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Farmers' Adaptive Strategies in Balancing Commercial Farming and Consumption of Nutritious Foods: Case Study of Myanmar

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Abstract: Food systems undergo rapid changes in response to economic and market forces, and environmental and dietary changes. This study aimed to disentangle adaptation strategies in farm households balancing interests in the commercial aspects of farming and the consumption of nutritious foods. The area of interest was Central Myanmar, Pakokku region. A literature-based framework was used to identify entry points for adaptation strategies at the farm household level. A purposive sampling strategy was used to select smallholders (<5 acres), engaged in market-oriented agriculture (≥ 10 years). In 14 households, in-depth interviews were conducted, using a life course perspective depicting the household history in relation to agricultural developments and household food and nutrition security. The narratives of smallholders confirmed that household food and nutrition security was grounded in mixed livelihood strategies, including migration. Diet quality depended largely on income. Supportive strategies were a frugal lifestyle, responsible use of resources, participation in community activities, and different forms of social innovation. The study shows how the understanding of local diets provides insights in entry points for nutrition-sensitive agriculture, and suggests a need for alternative adaptation strategies, replacing those promoting specialization and intensification, for more holistic solutions that reinforce the flexibility and resilience of farmers.

Keywords: Agricultural commercialization; food and nutrition security; salutogenesis; life course perspective; food systems; multi-level; positive deviance; Myanmar

1. Introduction: Food System Transitions and the Case of Myanmar

With the Sustainable Development Goal (SDG) of 'Zero Hunger' [1], much importance has been given to the role of nutrition in reaching the end of hunger for all by 2030. In the past, increasing food production has been the emphasis of agricultural strategies all over the world. However, worldwide, food systems are undergoing a rapid transition, in which existing supply chains are adapting to economic, environmental, market, and dietary change. There is an on-going shift from local food systems characterized by small-scale production by a large group of small holders to a growth of commercial agriculture by fewer, larger farmers and longer and more complex global supply chains [2]. Individual farmers are increasingly involved in processes of commercialization with substantial improvements in agricultural outputs [3], and play a crucial role in a food system as both producers and consumers [4]. However, commercialization of agriculture can have several adverse effects, especially in terms of equity and environmental consequences. With the increase of mechanization,

a consistent part of the rural labor force needs to be relocated in the industrial and service sector, with consequent loss of human and social capital, as well as environmental consequences due to the increased use of agricultural chemicals [5,6]. Where property rights are unclear, phenomena, such as land grabbing, can take place. Also, commercialization may lead to a decline in crop diversity for households [7]. In some cases, farmers that invested in cash crops were worse off in terms of nutritional status than subsistence farmers [8]. The persistence of malnutrition (undernutrition, micronutrient deficiencies) in low- and middle-income countries, alongside a worldwide growth in the prevalence of obesity, urges us to further investigate how to simultaneously stimulate individuals' healthy food production as well as consumption [9].

To explore the process and impact of major, and often irreversible, food system transformations, the case of Myanmar is an appropriate context. After 50 years of military rule, a civilian government was installed in 2011, and the first elections were held in November 2015 [10]. Therefore, the country was opened up to the world, allocating large concessions to foreign agribusiness companies [11]. The government expressed its intention to become a full member of the ASEAN (Association of South East Asia Nations) community and more relaxed regulation favored foreign investment. Nevertheless, the key strategies for the government to achieve national food security remained in rice production and local and international agribusiness prioritization [11]. The country faces the contradictory situation of being a net food exporter on the one hand, but experiencing high poverty and malnutrition rates on the other [12]. A major constraint in this regard is access to land: Nearly half of the rural households are officially reported as landless (no ownership). Confiscation of land and conflicts in some areas are two major reasons for landlessness [13]. Until recently, farmers' unions and networks were banned in the country [14]. Even though the interest in nutrition security is on the rise at the policy level, there is still a limited interconnection with the commercialization of agriculture [11].

This study aimed to contribute to a deeper and contextualized understanding of farm household sense-making processes—how people understand and give meaning to life events—in relation to the current rapid food system transition in Myanmar. The study sought to document the views of local smallholders by in-depth analysis of agricultural life stories to identify resilient and emergent strategies, incentives, and innovative practices leading to sustainable agricultural commercialization while achieving household food and nutrition security. The main research question was how do smallholder farmers develop and implement adaptive strategies in response to food system transformations leading to agricultural commercialization, in view of their agricultural livelihoods and diets during their life-course?

1.1. Theoretical Outline

This study used various theoretical entry points. Firstly, the study used a conceptual framework, developed from the literature, to identify and analyze development pathways from agricultural commercialization to nutrition at the household level [15]. The literature showed several pathways through which agriculture-oriented interventions may lead to positive food security and nutrition outcomes: Subsistence-oriented production (source of food); production for sale (source of income); and agricultural policies, affecting supply and demand factors defining the price of marketed food and non-food crops [16,17]. Key elements to define the framework were drawn from existing frameworks to assess food and nutrition security (FNS). For the nutrition components, the United Nations Children's Fund (UNICEF) framework on maternal and child undernutrition [18] and the framework for Actions to Achieve Optimum Fetal and Child Nutrition and Development [19] were used. For FNS, the Food and Agricultural Organization (FAO)'s Food Insecurity and Vulnerability Information and Mapping System [20,21] and the framework for pathways described by Hertforth and Harris [22] were used. For the commercialization components, the frameworks of Von Braun [23] and Kanter et al. [24], describing the linkages between agriculture, food systems, nutrition, and health, were used. The conceptual framework, presented in Figure 1, embraces a multi-level approach taking into account several factors and dynamics that affect farm household livelihood outcomes: Individual level (gender

and power dynamics); household level (food production, income generation, food purchase choices, off-farm labor, care practices, access to health care); community level (employment opportunity, collaboration, microfinance, care and social (infra)structure); and regional and macro level (price and trade policy). The ultimate focus of the framework is on the rural agricultural household interactions. In this space, farmers negotiate their assets with the external environment through their decision- and sense-making behaviours. These dynamics generate pathways, which cut across different levels and can take various shapes and forms, potentially leading to changes for farmers' livelihoods. It also seeks to include a life course perspective [20], emphasizing the non-linearity of many relations between inputs and outcomes.

Secondly, to disentangle sense-making and decision-making processes happening in response to commercialization, this study was based on three additional theoretical orientations. The salutogenic theory was used, developed by Antonovsky [25,26] for health promotion, which posits that life experiences help shape one's sense of coherence, whereby life is understood as more or less comprehensible, meaningful, and manageable. A strong sense of coherence helps one to mobilize resources to cope with stressors and manage tension successfully. In its more general meaning, salutogenesis refers to a scholarly orientation focusing attention on the study of the origins of health, contra the origins of disease. Salutogenesis is in harmony with developments across the social sciences that seek better understanding of positive aspects of human experience [27]. This theoretical orientation was adopted to guide the analysis of farm household individuals' strategies and coping mechanisms promoting nutritious food consumption and production throughout the life-course [28], using the concept of general resistance resources (resources that can aid resistance to stressors) [29].

