo Site Pyo	21.05	25.26	17.43	7.83	***
	Awba Htwet Toe	38.48	47.02	31.16	15.86	***
	Shwe Thee Nhan	27.36	31.23	24.05	7.18	***
	Others (mainly Armo) /a	1.19	1.99	0.50	1.49	***
Had downloaded this app (0/1)	Greenway	0.86	1.75	0.10	1.65	***
	Ooredoo Site Pyo	0.54	0.94	0.20	0.74	*
	Awba Htwet Toe	1.30	2.57	0.20	2.37	***
	Shwe Thee Nhan	0.54	0.82	0.30	0.52	
	Others (mainly Armo) /a	0.49	1.05	0.00	1.05	***
Owned at least 1 smartphone (0/1)		94.44	95.79	93.29	2.50	***
Number of smartphones owned by household		2.03	2.12	1.96	0.15	***
		(1.16)	(1.16)	(1.16)		
Number of respondents		1,853	855	998		

Source: IFPRI/World Bank/MSR 2020. Note: Almost all indicators are binary variables (0/1) and the figures are % of total respondents. the only exception is the number of smartphones owned and the figure is mean, and figures in parenthesis is the standard deviation; Statistically different at ** 5%, and * 10% level of significance. /a Other apps reported were Kaung Thu Kha Wi Sar Ya; PP (Agriculture), Shwe Na Gar Planting, Waterfall, World Plant Production Mobile, and Min Mahaw.

3.6.3 Water user groups

Forty percent of the men and women respondents were members of a WUG (Table 29). More men were members of WUGs than women. For those not members, 40 percent said they wanted to become members. Significantly more men than women would like to be a member of a WUG. Respondents had generally positive perceptions on the usefulness of WUGs. Ninety-two percent of respondents thought that WUGs are either useful or very useful, and 8 percent thought they are not useful.

Table 29. Proportion (%) of survey respondents by WUG membership and experience

Indicator	All	Men	Women	Diff.	
HH is a member of WUG (0/1)	40	41	39	3	*
<i>N (total sample in irrigation households)</i>	1,544	726	818		
Respondent wanted to be a WUG member (0/1)	40	49	31	18	***
<i>N (those not in WUG)</i>	925	425	500		
Believes that both husband and wife should be members of WUG (0/1)	75	70	80	-11	***
Believes both should have the opportunity to be leaders or officials of WUG (0/1)	89	89	89	0	
Believes both should be invited to participate in meetings and trainings (0/1)	81	80	83	-3	
Believes both should be actively involved in activities of the WUG (0/1)	93	93	94	-1	
Had ever participated in water distribution, cleaning and minor repair of the watercourses during the past 12 months (0/1)	67	85	48	37	***
Number of times participating	3.1	3.2	2.8	0.4	*
<i>N (WUG members or those who wanted to be WUG members)</i>	985	511	474		
Was an elected official of WUG (0/1)	22	30	15	15	***
Perceptions of WUG (0/1)	Very useful	76	77	75	2
	Useful	16	16	16	0
	A bit useful	5	6	4	2
	Not useful	3	1	4	-4
Had attended the meeting regarding WUG after its establishment (0/1)	36	49	23	27	***
Number of times participating	2.3	2.4	1.9	0.5	*
<i>N (WUG members only)</i>	619	301	318		

Source: IFPRI/World Bank/MSR 2020. WUG=water user groups; N=number of observations.

The main topics during WUG meetings were water usage or drainage/tunnel formation or repair, the WUG itself, and agriculture or agricultural practices in general (see annex tables 9 and 10). Twenty-nine percent did not know or remember the topic of the meeting. Most respondents said they found the meetings useful and that they learned about irrigation systems, how to reduce water wastage, how to use dam water systematically, the importance of water dam repair, fairness and unity in accessing water, and about agriculture and improving practices.

4. Summary and Learning Outcomes for ADSP

This report provides a baseline study on the status of gender equality, crop diversification, and nutrition of a sample of 998 households and 1,835 men and women in two pilot irrigation catchment areas in the Myanmar Agricultural Development Support Project. The main findings are summarized and the major

learning outcomes are discussed below.¹

4.1. Reducing the gender gap in knowledge access

Women were less likely than men to receive agriculture- and nutrition-related information and training. Women were also less likely to access information and communication technologies, such as smartphones, the Internet, and social media. Extension and training programs should involve both men and women rather than targeting only household heads, who are often men. A more commonly used channel for reaching most women with agricultural information was through other farmers or neighbors. Men and women had different channels for accessing nutrition-related information. Women were more likely to receive nutrition-related information from another farmer or a neighbor and extension workers, whereas men were more likely to receive nutrition-related information from radio, TV, and the Internet or social media.

4.2. Improving women's empowerment

Results show large gender gaps, in which fewer women than men achieved adequacy in all 11 indicators of empowerment. A total of 53 percent of women versus 25 percent of men respondents were not empowered; and 45 percent of dual-adult households have gender disparities. Strategies to empower women and reduce gender gaps in the irrigation catchment areas could be strengthened in ADSP activities.

The main contributors to disempowerment among women and men were attitudes about intimate partner violence and lack of group and influential membership. Women and men had high tolerance for and accepting attitudes about intimate partner violence against women. Gender-transformative approaches that emphasize zero tolerance of domestic violence should be promoted in the households and communities. Both men and women within the households should be targeted in these gender-transformative approaches.

Fewer women achieved adequacy in membership in groups and influential groups than men. Women were less likely than men to be members of water user groups (WUGs) and to participate in WUG meetings and activities. Women were also less likely than men to be part of any group or association. Greater participation of women should be promoted in groups and organizations. Women-only groups should be promoted, as well as women's participation and leadership in mixed-gender groups. A good starting point is by enhancing women's confidence and organizational management and leadership skills. Skills development trainings should be provided in ways that make them accessible and convenient for women, without worsening women's time burden. Strategies to provide childcare services during trainings and other activities could be explored.

