Marketing and Profitability of crops in Pyawt Ywar Pump Irrigation Project

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LIFT Livelihoods and Food Security Trust Fund

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Report outline

Executive summary

Rehabilitation of Pyawt Ywar scheme presents an exceptional opportunity to simultaneously redesign or upgrade the infrastructure, improve the irrigation operations and maintenance regime, establish economically viable cropping and management systems, and introduce innovative irrigation approaches that will support new forms of crop production. Livelihoods and Food Security Trust Fund (LIFT) of Myanmar has provided necessary financial support for undertaking this rehabilitation activity to International Water Management Institute and other project stakeholders (ICRISAT, WHH and National Engineering and Planning Services). The present study was undertaken as a part of achieving project output 3: improved market opportunities in the PYPIP area. Assessing the extent of marketable surplus among different crops, mapping of major marketing channels and estimating the price spread, identification of key issues in marketing and potential value-addition opportunities etc. were the major objectives of the current study. Overall, the agricultural marketing system in the country is in primitive stage. Role of local trader or middle men is inevitable in marketing of any commodity. The extent of awareness about commodity prices is very poor among producers because of lack of access to information. Often farmers' face distress sales due to financial needs and absence of public storage facilities. The extent of marketable surplus among study crops is very high (>80%) and they are highly dependent on markets for their disposal. The commodity-wise standards, processing and value addition etc. were almost absent across commodities. Relatively, the marketing efficiency is high for dry grains when compared with fruits and vegetables. Strengthening of public/private storage facilities and providing pledge loan facilities is the need of the hour to protect the interest of the farmers. Promotion of grain processing and value addition opportunities through involvement of farmer collectives or commodity groups will enhance price realization and incomes of farmers. Finally, Government of Myanmar should focus more on creating price awareness, commodity research and price advocacy to farmers.

1. Project background

Pyawt Ywar Pump Irrigation Project (PYPIP) is one of more than 300 pump irrigation projects (PIP) constructed by Government of Myanmar over the last 20 years as part of its strategy to increase agricultural production, particularly of rice. Many of these systems depend on pumping from the Ayeyarwady River and its tributaries to provide irrigation in the Central Dry Zone (CDZ). About 10% of the national area equipped for irrigation is supplied by river pumping, of which 70% is in the three central dry zone states of Magwe, Mandalay and Sagaing[1].

Overall, the performance of many of these systems has been disappointing. The review by the Auditor General's office in 2012 found that "sixty-seven river water pumping stations have achieved 16.3% of their target, providing water to 48,833 acres out of the 299,895 acres originally planned"[2]. Even where water has been available, yields and overall production have often been lower than expected.

The performance of the Pyawt Ywar PIP is relatively typical of the experience in the central dry zone. The scheme draws water from the Mu River through one primary and two secondary pump stations, irrigating a range of crops including paddy (monsoon and summer), green gram, chickpea, sesame, groundnut, wheat, maize and cotton. The scheme was constructed in 2004 with a nominal command area of 5000 ha, (1300 ac paddy + 3700 ac other crops), but actual area irrigated has consistently been much lower (1538 ac in 2013-14; and 950 ac in 2014-15). Poor performance of PIPs is reported to be the result of a range of technical, operational and agronomic issues, from an inefficient layout to inappropriate crop choices.

For PIP schemes to operate efficiently, sustainably, and profitably the issues introduced above must be addressed. Rehabilitation of Pyawt Ywar scheme presents an exceptional opportunity to simultaneously redesign or upgrade the infrastructure, improve the irrigation operations and maintenance regime, establish economically viable cropping and management systems, and introduce innovative irrigation approaches that will support new forms of crop production. Livelihoods and Food Security Trust Fund (LIFT[3]) provided necessary financial support (CfP/LIFT/2016/3/PIP) for undertaking this rehabilitation activity to International Water Management Institute (IWMI) and other project stakeholders (ICRISAT, WHH and National Engineering and Planning Services (NEPS)). The project also aims to assist in the diagnosis of systemic problems that impact irrigated agriculture to enable further development of national policies that impact rehabilitation and management of irrigation schemes across the Dry Zone.

The two broad distant and equally important outcomes targeted in the project (see Figure 1) are: 1) Improved livelihoods through irrigation and 2) Improved irrigation investment decisions. These outcomes will be achieved in-turn through five targeted outputs (Figure 1) planned under the project. They are:

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[1] Anderson 2012

[2] http://www.mmtimes.com/index.php/component/content/article/87-national-news/1055-committee-urges-action-on failing-irrigation-projects.html

[3] See more details at https://www.lift-fund.org/

a) Effective local management of PYPIP
b) Improved agricultural production from PYPIP
c) Improved market opportunities
d) Adoption of more sustainable agricultural practices
e) Reliable information available to decision makers on irrigation outcomes and best practices for PIPs

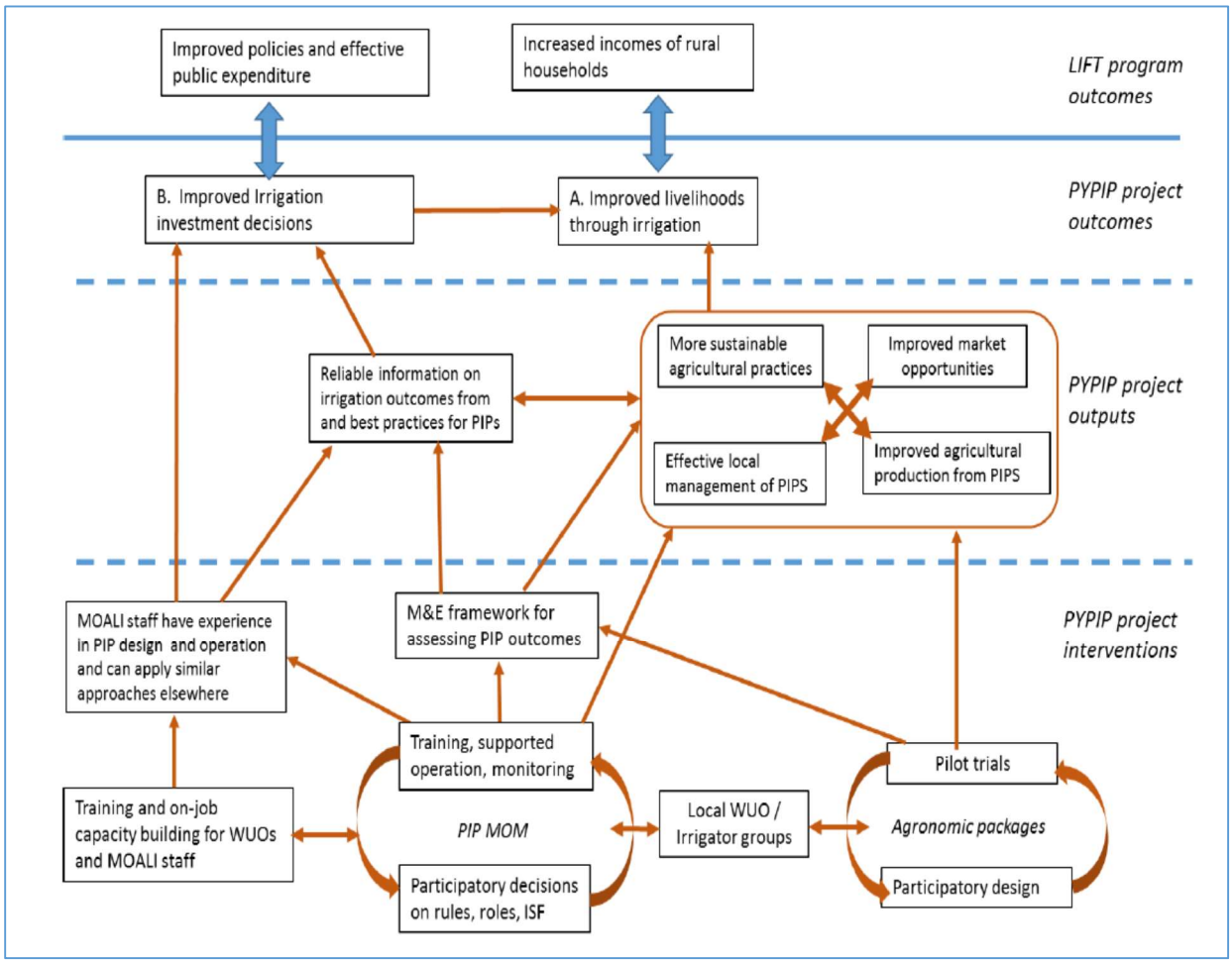


Figure 1: Proposed theory of change (TOC)

At PYPIP scheme level, changes will be promoted through participatory design and implementation of options for improved performance, integrating changes in scheme management, on-field water management (OFWM), and agricultural production. Attention also will be given to strengthening links between producers and market options. Farmer participation in the project will be facilitated through irrigator groups (IGs). Extension, training and capacity building will be provided to support irrigators and scheme managers in implementing new systems, and ensuring that these changes are sustainable in long-run. An iterative process of analysis, monitoring, evaluation and revision will feed back into an adaptive management cycle within the PYPIP.

2. Study rationale and objectives

The present study is undertaken as a part of achieving project output 3 (improved market opportunities) in the PYPIP area. Identification of improved market opportunities can only be underpinned through assessment of existing farming systems, extent of marketable surplus, access to different markets, mapping of different market channels, costs incurred in marketing, existing and future potential value-addition opportunities and other socio-economic constraints etc. The discussions with producer farmers as well as different value-chain actors will provide the deeper understanding about designing market-oriented farming systems to increase the profitability of targeted farmers' in the project area.

Since very little information have been gathered about current market linkages in the project baseline survey, there is no clue or source of information about the extent of farmers' access to different markets and the level of price realization for major agricultural commodities in the project area. A preliminary market study was undertaken to bridge this gap and document the existing market demand and potential value addition opportunities for different commodities. The study also specifically focused to cover a wide range of value chain actors (farmer, middlemen, traders/processors and exporters etc.) as well as few selected major agricultural commodities (paddy, greengram, chickpea, green chilies, bitter gourd and sesame) in five project villages. However, the specific objectives of the study are:

1) To deeply understand the level of market access, current output utilization pattern and extent of marketable surplus etc. for major commodities
2) Mapping commodity-wise major marketing channels and estimation of price spread
3) Identification of major issues in marketing and price realization at different levels
4) To assess the commodity-wise potential for value addition opportunities

3. Overview of project area and methodology

This section of the report highlights the overview of project area and methodology adopted exclusively for the present study. It is necessary to understand the project geography, existing cropping seasons, land use pattern and soil types etc. for better designing and targeting of different interventions as well as identification of location specific constraints if any.

3.1 Overview of project area

The project area is located in Myinmu Township of Sagaing Region, on Yangon-Monywa main road through Mandalay, about 35 miles west of Mandalay, and at GPS location of between 21^0 56'20" North and 22^0 01'40" North Latitude and 95^0 36' 07" East and 95^0 40' 50" East Longitude, as shown in project location map (see Figure 2). This location is situated at a straight line distance of 6 miles away from Myinmu. This pump irrigation project with a command area of 5000 acres was started in 2004/05 fiscal year and completed in 2015/2016 fiscal year. The main objective of the project is to provide supplementary irrigation to monsoon crops and double cropping of rice and other crops under irrigation during dry season. Total head for lifting water from Mu River to

the stilling basin of main pump station is about 100 feet. There are another two re-lift pump stations exists (Figure 2).

The mainstay of the inhabitants in the study area and its surroundings is agriculture. Though in many cases goats, pigs and fowls are raised in the areas, such livestock rearing is placed as complementary means to the mainstay, cropping activities. Agriculture in the areas is roughly divided into two categories if overviewed from the aspect of natural conditions. One of them is an extensive upland farming, here, relatively drought resistant crops such as pigeon pea, sunflower, sesame and groundnut, etc. are cropped on infertile sandy soils developing over gently undulating, or rolling hill relief. Secondly, in this area different types of agriculture can be observed ranging from intensive farming developed on fertile soils distributed along Ayeyarwady and Mu Rivers to extensively engage around hills. There is no village within the project boundary. Population in nearby five villages counts 7500 of which 1000 farmers are engaged in farming. A total of 1660 households reside in these villages. Villages are normally located in somewhat higher elevation where the village site is surrounded with fences in the same way as each homestead is bordered with fences.