The positive deviance theory was used to understand in which way successful farmers can guarantee sustainable livelihoods through commercialization strategies in an environment where others fail [30]. Social innovation theory was used to explore collective dynamics and the interactions between different actors, policies, and interventions [31]. The emerging field of social innovation, drawing on innovation, resilience, entrepreneurship, and organizational change thinking, seeks to understand how individuals, organizations, and networks can generate new solutions for multiple societal goals [32].

1.2. Definitions of Key Concepts Used in the Study

In this study, food system is defined as "a system that embraces all the elements (environment, people, inputs, processes, infrastructure, institutions, markets and trade) and activities that relate to the production, processing, distribution and marketing, preparation and consumption of food and the outputs of these activities, including socio-economic and environmental outcomes" (p. 12) [33].

Commercialization is defined as the agricultural transformation process in which individual farmers shift from a highly subsistence-oriented production towards more specialized production targeting markets both for their input procurement and output supply [34]. Specialization and commercialization could represent a more efficient strategy than subsistence for small farmers [35].

Food and nutrition security (FNS) is defined as "food and nutrition security exists when all people at all times have physical, social and economic access to food, which is safe and consumed in sufficient quantity and quality to meet their dietary needs and food preferences, and is supported by an environment of adequate sanitation, health services and care, allowing for a healthy and active life" [36].

General resistant resources are defined as those resources that can aid resistance to stressors. These can be of a physical nature (e.g., a strong physique, strong immune system, genetic strengths), art factual nature (e.g., money, food, power), cognitive nature (e.g., intelligence, education, adaptive strategies for coping), emotional nature (e.g., emotional intelligence), social nature (e.g., support from friends and/or family), or macrosocial nature (e.g., culture and shared belief systems). General resistance resources can be identified at different levels: Individual-level resources (internal, such as intelligence, religion, and philosophy, genetic, and constitutional); family-level resources (material and emotional support), and community- and society-level (material, knowledge, cultural stability, social support) [37].

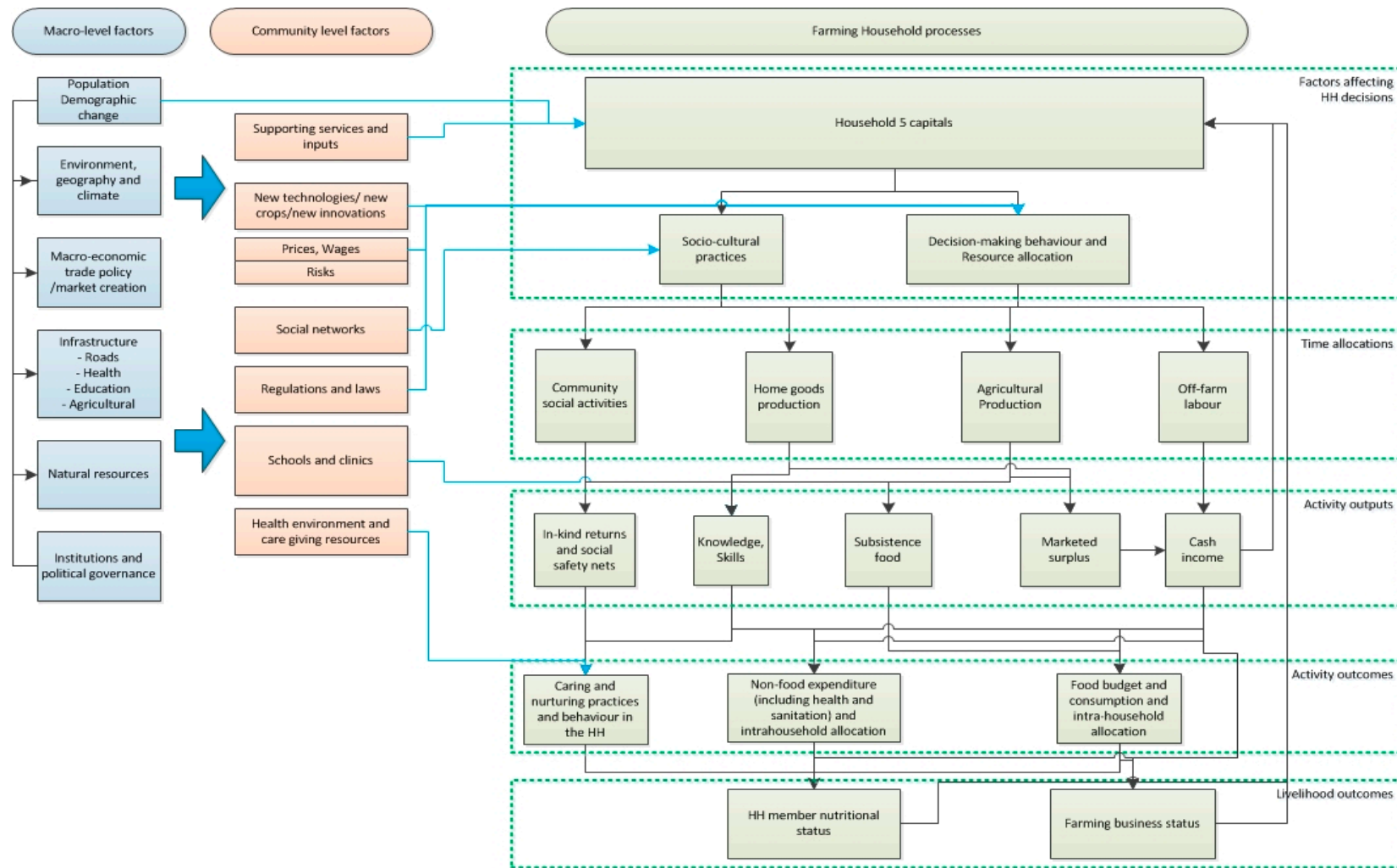


Figure 1. Conceptual framework of development pathways from agricultural commercialization to nutrition [15].

2. Materials and Methods

The Dry Zone of central Myanmar, as shown in Figure 2, was selected for our case study design [38]. This area is generally characterized as one of the most food insecure areas of the country [39]. In 2011, the food security assessment by the World Food Program (WFP) classified 17% of households as severely, and 24% as moderately food insecure [40]. Under-five malnutrition rates showed 7% of wasting and 29% of stunting [41]. Food availability strongly depends on monsoon rains (from May to October). A majority of households rely on rain-fed cultivation on flatland. Farm households generally own their agricultural land, but around 50% of the households in the area are estimated to be landless [42]. Most households grow three or more different types of crops, most commonly pulses, sesame, maize, and groundnuts, alongside animal sourced foods [13]. Over 90% of the households rely on markets for rice [39].