Other leading contributors to disempowerment for women were lack of access to and decisions on financial services, lack of work balance, and lack of intrahousehold harmony or respect among household members. More women and men in other households did not achieve adequacy in access to and decisions on financial services than those in irrigation households. More men in other households did not achieve adequacy in group and influential group membership than men in irrigation households. More women in other households did not achieve adequacy in work balance than women in irrigation households.

¹ The learning outcomes of this independent study will be used as a learning outcome for ADSP for future scale-up. The more targeted learning outcomes are being prepared and will be published as an upcoming Policy Note by ADSP Task Team.

Lack of work balance for men and women, especially for women, is a major issue. Labor-saving technologies in farming can help lessen the time burden for both women and men. Gender balance in childcare and family responsibilities, greater support by fathers, and shared household responsibilities can be promoted through gender awareness activities in the households and communities.

4.3. Improving nutrition

The priority food groups that should be promoted in the study area and in future nutrition education are (1) nuts and seeds, (2) eggs, (3) vitamin A-rich fruits and vegetables, (4) dark leafy vegetables, (5) other fruits, (6) beans, and (7) small fish with head and bones. Almost no one in the study group consumes dairy because of its limited availability and cost, people's preference, and in some cases lactose tolerance. A realistic approach to improving calcium intake given the existing consumption patterns and the short SUN project time frame, is to promote the consumption of small fish with head and bones as well as dark leafy greens. A diet with a greater diversity of food groups must be emphasized in the nutrition messaging, as the consumption of more food groups is associated with a greater likelihood of meeting nutritional needs. With development community fears of a potential health crisis following the health and economic crises from the COVID-19 pandemic, there is a critical need to focus on emphasizing the importance of diet quality, sanitation, and health.

The majority of respondents incorrectly answered questions on the following themes, therefore indicating weak nutrition knowledge. The following are examples of themes that should be promoted in the nutrition messaging, along with the other messages in the LEARN module:

- Rice porridge (tamingazi) is NOT the only solid food that children aged six months to two years old need to be healthy. Children aged six months to two years old need diverse foods, such as eggs, soft meat, fish, fruits, and vegetables, to be healthy.
- Breastfeeding women should eat beans, legumes, vegetables, fruits, eggs, and meats because diverse foods are good for the health of the mother and child.
- Many vegetables and fruits gathered from the wild can be as healthy as foods that are bought.
- Fathers should support pregnant or breastfeeding women by
 - Helping women with chores,
 - Making sure women get plenty of rest, and
 - Making sure women eat a variety of healthy foods.
- Washing vegetables before they are cut and using a lid when boiling vegetables are practices that can make prepared food more nutritious.
- Eat a greater proportion of body-building and protective food than what is usually eaten. The LEARN module has a specific quantity/proportion recommendation for a healthy and nutritious diet (1/2 energy-giving food, 1/6 body-building food, and 1/3 protective food according to LEARN's nutrition guideline).

Overall, most women and men in the sample communities apply good handwashing and sanitation practices. The areas that need further improvement and should be included in future health and nutrition messaging are (1) treating drinking water, for example by boiling; (2) proper garbage disposal, for example not burning garbage or throwing it into rivers, streets, or open spaces; (3) ensuring that no domestic animals enter the kitchen or food preparation areas; and (4) more frequent handwashing using soap and water, particularly after handling animals. Fewer men than women were practicing good handwashing practices with water and soap. Targeting men with health and nutrition messaging can help in this regard.

4.4. Improving crop productivity, diversification, and commercialization

Farmers were growing diverse crops in their farms. More diverse crops can be grown for several cropping seasons once the irrigation facility is improved. Productivity of rice and chickpeas in the past three seasons were comparable to the baseline estimates by ADSP; and the productivity of sesame is very low. The yield levels show wide variability across farmers. The current levels suggest the need for a better understanding of why there is wide variability and low yields achieved by many farmers in order to devise strategies improve the situation.

This paper has provided rich baseline data and descriptive analysis on the SUN study site. Further analysis are underway that analyzes in-depth the drivers of increased incomes, nutrition, women's empowerment, and gender equality in these focus areas. Finally, an intervention around gender and nutrition behavioral change communication that incorporates the lessons from this baseline paper is being designed and soon to be piloted.

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Annex Table 1. Sample households and villages

Irrigation site	Village	Number of WUGs	Number of WUG members	Number of non-WUG irrigation users	Number of other households	Village population	Sample WUG members	Sample non-WUG irrigation users	Total sample irrigation water users (WUG + non-WUG)	Sample other households	Total survey sample
North Yamar	I Yaung	9	88	39	60	187	42	0	42	6	48
North Yamar	Min Ma (East)	5	47	95	126	268	26	0	26	6	32
North Yamar	Koke Ko Su	0	0	143	41	184	0	24	24	6	30
North Yamar	Kyae Nin	0	0	319	135	454	0	26	26	6	32
North Yamar	Nar Daw Mauk	1	8	54	18	80	7	17	24	6	30
North Yamar	Thin Tee Kan	0	0	319	135	454	0	24	24	6	30
North Yamar	Kyay Tha Myar East	0	0	30	24	54	0	26	26	6	32
North Yamar	Khin Ma	0	0	135	90	225	0	26	26	6	32
North Yamar	Kyay Tha Myar West	0	0	269	93	362	0	24	24	6	30
North Yamar	Poke Par	0	0	34	120	154	0	26	26	6	32
North Yamar	Mon Kyaing	0	0	269	93	362	0	26	26	6	32
North Yamar	Ale Thi Tinn	0	0	89	61	150	0	24	24	6	30
North Yamar	Min Kan Gyi	25	222	0	187	409	65	0	65	6	71
North Yamar	Min Kan Tike	6	77	56	125	258	23	0	23	6	29
North Yamar	Pay Pin Su	5	19	38	157	214	23	3	26	6	32
North Yamar	Thee Gone	2	16	62	32	110	9	14	23	6	29
North Yamar	Thel Kone	0	0	65	16	81	0	23	23	6	29
North Yamar	Lel Ngauk	0	1	51	323	375	0	26	26	6	32
Sinthe	Aung Thar	0	0	97	103	200	0	23	23	6	29
Sinthe	Yway Su	0	0	45	66	111	0	23	23	6	29
Sinthe	Oke Shit Kone	3	57	118	115	290	20	6	26	6	32
Sinthe	Nyaung ngar Pin south	0	0	103	105	208	0	23	23	6	29
Sinthe	HTa Yan Kar	0	0	37	40	77	0	26	26	6	32
Sinthe	Kyay Chaung (N)	9	195	0	161	356	50	0	50	6	56
Sinthe	Kyay Chaung (S)	0	0	33	45	78	0	23	23	6	29
Sinthe	Mun Nan Kone	2	32	78	28	138	14	9	23	6	29
Sinthe	Ma Gyi Pin	3	20	11	176	207	17	6	23	6	29
Sinthe	Pyaw	1	6	24	60	90	6	19	25	6	31
Sinthe	Shar Tone Aing	1	17	16	26	59	17	6	23	6	29
Sinthe	Yae Twin Phyu	3	37	42	92	171	21	5	26	6	32
Total		75*	842	2,671	2,853	6,366	340	478	818	180	998