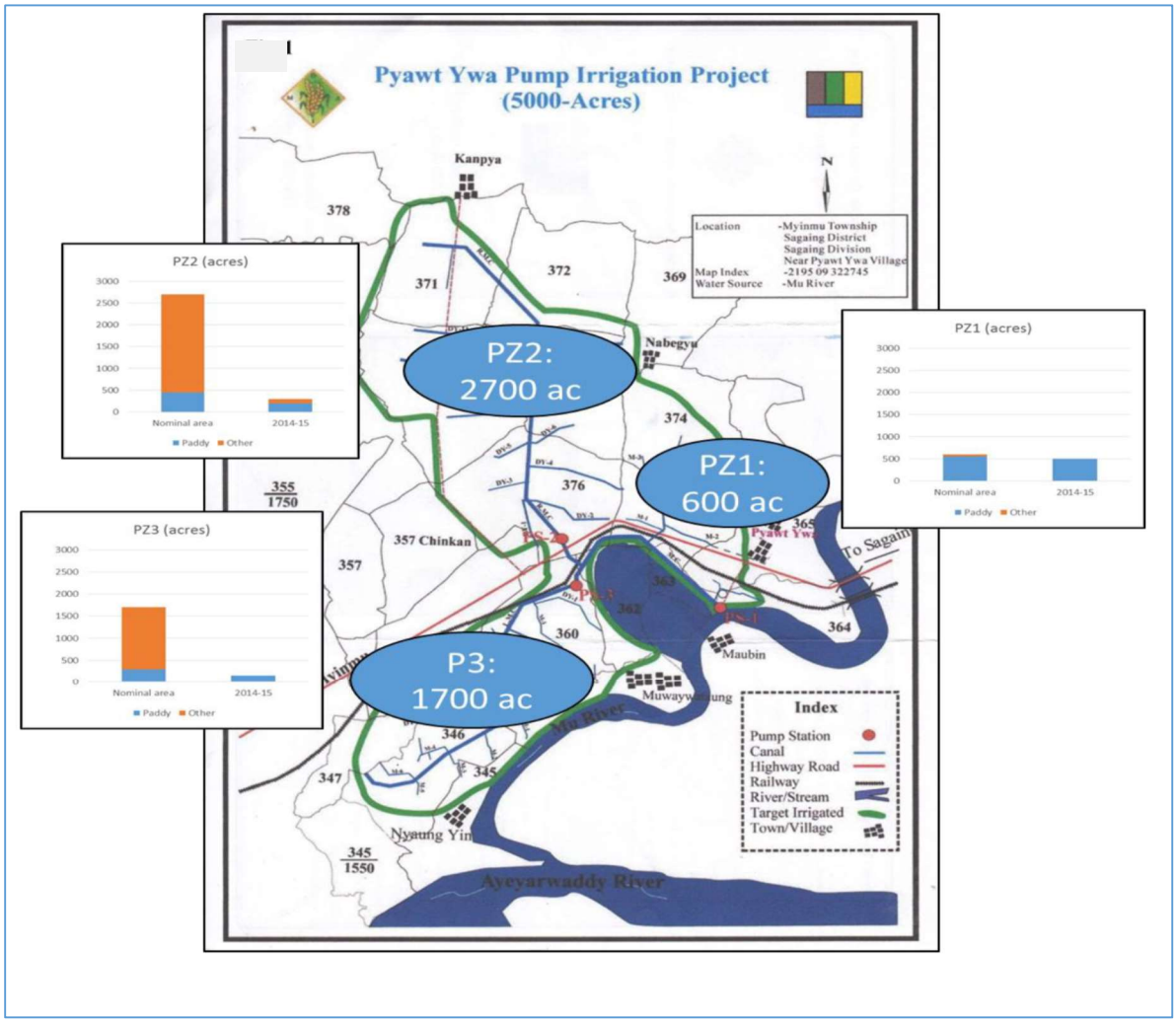


Figure 2: Map of Pywat Ywar Pump Irrigation Project area and three pump zones

The main purposes of the project are to improve the incomes of about 1,000 farmers in these villages by rehabilitating the scheme's physical infrastructure and management, gradually moving towards full user ownership, efficient and sustainable use of water. It is also planned to be a pilot development project, to revamp and demonstrate procedures and tools that can be used to increase the viability of pumped irrigation projects in general and the relevance of investment in other pumped irrigation projects.

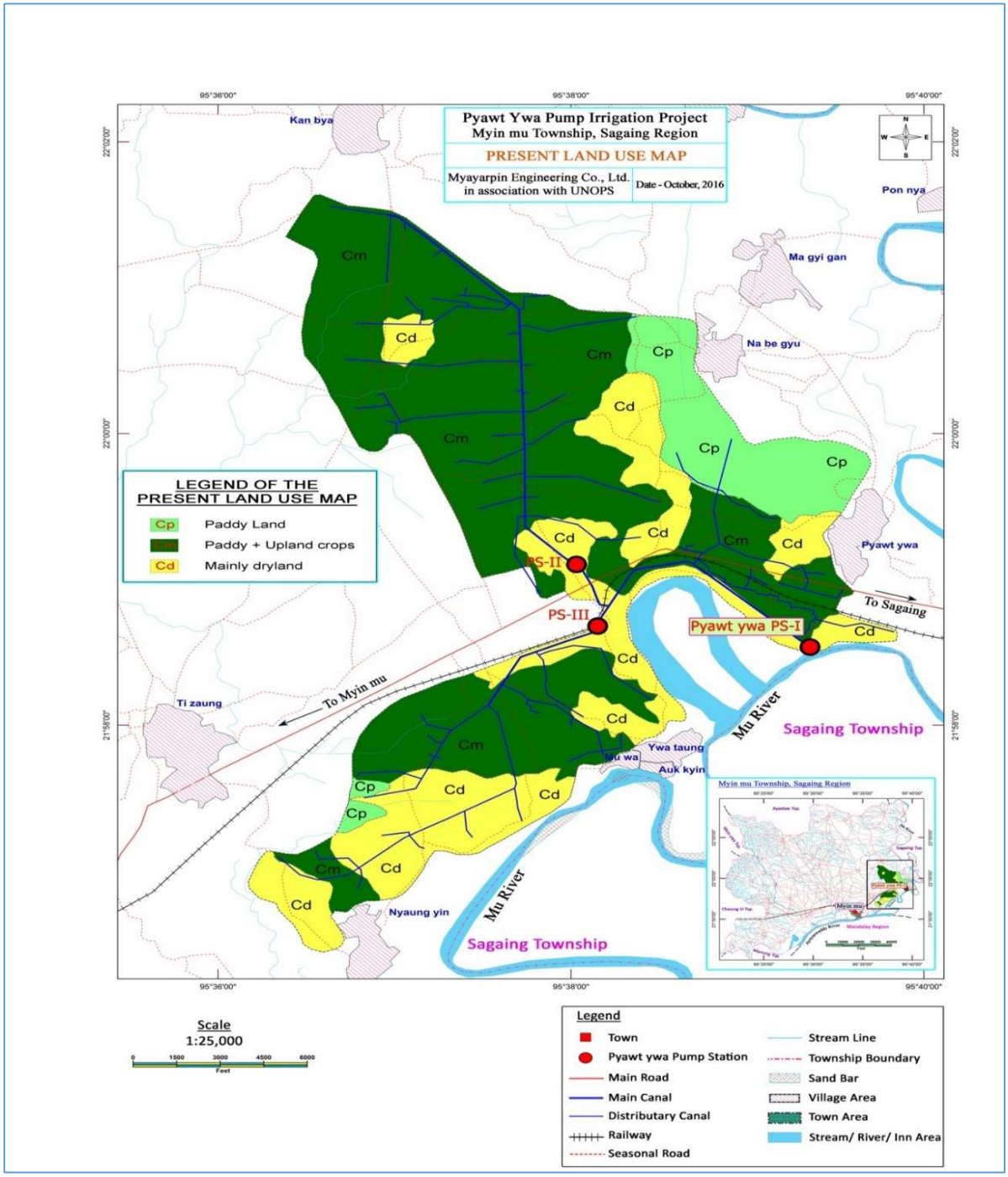


Figure 3: Land utilization pattern at PYPIP area, 2016

Figure 3 briefly depicts the pattern of land utilization in the project area under different major cropping systems during 2016[4]. Most of the land used for cultivation, though there are considerable amounts of grazing land and urban land. However, the urban land covers quite low proportion of land as the villages are outside of project command area. The acreages by types of land use are summarized in Table 1.

In Myanmar, two climatic periods exist, namely rainy season and dry season, by rough classification. On the other hand, one year is classified into 3 periods from daily life point of view. Namely, dry season is further divided into two sub-periods, in which part of dry season beginning soon after the end of season is called winter period because atmospheric temperature is low, and later part thereof that lasts until the onset of the next rainy season is called summer period because the highest atmospheric temperature is experienced in this period. Thus, climate of the dry zone is divided into summer or pre-monsoon period during March - first half of May, and winter period during November - next February that is to follow monsoon period of late May-October. In farming area with irrigation facilities, paddy can be cropped even in pre-monsoon period or summer in addition to monsoon period. Of the 6273 acres surveyed, about 1048 acres are under CP paddy (16.7%), 1684 acres are upland dryland crops (26.9%), 3281 acres under paddy with upland crops (52.3%) and stream channels, ponds and urban land are 260 acres (4.1%) (Table 1).

Table 1 Land-use pattern in the project area, 2016

Project land use	Area (acres)	% to total
Urban	82	1.3
Water (pond)	21	0.3
Stream (canal)	157	2.5
Cropland distribution		
(a) CP Paddy	1048	16.7
(b) cm paddy + upland crops	3281	52.3
(c) cd mainly dryland	1684	26.9
Total	6273	100%

It is equally worthwhile to deeply understand about different soil types existed in the project area for better targeting of different interventions as well as introducing new crops. Myayarpin Engineering Company Limited[5] has undertaken a comprehensive work on topographic and soil survey services in project area during 2016. Based on their findings, the major soils in the project

[4 & 5] Final Report on Soil Survey Services For Pyawt Ywa Pump Irrigation Project, Mya Yar Pin Engineering and Consulting Group, Myanmar

area are Eutric Gleysols used for paddy, claypan solodic Planosols and associated soils used for paddy and upland crops which are not very productive, and pellic Vertisols grown paddy and upland crops which are high yields, and ancient alluvium Ferric Luvisols which are used mainly for upland dryland crops (see Figure 4). The groundwater table in the project area is generally very deep more than 15 feet and rises in the rainy season to 5-10 feet from the surface on most of the irrigated land. However, the groundwater ranges from moderately saline to very saline. The study also highlighted about absence of proper drainage system in the project area to avoid waterlogging and salinization problems.

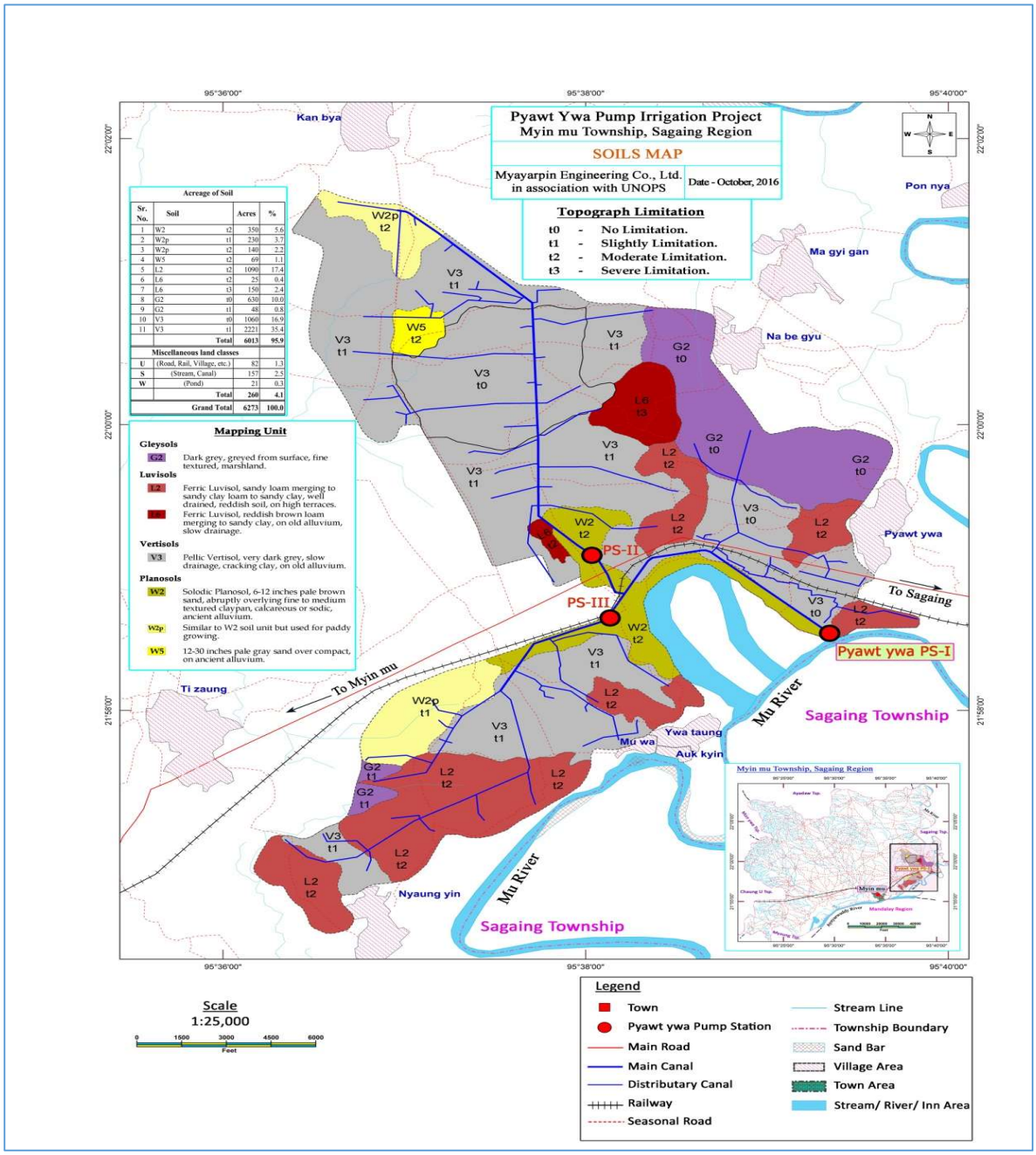


Figure 4: Soil map of Pyawt Ywar PIP area

3.2 Methodology

To better capture the objectives, the present study was constructed using a well-tailored research design. Both quantitative and qualitative research methods were used to cover the key research issues. Quantitative methods included analysis of data collected from both primary and secondary sources. Primary data was collected from primary producer, processors, traders/middlemen and exporters through cost-effective and innovative approaches. Due to paucity of time and budget availability in the project, the present study adopted Focus-Group Discussions (FGDs) as a method of data collection specifically focused on market related research issues. FGDs were organized among farmers in all five project villages with the help of WHH research team. The presence and proactive role of WHH research team has helped ICRISAT in smooth conduct of present study as well as collection of necessary data from different organizations. Information on the extent of landholdings, major cropping patterns, determinants of crop choices, economics of crop cultivation, extent of market access and price realization etc. were gathered from producer farmers' among targeted crops in the study. Personal interviews were exclusively conducted in case of processors, traders/middle men and exporter etc. to deeply understand the commodity movement at different layers. Similarly, the costs involved and the extent of value addition at each step were also elicited among respective stakeholders.

For better understanding about different market functionaries and nature of trading among different crops, personal visits were also made to Monwya and Mandalay Trader's Association. Mandalay Traders Association is one of the oldest and largest union in Myanmar where largest volumes of grains and pulses trading takes place. Historical secondary sources of information about the major agricultural commodity prices were also obtained from Mandalay Traders Association Office. The analysis of this data provided knowledge about historical price trends over time in the region as well as intra-price variations within a year. Qualitative information about farmers' perceptions/suggestions on nature of crops cultivation, potentiality of new crops and extent of market access etc. were also captured from all stakeholders in the value-chain. The collation and analysis of data was conducted using both quantitative and qualitative tools and techniques. Attempts were also made to integrate the information collected through FGDs as well as personal interviews. Overall, the following approaches/methods were used for generating this report.