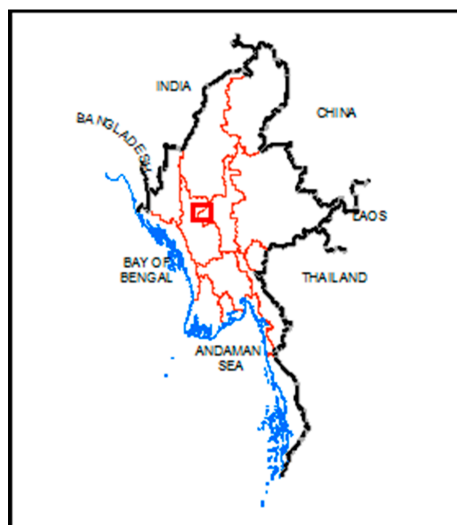


Figure 2. Pakokku township in the Dry Zone.

Income is derived mainly from casual wage labor, farming, small trade, and sales (of livestock). Farmers in the area have limited access to finance and inputs, especially for cultivation that is different from paddies, which are promoted by the government [42]. The region is also characterized by a high presence of female-headed households, due to migration of male family members, mainly to urban centers in Myanmar [39]. Main health issues are poor hygiene practices, poor access to latrines, and use of unprotected water sources, poor drinking water treatment practices, and inappropriate care for sick children. Girls tend to have less access to education than boys [39]. The study area was Pakokku Township in Magway division, in which five villages were selected: Kan Zauk, Sar Kyin, Aung Tha, Oo Yinn, and Yar Lar Lay. Most of the villages count 100 to 200 households [43]. Villages are organized around a group of leaders, who are supposed to actively help organize community activities (i.e., ceremonies) or development actions.

2.1. Sampling and Household Selection

A non-probability-based, purposive sampling strategy was used to select positive deviant farm households, i.e., those households reaching optimum results in an environment where the majority fails. To identify positive deviants, we based our inclusion criteria of farmers engaged successfully in commercial agriculture on local consultation with key stakeholders involved in agricultural development and food security in Myanmar, acknowledging that ‘positive’, ‘healthy’, and ‘successful’ are socially constructed concepts. We did so believing these parameters were sufficient for the aim of learning from the positive [44]. The criteria thus defined to select the households for this study were:

- Started farming as landless or smallholder (less than two ha of productive land). This threshold was based on the fact that land is the most commonly used dimension for measuring farm size, although other criteria can also be used. Small is a relative concept, depending on agro-ecological as well as socio-economic considerations, but a 1 or 2 ha threshold is frequently used to designate farms as small [45];
- engage or engaged in the past for at least 10 years in any form of market-oriented farming in the study area; and
- relate directly to current concerns of ‘scaling up’ of technology, methods, social innovation, and good and best practices.

Household selection was done on site, with support from a local non-governmental organization (NGO). Fifteen households were thus identified, out of which 14 households entered the study. The one drop out was a successful farmer who did not start as a smallholder. The inclusion of female-headed households was emphasized. In each selected household, the household head was asked to participate in the research. In some cases, more than one household member participated in the interview, resulting in 20 individuals interviewed (8 women, 12 men). All respondents had settled in the village where they were born.

Average self-reported farm size early in life was 1.6 acres (range: 0–8 acres), and grew to 7.5 acres (range 4–13 acres) at the time of the study. Average household size was 6.9 members (range: 5–10 members). Average age of the respondents was 51.8 years (range: 31–66 years). Only three households lived off agriculture, all others applied mixed livelihood strategies. Households produced an average of 5.2 commercial crops (range: 3–8), including food and non-food (cotton) crops. All household heads interviewed were literate, eight of them through monastery schools, and in nine out of 14 cases, one of the household members had attended university. The majority of children, however, supported the parents in agriculture activities or in off-farm jobs. In 10 out of the 14 households, migration was common among the youth, some leaving for cities in Myanmar (i.e., Mandalay and Yangon) and others to neighboring countries (i.e., Thailand and China). Table 1 summarizes the household characteristics involved in the study.

2.2. Data Collection

Data were collected during September–October 2017. Data were collected by means of qualitative in-depth interviews using narrative inquiry as the method, including a timeline technique [46]. Narrative inquiry and other forms of qualitative non-structured inquiry have been used to explore food stories in several studies. It has been applied to understand food choice factors [47], to explore food related meanings [48], eating disorders [49,50], relationships with food [51], and healthy eating [52]. Narrative inquiry has also been used to understand whole food systems, including production aspects [53]. The timeline technique was used as it is designed to respect contextual and historical influences, generating data based on stakeholders’ individual and collective perceptions, thus reflecting developments over time [54]. In addition, the timeline technique visualizes respondents’ perceptions of what matters most, and serves as a graphic tool to guide and summarize the interview while doing it, thus supporting both the researcher and respondent to gain insight and promotes learning on the spot [55,56]. The combination of methods was chosen to:

1. Capture thoughts and emotions of individuals in more depth compared to the traditional interview [57];
2. Capture the meanings attributed by respondents to their lives through the selection of memories [58];
3. Favor self-reflection through the process of expressing their personal life-story [59]; and
4. Favor a reflection on changes in societal and cultural norms from which is it possible to extract time and geographical bound socio-cultural practices [60,61].

Table 1. Respondent characteristics.

Village	# Resp	Sex	Age yrs	Education	# Household Members	Household Livelihoods	# Migrants/Household	Type Commercial Crop	% Product. Sold *	Acres Owned Start Farm **	Acres Owned (2017) **
Kan Zauk	2	F M	60 51	Primary Literate NS ***	8	Mixed ****	3	Groundnut, mung beans, toddy-palm	50%	0	5
	1	F	44	Primary	7	Agriculture	0	Ground nut, mung bean, pigeon peas, sesame, toddy-palm	90%	0	7
	1	M	56	Primary	6	Mixed	1	Ground nut, mung bean, pigeon peas, sesame, lablab bean, potato, tomato, onion	50%	5	5
Sar Kyin	1	M	41	Primary	7	Mixed	1	Pigeon peas, cotton, sesame	50%	0	5.5
	1	M	44	Literate NS	9	Mixed	1	Mung bean, pigeon peas, cotton, maize, sesame	80%	2	7
	2	F M	66 66	Illiterate Literate NS	8	Mixed	3	Ground nut, pigeon peas, cotton, maize, sesame	80%	0	13
	1	M	43	Primary	6	Mixed	0	Pigeon peas, cotton, lablab bean, maize, sesame	80%	0	10
Oo Yinn	2	F M	58 55	Literate NS Primary	5	Mixed	1	Maize, lablab bean, tomato, chili	90%	0	4
	2	F F	60 58	Primary Primary	6	Agriculture	0	Chick pea, maize, bean, chili, eggplant	80%	5	5
	1	M	31	Primary	10	Mixed	2	Maize, chick pea, tomato, eggplant, chilly	60%	8	9
Yae Lar Lay	3	F F M	57 50 58	Literate NS Intermediary Literate NS	5	Mixed	0	Groundnut, sesame, pigeon pea, mung bean, cotton	70%	0	10
Aung Tha	1	M	56	Literate NS	7	Mixed	2	Groundnut, pigeon pea, maize, sesame	70%	3	7
	1	M	41	Secondary	7	Agriculture	0	Chick pea, mung bean, green gram, maize, cotton, sesame, groundnut, pigeon pea	95%	0	9
	1	M	55	Literate NS	6	Mixed	2	Sesame, mung bean, pigeon pea, cotton, chick pea, groundnut and maize	70%	0	9