Note: WUG=water user group; *Same WUG can be found in several villages, therefore the total number of WUGs here is more than the actual number of WUGs formed as of survey period.

Annex Table 2. Definition of pro-WEAI Indicators

Indicator	Explanation	Definition of adequacy
<i>Intrinsic agency</i> Autonomy in Income	Regarding income, it is a measure of the internal and external motivations that determine a person's decisions.	More motivated by own values than by coercion or fear of others' disapproval. <i>Choses to use income how he/she personally wants to and does not feel he/she must use the income both as someone else says and as the family/community expects</i>
Self-efficacy	Belief in one's own abilities to succeed in certain situations or accomplish tasks	"Agree" or greater on average with 3 self-efficacy questions (from the original cutoff of agreement on at least 8 out of 8 statements)
Attitudes about intimate partner violence against women	What is your opinion on the acceptability of a husband beating his wife in different situations?	Believes husband is NOT justified in hitting or beating his wife in all 6 scenarios: <ol style="list-style-type: none"> 1) She goes out without telling him 2) She neglects the children 3) She argues with him 4) She is unfaithful 5) She applies for a new job or engages in a new livelihood without his consent 6) She burns the food
Respect among household members	How do you feel about some of other people in your household or family group and how do you think they feel about you?	Meets ALL of the following conditions related to another household member: <ol style="list-style-type: none"> 1) Respondent respects relation (ALL or MOST of the time) AND 2) Relation respects respondent (ALL or MOST of the time) AND 3) Respondent trusts relation (ALL or MOST of the time) AND 4) Respondent is comfortable disagreeing with relation (ALL or MOST of the time)
<i>Instrumental agency</i> Input in productive decisions	What decisions are you a part of? What is your role in making these decisions?	Meets at least ONE of the following conditions for ALL of the agricultural, wage, and non-farm business activities they participate in: ^{/1} <ol style="list-style-type: none"> 1) Makes related decision solely 2) Makes the decision jointly and has at least some input into the decisions 3) Feels could make decision if wanted to (to at least a MEDIUM extent)
Ownership of land and other assets	Do you own any assets? Do you own them solely or jointly?	Owens, either solely or jointly, at least ONE of the following: <ol style="list-style-type: none"> 1) At least three assets 2) Land
Access to and decisions on financial services	Do you contribute to household decisions on credit (e.g., taking out a loan)? Can you get a loan if you want to? Do you have access to a financial account?	Meets at least ONE of the following conditions: <ol style="list-style-type: none"> 1) Belongs to a household that used a source of credit in the past year AND participated in at least ONE sole or joint decision about it 2) Belongs to a household that did not use credit in the past year but could have if wanted to from at least ONE source

Indicator	Explanation	Definition of adequacy
		3) Has access, solely or jointly, to a financial account
Control over use of income	Do you have input in decisions on how income and output from all ag activities you participate in is spent or used? Do you have input in decisions on how income from non-agricultural activities is spent?	Has input in decisions related to how to use BOTH income and output from ALL of the agricultural and non-farm enterprise activities he/she participates in AND has input in decisions related to income from ALL wage activities he/she participates in, ² unless no decision was made
Work balance	How many hours a day do you work? How much of that time is spent on care giving for children?	Works less than 10.5 hours per day: Workload = time spent in primary activity + (1/2) time spent in childcare as a secondary activity
<i>Collective agency</i>		
Group membership	Are you a member of a group in your community?	Active member of at least ONE group
Membership in influential groups	Are you part of a group that is influential ³ in your community? How influential is your group in the community?	Active member of at least ONE group that can influence the community to at least a MEDIUM extent

Source: Malapit et al. 2019, with adjustments based on latest updates from the WEAI team (in *italics*) and adaptations done by the research team on the Myanmar and study context (in **bold**) ¹ For input in productive decisions, “participation” in an activity occurs when either (1) the respondent self-reports being a participant; (2) the respondent lists him/herself as a decision maker; or (3) the respondent reports having input into decisions. ² For control over income, “participation” is defined by household engagement in the activity except when (1) decision makers are considered “not applicable”; (2) output and income decisions for farm and non-farm business activities or income decisions for wage activities are deemed “not applicable”; and (3) the respondent does not report being a participant. ³ “Influential group” is defined by the respondent (i.e. his/her subjective idea of what is an influential group). The exact question in the questionnaire is: “To what extent does this [GROUP] impact life in the community beyond the group activities?”