Marketing channel

A general knowledge of the commonly used marketing channel is valuable to understand the marketing system, and the relation of markets and market agencies to one another. Market performance is a function of the number of scale and role of market intermediaries who provides services involving the transfer of producer to end user. The marketing channel showed the flow of goods from the production site (producer) to intermediaries and on to the exporters. To understand how the commodities move through the various channels, it is necessary to identify the role of various market places and marketing agents involved. By knowing the marketing channel one can estimate where is the deficit or surplus area. Traders can realize the channel

and they can choose the appropriate markets and analysis will make the different shares of specific intermediaries who participates at the marketing channels.

Marketing margin

Marketing margins are differences between prices at different level in the marketing channel. It captures the proportion of the final selling price to each particular agent in the marketing channel. Thus, it provides linkages between prices at various levels in the distribution system. Margins that vary widely among participants refer inefficiency at that level. Response of marketing margins to price changes is also indicates the efficiency of the channel. In this study, marketing margins were calculated by "concurrent method". Prices at consecutive levels of the marketing channels were compared at the same point in time. Data included representative costs and returns from the main participants in transportation, processing and storage. Analysis estimates the costs of all inputs, subtracting these costs from returns then gives profits at each level of the system. Hence, a marketing margin was specified as follows:

$M_t = P^l_t - P^{(l-1)}_t$

M_t = marketing margin between level (l) and its preceding level (l-1)

P^l_t = Price at market level (l), $P^{(l-1)}_t$ = Price at market level (l-1)

Price spread

It is the difference between the price paid by the consumer and the price received by the producer for a unit of the product.

Marketed and marketable surplus

Marketable surplus is a theoretical ex-ante concept which represents the surplus which the farmer/producer has available with himself for disposal once the genuine requirements of the farmer's family consumption, payment of wages in kind, feed, seed and wastage have been met. Marketed surplus as compared to marketable surplus is a practical ex-post concept and refers to that part of the marketable surplus which is marketed by the producer i.e., not only the part which is available for disposal but that part which is made available to the market or to the disposal of the non-farm rural and urban population.

The farmer, in case of commercial agriculture is motivated by profit considerations, so he takes his whole produce to the market and purchases his requirement from the market, but in the case of subsistence agriculture the concept of marketed and marketable surplus becomes relevant as the farmer generally produces for his own subsistence and it is only the remainder left after meeting his own requirements, that is taken to the market for sale. The concept of "marketable surplus" is subjective because the feature of retention of the farmer is a matter of subjective guess. The concept of "marketed surplus", on the other hand, is objective, because it refers specifically to the marketed amount i.e., to the actual quantity which enters the market.

4. Agricultural marketing system in Myanmar

Agricultural development cannot be achieved without a development of agricultural marketing systems. In general, the agricultural marketing systems in Myanmar seems to be at the beginning stage, even though the development stage may be different by crops and by regions. For example, trading pattern for dried products such as grain including rice, pulses, oilseeds products, and others is based on the samples in the crop exchange centers in major cities (see Figure 5 & 6). Moreover, even forward contracts are made for some crops in some of the crop exchange centers. The transactions seem to be fair and transparent because prices are determined by many buyers and sellers in open places within the centers. In this sense, the marketing for dried products is relatively developed, and operational and pricing efficiencies are relatively high. However, marketing facilities for fresh produce such as fruits and vegetables are not modernized and limited in space (see Figure 7). Prompt collection and distribution is important for fruits and vegetables together with cool/cold storage system, because the products are perishable. Overall, it is safe to assume that the agricultural marketing system is at the beginning stage due to lower marketing efficiencies arising from lack of storage, grading standards, transportation and proper roads.

A survey on the agricultural marketing system was conducted to encourage market-oriented production and to train extension workers so that they can advise farmers through the development of market information service system during the period of 1999 to 2000 with a cooperation of the Food and Agricultural Organization of the United Nations. The result of the survey was published in October 2000. In addition, a report on the marketing cost and margins was also published in July 2001. Both reports were very useful in helping to understand the current situation of agricultural marketing systems because they provide a bird's eye view of agricultural marketing situation in Myanmar.

Fig 5: Trading centre at Monywa Township

Fig 6: Trading centre at Mandalay town

Fig 7: Vegetables trading at Mandalay wholesale vegetable market

The Management Information System (MIS) Price Bulletin and the Agri-business News have published on monthly and weekly basis since late 2000, just after completion of the survey of agricultural marketing information systems in Myanmar. The News includes information on daily prices in Yangon and Mandalay markets, and of weekly prices of 14 agricultural markets across the country. The Bulletin and the News are useful to both policy makers and market participants such as wholesalers, exporters, and so on. However, the Bulletin and the News should concentrate more on improving the bargaining position of farmers or farmers' group because they are the most important target in developing marketing information system. In sum, it is doubtful that farmers fully utilize the Bulletin and the News.

For example, although the Agri-Business News is published and disseminated throughout the country but its wide reach is limited. However, the trade centers located at major townships are uploading the day to day price information into their respective face book accounts. The processors and wholesalers who have familiarity with information and communication technology could access this information. But this information is not fully circulated among farmers/farmer's group and in the rural area meaning that the News is not readily available to those who need them the most--the farmers. Instead, it is highly possible that the News is only used by the officers of Myanmar Agricultural Service in local areas for their extension work. Occasionally, the primary producers shall obtain this price information by contacting the processors, whole sale sellers and exporters located in their villages/townships through mobile. This is the major source of commodity price information dissemination in the country. Farmers' accessing the price data in the local newspapers or through television is very limited. According to the price reporters of MOAI, the commodity prices are surveyed one time a day for nearly 36 products. The reporter surveys the prices at a time when trading activities are relatively low. However, the price in the market should play a leading role of agricultural product prices of the entire country. The prices prevailing at both Mandalay and Yangon export markets will have much influence on the prices at other markets in the country.

Fig 8: Price display board at Monywa market

In contrast, the wholesale market for fruits and vegetables is merely a gathering place for a number of (big) retailers and consigners. The transactions in the wholesale market are made by direct contacts and on consignment basis between buyers and sellers, instead of open auction system, and details of transactions such as price and quantity traded are not recorded. The market wholesalers sell mostly on commission basis for the suppliers, and in often cases, some sellers abandon their products because of low selling prices which dip lower than their production costs. Presently, data or information on traded volume of commodity in the market is not available and the prices of traded products are also not recorded. In short, the transaction in the market is not transparent. However, it is noteworthy that the market is open seven days a week and 24 hours a day, and that the market has an important transit function.

The market trade authority offices in the country do not play any role of collecting agricultural produce from the producing areas and increasing the marketing efficiency in the market. The main function of these offices are providing trading enmities and display of daily trading prices across commodities. In other word, the markets are less developed from the view of function of wholesale market. In order to develop those markets into a modernized and transparent markets, it is necessary to establish wholesale corporations whose main functions are to collect agricultural products into the market and to induce traders and wholesalers to take part in the open auction system which is provided by the wholesale corporation. If the auction system together with legal and institutional support is settled down, the transparency of transaction would be greatly improved, and price and quantity traded in the markets would be clearer.

The cooperative movement in Myanmar has a long history, originating from the promulgation of India Cooperative Credit Societies Act in 1904, and the Cooperative Society Law had been revised and updated several times to promote cooperative movement. However, although agricultural cooperatives are organized in rural areas with a long history, their role in agricultural marketing is not well noted and ambiguous. They have few marketing facilities such as rice-milling, processing and storage in producing areas, and their role in improving farmers' bargaining power is not observable. The Ministry of Cooperatives mentioned that joint shipment by the cooperatives in rural areas is less than 10 percent of farmers' total shipment, and most of farmers sell their products to the primary collectors in a weaker position of bargaining. This can be cited as an evidence that agricultural cooperatives do not play an active role in selling agricultural products to get higher prices for farmers. The main functions of Ministry of Cooperatives are to supervise, regulate and educate cooperatives. Of course, those functions are important. However, it is also essential to strengthen the roles and functions of agricultural cooperatives to provide methods that will improve the standard of living in rural areas through promotion of farmers' position in bargaining in the process of modernization of agricultural marketing.

After critical review and ground level examination of current agricultural marketing practices in the country, the following major issues are identified. They are:

1) Agricultural marketing systems seem to be at the beginning stage of development. The Department of Agricultural Planning (DAP), has a greater concern on strengthening of market information system rather than planning of agricultural marketing policies and

coordination of the policies among Ministries, and a higher priority is given to strengthen the marketing information system.

2) For almost a quarter of the century, the agricultural marketing system was controlled by the State under the centrally planned economy system. The centrally planned economy mainly focused on self-sufficiency so that it leads to low of productivity. In addition, Government procurement of major farm produce with fixed price directed to a lack of price incentive to farmers. However, in 1998 market-oriented economic system was adopted so that Government's involvement was gradually reduced in the economy and the private sector played an active role in exportable of pulses. Poor market knowledge and other structural imperfections have been caused inefficiently in markets. The role of information in prices, the dynamic process of information transmission between markets in price discovery, and its implication for market efficiency are not well understood. Therefore the accuracy, reliability and promptness of market information are crucial in attaining pricing efficiency.

3) A better and wide use of the marketing information by farmers is an important issue that needs to be addressed. The current level of awareness and access of this information by farmers' is very low at rural Myanmar. Innovative communication approaches (community radios, television, newspapers and mobiles) should be used for enhancing rural penetration of information.

4) An effort to reduce marketing margins should be enforced by enhancing marketing efficiencies. Marketing efficiency can be increased by enhancing both operational and pricing efficiencies. Joint shipment through agricultural cooperatives is a good way to improve operational efficiency. An improvement of social infrastructure such as road contributes to increase in operational efficiency through reduction of transportation cost.

5) Investment in marketing facilities in both rural and consuming areas should be increased for modernization of agricultural marketing systems. Poor or lack of sufficient investments leads to poor marketing efficiencies.

6) The function of agricultural cooperatives should be renovated to improve marketing efficiency and bargaining power of farmers. Agricultural cooperatives should play a role of promoting farmers' socio-economic status and sharing common interests in economic activities. Therefore, the cooperatives should be active in ensuring better prices for farm products produced by farmers, and assisting in establishing marketing facilities to reduce the marketing costs.

7) Even though government control on agricultural export has been gradually reduced since 1988, there are still a number of restrictions to export agricultural products by private sector. However, the potential of agricultural export should be promoted by involvement of both public-private sector agencies.

5. Market survey key findings

The key findings emanated from this market survey are highlighted in the following sub-sections under section five of this report. The broad socio-economic profile of project villages, nature of agricultural production systems, mean productivity levels, access to different markets and various issues in marketing etc. were discussed.

5.1 Socio-economic characteristics of project villages

Table 2 highlights the brief socio-economic profile of sample villages covered in the project area. Among study villages, Nyaung Yin has the highest no. of households while Muu Wa village has the highest population. But, the no. of lift irrigation project beneficiary households and the corresponding coverage of cropped area under the project is very high in case of Pyawt Ywar village. For better brevity of results, the village-wise brief profiles are summarized below based on focus-group discussions (FGDs) as well as personal interactions with farmers.

Table 2: Socio-economic profile of project villages

Item/village name	Pyawt Ywar	Nabe Kyu	Kan Pyar	Muu Wa	Nyaung Yin
Village track	Pyawt Ywar	Nabe Kyu	Kan Pyar	Ywar Htaung	Nyaung Yin
Total HH	463	213	320	340	621
Population	1945	2234	1711	2890	2300
Male	952	1070	818	1380	1077
Female	993	1164	893	1510	1223
Scheme beneficiary HHs in the village	300	150	150	133	160
No. of acres covered in scheme	1000	905	977	736	864
No. of landless HH	94	20	50	80	121
Major soils	Vertisols, sandy loam, marshland	Vertisols, sandy loam, marshland	Vertisols, sandy loam, ancient alluvial soils	Sandy, marshland	Ferric luvisol, vertisol
Village falls under pump zone	PS1	PS2	PS2	PS3	PS3
Major crops	Paddy (summer and monsoon), chickpea, greengram	Paddy (summer and monsoon), greengram, chickpea, sesame, groundnut	Paddy (summer and monsoon), chickpea, sunflower, greengram, sesame, groundnut	Paddy (summer and monsoon), chickpea, greengram, sesame, groundnut, beans	Paddy, groundnut, tomato, sesame, groundnut, pigeonpea
Farmer groups	exists	exists	exists	exists	exists
No. of technology exposure field visits organized	Two	Two	Three	Six	Three

Pyawt Ywar village – paddy is the dominant crop cultivated in the village during pre-monsoon and monsoon periods. Chickpea is preferred to cultivate during winter season. On an average, the land holdings are between 2 to 5 acres. Pump-station -1 is the major source of water in the village. Monsoon paddy cultivation is little longer (145 days) than summer paddy (125 days). The monsoon paddy productivity levels are relatively lower (80-100 bsk per acre) than summer paddy (100-120 bsk per acre). However, the paddy quality is poor in summer and fetches lower price in market. The predominant soil types in the village are Vertisols and sandy loams. In general, traders visit the village and procure directly from farmers. There are no other sources of price information in the villages except traders. The demand for paddy is very high hence no value-addition/processing in the village. The bulk storage facilities either from public or private sector agencies are not available. This is one of major reason for forced sale of paddy because of poor storage facilities with farmers. The existence of farmer cooperatives are also absent. However, farmer groups are there in the village but their collective action is minimal.

Nabe Kyu village – the cultivation of paddy is limited under tube wells only. Crops such as green gram, groundnut and sunflower are preferred to cultivate under uplands. The cultivation of chickpea is restricted to Vertisols during the winter season. In general, the average productivity levels across crops are slightly lower because of poor fertility status of soils and limited water availability. Pump station – 2 is the major source of water but they expected to receive it from 2019 monsoon season due to canal renovation works. Except paddy, rest of the crops are marketed at Monywa Township. The harvest of groundnut disposes immediately while in case of pulses they hold for some time. The farmers are not happy because the prices received by them is not remunerative. The major source of price information is middle men and they don't access the information available in television and newspapers.

