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Results of Cassava Processor Survey in the Ayeyarwady Region of Myanmar in 2018¹

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Summary

Cassava is one of the most important crops in the uplands of the Ayeyarwady region in Myanmar. The crop not only has much potential for improving the livelihood of poor farmers living in the uplands but also the ability to contribute to the regional economy. The rising demand for cassava in both the domestic and international markets has the potential to be translated into higher incomes and improve livelihoods for farmers growing the crop. Moreover, cassava has been regarded as a pro-poor crop due to its versatility and ability to grow reasonably well in soils with low fertility and areas with unpredictable rainfall. However in many cases the potential gains are not necessarily being realized by the poorer smallholders. Cassava yields are generally quite low for these farmers due to limited access to inputs and technologies which are generally a prerequisite for higher returns. While research on appropriate cultivation techniques is necessary to address the knowledge gap related to optimal cultivation methods for specific regions, practical methods of guaranteeing smallholders better access to the necessary knowledge and inputs remains a significant challenge.

One promising avenue for increasing productivity and profitability of smallholders as well as overall growth and improved sustainability of the entire cassava industry is through better value-chain linkages between the industry actors. As part of the larger goals of the current project that aims to address these issues, this particular study is focused on a survey of cassava processors to understand their role in the value chain, taking into account not only the

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mechanisms involved in processing starch, but also the challenges related to their operations as well as opportunities for achieving growth in the industry through better linkages with other value chain actors; particularly smallholder farmers.

This paper provides results of semi-structured surveys conducted with a total of 37 processors from a total of 200 that are currently operating in Hinthada and Patheingyi districts. The selected processors represented a wide range of processors with processing capacity ranging between 1,500 viss/day to 35,000 viss/day, although the majority had a capacity of less than 5,000 viss/day.

The activities of processors revealed that they were involved in more than just operating facilities for processing cassava, with all of them involved in growing cassava themselves. As farmers themselves, the processors are well aware of the challenges and limitations in relation to cassava cultivation by smallholders. According to their responses, there is very little fertilizer use and despite the growing problems from pests and diseases, currently there are no pesticides or insecticides that have been introduced.

In addition to cassava sourced from their own farms, each of the processors also secure cassava from between 4 and 70 farmers. Between 70 to 80% of purchases are made under contractual agreements while the remainder are made on the spot. The contractual agreements generally involve a loan to the farmers of about 200,000 kyat/ acre and is associated with a 3-4% monthly interest rate. Over half of the interviewed processors claim to have difficulties in purchasing enough cassava roots to meet their capacities.

Two thirds of processors also make recommendations to farmers in terms of the time of harvest which is between January and March. In addition, processors provide farmers with information about cassava prices as well as the desired quality specifications of the cassava roots. Furthermore about 50% of processors are also involved in providing recommendations in terms of how production can be improved.

Specific concerns were raised by the interviewed processors regarding challenges they faced for operating their factories. Access to electricity and water is not uniform across processors with some processors emphasizing their lack of access to clean water. There appeared to be quite a bit of variability in terms of the type of factory equipment being owned, with one of the key production challenges being the lack of access to state of the art technologies. Furthermore, lack of capital meant processors were working with machinery that were deemed obsolete. The lack of treatment for wastewater was also considered to be a significant issue both from a production as well as an environmental point of view.

In terms of the future of their businesses, over three quarters expected to remain in the cassava processing business in five years' time while the remainder believed they would have quit due to old age or the rising cost of labour. Over 62% indicated a desire to improve and expand their businesses through increased investments if they were able to access necessary capital. Additional challenges faced by processors for operating their daily businesses involved labour shortages, limited capital, lack of new technologies, and market volatility. Cassava roots from the processors are sold to larger traders/ companies in the Aungmye area of Hinthada where two starch traders are dominant. Additionally starch is also sold to agents travelling from Yangon who travel to purchase starch directly from the processors.

Over 60% of processors have a formal contract with their purchasers. These contracts involve a loan from the purchasers for running their factories. The funds received are used for various operating activities which also includes loaning them to traders and cassava farmers. Purchasers also provide guidelines for the quality of starch which if not met is subject to lower prices. Processors also received information on cassava prices from agents and traders and in some cases even from farmers and/or neighbours. On the other hand none of the processors had received any price related information through government agencies.

Apart from public infrastructure such as roads, there appeared to be minimal support from government agencies. Instead there appeared to be a range of activities and services from the private sector for ensuring a functional industry. Given the range of activities and services provided by the different value chain actors in addition to the normal business centric activities, it appears that there already exists a supportive system in place. Furthermore, almost all of the processors described their relationship with both farmers as well as cassava traders to be strong. This is a promising sign for building more resilient and constructive arrangements between the different actors. A keen interest in cooperating in the current cassava project as well as on any subsequent projects was also expressed by the interviewed processors.

1. Introduction

Cassava is one of the most important crops in the uplands of the Ayeyarwady region in Myanmar. Cassava is a resilient crop and can be grown with limited amount of investments in inputs including water and fertilizers, which makes it an ideal crop for poor farmers. With the growing demand for starch and hence cassava, both in the domestic and international markets, there is significant potential for growth in the industry and in the process, for smallholders to make significant gains. Sustainable intensification of cassava thus has the potential improve the livelihoods of smallholders many of whom are living in poverty.