* Self-reported percentage of agricultural production sold to the market; ** self-reported farm size; *** NS = No formal schooling or education; **** HH Mixed livelihoods refers to on- and off-farm/non-farm income generation.

The interview procedure included the following steps [52]:

1. Introduction and collecting data for respondent and household characteristics.
2. Drawing up the timeline: A timeline was drafted on a flipchart, whereby respondents freely included important moments, transitions, turning points, etc. in relation to agricultural practices and their diets.
3. In-depth interview: Respondents described their personal experience in relation with agriculture and their diets in line with the events graphically plotted on the timeline. Particular attention was given to important stages over the life course and how respondents dealt with challenges and stressors.
4. Reflection on healthy food: Respondents were asked to select an item, which they associated with healthy food, and to explain their choice.

The interviews were conducted in Burmese, were recorded, and then transcribed verbatim to English by the translator.

2.3. Data Analysis

Thematic analysis was applied, using QDA Miner Lite software. The concept of general resistance resources, as defined in the salutogenic theory, were used to develop top down coding to identify adaptive strategies. Both top-down and bottom-up coding were applied. For top-down coding, transcripts of the interviews were coded according to the theoretical framework, departing from the characteristics as described for the general resistant resources. For bottom-up coding, a sample of interviews was taken and analyzed. From these transcripts, salient points were underlined and more elaborated sentences were added as comments on the margin. These sentences expressed a slightly higher level of interpretation and were added to the final list of codes. Thus, a combined list of top-down and bottom up coding was compiled. Two researchers did coding and discussed inconsistencies until consensus on the interpretation was reached. Finally, findings were systematically described upon discussion of the clustering of emerging themes in the research team. Quotes supported the results to transmit unique concepts and meanings.

3. Results: Farm Household Adaptive Strategies over the Life Course

All respondents were involved in agriculture since childhood. They generally had to leave school to help their family in the fields or with other income-generation activities, usually upon finishing primary school. Childhood was generally described as a period of poverty during which food was occasionally scarce and it was difficult to purchase other goods (i.e., clothes). After marriage, the main life events described were related to childbirth and child development. Respondents indicated that, compared to their parents, the current generation of farmers moved from semi-subsistence farming to more market oriented farming. As someone said:

“When I was a child, my parents were selling half of the total harvest and we were eating the rest. Now, I store my crops in my house and I wait until market prices are going up. We can also send our crops to warehouses. They will keep it for you and you can sell to them at any time. In the past, we did not have this option. Today, I grow crops with a market-oriented view.” [Male respondent Sar Kyin]

3.1. Agriculture-Related Events and Adaptive Strategies

During youth, respondents worked for others in order to save money and be able to buy land and start a commercial farm for themselves. A common source of additional income in the area was climbing toddy-palm tree (*Borassus flabellifer* L.) to collect the juice (toddy), practiced by young adults, both men and women. The toddy ferments naturally and is locally popular as a beverage.) Young women were also involved in raising animals, the selling of sweets and vegetables, and cotton fabric production. Young men worked as pond diggers, shepherds, gold diggers, farm laborers, woodcutters, brokers, teachers, and cooperative workers. Some temporarily migrated to neighboring villages.

A major life event was leaving the parental house, with having access to land as an important precondition. Some respondents started their own farm by borrowing land while the majority directly purchased the land. The main push factor to leave the parental house was family growth rather than getting married and the consequent pressure on the parental household resources. Five respondents indicated that they inherited a piece of land from their parents.

Respondents highlighted the flexibility in gender role division whereby women could buy and inherit land, manage the farm, and conduct economic activities as a response to the absence of a productive male member of the family. Female respondents indicated that they were not only involved as a labor force in the fields, but they were actively participating or leading the decision-making processes at the farm (household).

The main events and stressors for agriculture in the Dry Zone, where most farming is rain-fed, relate to harvest loss due to climate or water-related problems, pests and pests or infestations, as is illustrated in Figure 3. These events easily endangered families to become indebted. One respondent recalled:

“Around 1999–2000, due to intensive rainfalls, < . . . > there was famine, particularly scarcity of rice and also our crop (mung bean) in the field was damaged by fungus and we could not sell it. Therefore, I borrowed money with high interest rate. I faced debt-burden and it was a very difficult time for me. I tried to raise pigs to have an income. In that period, my husband was bitten by a snake and got sick. This created more difficulties in our family.” [Female respondent Kan Zauk]