Kan Pyar village – the village is dominated by upland area (nearly 75%) while low land occupies the rest. Paddy and chickpea/sunflower are the preferred choices in case of lowland during monsoon and winter seasons. In case of upland, the preferred crop choices are green gram, sorghum, groundnut, sesame etc. The crop lands are fallow during pre-monsoon period due to limited water availability. In general, paddy is cultivated under rainfed conditions and the mean productivity levels are around 20-40 bsk per acre. Farmers' perceive that the cultivation of paddy and sesame are remunerative and less risky than others. Pump station -2 is the major source of water but they expected to receive from next year. The village is composed of Vertisol, sandy loams and ancient alluvial soils. Majority of farmers' sell their produce in Myinmu Township itself. The study farmers' expressed that high price fluctuations and lack of information on prevailing market prices are major constraints. They also opined that the crop productions are small and transportation costs incurred by them are high. Overall, the farming systems in the village are more diversified including livestock rearing (cattle, sheep and piggery).

Muu Wa village – the village is composed of nearly 2/3rd upland cropped area and 1/3rd of low land area. Paddy, sesame, green gram, chickpea, groundnut and pigeonpea are major crops grown in the village. The mean productivity levels are reasonably good with few issues (high

pesticide usage and high labor costs) in green gram cultivation. The cultivation of flowers and vegetables (beans, cucumber and tomato) are quite common in low lands and where they have the access to water through bore wells. Brokers from neighboring Townships visit the village and procure paddy directly from farmers. However, the produce of pulses and oilseeds are to be marketed in Myinmu Township. In general, the local traders in Myinmu Township did not show interest to procure paddy. The extent of awareness about prices information is poor among farmers. They are highly dependent on brokers from day to day price information. Pump station – 3 is the major source of irrigation water in the village. The farmers' opined that the cultivation of vegetable is more profitable than the traditional crops. All the vegetable produce is marketed at Mandalay wholesale market with the help of 'truck drivers' who play a critical role in connecting the producers with wholesales. Uncertainty in water availability in the project area is the biggest concern expressed by villagers. This is due to various reasons – power cuts; debris blockage in pipes; water supply pipes break down and canal bund damage etc. Even though pump station-3 started functioning since last year very often farmers' face these difficulties.

Nyaung Yin village – the village is situated very close to river bank. About half of the total cropped area in the village is low land while the rest is upland. A significant no. of tube wells (around 100) exists in the village and supplies the irrigation water to crops. The cultivation of vegetables (tomato, eggplant, onion and bitter gourd) and orchards (mango, banana and guava) are highly preferred under tube wells. The other major crops cultivated in the village are paddy, chickpea, green gram and groundnut. The village falls under pump station -3 and having good access to irrigation water. All the traditional crops are marketed in Myinmu Township immediately after harvest. The extent of awareness about market prices is very low among farmers. They are highly dependent on middlemen for marketing of their crops. In general, farmers are not happy about price realization but there is no alternative. However, the vegetables are traded at Mandalay whole market through 'truck drivers'. Among major crops, groundnut is ranked as highly profitable crop followed by chickpea, paddy and pigeonpea. Relatively, the production risks are low in case of groundnut and market prices are stable. They also indicated that the cultivation of green gram is risky because of high labor and pesticide costs.

Table 3: Pattern of output utilization and marketed surplus

Commodity	% total output used for			
	Consumption	Seed purpose	Sell in market	Others if any
Paddy	40-50%	5%	55%	0%
Green gram	6%	4%	90%	0%
Chickpea	4%	6%	90%	0%
Sesame	5%	5%	90%	0%
Green chili	1%	0%	99%	0%
Bitter gourd	1%	0%	99%	0%
Eggplant	1%	0%	99%	0%

Table 3 clearly summarizes the crop-wise pattern of out-put utilization and the extent of marketed surplus in the project villages. It is clearly evident from the data that except paddy, all other crops are highly dependent on market for their disposal. The extent of their domestic consumption is even minimal in case of pulses and oilseeds. They are highly dependent on pulse export market hence the high price volatility in their output price realization. Even in the case of paddy, nearly 55% of total produce is sold out in the open market. There is ample scope for commodity processing and value-addition opportunities for enhancing the domestic consumption of these commodities as well as reduction of malnutrition.

5.2 Nature of agricultural production systems

Table 4 furnishes the details about major agricultural production systems present in different agro-ecosystems and soil types. It is worthy to understand different agricultural production systems prevailing and their corresponding market demands in different project villages. All the study villages are composed of both low and upland elevations. In general, cultivation of paddy is highly preferred during pre-monsoon and monsoon seasons in the lowland with access to irrigation water. These lands are also preferred for cultivation of chickpea and sunflower crops during winter season. The nature of crop diversity is much higher in case of uplands. The cultivation of pre-monsoon crops in those lands are not preferred due to limited soil moisture availability. Both pulses (green gram/pigeonpea/beans) and oilseeds (groundnut/sesame/ sunflower) are widely cultivated depends up on the onset of the monsoons and soil moisture availability. Sandy loams are the dominant type of soils exists in case of upland areas. The cultivation of season vegetables (tomato/eggplant) are preferred in case of alluvial and marsh type of soils. Overall, the trend of different agricultural production systems and corresponding crop calendars in Myanmar are summarized in Fig 9.

Upper Myanmar accounts for virtually all of Myanmar's pigeonpea and chickpea production. Pigeonpea, the dry zone's dominant pulse, is a long-cycle monsoon crop which farmers have grown since ancient times as a fodder crop for the region's many livestock. Farmers frequently intercrop pigeonpea with a wide variety of other monsoon and winter season crops, including sesame, groundnut, cotton, sorghum and green gram. As relative prices shift, from year to year, the intercrops become more or less prominent. During 2009 and 2010, when pigeonpea prices spiked, pure cropping became common. In the past few years, soaring prices of sesame and groundnut in the presence of falling pigeonpea prices have led to reduction in pigeonpea area at the expense of the oil crops.

Chickpea is exclusively a cool season crop, planted frequently in lowlands following the monsoon paddy harvest. Green gram offers the largest diversity of cropping practices. Depending on the variety and land type available, farmers can grow green gram in the monsoon, in the cool season and even in some cases as an irrigated summer crop. This contrasts starkly with farming practices in lower Myanmar, where farmers produce green gram as a winter crop immediately after harvesting their monsoon paddy. As a result of this diversity in geographic and seasonal

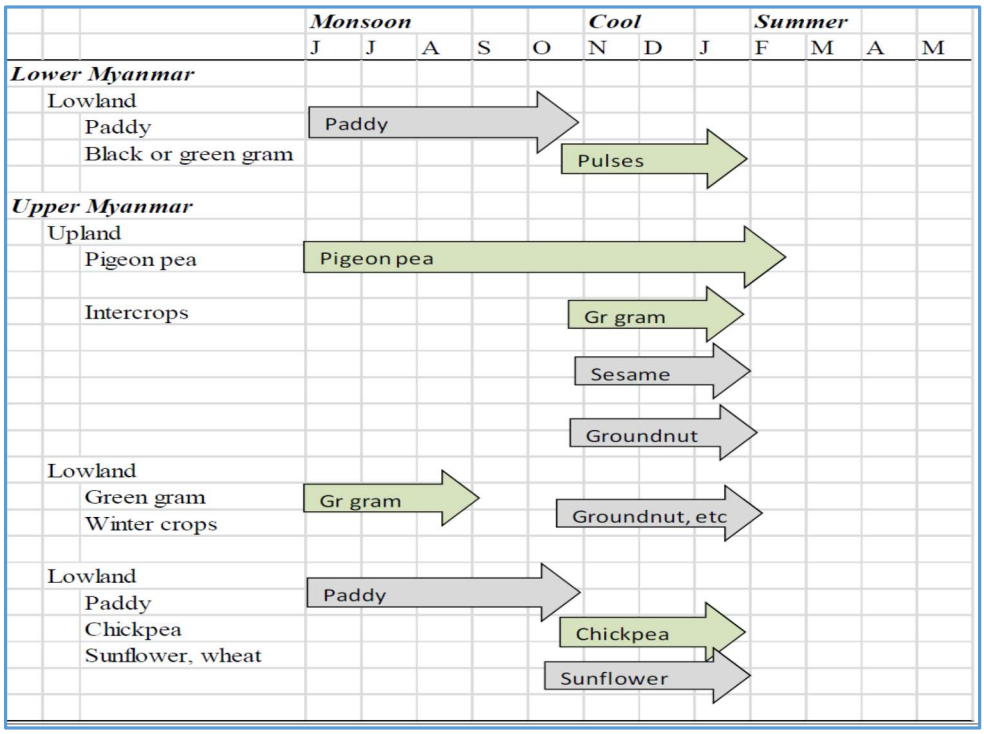
production, green gram offers a longer marketing season as well as more varied marketing circuits than other pulses.

Table 4: Nature of agricultural production systems in project villages

Village	Elevation	Soil type	Pre-monsoon crops	Monsoon crops/early monsoon crops**	Winter crops /late monsoon crops*
Pyawt Ywa	Low land	Vertisol	Paddy/green gram	Paddy	Chickpea
	Upland	Sandy loam	NA	Sesame/green gram	Groundnut/sunflower
	Low land	Silty clay	Green gram	NA	Chickpea/Onion
Nabe Kyu	Low land	Vertisol	Paddy/green gram	Paddy	Chickpea
	Upland	Sandy loam	NA	Groundnut/green gram/sunflower	NA
	Low land	Silty clay	Green gram/paddy	NA	Chickpea/Onion
Kan Pyar	Low land	Vertisol	NA	Paddy (dry)	Chickpea/sunflower
	Upland	Sandy loam	NA	Sesame/green gram	Groundnut/sunflower
	Low land	Alluvial	Sesame	NA	NA
Muu Wa	Low land	Vertisol	Paddy/green gram	Paddy	Chickpea
	Upland	Sandy loam	NA	Sesame/green gram/mung bean	Groundnut/beans
	Low land	Marsh	NA	NA	Paddy
Nyaung Yin	Low land	Vertisol	Sesame	Paddy	Chickpea
	Upland	Sandy loam	NA	Green gram/tomato	Groundnut/tomato
	Low land	Marsh	NA	NA	Melon/ vegetables

** late monsoon crops applicable only in case of uplands; ** early monsoon crops applicable only in case of uplands*

Fig 9: Different production systems and corresponding crop calendars



Source: Steven et al. 2014

Pulses in lower Myanmar are grown after monsoon paddy on residual moisture. Land allocation between the two main pulses, black gram and green gram, depends on farmers' perceptions of profitability, relative prices and risk preferences. Black gram is seen as the more robust crop, less susceptible to moisture stress and especially to insect damage. Green gram is perceived as more vulnerable and therefore needing careful, regular insect pest management. But green gram prices are higher than black gram, and the crop is seen as potentially more profitable for farmers.

5.3 Average productivity levels of major crops

Table 5 highlights the comparison of mean productivity levels of major crops cultivated across project villages. Productivity is one of the key factor determining the economic viability of crops in a given location. Relatively, the extent of crop diversity among project villages is very limited because of water scarcity and limited exposure towards new crops. Historically, the project farmers' have been cultivating these crops due to lack of alternate market opportunities. However, the inherent production risks as well as high price volatility in these crops are the major challenges limiting the livelihood development in the region. The focus-group discussions (FGDs) organized across five villages clearly highlights the productivity variations among crops. For example, the pre-monsoon and monsoon paddy productivity levels are not consistent among villages. Similarly the case of chickpea, green gram and groundnut crop productivity levels. This data clearly lend support for high production risks involved in crops cultivation.

Table 5: Mean productivity levels of major crops

Village	Crop	Mean productivity (baskets/acre)
Pyawt Ywa	Paddy *(pre-monsoon)*	100-120
	Paddy *(monsoon)*	80-100
	Chickpea	08-10
	Green gram	10-15
Nabe Kyu	Paddy *(pre-monsoon)*	100-110
	Paddy *(monsoon)*	80-90
	Chickpea	3-8
	Green gram	10-12
	Groundnut	40-50
Kan Pyar	Paddy *(rainfed)*	20-40
	Chickpea	8-10
	Sesame	4
	Green gram	13
Muu Wa	Paddy *(pre-monsoon)*	80-100
	Paddy *(monsoon)*	100
	Paddy *(rainfed)*	50-60
	Chickpea	10-15
	Sesame	10-12

Nyaung Yin	Paddy *(monsoon)*	70-80
	Chickpea	13-15
	Green gram	10-12
	Groundnut	50-60

5.4 Economics of crops cultivation

The economics of crops cultivation across project villages are summarized in this section of the report. The profitability of agriculture directly determines the livelihoods and living standards of farmers in the region. In general, the viability of irrigated and rainfed agriculture in Myanmar is as similar as other regions of the world. The costs and returns of paddy and chickpea in Pyawt Ywa and Nabe Kyu villages are summarized in Table 6. Relatively, the extent of investments in paddy per acre is more than double when compared with the investments in chickpea. The cultivation of paddy is more or less same in monsoon and pre-monsoon (summer) seasons except the differences in productivity levels per acre as well as price realization per basket.

Table 6: Economics of crops cultivation in Pyawt Ywa and Nabe Kyu villages *(Kyats per acre)*

Operation/crop	Paddy *(monsoon)*	Paddy *(summer)*	Chickpea *(winter)*
Land preparation	43,000	43,000	35,000
FYM	25,000	25,000	0
Seeds cost	18,000	18,000	75,000
Sowing costs*	78,000	78,000	33,000
Micro-nutrients	0	65,000	0
Fertilizers	65,000	0	15,000
Pesticides	0	16,000	0
Weedicides	0	58,000	0
Irrigation costs**	58,000	40,000	20,000
Harvesting costs	60,000	60,000	5,000
Threshing	60,000	40,000	5,000
Marketing	28,000	0	0
Others	0	0	0
Total costs	**435,000**	**443,000**	**188,000**
Yield (baskets)	90	100	10
Price (kyats)/basket	8000	6200	22000
By-products	2,00,000	2,00,000	0
Total returns	**920,000**	**820,000**	**220,000**
Net returns	**485,000**	**377,000**	**32,000**
B:C ratio	**2.1**	**1.9**	**1.2**
** includes transplanting cost in case of paddy; ** includes labor costs*			

Overall, the cultivation of paddy is more profitable in monsoon when compared with pre-monsoon season. The net returns in per acre of paddy is much higher (about 10 times) than the chickpea cultivation per acre. There is quite significant disparity in net returns per acre between irrigated and rainfed agriculture. The mean productivity levels of chickpea per acre is lower due

to the problem of recurrent wilt occurrence. The price realization of chickpea is also lower because farmers' sell their produce immediately after crop harvest due to lack of on-farm storage and cooperative warehouse facilities. In general, the prices of chickpea shoots up slowly in accordance with the export market demand. On the whole, the estimated B:C ratio of paddy is quite high when compared with chickpea.