While many farmers have managed to take advantage of the boom crop, such gains have not been realized by others. This inability is a direct result of smallholders' lack of access to necessary information, technologies, and inputs required for improving yields. The key to sustainable access to these inputs as well as output markets and furthermore the realization of higher profit margins is through better linkages of smallholders with the rest of the value chain actors. While external development agencies as well as the government may be able to temporarily supply some of these necessary inputs, sustainability is more likely to be achieved through the private sector, especially if all value chain actors providing these inputs and services are provided with adequate incentives that result in higher margins for all those involved. As such it is important to create better partnerships between the value chain actors and promote better cooperation to sustainably grow the entire industry.

As a part of a larger research project, this particular study explores the activities of one particular group in the value chain, namely the processors that are involved in purchasing fresh cassava roots directly from farmers and processing them to extract starch before selling them to other traders and companies. With a significant role along the industry value chain, this study reports on a survey of cassava processors to understand their role in the value chain, taking into account not only the mechanisms involved in processing starch, but also the

challenges related to their operations as well as opportunities for achieving growth in the industry through better linkages with other value chain actors; particularly smallholder farmers.

The paper begins with some context on the farming practices in the Ayeyarwady region followed by the key characteristics of cropping systems in the survey sites. This is followed by the methodology adopted for engaging cassava processors before presenting detailed results related to the surveyed processors, their own cassava cultivation operations, information about their starch factories and challenges, relationships with other actors along the value chain, details on their purchases, sales, cost structures as well as future plans. The report discusses some of the implications for addressing improvements before ending with a brief conclusion.

2. Ayeyarwady Agricultural Context

The majority of farmers in the Ayeyarwady region are smallholder farmers owning less than 10 acres of land. Their primary crops grown in the lowlands are rice and pulses with black gram (*Vigna mungo*) and mung bean (*Vigna radiata*) as the two main varieties of pulses in the region. The upland areas are dominated by cash crops including cassava, maize and soybean, while other horticultural crops such as tomato, chili, green leafy vegetables, etc. are also grown primarily for household consumption. Additionally betel leaves and bananas are grown by some farmers. Rainfed cropping systems are common but where irrigation facilities are available, farmers irrigate their crops.

The paddy-paddy or paddy-pulses-paddy pattern dominates the irrigated and rainfed lowland areas. Many farmers grow rainfed rice during the monsoon but also supplement with irrigation water if such facilities are available. All of the summer paddy crops in this region are grown utilising irrigation. In the rainfed upland areas, most farmers grow cassava. This is particularly the case for farmers in Kyonpyaw, Lemyethna, and Hinthada townships. The study and hence the processor survey primarily focused on upland cassava crops, but also addressed other dominant crops as well as possible niche crops to assess the potential mutual benefits with the cassava-based system.

Key Characteristics of Cropping Systems in the Survey Sites

A majority of farmers in the survey sites practice cassava-based cropping systems which constitutes of lowland rice and maize, bean and chili in addition to cassava in the uplands.

Cassava is generally planted as a monocrop during the early monsoon season under rainfed conditions although some farmers also plant them in the post-monsoon season. While traditional land preparation (ploughing and harrowing) methods using cattle and buffalos are still prevalent the use of two-wheel tractors is also becoming more common. Traditionally cassava is planted on mounds with two planting stakes but some farmers have also opted for planting by vertical method on ridges. Farmers use little amounts of farmyard manure, urea, and NPK compound fertilizers and no insecticides for controlling insects. Manual weeding methods are common although some farmers apply herbicides. Cassava is usually harvested manually about 9 to 10 months after planting during the dry season starting from January to April.

3. Methodology: Cassava processing survey in Ayeyarwady region of Myanmar

A desk study was undertaken to gather secondary information on the mechanisms involved in the processing of cassava as well as challenges incurred by processors in the Ayeyarwady region. With some background information, a questionnaire for conducting a survey with local processors was developed. Furthermore, logistical issues were discussed in collaboration with local authorities, farmers and processors prior to conducting the interviews (Figure 1).



Figure 1: Developing questionnaire with survey team

The survey questions were designed to collect information on the existing supply chain structure, with details on the role of cassava processors. In this regard information was collected on their current cassava growing area and production; the information about their factory such as access to the electricity, power source, type and cost of machine, and capacity of factory, water source, labour requirement and waste water system; purchasing and sale information such as from whom do they purchase/sell cassava roots/products (how many farmers/suppliers), quantity of each type of product do they purchase/sell annually, quantity of cassava roots/products did they purchase/sell previous year, contract arrangement, service provision; information on cost-structure such as key elements of variable cost of production, overall capital investment and age of equipment; information about access to credit and provision of credit such as insights on market opportunities, institutional effectiveness and perception and knowledge of processing, respectively; information about access to information and training; and their future plans.

The team also collected information on length of time in business, other businesses the individual is involved in (apart from cassava processing), age of equipment, design capacity of processing unit, actual usage of processing unit, sources of information and knowledge about processing formal and informal groups they belong to, benefits they get from being members of a cassava association and government agencies. In addition, processors were also queried about all of the actors that each processor is buying and selling from. Finally the surveys assessed the motivation processors for improving the cassava sector along with their attitudes towards collaborative work with other stakeholders.