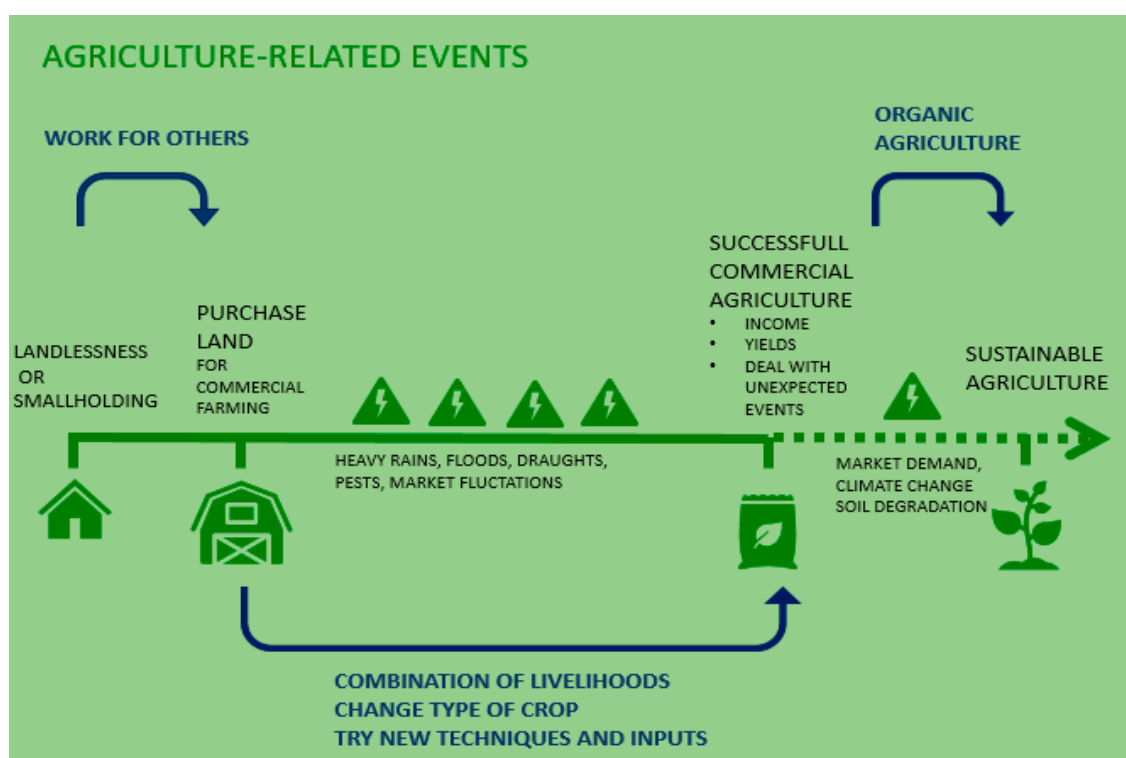


Figure 3. Timeline agriculture-related events; blue line and text indicate adaptive responses.

In response to such stressors, the majority of the respondents engaged in immediate, short term adaptive strategies, such as temporary income generation activities (raising pigs, making handcrafts, off-farm work, etc.); contracting debts, using jewelry as collateral, and selling livestock and carts; or collective action, for instance, to prevent the village from flooding.

More long-term adaptive strategies related predominantly to income stability to provide their family with good living conditions by improving yields and profits, and working with improved

inputs and cultivation techniques. Most respondents felt that a stable income could not be achieved by agriculture alone.

Adaptive strategies aiming for improved yields and profits, and being more responsive to price fluctuations were geared through experimentation with new inputs and techniques. Another example was a group of farmers, who organized themselves to rent a truck for selling their products to the market, thus avoiding the intermediation of middlemen, and obtaining better prices and access to new information.

Respondents showed awareness regarding more sustainable ways of food production and consumption, including the possibility to produce organic products. The main problems highlighted related to soil degradation and environment-related health problems. Respondents envisaged continuing to farm, but there were concerns regarding the sustainability of the current agricultural practices. In response, some started to experiment with organic farming. In one village, farmers collaborated to produce organic groundnuts and constructed a mill for common use to produce organic groundnut oil. Others, however, were more skeptical about the economic opportunities, and considered organic farming as going back to methods that are more traditional. Most respondents indicated that they practiced organic food production for household consumption while they were using chemical fertilizers for the crops designated for the market.

Resistance resources used in adaptive strategies for agriculture.

Key resistance resources used in adaptive strategies for agriculture were identified.

- At the individual level, the Buddhist practices and beliefs were mentioned as an important resistance resource to guarantee fortune and good health in the present and in the afterlife. Practicing religion offered support to cope with events beyond people's control. Other individual level resources mentioned were related to (personal) values, knowledge, internal strength, and being healthy. Some respondents explained that they could rely on their own or others' knowledge in the household, and their ability to properly apply it in certain situations.
- At the family-level, family ties were mentioned as the main network of resources, providing material support and a sense of belonging. Through family ties, respondents gained access to different kinds of capital:
 - Natural, i.e., inheritance of family land;
 - Physical, i.e., family assets, such as cattle, carts, bicycles, motorcycles, or agricultural tools;
 - Financial, i.e., credit; relatives were mentioned as a source of financial capital in the form of credit, but also children's remittances and physical help in agriculture were crucial for the sustainment of the household;
 - Human, i.e., educational level of family members. Respondents made efforts to support their children to complete their studies and find jobs outside the agricultural sector, as input from the farm, but also hoping to spare them from the difficulties and struggles experienced by the parents; and
 - Social (i.e., family unity, perseverance); respondents indicated that parental support was particularly relevant in the past, when they were young and lived under the parental roof with the aim to save money for their own future investments.
- At the community level, community or social support from the village or the monasteries were mentioned. Respondents highlighted a sense of unity and solidarity in their communities, which helped farmers to develop their business, for example, farmers organizing to rent a truck to sell directly to the market in order to avoid brokers' intermediation, or villagers mobilizing themselves to secure the riverbank during a flood. Other forms of resistance resources were mutual support among families during hard times, joint production of handcraft, or support of each other by borrowing money at low interest rates. An important community level resource was access to and sharing of agricultural knowledge and information through different sources (traditional

knowledge, observation of other farmers, private companies, trainings by non-governmental organizations, radio, TV, social media, books, university, smart phone). The majority of the respondents indicated that the main source of information on market prices and agricultural inputs and new techniques and inputs stems from fellow farmers.

- At the societal level, respondents mentioned the increased presence of NGOs, private companies, a university, and, to some extent, governmental extension services over the years. These actors provided farmers with trainings (on agriculture, food, or vocational training), access to agricultural inputs (fertilizers, pesticides, seeds, tools, etc.), and market information. The presence of microfinance organizations allowed farmers to access lower interest rates compared to informal moneylenders. Some respondents felt that the support of NGOs was fundamental. Others, however, expressed concerns related to dependency and the real effectiveness of the help received. At the institutional and governance level, the transition towards more democracy created space to form organizations. While, until recently, law in Myanmar forbade meetings of more than five people, during the interviews, it became evident that associations are more common now at the village level. Some respondents expressed the wish to be able to organize more structured farmers' organizations, enabling farmers to improve access to better information and prices and advocate for farmers' rights. Other societal resistance resources were related to improved infrastructure (roads, smartphones, and internet) and inputs (better seeds, fertilizers). Increased mobility of goods, people, and information created better opportunities for the farm households to commercialize their products to the market. Table 2 summarizes an overview of the adaptive strategies in agriculture described by the respondents.

Table 2. Respondents' main adaptive strategies in agriculture.