Table 7: Economics of crops cultivation in Kan Pyar village *(Kyats per acre)*

Operation/crop	Paddy *(rainfed)*	Chickpea *(winter)*	Sesame *(monsoon)*	Green gram *(monsoon)*
Land preparation	30,000	60,000	30,000	36,000
FYM	15,000	0	15,000	15,000
Seeds cost	10,000	45,000	4,500	20,000
Sowing costs*	6,000	6000	4000	4000
Micro-nutrients	0	0	0	22000
Fertilizers**	22,000	15000	3000	52000
Pesticides	0	15000	0	15000
Weedicides	0	0	30000	14000
Irrigation costs***	0	0	0	0
Harvesting costs	50,000	16000	12000	40000
Threshing	18000	2400	6000	3900
Marketing	0	0	0	0
Others	0	0	0	0
Total costs	**151,000**	**159,400**	**104,500**	**221,900**
Yield (baskets)	40	8	8	13
Price (kyats)/basket	8000	20000	20000	28000
By-products	80,000	0	0	0
Total returns	**400,000**	**160,000**	**160,000**	**364,000**
Net returns	**249,000**	**600**	**55,500**	**142,100**
B:C ratio	**2.6**	**1.0**	**1.5**	**1.6**

** direct seeding costs only; ** foliar spray application only; *** includes labor costs also*

As discussed previously, Kan Pyar village is dominated by rainfed and upland crops cultivation. The economics of crops cultivation in the village is furnished in Table 7. Among all, the cultivation of rainfed paddy is more remunerative although the mean productivity levels are very low. Farmers' who has access to Vertisol grow paddy during monsoon season with minimal inputs and reap substantial economic returns. As highlighted earlier, the cultivation of chickpea just recovered the costs incurred and did not earn any profits. Green gram found to be the next best profitable crop after paddy in the village grown in the upland sandy loam soils. However, the costs incurred towards pest management and harvesting is significantly high in green gram. According to sample farmers, sesame is the low investment and less risky crop where the minimum profits are assured because of stable market prices. So many farmers preferred to grow sesame and green gram crops when compared to chickpea.

The cultivation of groundnut is quite prominent in Nyaung Yin project village along with other crops. So, the economics of groundnut cultivation was elicited through FGD from sample farmers' and summarized in Table 8. The data clearly indicated that the cultivation of groundnut is highly

profitable among rainfed crops grown in the village. The crop is highly preferred to grow in sandy or alluvial soils during winter season. Even though the investments per acre is very high and the corresponding returns stood on the top. The extent of risk involved in its cultivation is also marginal. It has earned a decent economic returns with B:C ratio of 2.0.

Table 8: Economics of groundnut cultivation in Nyaung Yin village *(Kyats per acre)*

Operation/crop	Groundnut *(winter)*
Land preparation	40,000
FYM	23,000
Seeds cost	70,000
Sowing costs	8,000
Micro-nutrients	8,000
Fertilizers**	46,000
Pesticides	40,000
Weedicides	25,000
Irrigation costs**	0
Harvesting costs	20,000
Threshing	10,000
Marketing	0
Others	0
Total costs	**290,000**
Yield (Viss of kernels)	250
Price (kyats)/Viss	2200
By-products	25,000
Total returns	**575,000**
Net returns	**285,000**
B:C ratio	**2.0**
*** includes labor costs*	

Green chili has been identified as one of the potential crop to be introduced in the project villages to increase the economic returns and livelihoods of farmers. Couple of research trials were also conducted by WHH team to understand its performance as well as to bring confidence among farmers during the last two monsoon seasons. Green chili is chosen to introduce because of its highest profitability in its cultivation as well as growing domestic demand. The project neighboring villages (such as Chaung U) are cultivating green chili successfully over the last ten years. The present study has covered green chili in neighboring villages to deeply understand the pros and cons in its cultivation and existing linkages for marketing and price realization.

The crop duration of green chili is longer (6-8 months) and it requires assured supplemental irrigation support beyond rains. The crop investment requirement per acre is very high (1.31 million kyats) when compared with paddy (0.45 million kyats). So, the enthusiastic farmers' need to assure of these two (water and high investments) before moving forward. The other biggest challenge in its cultivation is access to assured market. The bulk procurement of green chili can only takes place at Mandalay wholesale vegetable market which is 80 miles (130 km) away from project villages. However, there are village-level brokers or middlemen in the neighboring villages

to lift the produce and send it to Mandalay market. At the moment, such market linkages or middle men are not exist in the project villages. 'Thermo-11' is the most preferred hybrid occupying nearly 80% of total chili cropped area in the neighboring villages. Since it is marketed by private seed company, farmers' are dependent on market for seed every year. Availability of sufficient quantity of seed is another constraint expressed by chili growers in Chaung U.

Overall, the market demand for green chili is good but price fluctuations is an issue. The producers are heavily dependent on local buyers for marketing. The local buyers are in turn dependent on 'truck drivers' who fetch the produce from villages and handover to wholesalers at Mandalay market. The 'truck drivers' are the key connectors for the movement of both physical and financial transactions. However the producer farmers' have good faith on local buyers and truck drivers. Farmers' access the price information through phone contacts only. Awareness about television and daily newspaper sources of information is very limited. There are no proper storage facilities at villages and never store for more than one day due to its perishability. They didn't follow proper marketing standards at Mandalay market and the local buyers will buy the entire produce. All these transactions are held on cash basis and farmers' are satisfied with existing system.

Table 9: Economics of green chili cultivation in neighboring villages *(Kyats per acre)*

Operation/crop	*Kyats per acre*
Land preparation	120,000
FYM	30,000
Seeds cost	70,000
Sowing costs*	50,000
Micro-nutrients	100,000
Fertilizers**	574,000
Pesticides	200,000
Weedicides	18000
Irrigation costs***	52,000
Harvesting costs	18,00,000
Stalking with bamboo	50,000
Marketing	0
Others	50,000
Total costs	**1,314,000**
Yield (Viss)	7000
Price (kyats)/Viss	1000
By-products	0
Total returns	**7,000,000**
Net returns	**5,686,000**
B:C ratio	**5.3**
** includes nursery and transplanting costs ; ** includes all types of fertilizers; *** includes labor costs also*	

Table 9 presents the economics of green chili cultivation in the project neighboring villages. The analysis clearly lends support that the cultivation of green chili is highly profitable (B:C ratio 5.3) than any other crop. However, the crop requires assured irrigation support and very high

investments per acre when compared with other crops. The application of fertilizers (22%) & pesticides (6%) and harvesting (58%) operations accounting for significant shares in total cost of cultivation per acre. The economic returns are quite significant and chili growers earned decent net returns per acre. Anthracnose disease is the major concern and none of the pests is a major problem.

Eggplant and Bitter gourd are other prominent vegetable crops targeted to introduce in the project villages. Bitter gourd trials have been undertaken by WHH team to understand its performance as well as to bring confidence among farmers. The commercial cultivation of these vegetable crops (eggplant, bitter gourd, lady finger, tomato, chili etc.) are extensively taken up in Kayak See Township. The villagers in this Township have been growing vegetables since last 40 years. The cultivation of vegetables are preferred because of its high profitability than traditional crops and growing market demand for them. Based on farmers' feedback, the net returns are very high in case of eggplant followed by bottle and bitter gourds. However, farmers' need experience in its cultivation and should not be afraid of price fluctuations.

Table 10: Economics of eggplant and bitter gourd cultivation in study villages *(Kyats per acre)*

Operation/crop	Eggplant	Bitter gourd
Land preparation	100,000	120,000
Planting bed preparation	10,000	10,000
FYM	50,000	0
Seeds cost	16,000	25,000
Sowing costs*	15,000	8000
Micro-nutrients	0	12000
Fertilizers**	375,000	80,000
Pesticides	100,000	120,000
Weedicides	0	10,000
Irrigation costs***	10,000	70,000
Harvesting costs	360,000	80,000
Stalking with bamboo	0	105,000
Marketing	100,000	600,000
Others	0	0
Total costs	**1136,000**	**1240,000**
Yield (Viss)	8000	4000
Price (kyats)/Viss	500	500
By-products	0	0
Total returns	**4000,000**	**2000,000**
Net returns	**2864,000**	**760,000**
B:C ratio	**3.5**	**1.6**
** includes direct sowing costs; ** includes all types of fertilizers and foliar spray also; *** includes labor costs also.*		

Both eggplant (duration 7 months) and bitter gourd (duration 4 months) requires supplemental irrigation and high crop investments per acre for their cultivation. The present study has covered these two crops to deeply understand its performance as well as map the existing marketing linkages. The farmers' participated in FGD rated eggplant as a less risky and more profitable crop

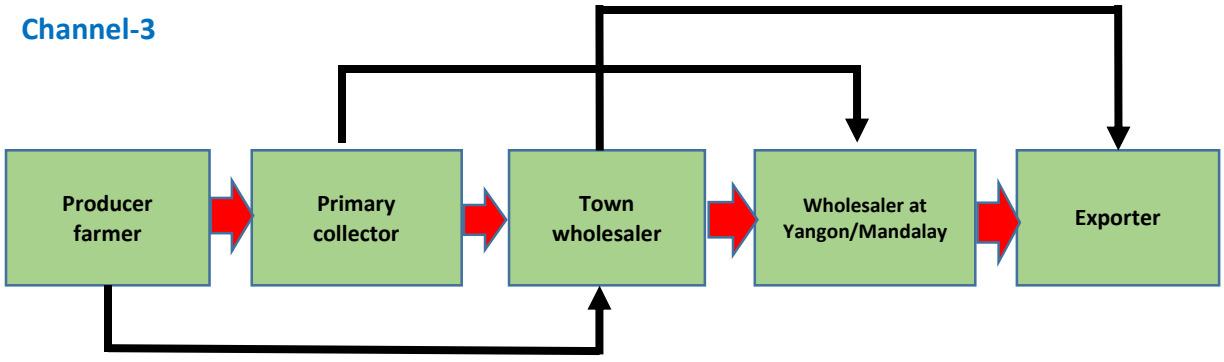
among all vegetables. In case of bitter gourd, the price volatility is high and stalking of plants is required for better harvest of the crop. The comparison of costs and returns per acre between these crops are furnished in Table 10. Even though the total investments per acre is on par among two crops, the total returns are almost double in case of eggplant crop when compared with bitter gourd. But the net returns are remarkably high (3-4 times) in eggplant than its counterpart. It is quite evident and easy to introduce the eggplant crop in the project villages than bitter gourd for enhancing the livelihoods of the farmers.

Overall, the analysis has clearly brought out that the cultivation of paddy (rainfed) is much more profitable than monsoon and pre-monsoon paddy. Among upland crops, groundnut performed extremely well followed by green gram, sesame and chickpea crops. However, sesame was referred as the safest crop than any other dryland crop. All the vegetables (green chili, eggplant and bitter gourd) are rated as highly profitable crops but they need huge crop investments per acre.

5.5 Mapping of market channels and estimation of price spread

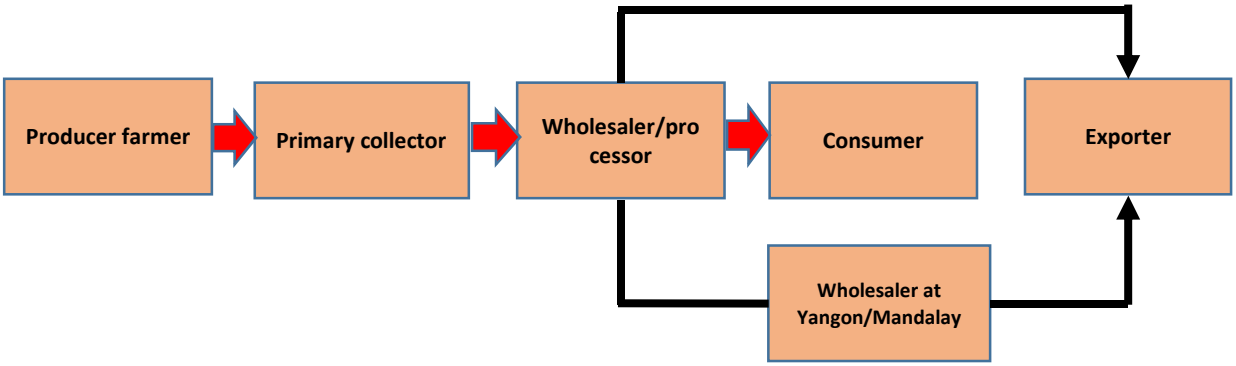
One of the major objective of the present study is mapping of major market channels for both dry crops as well as for fruits and vegetables. A marketing channel is the people, organizations, and activities necessary to transfer the ownership of goods from the point of production to the point of consumption. Basically, they are the various channels or platforms through which the products reach to the consumers or the end-users. They are also known as the distribution channels. In general, we may observe four types of channels in agriculture:

1) Direct marketing - where producers supply directly to consumers
2) Producers to primary collectors/retailers and to consumers
3) Producers to primary wholesalers, wholesalers at distant market and to exporters
4) Producers to wholesalers to retailers/processors to consumer/exporters



Among these, the most prominent market channel observed at PYPIP project area are: Channel-3 (Producer to primary collector, wholesaler at distant market and to exporter) and Channel - 4 (Producer to wholesaler/processor to consumer/exporter). These two major channels are depicted here for better brevity of information and understanding about different stakeholders engaged along the value chain.

Channel-4



Major share of dry grains produced in the project area including paddy are transacted through any one of these two channels. In the absence of public regulated markets in Myanmar, the primary producers sell their produce either in the villages or in the nearby Townships. In general, the village traders visit the villages and procure paddy directly from farmers'. But the situation is contrast in case of pulses and oilseeds. Farmers need to carry their produce to nearby Townships and dispose them at prevailing market prices. After pooling of sizable quantity, the village traders either sell to wholesalers at Mandalay/Yangon market or bulk processors. The wholesalers at Mandalay/Yangon market do necessary physical cleaning and export to different destinations based on their quality. About 75% of total pulse export is targeted towards India and hence the domestic price is greatly influenced by Indian market. Home storage and consumption of pulses/oilseeds is very limited. Farmers' face difficulty in storing the crop without spoilage. So they frequently convey their produce to a trader for storage straight after harvest with the price to be agreed later at time of sale. This model is seen as a win-win as it ensures the trader has commodity in stock to take advantage of a good offer, while the farmer is relieved of storage risk.