Annex Table 3. Asset ownership (disaggregated)

Asset	Household owns		Respondent solely or jointly owns ¹		N Women	N Men
	Women	Men	Women	Men		
Land			72	83	929	848
Large livestock	61	65	100	100	929	848
Small livestock	11	11	100	100	929	848
Poultry/small animals	22	22	100	100	929	848
Nonmechanized farm equipment	95	96	100	100	929	848
Mechanized farming equipment	62	66	100	100	929	848
Nonfarm business equipment	22	24	100	100	929	848
Large consumer durables	92	93	100	100	929	848
Small consumer durables	99	99	100	100	929	848
Cell phone	95	96	100	100	929	848
Means of transportation	90	92	100	100	929	848
House or other structures	90	91	100	100	929	848

Source: IFPRI/World Bank/MSR 2020. Note: ¹ except for land, the proportion of other assets solely or jointly owned is conditional to the household ownership. N=number of respondents

Annex Table 4. Self-efficacy (Agreement on statements)

Statements	All		Irrigation HH		Other HH		N Women	N Men
	Women	Men	Women	Men	Women	Men		
I will be able to achieve most of the goals that I have set for myself	96	98	97	98	95	98	929	848
Compared to other people, I can do most tasks very well	96	97	96	97	95	95	929	848
Even when things are tough, I can perform quite well	97	97	97	97	95	98	929	848

Source: IFPRI/World Bank/MSR 2020. HH=household; N=number of observations

Annex Table 5. Access to and decisions on financial services (disaggregated)

Source of credit	Household has credit access		Household used credit		Respondent solely or jointly decided to use credit ^{/1}		N Women	N Men
	Women	Men	Women	Men	Women	Men		
Nongovernmental organization	71	73	7	6	81	80	929	848
MADB	85	88	70	74	67	93	929	848
Other government bank	80	82	20	21	75	81	929	848
Private bank/financial institution	50	49	1	0	50	100	929	848
Informal/private moneylender/gold/pawn shop	56	53	2	1	81	70	929	848
Formal/ private moneylender/gold/pawn shop	60	58	3	2	85	90	929	848
Agri-traders, rice and oil mill, agricultural input supplier, agricultural machinery supplier	58	59	3	3	76	88	929	848
Friends or relatives	81	82	8	8	89	91	929	848
Loan and savings groups; microfinance or lending	77	76	13	10	85	80	929	848
Informal credit/savings groups	60	55	1	1	79	91	929	848

Source: IFPRI/World Bank/MSR 2020. Note: ^{/1} Conditional on household's use of credit. N=number of respondents. MADB=Myanmar Agricultural Development Bank; N=number of observations

Annex Table 6. Input in productive decisions (disaggregated)

Activity	Participates in activity		Had at least some input in decision making ^{/1}		Feels like can make decision ^{/1}		N	N
	Women	Men	Women	Men	Women	Men	Women	Men
Rice farming	89	100	96	100	78	98	768	713
Nonrice farming	92	100	97	100	80	99	660	627
Large livestock raising	85	99	93	99	77	98	477	457
Small livestock and poultry raising	94	88	97	97	89	91	217	186
Wage Employment	83	86	98	98	88	94	376	348
Nonfarm economic activities	88	83	97	97	84	90	200	187
Major household expenditures			85	96	75	96	929	848
Minor household expenditures			98	66	94	63	929	848
Purchase of food			98	60	94	53	929	848

Source: IFPRI/World Bank/MSR 2020. Note: ^{/1} Conditional on household's participation in that activity. N=number of respondents

Annex Table 7. Control over use of income (disaggregated)

	Had some input into outputs		Had some input on income generated		N	N
	Women	Men	Women	Men	Women	Men
Rice farming	93	96	94	94	761	713
Nonrice farming	96	95	96	94	656	627
Large livestock raising	89	98	91	96	458	454
Small livestock and poultry raising	92	88	94	84	217	181
Wage Employment			93	86	374	346
Nonfarm economic activities	92	87	94	86	190	172

Source: IFPRI/World Bank/MSR 2020. N=number of observations

Annex Table 8: Respect among household members (disaggregated)

	Husband/wife		Other adult within the household Women
	Women	Men	
Respondent always has respect for the other household member?	95	94	93
Respondent always feels the other household member has respect for the respondent	93	95	96
Respondent always believes the other household member will make choices that are beneficial for the respondent and the family	97	97	96
When the respondent disagrees with the other household member, the respondent always is comfortable telling that person that he/she disagrees	79	84	79
<i>N</i>	790	791	68

Source: IFPRI/World Bank/MSR 2020. N=number of observations

Annex Table 9. Proportion (%) of WUG members by topics of WUG meetings

Topic	N	%
Water usage/water drainage repair	54	25
Drainage/Tunnel formation and cleaning	22	10
Agriculture, agriculture practices, land management	20	9
Method of systematic usage of dam water (village allocation, water-giving rotations, upgrade water flow route)	12	5
Forming WUG/awareness of laws/rules	23	10
Avoiding lack of access to water	8	4
Irrigation	7	3
Using water in fairness or helping each other get farm water	6	3
Collectively building/repairing gully hole in farm	5	2
Do not know/do not remember	63	29
Total	220	100