Stressor	Adaptive Strategies Applied	Goal	Key Resistance Resources
Endangered family living conditions	Agriculture with diversified production (incl. cash crops)	Income stability	Individual: Physical health, strength, (tacit) knowledge, perseverance, faith, austere lifestyle Family: Parental support, land, financial capital and credit, remittances, labor, education and agricultural knowledge of family members, social support Community: Information sharing of agricultural knowledge, sense of unity and solidarity, business collaboration, (social) protection, collaboration for disaster mitigation Society agriculture, food, or vocational training by various actors (NGOs, private companies, knowledge institutes), government extension services), microfinance, improved infrastructure, increased opportunities for famers cooperating and organization
	Agriculture and husbandry		
	Agriculture, husbandry, and migration		
	Agriculture, husbandry, and self-employment		
	Agriculture and migration of a family member		
	Agriculture and self-employment		
Harvest loss due to climate or pests	Change type of crops in response to climatic conditions	Improve yields and profit	
	Increase use of chemical pesticides and fertilizers (organic and chemical)		
	Crop rotation	Better inputs and cultivation techniques	
Price fluctuations	Change type of crops in response to market fluctuations	Responsiveness to price fluctuations	
	Storage of products until prices are favourable to sell		
	Improved information on market prices		
Viability of farming and food system	Join forces to facilitate/improve market access	Sustainable farming	
	Participate in training		
	Continue with or re-introduction of rational farming practices/Traditional tillage		
	Organic farming		

3.2. Farm Households' Diet-Related Events and Adaptive Strategies

For diet-related life events, respondents described a transition towards better access, availability, and stability of diverse diets. In the past, families used to rely on home production for food. Markets were difficult to access due to road conditions, and could only be reached by car or on foot. Food availability in the past was considered to be even more dependent on seasonality and natural events than today. Rice was rarely cultivated in the area. Three farmers mentioned that the demonetization, leading to political events in 1988, negatively affected the availability of rice and forced them to mix rice to other grains. Most of the respondents (13 out of 14) were used to consuming rice

alongside or substituted with other staple foods (i.e., maize, millet), but this was generally associated with poverty and disliked by respondents.

Collecting plants and food from the forest, such as bamboo shoots and mushrooms, was common during childhood. The local food environment offered a wide diversity of non-processed food that was considered stable, available, and accessible by respondents. Traditional crops included beans, rosella, gourd, eggplant, potato, water spinach, groundnut (oil), sesame, tomato, chilly, pumpkin, bitter melon, watermelon, and other plants growing naturally. As was highlighted:

“At my parent’s time, this area was very poor and vulnerable and we used to eat food in a traditional way. There were available only local vegetables and fruits like beans, rosella and bean leaves that we grow ourselves.” [Male respondent Kan Zauk]

Respondents indicated that, compared to their childhood, the current diet had improved. They ate fish, meat, eggs, milk, and fruits more often because of increased incomes, improved access to markets, and improved political stability, notably moderating the price of rice (Figure 4). At the moment of the interview, most respondents owned a motorcycle and roads were in good condition even though they were not paved. Meat and (dried) fish were particular food items associated with income increase, but most households also relied on the market for rice.

Respondents were also asked what type of crops were produced for home consumption, and what foods were bought from the market. Main foods grown for home-consumption were maize, sesame, groundnut, pulses and beans, chili, onion, potato, and various vegetables and fruits (bananas, mango, and watermelon). Main foods bought from the market were rice, noodles, chickpeas, yard long beans, spices (garlic, ginger), potato, sweet potato, various vegetables and fruits, oil, eggs, meat, chicken, fish, cookies, tea, and soya chunks. Some farmers were more dependent on the market for access to food. Others made an intentional choice for depending on the market for economic or health-related reasons.

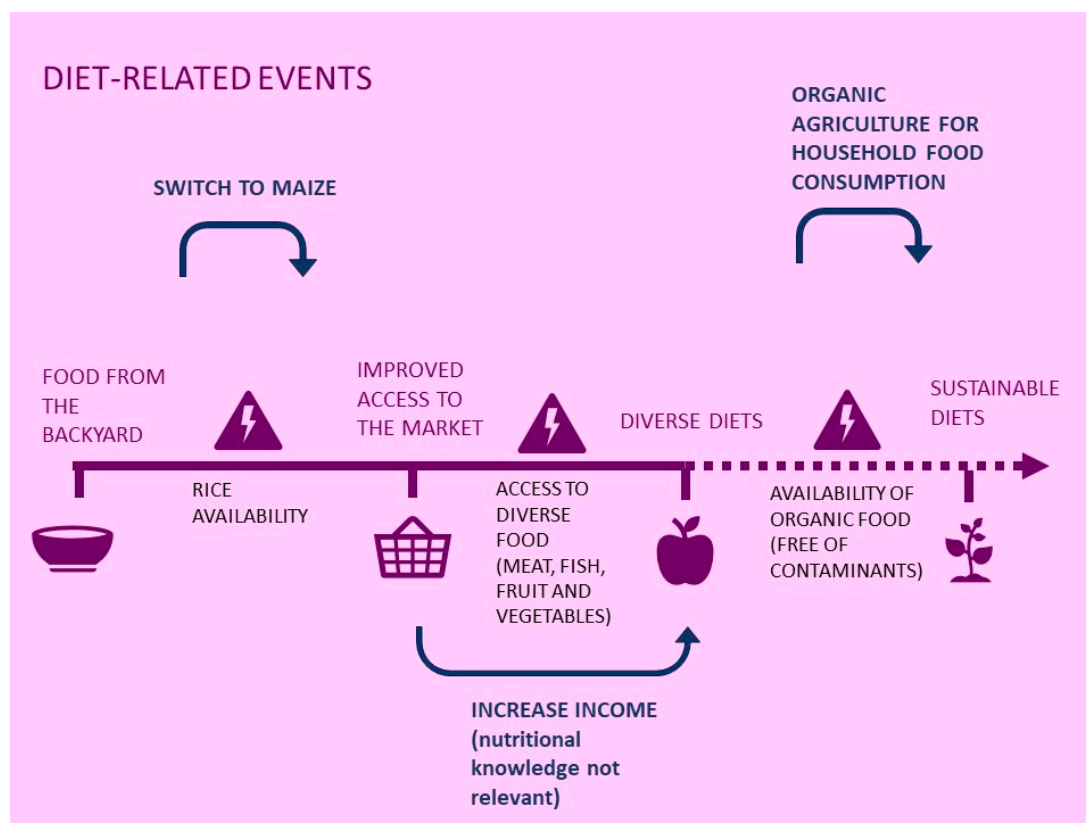


Figure 4. Timeline diet-related events; blue line and text indicate adaptive responses.

When asked about their eating habits, respondents indicated that, traditionally, respondents consumed three meals a day. Meals consisted of a main dish (usually rice or rice noodles) and two or more different curries—made of vegetables, pulses, grains, fish, mushrooms, bamboo shoots, meat—served in small portions and placed in the middle of the table. Women were in charge of food selection and preparation.