Commodity exchanges vary in their operation with a few conducting auctions and most functioning as meeting places where private traders are made and then recorded. All are membership based organizations with an annual membership fee. The large regional traders operate warehouses. Smaller brokers, without financing and often with very limited storage facilities, serve as intermediaries linking farmers with traders on the exchange. On average, each exchange-based trader procures from 40-50 smaller village-based traders. Smaller farmers, however, depend on local traders and brokers to link them to the regional assembly markets.

Farmers often develop long-term relationships with traders who market for them. Given volatile prices, and accusations of market manipulation during the price spikes, most traders agree that smaller traders frequently move in and out of the business. The exporters on their own account or sell to Singapore-registered trading companies on an FOB basis.

A weak point in the domestic marketing channel is the lack of effective transmission of quality criteria from exporters to farmers. The crop produce is often handled multiple times from farmer to village trader to the wholesaler, with higher and lower qualities sometimes being mixed to avoid penalties from exceeding threshold size tolerances. Almost all value-added processing occurs at the exporter level. Exporters address this weakness by price discrimination on the basis of origin or knowledge of individual trader's historical record of ability to secure quality produce. Overall, the macro picture at the country level for dry grain commodity movement are depicted in Fig 10.

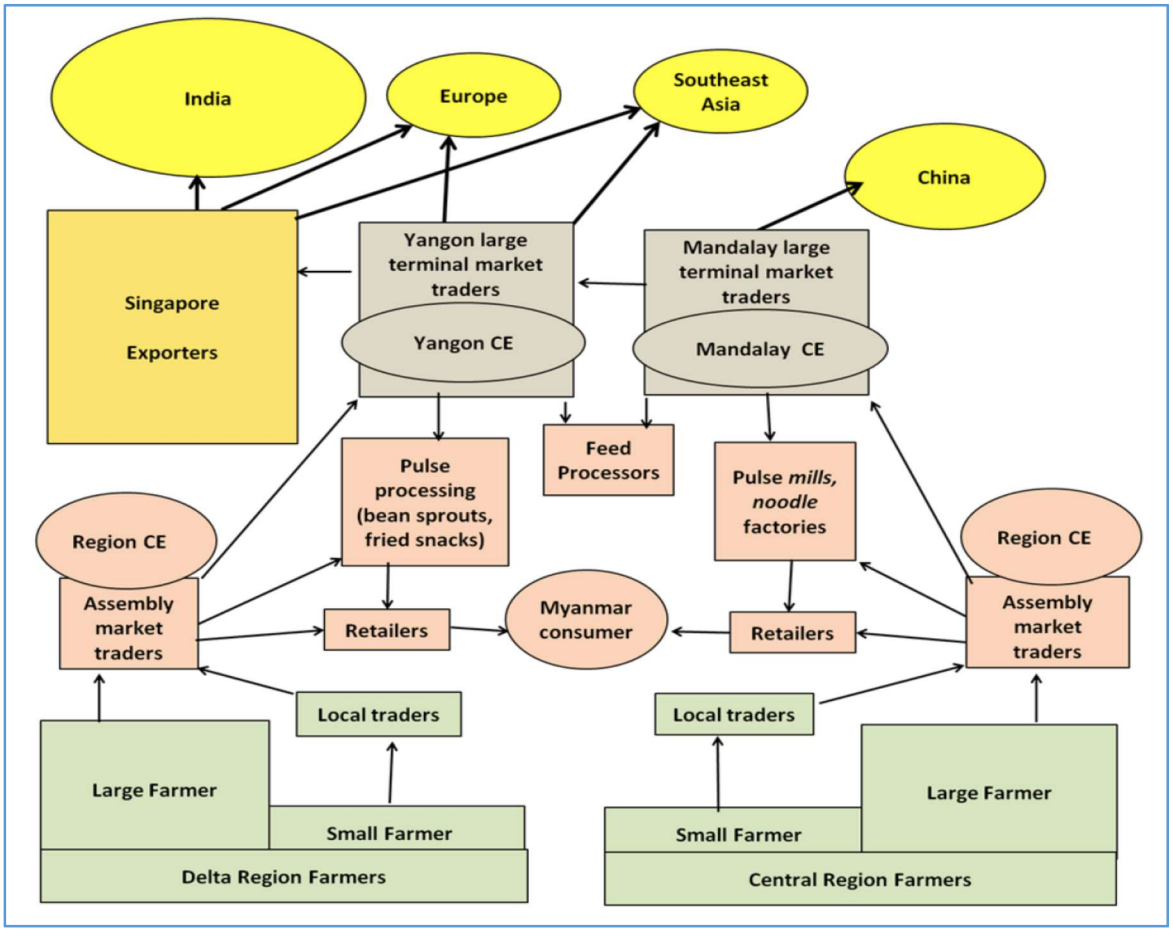
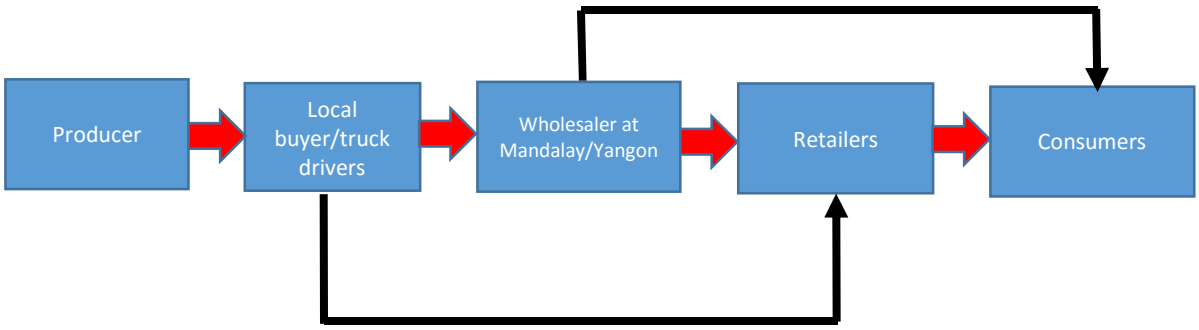


Fig 10: Commodity value chain at Myanmar CE: commodity exchange

Major vegetable/fruits marketing channel



The market channel in case of fresh fruits and vegetables is more simplistic because of involvement of less no. of middlemen or actors in the commodity movement. Further, there is no role of processing and value addition because of their perishability nature. Due to very poor demand for fruits and vegetables in the project villages and neighboring Townships, the producer farmers have to carry and dispose them at wholesale fruit & vegetable market located at Mandalay/Yangon. The producer famers send their produce with 'truck drivers' who in turn deliver them at Mandalay/Yangon market to wholesalers. They collect the money from wholesalers and return it to farmers. They are the key players in connecting the producer farmers with wholesalers. The wholesalers at Mandalay/Yangon sell the produce either to retailers or consumers directly. As highlighted earlier, the wholesale markets are very primitive and no record of quantity traded and prices. All these markets are also not backed up with any storage facilities. Hence the efficiency of marketing is lower when compared with dry grain trading.

Estimation of price spread

Estimation of price spread among crops is one of the major objectives of the present study. The calculation of producer's share in consumer rupee determines the level of marketing efficiency and the extent of price spread. The crop-wise estimations are summarized below:

The analysis clearly reveals that the producer's share in consumer's rupee was only 38% in case of paddy marketing per basket (Table 11). The farmer's net margin in consumer's rupee was about 15%. Much value addition per basket is taking place during processing i.e., from conservation of paddy into rice. The processors are gaining more margins than the primary producers. However, the farmers' would like to participate only in paddy trading because of high demand. There is a strong need for setting up of farmer cooperatives as well as encourage them to participate in rice trading rather than paddy.

Table 11: Estimation of price spread for paddy crop *(kyats per basket)*

Item	Kyats per basket	% of consumer price
Price received by farmer	8000	38.1
Unit cost of production	4833	23.0
Farmer's net margin	3167	15.1
Transport cost to Township	(300)	-
Commission of local trader (@ 2%)	(200)	-
Local trader's selling price (paddy)	9000	42.9
Local trader's net margin	500	2.4
Processing cost	(500)	-
Loading and unloading costs	(300)	-
Processor's selling cost (Rice)	20000	95.2
Processor's net margin	700	3.3
Packaging cost	(150)	-
Handling and storage costs	(200)	-
Retailer's selling price	21000	100.0
Retailer's net margin	650	3.1
Consumer's purchase price*	21000	100.0
** exclusive of government taxes and other fees if any*		

Table 12: Estimation of price spread for green gram crop *(kyats per basket)*

Item	Kyats per basket	% of exporter's price
Price received by farmer	28000	82.4
Unit cost of production	17069	50.2
Farmer's net margin	10931	32.2
Transport cost to Township	(300)	-
Commission of local trader (@ 2%)	(400)	-
Local trader's selling price	29000	85.3
Local trader's net margin	300	0.9
Transport cost incurred by wholesaler	(800)	-
Cleaning cost incurred by wholesaler	(400)	-
Wholesaler's selling price at Mandalay	32000	94.1
Wholesaler's net margin	1800	5.3
Grading cost	(500)	-
Packing cost	(200)	-
Storage and fumigation	(100)	-
Loading and unloading costs	(50)	-
Exporter's selling price at port*	34000	100.0
Exporter's net margin	1150	3.4
** excluding of export cess, port fee, conversion charges etc.*		

Table 13: Estimation of price spread for chickpea crop (*kyats per basket)*

Item	Kyats per basket	% of exporter's price
Price received by farmer	22000	78.6
Unit cost of production	18800	67.1
Farmer's net margin	3200	11.4
Transport cost to Township	(400)	-
Commission of local trader (@ 2%)	(400)	-
Local trader's selling price	23500	83.9
Local trader's net margin	700	2.5
Transport cost incurred by wholesaler	(1000)	-
Cleaning cost incurred by wholesaler	(500)	-
Wholesaler's selling price at Mandalay	26000	92.9
Wholesaler's net margin	1000	3.6
Grading cost	(300)	-
Packing cost	(200)	-
Storage and fumigation	(150)	-
Loading and unloading costs	(150)	-
Exporter's selling price at port*	28000	100.0
Exporter's net margin	1200	4.3
** excluding of export cess, port fee, conversion charges etc.*		

Table 14: Estimation of price spread for sesame crop (*kyats per basket)*

Item	Kyats per basket	% of exporter's price
Price received by farmer	20000	83.3
Unit cost of production	13062	54.4
Farmer's net margin	6938	28.9
Transport cost to Township	(300)	-
Commission of local trader (@ 2%)	(400)	-
Local trader's selling price	21000	87.5
Local trader's net margin	300	1.3
Transport cost incurred by wholesaler	(800)	-
Cleaning cost incurred by wholesaler	(400)	-
Wholesaler's selling price at Mandalay	22000	91.7
Wholesaler's net margin	800	3.3
Grading cost	(300)	-
Packing cost	(200)	-
Storage and fumigation	(200)	-
Loading and unloading costs	(150)	-
Exporter's selling price at port*	24000	100.0
Exporter's net margin	1150	4.8
** excluding of export cess, port fee, conversion charges etc.*		

Table 15: Estimation of price spread in green chili crop (*Kyats per Viss*)

Item	Kyats per viss	% of consumer's price
Price received by farmer	1000	60.6
Unit cost of production	188	11.4
Farmer's net margin	812	49.2
Transport cost to Township	(50)	-
Commission fee	(50)	-
Local trader's selling price	1200	72.7
Local trader's net margin	100	6.1
Transport cost incurred by wholesalers	(100)	-
Handling cost	(50)	-
Wholesaler's selling price at Mandalay	1500	90.9
Wholesaler's net margin	150	9.1
Grading and packing costs	(50)	-
Handling costs	(50)	-
Retailer's selling price	1650	100.0
Retailer's net margin	50	3.0
Price paid by consumer*	1650	100.0
** exclusive of government taxes, other fee if any* *620 Viss = one Metric ton*		

Table 16: Estimation of price spread in eggplant crop (*Kyats per Viss*)

Item	Kyats per viss	% of consumer's price
Price received by farmer	500	58.8
Unit cost of production	142	16.7
Farmer's net margin	358	42.1
Transport cost to Township	30	-
Commission fee	40	-
Local trader's selling price	600	70.6
Local trader's net margin	30	3.5
Transport cost incurred by wholesalers	50	5.9
Handling cost	20	2.4
Wholesaler's selling price at Mandalay	750	88.2
Wholesaler's net margin	80	9.4
Grading and packing costs	20	-
Handling costs	30	-
Retailer's selling price	850	100.0
Retailer's net margin	50	5.9
Price paid by consumer*	850	100.0
** exclusive of government taxes, other fee if any* *620 Viss = one Metric ton*		

Table 17: Estimation of price spread in bitter gourd crop (*Kyats per Viss*)

Item	Kyats per viss	% of consumer's price
Price received by farmer	500	58.8
Unit cost of production	310	36.5
Farmer's net margin	190	22.4
Transport cost to Township	30	-
Commission fee	30	-
Local trader's selling price	600	70.6
Local trader's net margin	40	4.7
Transport cost incurred by wholesalers	50	-
Handling cost	20	-
Wholesaler's selling price at Mandalay	750	88.2
Wholesaler's net margin	80	9.4
Grading and packing costs	20	-
Handling costs	20	-
Retailer's selling price	850	100.0
Retailer's net margin	40	4.7
Price paid by consumer*	850	100.0
** exclusive of government taxes, other fee if any*		

Relatively, the market channels in case of green gram, chickpea and sesame are much efficient (see Tables 12, 13 and 14). The producer's share in unit exporting price is around 80%. The net margins received by pulse and oilseeds growers is much higher (except in chickpea) than paddy cultivators. The wholesalers at distant market and exporters obtaining good margins than the local trader who purchases from villages. Most of the times, farmers' would like to dispose their produce immediately after harvest due to financial needs and lack of storage facilities. If farmers' can wait for 3-4 months after harvest, the price realization will be much higher due to increase in export demand. Construction of public or cooperative storage facilities is need of the hour to protect the interests of the pulse & oilseed farmers.

The market channels in case of vegetables (green chili, eggplant and bitter gourd) rather weak because of poor marketing channels (see Tables 15, 16 and 17). The producer's share in consumer's rupee across three vegetables is about 60%. About 40% of total profits are gained by middlemen who involved at different stages of marketing channel. The wholesalers located at Mandalay accrued significant margins followed by retailers and local traders. Strengthening the market access to producers is the need of the hour for increasing the efficiency in vegetable trading.