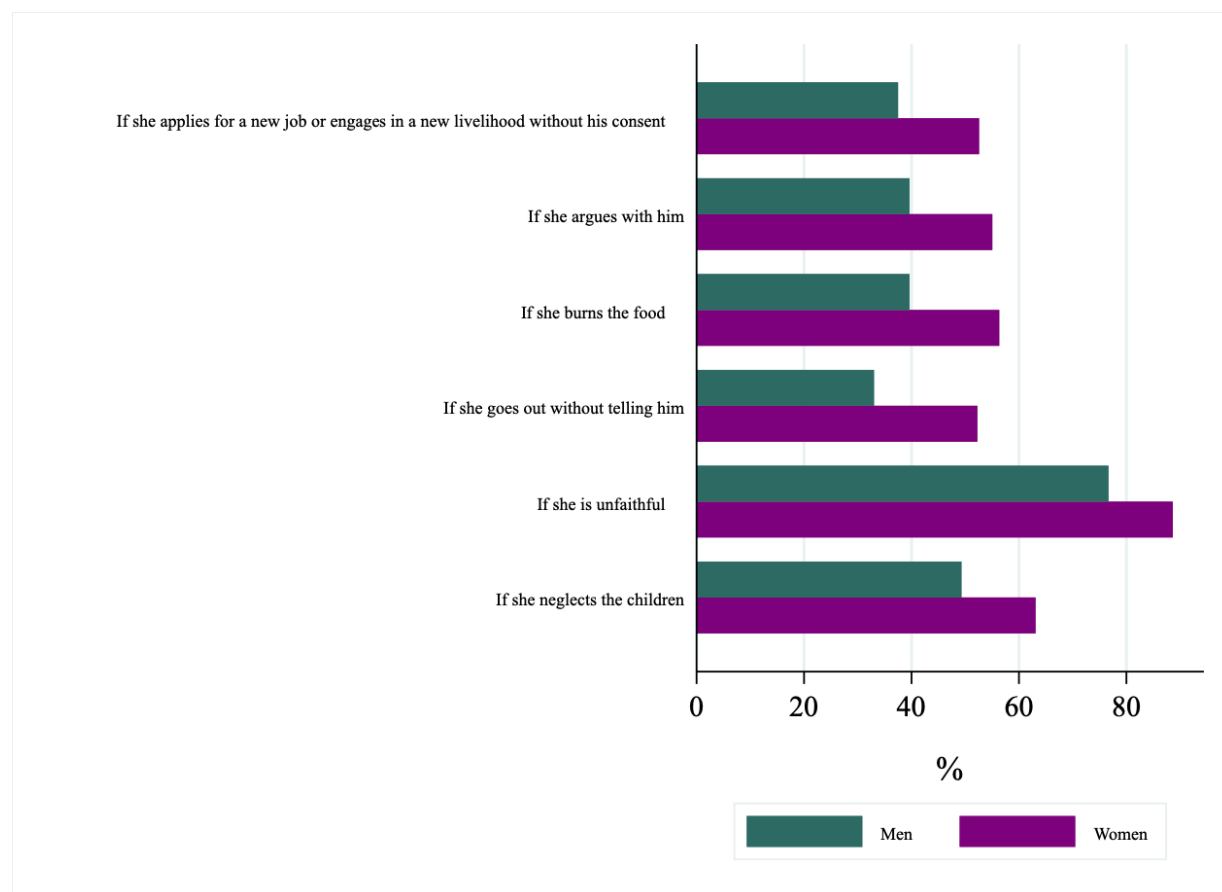
Source: IFPRI/World Bank/MSR 2020. N=number of observations

Annex Table 10. Proportion (%) of WUG members by lessons learned from WUG meetings

Useful lessons learned	N	%
Understand irrigation system	90	30
Avoid water wastage	50	17
To utilize dam water systematically	28	9
Came to realize the importance of water dam repair	26	9
Better paddy, improved outcomes	14	5
To live united and to get fairness in water access	14	5
Get water easily	12	4
Knowledge regarding agriculture and irrigation	8	3
Control water easily by making gully holes in the field	6	2
Gain knowledge	6	2
Get method of effective crop production	2	1
Get experiences of reporting water difficulties	2	1
Guidance on paddy trading	2	1
Select own tunnel leaders and use systematically for benefits	2	1
Do not know/do not remember	34	11
Total	296	100

Source: IFPRI/World Bank/MSR 2020. N=number of observations

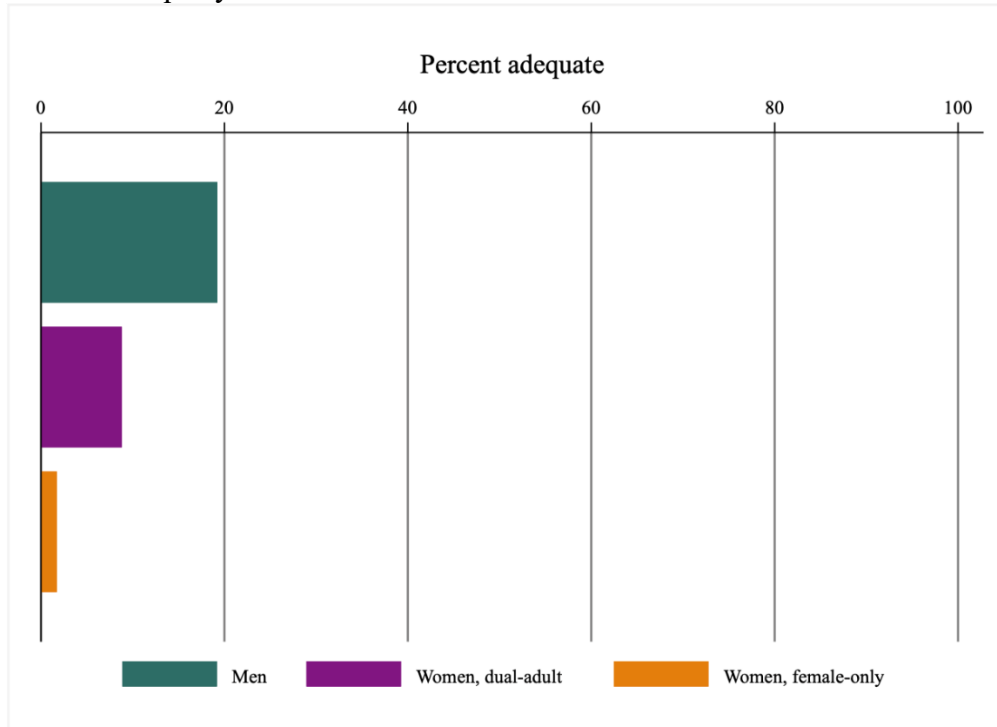
Annex Figure 1. Proportion (%) of survey respondents saying that a husband is justified in beating his wife by scenario