In the Ayeyarwady region, there are more than 200 cassava processors of which 134 are registered processors that are part of the Cassava Growers Millers and Traders Association (CGMTA). The total annual production for all registered processors in 2017 was estimated at

58,074 tons (Table 1). The names of all registered processors in the three townships, their location and processing capacities are presented in Appendices A, B, and C.

Table 1: Number of the registered starch plants and the annual production capacity (2017)

Township name	Number of starch plants	Production capacity (ton/year)
Kyonpyaw	104	42,984
Hinthada	10	8,895
Lemyethna	20	6,195
Total	134	58,074

Processor surveys were conducted in October, 2018 by Daw Nilar Aung, Regional DOA staff and U Kyaw Thura, Cassava Growers, Millers and Traders Association (CGMTA), and Dr Tin Maung Aye, (as a consultant working with the team) (Figures 2 and 3). The surveys which were conducted on a one-to-one basis with the processors lasted up to two hours. They generally began with a brief overview of the objectives of the study followed by a request to continue.



Figure 2: Interviewing cassava processor in Hinthada township (right) and in Lemyethna township (left)



Figure 3: Interviewing cassava processors in Shar Khe village (right) and in Kyonpyaw township (left)

The three townships within the Ayeyarwady region where the cassava processor surveys were administered are shown in Figure 4.



Figure 4: Survey locations in Ayeyarwady region, Myanmar

A total of 18 processors from Hinthada district (Hinthada township and Lemyethna township) and 19 processors from Patheingyi district (Kyonpyaw township) were interviewed. The 37 participating processors were predominantly male with only one female participant. About 60% of participants belonged to the Kayan ethnic group (22 processors) while the remainder (15 processors) were of Burman ethnicity. The age of processors ranged between 29 to 65 year old, with over half above the age of 50. All processors are also involved in growing their own cassava crop. 87% of processors claim to have grown cassava for more than 10 years while only a few processors (13%) have planted cassava for less than 10 years (Figure 5).

Two of the processors were also involved in selling agricultural inputs (i.e. fertilizers) at local grocery shops, while one of the processors was also employed with the district administration

office. Of those interviewed, 37% indicated that their involvement in the starch processing business had been for more than 7 years, while only a few processors (8%) were new in the business (less than 6 months). In addition to cassava growing and processing, 21% of all processors are involved with other farming businesses which include rice, bean, and banana. A total of 3 processors (8% of all processors) indicated that they were a member of a cassava association, while one processor claimed to be a part of an informal cassava network group. Membership with the cassava association entitles members to access various benefits such as new technologies, new cassava varieties, and market information.

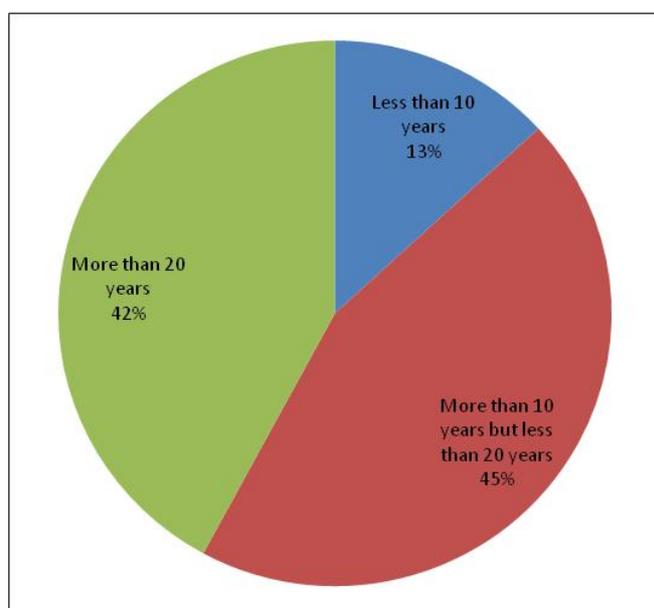


Figure 5: Years of cassava cultivation of interviewed processors (%)

Current cassava growing area, production, and yields

The average cassava production area per processor was 19 acres⁶, varying between 2 acres and 80 acres. About half of the processors had land areas that were less than 10 acres. The average annual production per processor ranged from a high of 111,125 viss⁷ per processor (178 tons) in Lemyethna township to a low of 49,818 viss per processor (80 tons) in Hinthada township and 57,333 viss per processor (92 tons) in Kyonpyaw township. Average cassava growing area and annual production of processors in each of the three townships are shown in Table 2.

The average cassava yield was 3,118 viss per acre in Kyonpyaw township, 3,362 viss per acre in Hinthada township, and 4,254 viss per acre in Lemyethna township (Figure 6). However, the yield per acre ranged from a high of 15,000 viss per acre (61 tons per hectare) in Lemyethna township to a low of 1,000 viss per acre (4 tons per hectare) in Kyonpyaw township. Average annual production of three townships was about 66,729 viss (107 tons) per processor, giving an average yield of 3,512 viss per acre (14.3 tons per hectare). The average yield was significantly lower than potential yield in Myanmar which has been projected to be in the range of 30 tons per hectare.