Preferred export destinations

Since Singapore serves as a transit-point for the bulk of all pulses (black gram, pigeonpea and chickpea) leaving Myanmar by sea, most of the Singapore reported volumes likewise end up in

the Indian market. Green gram enjoys a more diversified set of market outlets. Over the past five to ten years, overland exports of green gram to China have become significant. A growing number of high-value markets such as Thailand, Taiwan, Indonesia and Malaysia attract green gram exports from Myanmar. European buyers have also entered the market recently, although it remains to be seen whether Myanmar will be able to meet strict traceability requirements. China and the high-value markets in East Asia and Europe prefer the top quality (large diameter) green gram used for making bean sprouts.

Chickpea, unlike the other pulses, attracts a large domestic market in Myanmar. Dehuller mills split chickpeas for use in making dahl. In addition, roughly quite good no. of vermicelli factories in Upper Myanmar currently use chickpeas to make fermented noodles. Although the factories can use any pulses as a substrate for making noodles, India's cessation of chickpea imports in 2013 has resulted in abnormally low domestic chickpea prices, making it currently the preferred input in the vermicelli factories. Domestic consumers eat a small share of chickpea/black gram production, primarily as fried snack food.

Table 18: Geographic distribution of production, assembly market and export

	Major Producing Regions	*Commodity Exchanges* and Other Key Assembly Markets	Export Marketing
Lower Myanmar			
Black gram	Ayeyarwady Bago East Bago West	*Hinthada, Danuphyu, Maupin*, Nyaung Tone, Wakema *Pyay*, Bago	Yangon → India
Green gram	Yangon Bago East	*Yangon*, Thongwa, Kayan *Pyay*, Bago	Yangon → India, Indonesia, etc
Upper Myanmar			
Green gram	Magway Mandalay Sagaing	*Magway, Pakokku, Aunglan* *Mandalay, Myingyan* *Monwya, Shwebo*	Mandalay → China
Pigeon pea	Sagaing Magway Mandalay	*Monwya, Shwebo* *Magway, Pakokku, Aunglan* *Mandalay, Myingyan*	Yangon → India
Chickpea	Sagaing Mandalay Magway	*Monwya, Shwebo* *Mandalay, Myingyan* *Magway, Pakokku*	Yangon → India

Source: Steven et al. 2014

Pulse marketing in Upper Myanmar centers around the Mandalay Commodity Exchange and roughly 2000 pulse traders who operate there. The links between the Mandalay and Yangon exchanges remain strong. All of the pigonpea and chickpea exports transit exchanges in Upper Myanmar, often via Mandalay. The bulk of the green gram produced in Upper Myanmar gets exported north to China, via Mandalay, while the remainder heads south to Yangon for shipment to India and other Asian markets. The export traders and brokers, based in Mandalay for the China market and in Yangon for India and elsewhere, are the key players in this marketing system. Although market participants rarely hold long-term stocks, traders estimate that short-term trading stocks (of 2-4 months in duration) are held throughout the system by exporters (40%), regional traders (30%) and large farmers (30%). Traders at six regional commodity exchanges supply terminal market wholesalers in Mandalay while traders at another five in exchanges Lower Myanmar supply the trading floor in Yangon (Table 18).

5.5 Market behavior and spatial market integration

Market behavior

As the first major agricultural sector to be liberalized, in 1988, pulses offered uniquely attractive returns to both farmers and traders. In quick succession, government dropped production quotas on pulses, liberalized domestic marketing and opened export marketing to private traders. Farmers and traders responded with alacrity to these new opportunities, propelling pulse production and exports rapidly upwards for several decades. By 1991, pulses surpassed rice to become Myanmar's most valuable agricultural export. While production quotas on paddy continued until 2003, pulses became the first major agricultural commodity to face a completely liberalized production and marketing environment. The parallel emergence of a ready market for pulse imports in India provided a large external demand outlet right on Myanmar's doorstep (see Fig 11). However, a series of sharp pullbacks in pulse exports also occurred in 2005 and 2011, triggered largely by changes in the Indian market which serves as destination for the majority of Myanmar's pulse exports. Since then, the export performance has proven choppy.

The secondary data (2016-18) about weekly wholesale market prices of selected agricultural commodities was collected from Borkers, Traders and Millers Association office located at Mandalay. The analysis of this data provided a deeper understanding about historic price trends as well as the extent of price deviations among different seasons in a year. Wherever possible, crop variety wise per unit differences in price realization was also highlighted. The crop-wise historic market trends are summarized in Figs 12 to 15 for better brevity of results.

The illustrations below have clearly visualized the historical price trends among major crops cultivated in the project area. The extent of decline in wholesale prices per basket was much conspicuous in chickpea followed by groundnut (red type). However, the wholesale price trends in case of green gram and sesame (white) was positive and in increasing trend because of high export demand. The export demand for chickpea gone down significantly because of import

restrictions from India. Lack of uniformity, poor quality and aflatoxin contamination etc. limited the export demand for groundnuts in the country.

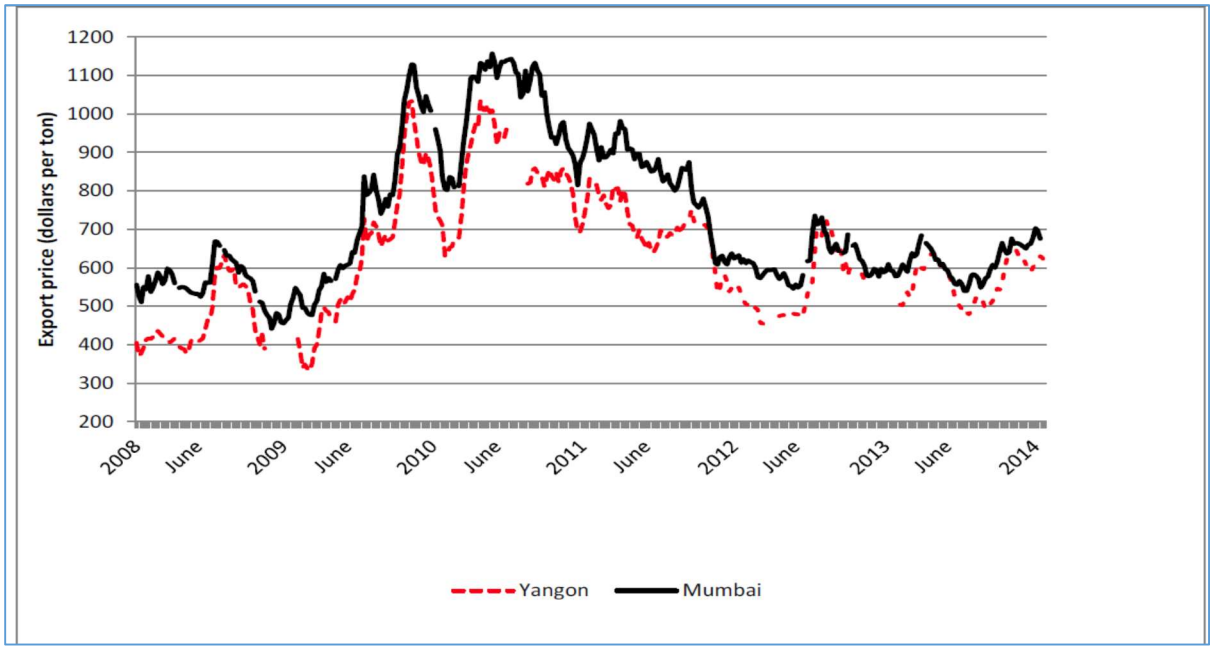


Fig 11: Black gram price movements in Mumbai (India) and Yangon Source: Steven et al. 2014