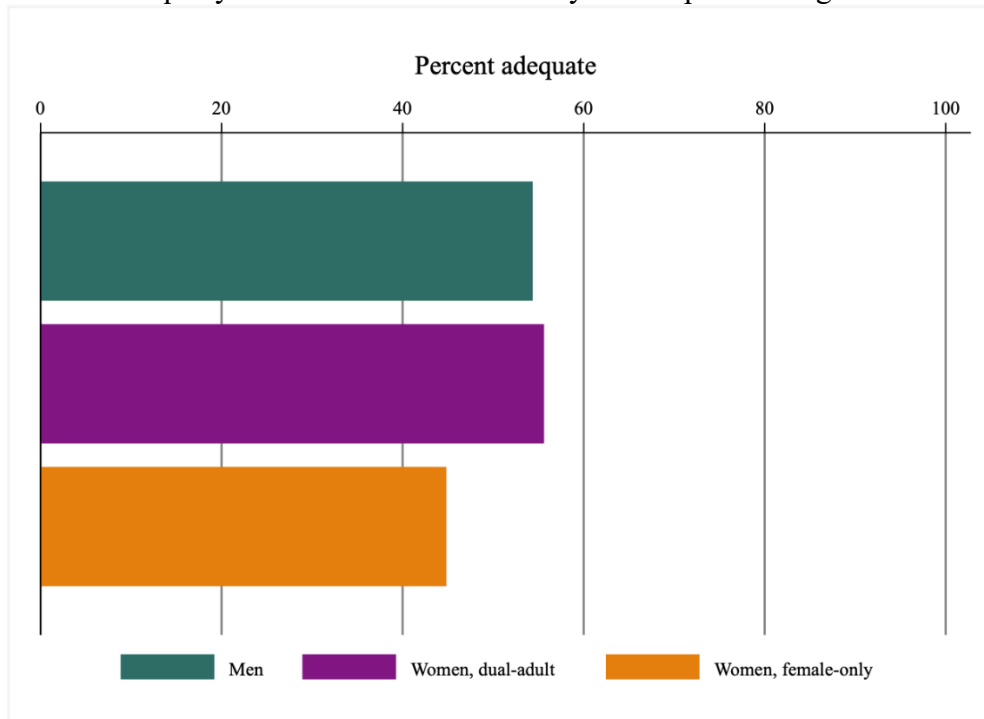
Source: IFPRI/World Bank/MSR 2020.

Annex Figure 2. Proportion (%) of survey respondents by adequacy in empowerment domains by household type.