⁶ 1 acre = 0.4047 ha

⁷ 1 viss = 1.633 kgs

Table 2: Cassava area, production and yield by processors (2017/2018)

Item	Kyonpyaw	Hinthada	Lemyethna
No of interviewed processors	18	11	8
Total cassava area (ac)	331	163	209
Average area per processor (ac)	18.4	14.8	26.1
Total cassava production (viss)	1,032,000	548,000	889,000
Average production per processor	57,333	49,818	111,125

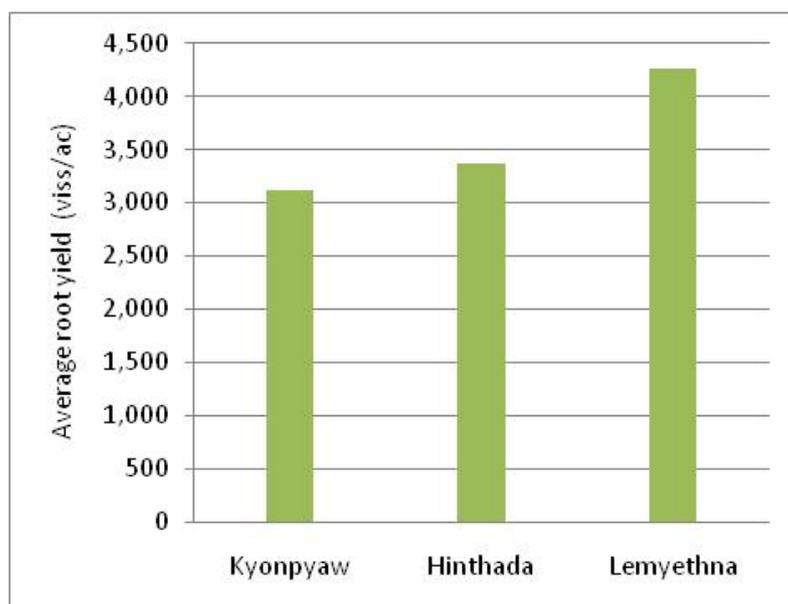


Figure 6: Average cassava root yield in the three survey townships

4. Information about starch factories

Hinthada and Pathein districts are major producers of cassava with more than 200 starch production factories all owned by locals. Cassava inputs for factories are sourced from within the two districts.

Access to electricity is not uniform across all processors both Pathein and Hinthada districts. The main power source for cassava starch factories is diesel although one factory in Shar Khe uses only rice husk and two factories use gas as their source of power. However, some factories (13% of processors) use either both diesel and gas or both diesel and rice husk. The water source for 70% of starch factories is deep-well and for the remaining 30% it is tube-well. Processors generally do not have issues for accessing necessary amounts of water for processing, however, a few expressed challenges related to getting access to clean water.

A majority of processors (78%) have three types of machines (peeling, grinding, and stirring machines) to process their cassava roots at their starch plants. Normally processing plants are equipped with a single unit of each type of machine, although several do contain two of each. While three of the processors (8%) also have drying machines to dry their starch, there are

some processors (32%) with only one of three main machine types (for example only a grinding machine). According to the respondents, processors do not make regular purchases of equipment/ machines. Only two processors indicating having replaced their machines three years after first use.. About 40% of processors have less than three settling tanks and over 50% have between three and five settling tanks, while a handful (less than 10%) have more than eight. The settling tanks are made from tarpaulin and lined with bamboo. Most processors (95%) peel the cassava roots before grinding which are primarily used for making fertilizers. Machines are used to grind the roots and extract the starch although two of the processing factories were involved in conducting this task manually.

The daily cassava processing rate per processor varied between 1,500 viss and 35,000 viss per day. A majority of processors (more than 80%) operated in small batches, and the maximum quantity of roots they processed in one day remained under 5,000 viss per day, except for one processor in Kyonpaw who processed about 40,000-50,000 viss per day. Starch conversion rate from fresh roots varied from 23-35%, with an average conversion rate of 30%. On average residue from processing starch amounted to between 9 and 14 % of the fresh roots by weight.

In addition to household labour, additional labourers are hired for conducting various tasks in the processing factory. Across the two surveyed districts, the number of workers in per factory varied from 10 to 30. Generally male workers were employed to transport roots and female workers were employed for activities related to starch extraction. For other processing activities such as peeling, washing, grinding, and drying, there were similar numbers of male and female workers.

Many processors drain their waste water onto farmlands and low lands, but some processors retain waste water in ponds and wells. Currently there are no systems in place for reusing or recycling waste water. Half of the interviewed processors complained about having problems related to bad odor with waste water management.

Relationship with farmers and traders

Cassava processors generally seemed to have a good relationship with the local farmers and traders/agents. Of processors that bought cassava fresh root from farmers, around 68% described the relationship as strong, while only about 5% regarded the relationship to be medium. Of those processors (only 32%) answered that their relationship with starch traders/agents was strong (Table 3).

Table 3: Relationship between processors, farmers and starch traders

Relationship	Farmers	Starch Traders/Agents
Strong	68%	32%
Medium	5%	68%
Weak	27%	

Purchase of raw materials

Processors in both districts act as large-scale growers (more than 10 acres). They produce fresh roots themselves and also purchase additional quantities of fresh roots directly from other local farmers, which range from 4 to 70 farmers, with the exception of one large processor in Shar Khe of Kyonpaw Township that purchased fresh roots from 200 local farmers.