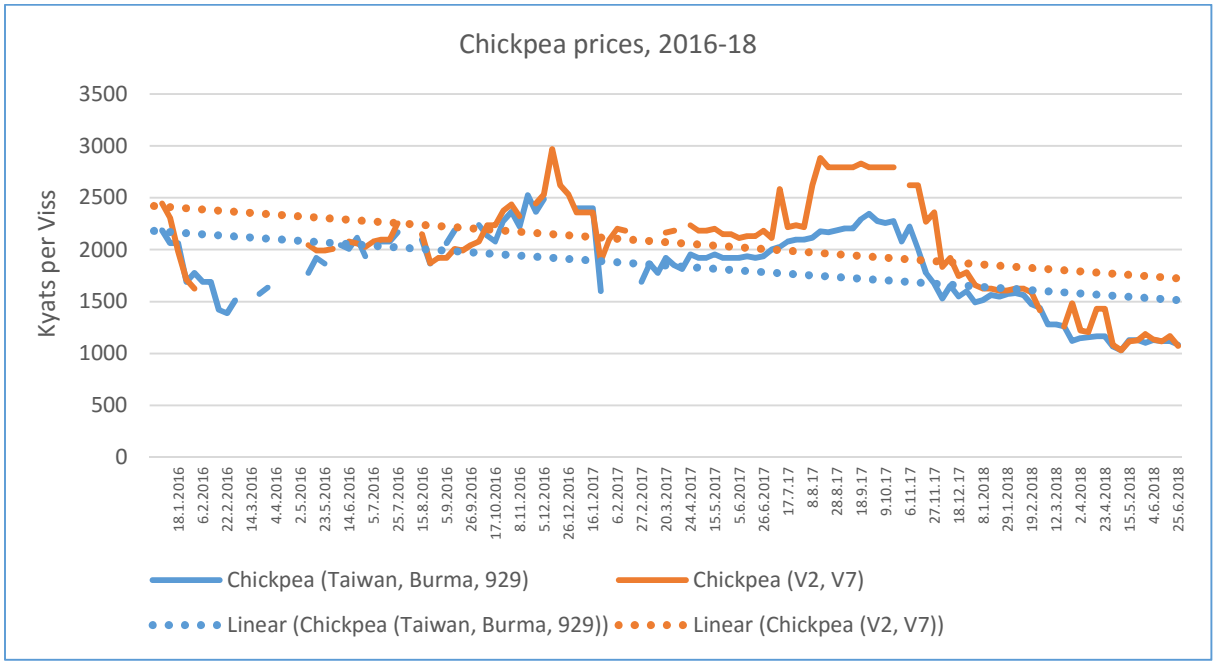


Fig 12: Variety-wise chickpea wholesale prices received at Mandalay, 2016-18

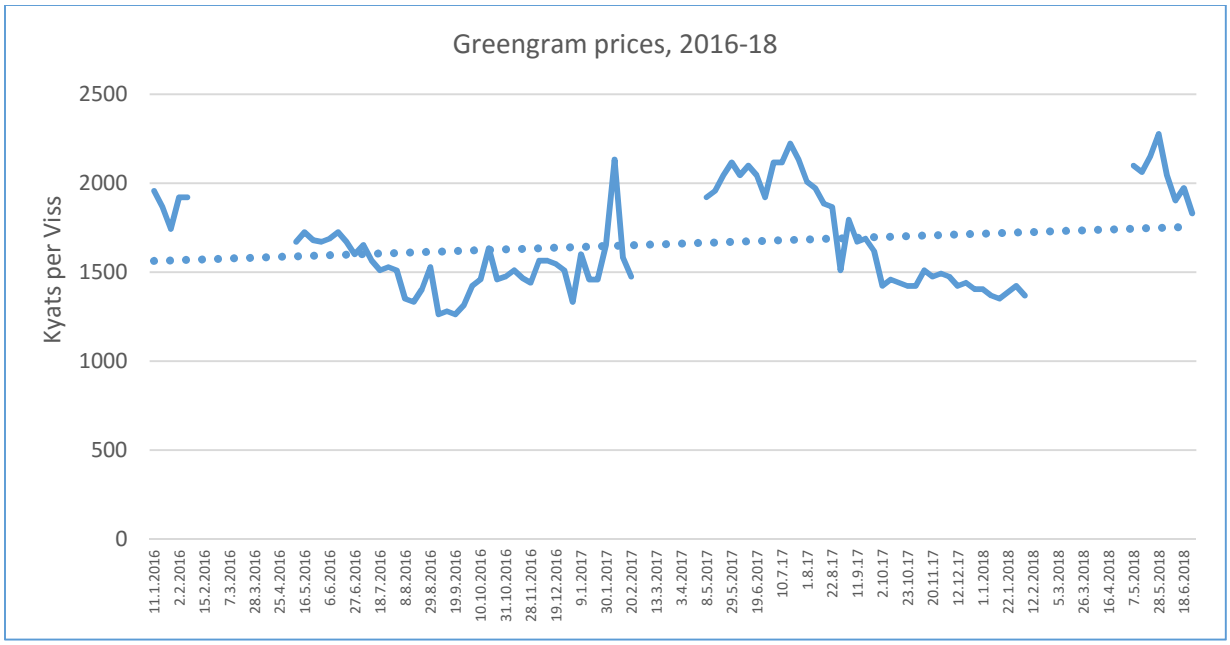


Fig 13: Green gram wholesale prices received at Mandalay, 2016-18

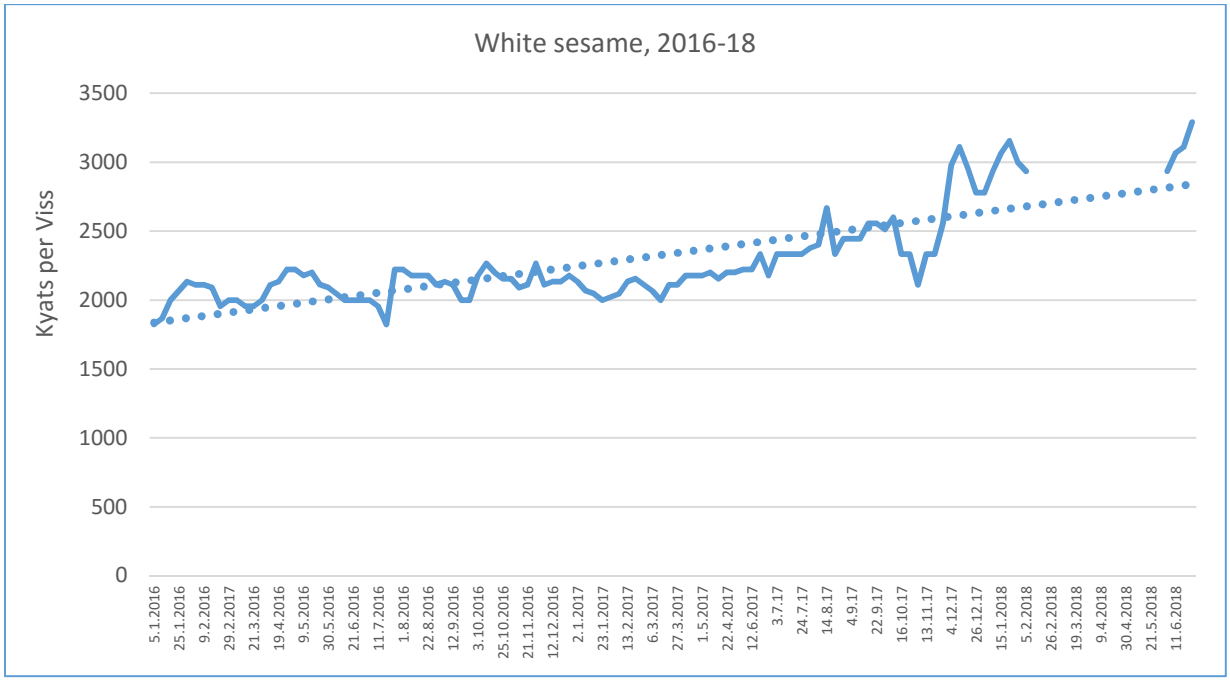


Fig 14: Sesame (white) wholesale prices received at Mandalay, 2016-18

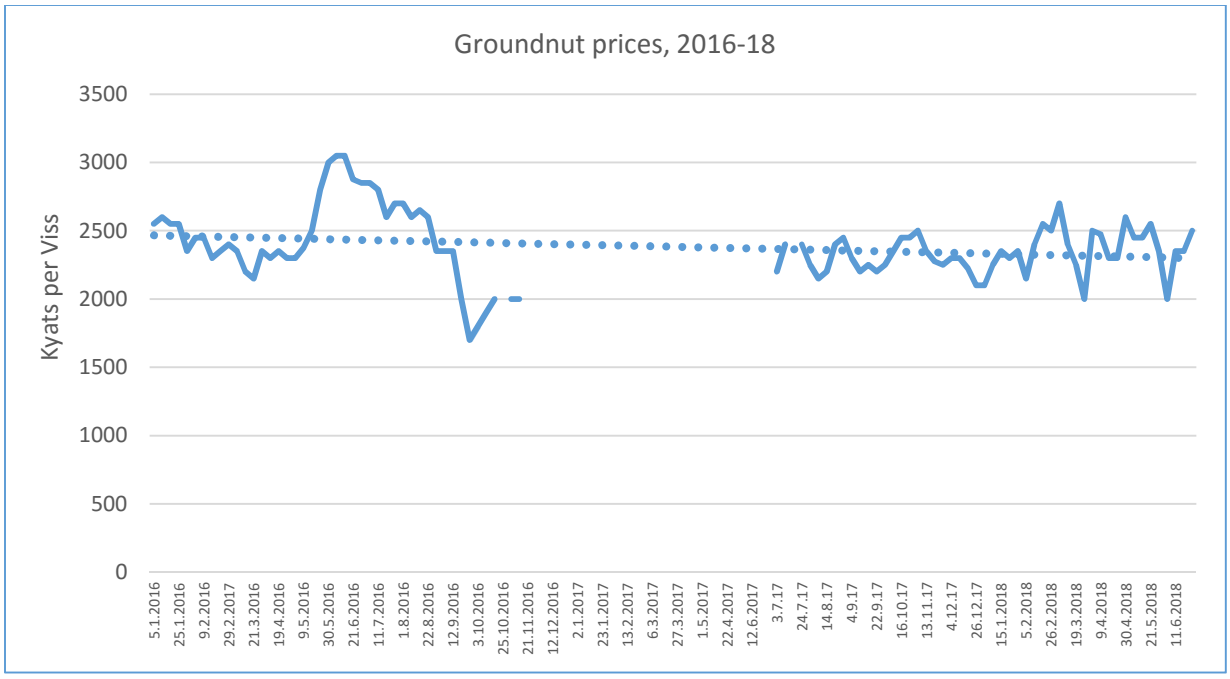


Fig 15: Groundnut wholesale prices received at Mandalay, 2016-18

Spatial market integration

Close communications between Yangon and Mandalay lead to tight linkages between these two terminal export market hubs and among the regional assembly markets that supply them. Given improved cellphone access and improved availability of price information, spatial price spreads generally reflect costs of movement between the various feeder markets and the export hubs. Over the past 25 years since private market liberalization, industry leaders indicate that marketing margins and the number of steps in the marketing chain have fallen as a consequence of improved telephone communication, better market price information and increased sale of the trade. While farmer to exporter involved 3-4 sequential transactions during the early years of the pulse market liberalization, that number now lies closer to 2-3 steps. Increased trading volumes, growing numbers of intermediaries and improved price information have all contributed to increased market efficiency. Unlike in the early decades, price information now circulates freely throughout the marketing system. Expansion of communication network and growth of public and private market information services have improved knowledge of export and terminal market prices throughout the marketing system.

Thaung and Choi (2007) investigated the performance and efficiency of marketing systems of chickpea, green gram and pigeonpea in each selected Townships of Myanmar. They analyzed the market integration which indicates the degree of co-movement of prices in spatially separated markets such as Yangon and Mandalay. The study assumed that Mandalay current wholesale price depend upon the Yangon current wholesale price and taking one to five lags weekly wholesale price of both Yangon and Mandalay markets. The study found that the percentage of

co-integration was 57% for chickpea, 65% for green gram and 85% for pigeonpea. The study concluded that there exist the highest long-run co-integration for pigeonpea price correlation and moderately co-integration for both chickpea and green gram within the Yangon and Mandalay markets. A high degree of market integration suggests that these markets are well connected. Therefore, the co-movement of prices gives an indication of degree of market integration. Knowledge of the structure of market integration enables the policy makers to predict the price effect of a shock in one regional market on other regional market to which it is connected.

Export marketing channels appear to be competitive but costly. By competitive we mean that individual players in the export trade do not appear to be able to manipulate prices in their favor. But high trading costs, especially but not limited to transport costs, result in high price spreads between domestic and international terminal markets. For example, a breakdown of the $ 175 per ton price spread for large green gram between Mandalay and Ruili markets.

5.6 Key issues in marketing

Several key issues were observed while interacting with producer farmers, local traders, processors, wholesalers and exporters regarding the marketing of selected commodities in the PYPIP area. The Focus-Group-Discussions (FGDs) organized at project villages also brought out major issues faced by farmers. They are summarized and highlighted below:

1) The agricultural marketing system in Myanmar is in primitive stage. There is no regulated marketing system exists in the country which procure grains or pulses from farmers at a common place and regulate the prices for different commodities

2) Trader's role is inevitable to market any agricultural commodity in the country. All the transactions happens on cash basis without any delay. Farmers' have good faith on village traders as well as prices offered by them. Often, traders also provide credit to farmers and collect the produce with buy-back arrangement

3) Farmers' have very poor awareness about prevailing market prices across commodities. They never access commodity price information directly either through television or newspapers. They dependent on local traders or neighboring farmers for obtaining price information using mobiles

4) Local trader's collect extra produce (one pyi) than the prescribed volume while purchasing from farmers because they consider it as a weight loss. It is being practiced in few villages while not in other villages. It was noticed much higher for paddy (2-3 pyi) when compared with other commodities

5) In general, trading for different commodities takes place on volume basis (baskets) rather than on weight basis (kgs). However, the trade at Mandalay export market happens on weight basis. There are no prescribed product standards for different commodities in procurement. They only follow the physical samples provided by the Yangon/Mandalay wholesale traders

6) Among different commodities, the trading for paddy is lower because of lower demand. It is much higher for pulses and oilseeds due to their export demand. None of the study farmer participate in rice trading because of poor demand

7) Except paddy, rest of all commodities produced in project area have very high marketable surplus because of very low domestic consumption and demand. Historically, the export markets in Myanmar (especially pulses) are highly dependent on Indian market for imports. This has led to high volatility in pulse exports from Myanmar. Lack of consistent export policy resulted in unstable export prices for different commodities

8) The Myanmar government announces the minimum floor price only for paddy crop. For the rest of crops, there is no minimum floor price for procurement. So, farmers could not able to realize remunerative prices for these crops

9) In the absence of bulk storage facilities (both public and cooperatives), farmers are exposed to forced sale due to the financial needs. Because of lack of collective action among farmers, the bargaining power is poor. This problem is more conspicuous in case of perishable commodities

5.7 Opportunities for increased market access and value addition

Improved market access and value addition opportunities were identified among selected crops in the PYPIP area. Establishment of these inclusive opportunities not only increases the producer's share in consumer rupee but also enhances the livelihood opportunities of small and marginal farmers in the region. The crop-wise avenues identified are as follows:

Crop	*Opportunities for increased market access and value addition*
Paddy	- Ample scope for establishment of farmer collectives and enhancing bargaining power - Huge potential for paddy processing, value-addition and marketing - Enhancing awareness about prevailing market prices and future trends - Strengthening public storage facilities and providing pledge loans - Livestock rearing (eg. piggery/buffalo) can be promoted with efficient utilization of paddy processing byproducts
Chickpea	- Creating public or cooperative storage facilities for avoiding distress sale - Financing the farmers based on warehouse receipts or pledge loans - Enhancing domestic consumption/value-addition by creating awareness - Strengthening market research for better price advocacy and dissemination

	- Diversification of exports using product standards and quality parameters
Green gram	- Broadening the export base by adopting export standards & quality care - Enhancing domestic consumption/value-addition by creating awareness - Strengthening public or cooperative storage facilities for better price realization - Policies for promoting value addition opportunities - Strengthening market research for better price advocacy and dissemination
Sesame	- Broadening the export base by adopting product standards - Enhancing awareness about prevailing market prices and future trends - Establishment of farmer collectives and enhancing their bargaining power - Strengthening public or cooperative storage facilities and providing pledge loans for farmers - Policies for promoting value addition opportunities
Green chili	- Enhancing the market access of small and marginal farmers is the need of hour - Avoid distress sales by establishing farmer collectives/groups - Strengthening public marketing system in case of fruits and vegetables - Enhancing the productivity and quality parameters through better management practices and capacity building
Eggplant	- Diversifying the farming systems through vegetables and enhancing farm incomes - Enhancing the market access of small and marginal farmers - Avoid distress sales by establishing farmer collectives/groups - Creating awareness and knowledge about market prices - Enhancing the productivity levels through better management practices
Bitter gourd	- Strengthening farmer collectives/groups and avoid distress sales - Minimizing the risk in agriculture and enhancing incomes through vegetable cultivation - Creating awareness and knowledge about market prices - Providing knowledge & capacity on production and post-harvest handling - Strengthening the public storage facilities

6. Summary and conclusions

The agricultural marketing system in Myanmar is in primitive stage. There is no regulated or public marketing system exists in the country which procure grains from farmers at a common place and regulate the prices for different commodities. Trader's role is inevitable to market any agricultural commodity in the country. Local traders at village-level procure the grains from farmers at prevailing market prices. The farmers' awareness about prevailing market prices is very poor and they in turn dependent on traders/wholesalers for price information. The primary producers never access any price information available either in the television or newspapers. All the financial transactions happens on cash basis without any delay. Farmers' have reasonably good faith on village traders as well as prices offered by them. Often, local traders also provide credit to farmers and buy-back all the crop harvest. The market prices of different commodities are determined based on Yangon/Mandalay wholesale market prices. Relatively, the markets operate more efficient in case of dry grains when compared with perishable commodities because involvement of few actors and low demand.

In general, the production risks are high in case of dryland crops when compared with low land crops. There is huge disparity among productivity levels per acre across crops and project villages. The extent of marketable surpluses among study crops in the project area is very high (>80%) and farmers' are highly dependent on market for their disposal. In the absence of bulk storage facilities (both in public and cooperatives), farmers are exposed to forced sale of grains due to the financial needs. Lack of collective action or commodity groups among project farmers led to weak bargaining power. Relatively, the extent of crop diversity among project villages is very limited because of water scarcity and limited exposure towards new crops. Historically, the project farmers' have been cultivating these crops due to lack of alternate market opportunities. However, the inherent production risks as well as high price volatility in the recent period are posing greater challenges and limiting the livelihood development in the region.

Overall, the economic analysis among study crops have clearly concluded that the cultivation of paddy is profitable than other monsoon crops. Among upland crops, groundnut performed extremely well followed by green gram, sesame and chickpea crops. However, sesame was referred as the highly profitable and less risk crop than others. Practice of commodity standards, grading, processing and value-addition etc. are almost negligible in project villages. All the vegetables (green chili, eggplant and bitter gourd) are rated as highly profitable crops but they need huge crop investments and assured market linkages. The estimated marketing efficiency are high in case of dry grains than other crops. Producer's share in consumer's price is relatively high in case of pulses and oilseeds trading than fruits and vegetables.

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References

Anderson Irrigation and Engineering Services Ltd. 2012. *Increasing the efficiency and effectiveness of pumped irrigation schemes in the Central Dry Zone of Myanmar.* Working Paper 3 - Agriculture. Yangon, Myanmar: Livelihoods and Food Security Trust Fund (LIFT); United Nations Office for Project Services (UNOPS); and Water Resources Utilization Department.

Cools, J.W.F. 1995. *Farming systems in the Dry Zone.* Agricultural development and environmental rehabilitation in the Dry Zone project. Final Mission Report. Field document 10. Report no.MYA/93/004. Rome, Italy: Food and Agriculture Organization of the United Nations (FAO), Forestry Department; New York, USA: United Nations Development Programme (UNDP). 111p.

Final Report on Soil Survey Services For Pyawt Ywa Pump Irrigation Project, Mya Yar Pin Engineering and Consulting Group, Myanmar

Steven Haggblade, Boughton Duncan, Seng Kham L. and Thaung Myo 2014. Winds of Change: A Rapid Appraisal of four pule value chains in Myanmar, Michigan State University (MSU) and Myanmar Resource Development Institute (MDRI/CESD), USAID Report, Myanmar.

Thaung Nyein Nyein 2007. Market performance of selected pulses in Myanmar, International Conference in honor of the 60th Anniversary, 24-25th May, 2007, Ulaanbaatar, Mongolia.