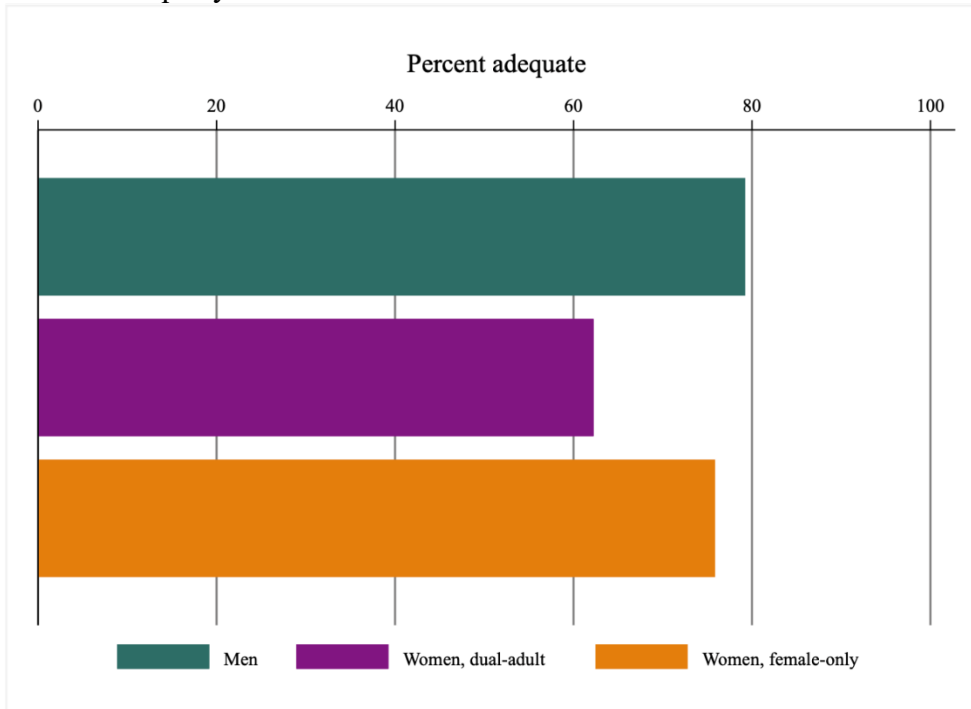
a. Adequacy in attitude about IPV



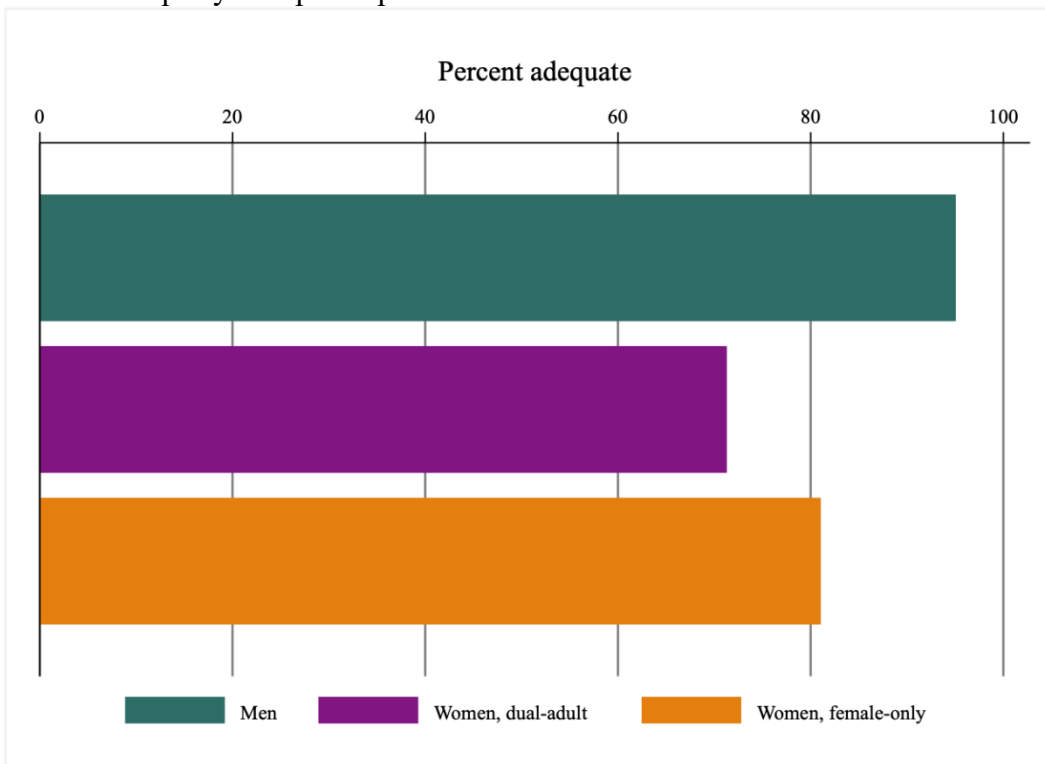
b. Adequacy in intrahousehold harmony and respect among household members



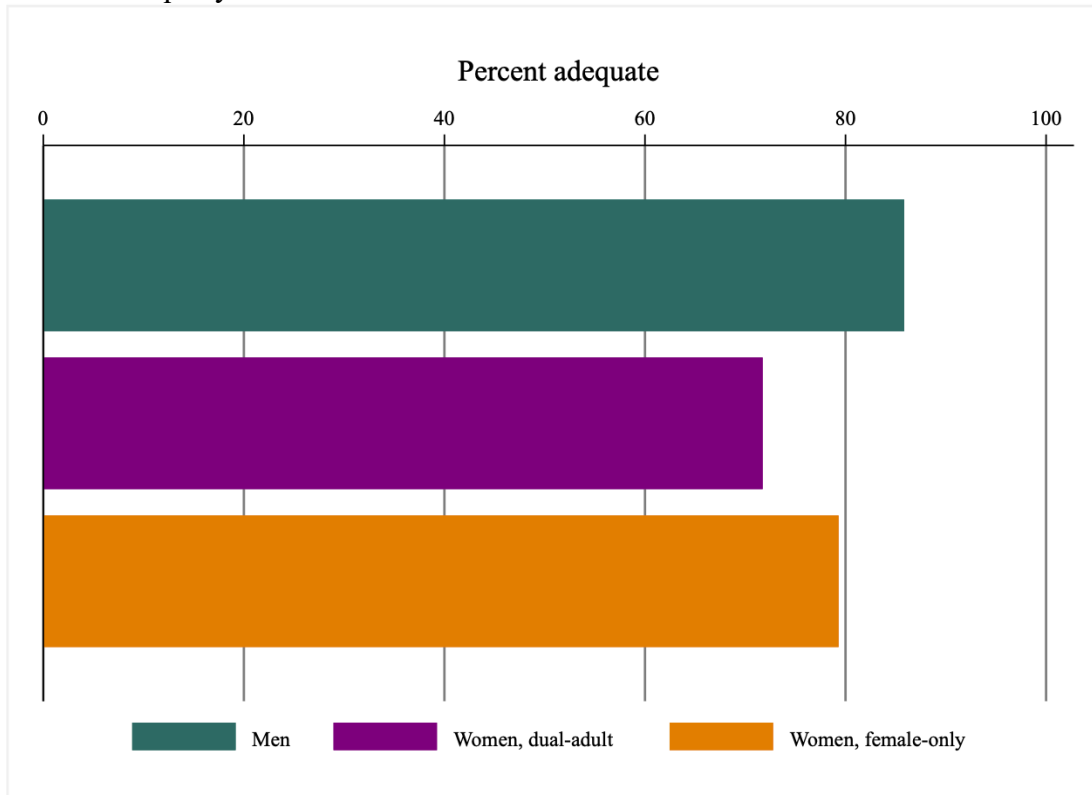
c. Adequacy in access to and decision on financial services



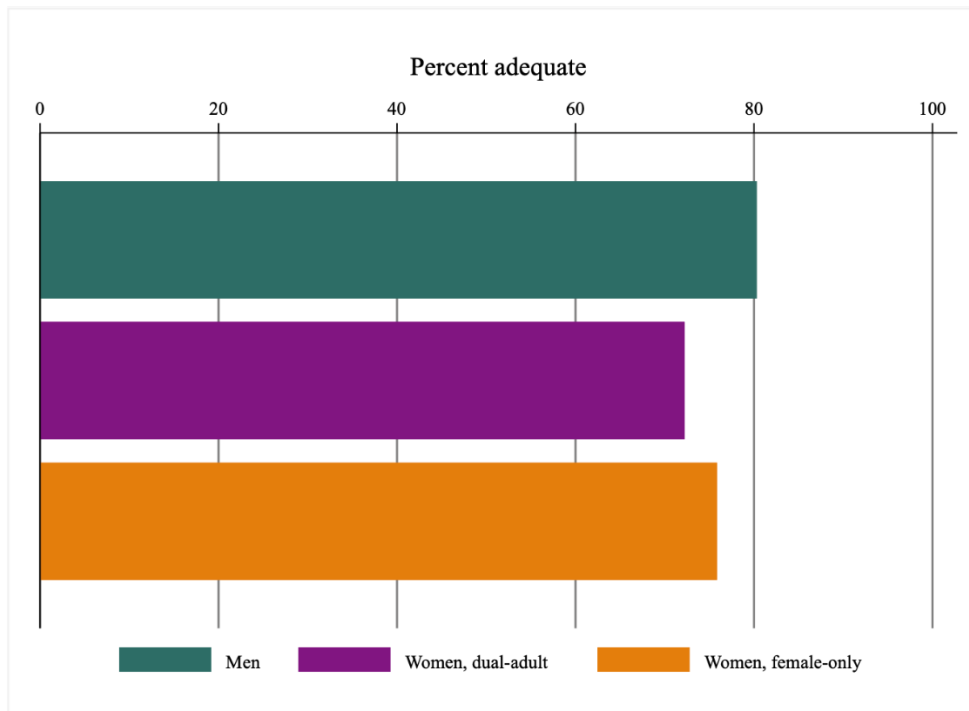
d. Adequacy in input to productive decisions