The amount of cassava roots purchased per processor varied between 70,000 viss to 500,000 viss per year. Annually many processors buy over 100,000 viss of cassava roots. The average purchasing price of cassava roots in 2017 was 120-130 kyat/viss with a maximum price of 150 kyat/viss. More than half of the interviewed processors claim to have difficulties in purchasing enough cassava roots. One of the main reasons stated was due to financial limitations. Generally, 70-80% of the purchases are made under contractual arrangements and 20-30% are made directly with farmers without previous contracts. Most processors have formal contracts with local farmers which generally include a loan at the rate of 200,000 kyat / acre with a 3-4% monthly interest rate.

Two thirds of the interviewed processors made recommendations to farmers for harvesting their cassava crop between January and March. Moreover, processors also provide farmers with information about cassava prices. Quality of purchased cassava is based upon starch content assessed by the size of the roots, although starch content is not tested for. Some processors provide farmers with information about the quality of the cassava roots with about 50% providing recommendations on how production can be improved. Key recommendations included changing crop varieties (to Thai varieties) and using fertilizers. Farmers generally appeared to accept such recommendations with most farmers producing cassava that met the quality requirements of the processors. However, there were a few farmers that struggled to meet these standards. About 30% of processors offered a discounted price for cassava that did not meet their standards. The negotiations related to discounted prices with farmers was either made at time of purchase (at harvesting) or after delivering to the next buyer.

Sales

The processors sell starch and cassava by-products primarily to larger traders/companies in the Taung area of Hinthada district. There are not many traders/companies involved in the cassava starch business in Myanmar with U A Chon and Tun Myitar the two main cassava starch traders in the Ayeyarwady region. Processors also sell their products to agents from Yangon who travel to buy products directly from local processors and transport them back to Yangon. In 2017, the selling price of cassava starch was between 600 and 650 kyat/viss and the maximum selling price was 800 kyat/viss. The selling price of by-products was between 1600 and 1800 kyat/bag (1 bag = 9 viss) and the maximum selling price was 2,100 kyat/bag.

Over 60% of processors do not have formal contracts with their purchasers (i.e, traders/companies). The ones with formal contracts are primarily to secure credit for operating their business. The quality of starch customers (starch traders and agents) are generally after is white coloured starch with low moisture content (<14%). Only 30% of processors are capable of consistently meeting these quality requirements and so a discounted price may be agreed upon for poorer quality cassava, such as ones with higher moisture content or undesired colour. Traders and companies buying cassava provide recommendations to processors for improving the quality of starch, such as through proper drying methods. Processors in return generally take up these recommendations as they result in higher prices.

A stylized value chain map for the Ayeyarwady region which is primarily oriented towards the domestic market for starch and cassava by-products is shown in Figure 7.