Food choice was not primarily guided by scholarly knowledge on nutritious foods or nutrition, oftentimes introduced through training by NGOs. The information of ‘declarative’—factual and evidence-based—nutritional knowledge seemed more related to food choice for children, rather than to respondents’ choices relating to the production of food and daily choices of food. Fish, meat, eggs, milk, potatoes, and seasonal vegetables were considered good food for children. As someone said:

“In the past, we never considered eating healthy food and we were just eating for work and living. We had to eat what we had. Lately we got some money, we buy what we want to eat but without thinking about nutritious food consumption.” [Female respondent Kan Zauk]

Food and nutrition security considerations at the household level were mainly related to the affordability of certain kinds of food (like meat and fish) and access to organic food, understood as access to food free from contaminants. A main concern expressed by respondents connecting health to food related to their awareness around the contamination of food by pesticides, fertilizers, and other products endangering their health. Respondents reported to have learned about it from books, trainings, and from others. For this reason, some of the respondents preferred to grow organic food for their household consumption or buy organic food from other farmers.

Resistance resources used in adaptive strategies for diet-related events.

Key resistance resources used in adaptive strategies for diet-related events were identified, and related to a large extent to what was also found for the adaptive strategies in agriculture. Most prominently:

- At the individual level, practicing religion offered support to cope with events as well as (personal) values, tacit knowledge on food, internal strength, and being healthy.
- At the family-level, the family income as a means to get access to market goods, came out most prominently, but also other kinds of household capital:
 - Physical, i.e., cattle, motorcycles;
 - Financial, i.e., credit; relatives were mentioned as a source of financial capital, children’s remittances were crucial for the sustainment of the household;
 - Human, i.e., educational level of family members; and
 - Social (i.e., family unity); respondents indicated that family support was particularly relevant in relation to child and family care. In addition, wives were taking over tasks of the husband in the case of absence or illness.
- At the community level, respondents, as was mentioned for agricultural events, highlighted access to and sharing of knowledge and information on nutrition, health, food preparation, and care, mainly originating from trainings by NGOs, radio, TV, and social media. In addition, knowledge sharing on organic food farming for home consumption was highlighted.
- At the societal level, respondents, as was mentioned for agricultural events, highlighted in particular the role of NGOs as a source of information. In addition, the improved roads, increasing mobility, and access to smartphones and the internet, were re-emphasized. Respondents expressed the wish to be able to organize more structured farmers’ organizations. Table 3 summarizes an overview of respondents’ adaptive strategies in diet-related events.

Table 3. Respondents' adaptive strategies to diet-related events.

Stressor	Adaptive Strategies Applied	Goal	Key Resistance Resources
Lack of nutritious food	Collecting food (from the wild)	Stability of access to food	Individual: Physical health, strength, (tacit) knowledge, faith, austere lifestyle Family: Financial capital and credit, remittances, labor, education and tacit knowledge of family members, family care and social support Community: Information sharing of knowledge on nutrition, food safety and health, and on organic food production, sense of unity and solidarity Society Nutrition and health training by various actors (NGOs, improved infrastructure)
	Home production of food		
	Eating less preferred food		
	Regular meal frequency	Better dietary diversity	
	Home production of food		
Buying foods from the market, in particular animal sources foods	Increased income		
Lack of market access		Commercial farming	
		Remittances	
		Off-farm labour	
		Purchase of means of transport	
Join forces to facilitate/improve market access			
Lack of food safety and unhealthy diets	Participate in training	Sustainable diets	
	Continue with or re-introduction of rational farming practices/ no contaminants		
	Organic food production for home consumption		

4. Discussion

The aim of this study was to disentangle adaptive processes in farm households in Myanmar, balancing interests in commercial farming and consumption of nutritious foods, through an in-depth analysis of agricultural life stories (narratives) in order to identify resilient and emergent strategies, incentives, and forms of social innovation.

Relating to the research question 'How do smallholder farmers develop and implement adaptive strategies in response to food system transformations leading to agricultural commercialization, in view of their agricultural livelihoods and diets during their life-course?', our findings indicate that the selected farm households all started as landless or as smallholders, and became successful over time. Transitions had a role in shaping respondents' orientations towards agriculture and food. Most respondents had in common a smooth transition from the parental to the conjugal house, to which the majority attributed an increased sense of wellbeing relating to parental support, as most of them lived under the parental roof, working for others and saving money until they cumulated enough capital to purchase land. These findings are consistent with results reported by Croll [62], who, based on ethnographic studies across East, Southeast, and South Asia, suggested that generations have taken new steps to invest in the intergenerational contract, which has been renegotiated and reinterpreted by both generations in support of a robust and reciprocated cycle of care.

The farm households identified were involved in an agricultural transformation process, shifting from a subsistence-oriented production toward a more market-oriented agriculture. However, during this process of commercialization, farmers did not specialize to become more efficient, as suggested by Jaleta et al. [34], but diversified their agricultural production in order to become more resilient to various types of stressors. Contrary to the observations of Rerkasem et al. [7], the process of commercialization did not seem to result in a decline in crop diversity per household, as an important adaptive strategy was to change crops in response to climate stressors or market fluctuations. Being flexible and diversifying livelihood strategies emerged as successful strategies to deal with recurrent challenges of different natures. This is consistent with findings reported by Ellis [63]. He found that many of the attributes to diversification as an individual or household level survival strategy might be associated with success at achieving livelihood security under improving economic conditions as well as with livelihood distress in deteriorating conditions rather than just being a strategy of desperation, or a transient phenomenon. Ellis concluded that acquiring the capability to diversify income sources signifies an improvement in the livelihood security and income-increasing capabilities of the rural household, and therefore advocated that policies that reduce constraints to diversification and widen its possibilities are, in general, desirable. Diversification within agriculture to take advantage of new markets is also a desirable policy emphasis.

Farmers' sense-making and decision-making processes considering agriculture engagement were found to differ from those around family food and nutrition security. This is suggested by the finding that a common strategy was to produce (or buy) organic food for household consumption and use chemical inputs for agri-business. Some farmers even expressed a preference for organic, more sustainable ways of agricultural production, but for economic reasons, the majority had to rely on non-organic inputs and practices. The importance of food pricing is an influential factor when it comes to the consumption and production of organic food. Meeker and Haddad had similar observations [17].

Increases in income due to agricultural commercialization and diversified livelihood strategies contributed largely to increased dietary diversity, which is consistent with findings reported by Meeker and Haddad [17]. Income from off-farm sources played an important role for the household wellbeing and especially for accessing food, since all the respondents were dependent from the market for rice. The scarcity of processed food in the local markets induced an increase of fruit, vegetables, meat, and fish consumption. This trend may change in the future, when an influx of processed foods can be expected in response to the on-going transitions in Myanmar.