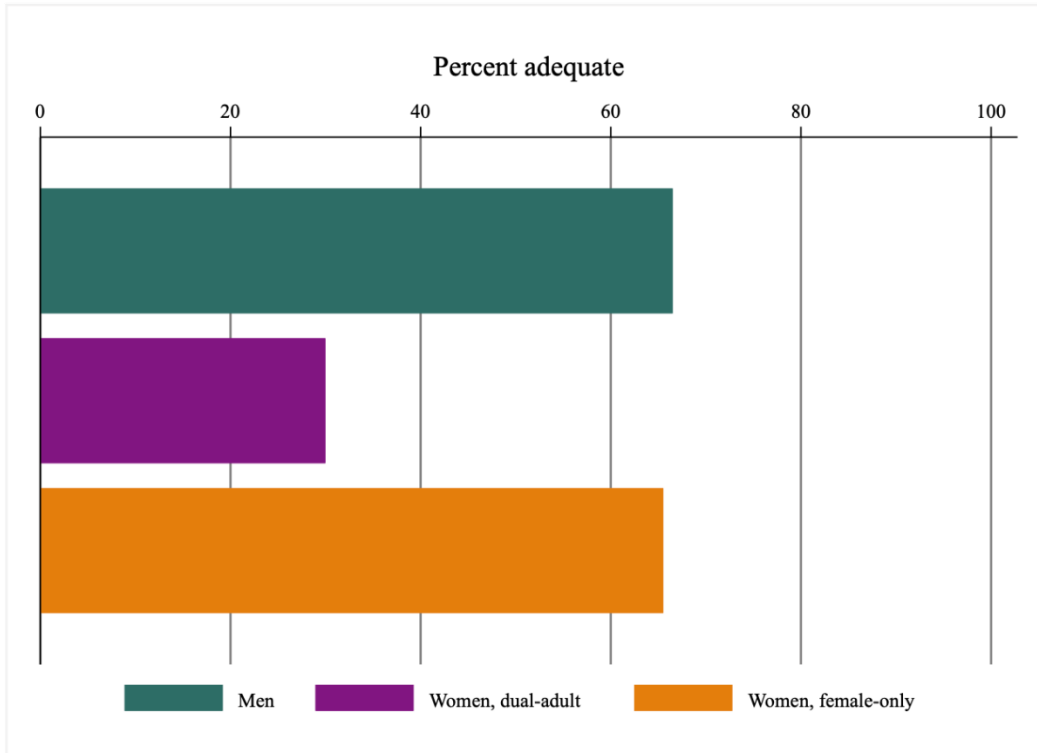
e. Adequacy in control over use of income



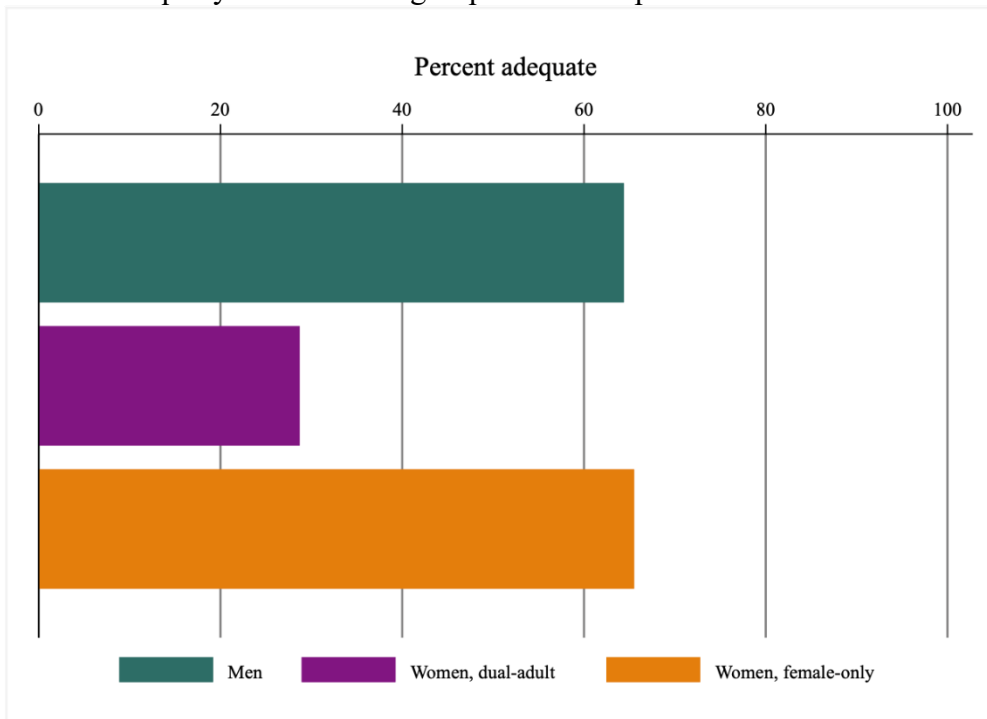
f. Adequacy in work balance



g. Adequacy in group membership



h. Adequacy in influential group membership



Source: IFPRI/World Bank/MSR 2020.

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INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

www.ifpri.org

IFPRI HEADQUARTERS

1201 Eye Street, NW
Washington, DC 20005 USA
Tel.: +1-202-862-5600
Fax: +1-202-862-5606
Email: ifpri@cgiar.org