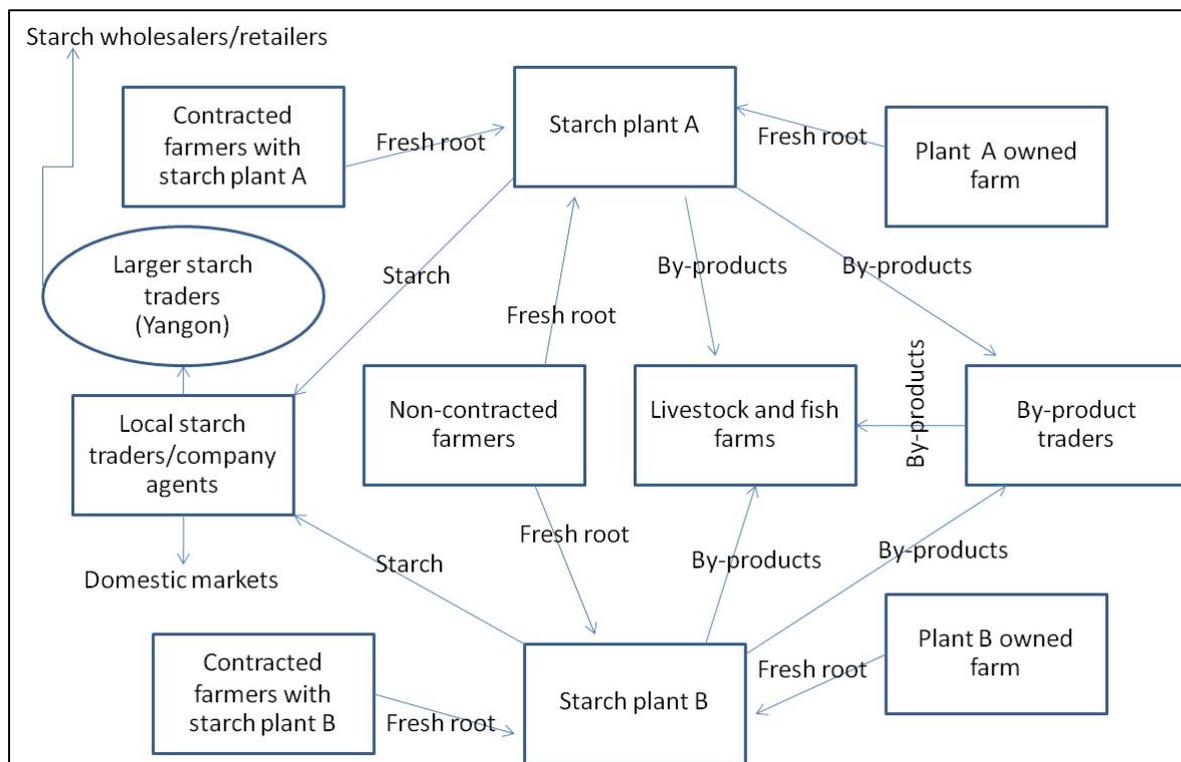


Figure 7: Stylised Cassava Value Chain Map, Ayeyarwady region, Myanmar

Cost structure

Costs associated with harvests, transportation, grinding and starch extraction, fuel, and labour make up the major components of variable costs when it comes to starch production. The overall level of capital investment varies depending upon the location of the starch plant, land price, size of land and building, and the capacity of processing machinery. 80% of processors claim to have invested more than 10,000,000 kkyat into their production facilities with 3,500,000 kkyat and 38,000,000 kkyat stated as the minimum and maximum levels of overall investments.. However, a sizable proportion of the equipment in these plants appeared to be obsolete with 50% of purchased equipment being more than 10 years old and 30% more than 15 years old.

Access to credit

A total of 38% of processors had only obtained a single loan either from wealthier friends or traders for operating their business. The loan amounts which ranged from 500,000 to 10,000,000 kkyat were used for various purposes including the purchase of new machinery and repair work on existing equipment, purchase of cassava roots, and for lending money to farmers. Conditions of loan also varied across lenders from those without interest to those with interest (3-5%). Furthermore conditions were also established in relation to the timing for repayment of loans which was generally after the harvest season.

Contract farming agreements generally involve a loan to the farmers of about 200,000 kyat/acre and are often associated with a 3-4% monthly interest rate, but 65% of surveyed processors indicated that they loaned money to farmers with a 5% monthly interest. The loans were either short term loans lasting between two to four weeks or needed to be paid post harvest. As a result of being exclusively involved in the domestic market it was no surprise that only a handful of processors (16% of processors) monitored the price of cassava products (i.e. of root and starch) in overseas markets, while almost all monitored the local price of cassava products.

Access to information

The primary source of information regarding local cassava prices was obtained through agents/traders. Colleagues and neighbours were also regarded as leading sources of information for cassava root and starch markets. A few processors pointed to farmers and neighbours within their village as their main sources of information, while government agencies and/or cassava associations were not regarded as a source by any of the processors.. A majority of processors own smart phones for communication while 32% also have access to the internet on a daily or weekly basis (claimed to use primarily for social media). Almost all processors expressed an interest for receiving information on cassava root and starch prices.

Future plan

Three quarters of surveyed processors believe that in five years time they will still be involved with in cassava business. The remaining respondents however expected to have quit the business either as a result of old age or due to labour shortages. Over 62% of processors expressed their intent of making further investments in their starch processing facilities if they had access to more capital, while 20% of respondents preferred not to make such investments. Some of the key challenges faced by processors for conducting their business were labour shortage, limited capital, lack of new technologies, and market volatility.

5. Implications

The exchange of ideas and practical experiences on cassava production and processing systems, discussions about growing practices and cultural problems, as well as, presentations of standards used in processing equipments, purchasing and sales of root and starch, and investments and processing methods, enabled us to gauge the real situation of cassava production and processing in the area.

Below the highlights based on survey information, observations and knowledge exchange:

- The development of cassava sub-sector (production and processing) requires a national strategy by the Myanmar Government, which should not only involve detailed planning on cultivation practices but also help structure the output markets.;
- The partnerships between DOA, cassava processors, traders and smallholder cassava farmers can be useful for working on a Private-Public partnership program to support

local farmers with high-yielding varieties, high-quality planting material, and appropriate cassava production.;

- The development of a more comprehensive strategy for the development of the sector will require appropriate training programs along with quality control to ensure that the products meet international standards.
- Knowledge about the interaction between genetic quality of planting materials, right fertilizer application and, disease and pest management methods are crucial for increasing cassava yields. Furthermore advantages of a site-specific crop management strategy may also be incorporated into on-farm trials; Additionally, the physical and chemical properties of soil and water on the quantity and quality of cassava and hence the starch produced in particular climatic conditions need to be assessed;
- A review of current cassava production and processing methods reveal negative impacts upon the environment. While the cultivation process results in negative impacts upon the soil, outdated cassava processing machinery and the lack of appropriate waste water management systems have negative impacts upon soil and natural water resources. While the actual practice of cassava processing does not present serious hazards such as environmental contamination or biodiversity destruction, there is much improvement to be made in terms of by-products and waste water management;
- A more comprehensive evaluation of existing starch processing practices is necessary to make appropriate recommendations to small processors for sustainably and profitably improving productivity of processors;

6. Conclusion

The engagement with cassava processors in the Ayeyarwady region of Myanmar through semi-structured interviews provided valuable information regarding the current practices employed by smallholder processors in the region as well as existing limitations and potential avenues for improvements. As all processors were also involved in growing cassava themselves, insights were provided not just in terms of challenges related to the operation of processing plants, but also limitations for producing cassava. Lack of access to improved cassava varieties, appropriate inputs including fertilizers and pesticides as well as information on more sustainable cultivation practices were highlighted as constraints to production. As a result of lower yields, processors were generally unable to secure adequate levels of fresh starch roots for their processing factory capacities.