Consumption patterns did not seem to differ very much from the traditional diets consumed by previous generations, despite the fact that respondents also highlighted an increased access to and availability of (more diverse) foods over their life. This aligns with findings reported by Devine et al. [61] and Rosen [52], who indicated that the positive connotation associated with eating traditional foods might be a result of positive family interactions around food and eating. In addition, as Swan suggested, declarative knowledge (knowing the facts about nutritious food) is less influential for people's diets than procedural knowledge (how to acquire certain skills in relation to food) [64].

Our findings also indicated that Myanmar farmers were able to regain stability and structure after stressful life events, and apply craftiness and fortitude during challenging moments. In the literature, these skills were found to be connected with healthy eating habits [55]. Higher perceived neighborhood collective efficacy is another predictor for healthy eating habits [64].

Our case study showed that women made decisions in relation to both production and consumption of food. Women were in charge of food utilization at the household level. In some cases, they were in charge of the farm and they could buy land. In line with this, women defined themselves as skillful in the art of selecting, purchasing, and preparing good meals for their family. This supports the role of women in ensuring food and nutrition security at the household level [17].

Our findings indicated some evidence for new forms of inclusive community-led organizations taking root, often in connection with the process of democratization in Myanmar. Until recently, in Myanmar, people were not allowed to meet in public at the community level. Limitations for bottom-up forms of organization were still present at the moment of the interview, but some forms of organizations existed and some respondents were actively participating or even leading community groups. Most of the strategies identified in this study, mostly introduced and guided by actors, such as schools, NGOs, or the government, can best be defined as socio-political or socio-organizational innovations derived from the recent possibility of citizens to exercise their rights of free association [65]. Village level organizations promoted grassroots solutions for pressing societal issues (the common mill) and some individuals were willing to organize more systemic innovation involving organizational and institutional frameworks [66].

Overall, this study shows how individuals developed a wide set of adaptive strategies in response to a wide set of stressors (family-, agriculture-, diet-related). Our study confirms that agricultural commercialization and food and nutrition security are interrelated through a set of pathways, which are embedded in local sense-making and decision-making patterns. Turning points that had a positive influence on respondents' ways of producing and consuming food were: (i) Inheritance or purchasing of land; (ii) introduction of better agricultural input; (iii) improved access to the market, and (iv) participation in agricultural and nutritional trainings.

Methodological Considerations

The study was built on a conceptual framework for the analysis of pathways for linking agricultural commercialization to nutritious food consumption [15] to support the analysis at multiple levels. Specifically, the framework helped to disentangle the agricultural household interactions with the external environment. Furthermore, the study combined three theoretical orientations, which proved useful to generate a rich and contextualized description of farm household sense-making processes in relation to the rapid agricultural transitions currently occurring in Myanmar, and the implications for household food and nutrition security. The theoretical lenses of salutogenesis and life-course perspective helped to identify how experiences shaped respondents' connection with agriculture and food. Use of narrative techniques, in particular the timeline technique, generated actor-driven data and generated fruitful discussions on identifying what actually happened over time.

The theoretical lens of positive deviance helped to develop an approach to identify farm households who practiced affordable, acceptable, and sustainable strategies, which might have potential to be adopted and shared within the Myanmar context [67]. Selection criteria for positive deviants, though, are highly dependent on the context of the research [45]. In previous studies involving positive deviants, farmer's income (high), land ownership, and absence of debts were used as criteria for inclusion [68]. For this study, particular importance has been given to farm size [45].

Several limitations to our exploratory study need to be highlighted. Firstly, the case study approach does not support easy generalization of our findings beyond the area of focus. Our sample consisted of respondents selected by local actors. Participation was on a voluntary basis. This may have created a bias in favor of respondents most willing to talk about their lives. Therefore, our findings relating to successful adaptive strategies in response to life-, agriculture-, and diet-related events, cannot simply be extrapolated to other actors or regions. In addition, we have not included non-farm rural households, which may equally suffer from stressors in life, agriculture, and diets, which offers an interesting avenue for future research.

Secondly, the timeline technique builds on techniques for organizational and intercultural learning [69,70], requiring good facilitating skills to manage the conversation and watch over the process of sense making of the actor-driven retrospective recollection of events and the determination of their significance. The fact that we had to work with a local enumerator and with translations of transcripts may have affected the process of capturing all fine details in conversations, thus setting some practical boundaries to our information needs and data collected. In addition, different beliefs about agriculture and food concepts across cultures may have influenced our understanding and interpretation of the information [71].

Thirdly, the positive deviance approach could insufficiently be substantiated with quantitative data for selection of successful farm households, due to a lack of reliable data in Myanmar. Ideally, a case-based qualitative exploratory design, like the one we used, should add or include further quantitative assessments to underpin the contextualized observations [44].

5. Conclusions

This study shows how an understanding of local diets provides insights on possible entry points for nutritionally sensitive agriculture. The diversification of livelihoods and social and emotional components, identified in this study, played a major role in guaranteeing successful outcomes. This suggests a need for alternative strategies moving away from specialization and intensification strategies usually promoted by agri-businesses. This also suggests a need for alternative strategies of (international) NGOs, whose interventionist and project-based approaches usually offer standardized solutions and restricts farmers in mono-directional livelihoods.

This study also shows how important holistic solutions and resilience strategies are for success. Therefore, reinforcing the flexibility and resilience of successful farmers should be a key element to integrate into project strategies. Having diversified livelihood strategies allows farmers to experiment and innovate while holding a strong fallback position represented by other sources of income.

In addition, this study showed how emotional and economic support during youth could represent a solid base for the future. Overall, this study seeks to underline the importance for policies and interventions to be informed by participatory and holistic baseline assessment whereby the theory of change of all the relevant stakeholders is taken in account. As emerged from this study, declarative knowledge transmitted through formative training did not seem to have significant implications for people's food choices. The inclusion of procedural knowledge in food and nutrition security programs and the impact of procedural knowledge transmission rather than declarative could represent an interesting field of research.

6. Ethical Considerations

All participants entered into the research with voluntary consent. They were provided with information about the purpose and contents of the study. Guarantees of confidentiality and anonymity were given prior to each interview. Moreover, participants were able to withdraw from the study at any time for any reason. The authors declare that the study was conducted in accordance with general ethical guidelines for behavioral and social research in the Netherlands. These guidelines stipulate that behavioral research falls outside the scope of the Act on review of medical research involving human subjects (WMO) when a study is not of a medical nature, and subjects do not receive a particular treatment or are asked to behave in a particular way [72].

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Acronyms

ASEAN	Association of South East Asia Nations
FAO	United Nations Food and Agricultural Organisation
FNS	Food and Nutrition Security
LMICs	Low and Middle Income Countries
NGOs	Non-governmental Organizations
SDG	Sustainable Development Goal
UNICEF	United Nations Children's Fund
WCDI	Wageningen Centre for Development Innovation,
WFP	World Food Program
WUR	Wageningen University & Research

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