While the processing factories currently appear to have more capacity and able to process increased volumes in the event of higher cassava yields, they too have significant challenges of their own. Concerns were raised by processors regarding lack of access to new technologies as processing factories still relied on old and outdated machinery. Lack of adequate facilities

related to energy (electricity) and clean water were cited as additional limitations. Finally, the lack of appropriate waste water management appeared to result in operational as well as environmental challenges. While low cassava yields is currently viewed as the bottleneck in the industry, the processing sector also requires adequate investments to improve its productivity to ensure its readiness for increased cassava yields.

The cassava processors already seem to be involved in providing various other services to farmers in addition to simply buying fresh cassava roots from them. It is common for processors to provide credit to farmers to aid with their costs of cultivation. Additionally, information on cassava prices and recommendations on better cultivation methods are also provided. These types of additional exchanges have promoted good relationships with farmers as well as with actors down the value chain such as traders and companies where their starch is sold. Moreover, both farmers and cassava processors are keen on cooperating with the current project for building better partnerships for promoting sustainable growth.

While such partnerships between value chain actors are key in ensuring sustainable growth of the industry, there is an important role for the government to play by facilitating these relationships through various training programs and workshops and adequately monitoring such engagements. Additionally, it is also important that the government promotes an environment that facilitates innovation and productivity gains through the provision of public services (facilities), ensuring competitive markets, and maintaining quality control.

Appendices

A. List of registered cassava processors in Kyonpyaw Township

No.	Owner name	Plant Location	Village Tract	Capacity (ton/year)
1	U Moe Naing Lwin	Daw Malay Su, Kan Thon Sint	Kan Thon Sint	816
2	U Pout Sa	Kan Thon Sint	Kan Thon Sint	163
3	U Soe Lwin	Kan Thon Sint	Kan Thon Sint	490
4	U Tun Aung	Kan Thon Sint	Kan Thon Sint	816
5	U Ba Nyar Oo	Bayargyi, Lae Sait	Lae Sait	326
6	U Thar Win Nyo	Bayargyi, Lae Sait	Lae Sait	326
7	U Than Win	Bayargyi, Lae Sait	Lae Sait	816
8	U Maung Maung Win	Lae Sait	Lae Sait	163
9	U Kyaw Myint	Lae Sait	Lae Sait	816
10	U Myint Oo	Lae Sait	Lae Sait	163
11	U Kyaw Thura	Naung Pin thar, Lae Sait	Lae Sait	326
12	U Tun Tun Oo	Tha Yet Chang, Inn Ye	Inn Ye	163
13	U Sein Hla	Inn Ye	Inn Ye	326
14	U Than Lat	Inn Ye	Inn Ye	816
15	U Kyi Lin	Inn Ye	Inn Ye	326
16	U Kyaw Aung	Inn Ye	Inn Ye	163
17	U Sanay Win	Dawn Ine, Za Yit Yo	Za Yit Yo	490
18	U Than Htwe	Lae Swe, Za Yit Yo	Za Yit Yo	326
19	U Naing Hla Htut	Dawn Ine, Za Yit Yo	Za Yit Yo	163
20	U Ohn Kyaing	Tha Phan Chang	Tha Phan Chang	816
21	U Tun Nge	Thon Ine Tan, Tha Phan Chang	Tha Phan Chang	490
22	U Kyaw Soe Aye	Tha Phan Chang	Tha Phan Chang	326
23	U Nyut Win	DaeKwin, Phan Chang	Tha Phan Chang	163
24	U Tun Nge	DaeKwin, Phan Chang	Tha Phan Chang	163
25	U Myo Myint Shin	Shwe ka Nyin Pin	Shwe ka Nyin Pin	326
26	U Hla Myint	Shwe ka Nyin Pin	Shwe ka Nyin Pin	163
27	U tun Lwin	Shwe ka Nyin Pin	Shwe ka Nyin Pin	163
28	U Than Oo	Shwe ka Nyin Pin	Shwe ka Nyin Pin	163
29	Daw Khin Hla Win	Balate, Intayaw	Intayaw	163
30	Daw May Kyi	ThaHtaykon, Intayaw	Intayaw	163
31	U Man Ba Yan	Balate, Intayaw	Intayaw	326
32	U Man Joset	Intayaw	Intayaw	163
33	U Win Naing Tun	Intayaw	Intayaw	326
34	U San Myint	MyutSu, Intayaw	Intayaw	163
35	U San Nge	Kon Chan Kon, Intayaw	Intayaw	163
36	U Myo Khine	A Taung	A Taung	490

37	U Aung Than	A Taung	A Taung	490
38	U Maung Maung	A Taung	A Taung	326
39	U Tun Shwe	A Taung	A Taung	326
40	U Soe Win	A Taung	A Taung	1143
41	U Tun Nay	KayinSai	KayinSai	326
42	U Kyi Win	KayinSai	KayinSai	163
43	U Thaung Win	KyarInn, KayinSai	KayinSai	163
44	U Aung Ko	KyarInn, KayinSai	KayinSai	163
45	U Than Htay	KyarInn, KayinSai	KayinSai	326
46	U Ohn Kywe	KyarInn, KayinSai	KayinSai	163
47	U Win Soe	Keelne	Keelne	326
48	U Myo Min Thaung	Keelne	Keelne	490
49	U Thet Naing Oo	Keelne	Keelne	490
50	U Aung Tin Shan	Keelne	Keelne	1143
51	U Moe Naing Lwin	TheKon, Keelne	Keelne	163
52	U Kan Myint	TheKon, Keelne	Keelne	163
53	U Pho Sein	TheKon, Keelne	Keelne	163
54	U Myo Kyaw Thu	TheKon, Keelne	Keelne	326
55	Daw Khin Than	TheKon, Keelne	Keelne	163
56	U Aung Than Oo	TheKon, Keelne	Keelne	163
57	U Khin Thein	Yon Chang, Taung Gee	Taung Gee	490
58	U Mya Kyaing	Taung Gee	Taung Gee	326
59	U Aung Myint Soe	Balangee, TanLaeson	TanLaeson	490
60	U Sein Win	Balangee, TanLaeson	TanLaeson	490
61	U Htay Aung	Thetkae Pyin	TanLaeson	163
62	U Htet Win Hlaing	Mae Ga Yet	Mae Ga Yet	163
63	U Than Htut	Kyar Chang, Pite Taw	Pite Taw	326
64	U Tun Myint	Pite Taw	Pite Taw	326
65	U Naing Win	Kyar Chang, Pite Taw	Pite Taw	163
66	U Yu Paing Tun	Kyar Chang, Pite Taw	Pite Taw	326
67	Man A Chat	Tawgee	Tawgee	490
68	U Steven	Kon Maezale, Tawgee	Tawgee	326
69	U Chit Way	Kwin Baw, Zayut Sait	Zayut Sait	2000
70	U Win Than	Thae Kon, Zayut Sait	Zayut Sait	3265
71	U Aung Chit	Kwin Baw, Zayut Sait	Zayut Sait	1500
72	U Shwe Bo	Zayut Sait	Zayut Sait	816
73	U Myo Myint Aung	Zayut Sait	Zayut Sait	326
74	U Hlaing Than	Pha Lu Tite, Kwin Baw kwin	Kwin Baw	163
75	U Chit San Htay	Pha Lu Tite, Kwin Baw kwin	Kwin Baw	163
76	U Than Tun	ThaPyuKwin, Kwin Baw kwin	Kwin Baw	326
77	U Thar Lwin	ThaPyuKwin, Kwin Baw kwin	Kwin Baw	163
78	U Myint Kyaing	Malar Chon, Kwin Baw kwin	Kwin Baw	326

79	U Kyaw Thura	Aung San	Aung San	490
80	U Khin Win	Ke Bounng	Pin Lon	326
81	U Myint Kyaing	Htang Lon, Pin Lon	Pin Lon	816
82	U Kyaw Soe Aye	Lae Te Kon, Pin Lon	Pin Lon	163
83	U Sa Win Kyi	Taw Chang	Taw Chang	490
84	U Kyi Shain	Taw Chang	Taw Chang	816
85	U Win Aung	Chang Sout, A Su Gee	A Su Gee	490
86	U Thar Win Nyo	Chang Sout, A Su Gee	A Su Gee	326
87	Daw Htar New Oo	Sin Goung	Sin Goung	326
88	U Ohn Myint Thein	Inngalar	Nga Ge Htu	163
89	U Aye Lwin	Yay Tain, Kan Su	Kan Su	326
90	U Aung Aye	Yay Tain, Kan Su	Kan Su	163
91	U Aung Tin Shan	Yay Tain, Kan Su	Kan Su	163
92	U Lwin Myo Khine	Sin Goung, A Kwe Tan	A Kwe Tan	816
93	U Aung Myo Myint	Ywa Thit, Pyin Cha Sait	Pyin Cha Sait	490
94	U Kyi Htwe	Potpalin, Shar Khe	Shar Khe	490
95	U Than Naing	Potpalin, Shar Khe	Shar Khe	490
96	U Kyaw Naing Soe	Potpalin, Shar Khe	Shar Khe	490
97	U Thein Tun	Kying Su, Kutaw	Kutaw	326
98	U Kyin Sai	Kying Su, Kutaw	Kutaw	163
99	U Sein Than	Thazin Inn, Kutaw	Kutaw	490
100	U Nyan Maung	A Wine Nin Kome	A Wine Nin Kome	326
101	U Kyaw Win	A Wine Nin Kome	A Wine Nin Kome	163
102	U Mya San	A Wine Nin Kome	A Wine Nin Kome	326
103	U Phu Lone	A Wine Nin Kome	A Wine Nin Kome	163
104	U Maung Khine	A Wine Nin Kome	A Wine Nin Kome	163
Total				42984

B. List of registered cassava processors in Lemyethna Township

No.	Owner name	Plant Location	Village Tract	Capacity (ton/year)
1	U Khin Maung Tun	Ka Mout Su	Ka Mout Su	326
2	U Soe Than	Ka Mout Su	Ka Mout Su	326
3	U Aung win	Ka Mout Su	Ka Mout Su	326
4	U Myint Aye	Ka Mout Su	Ka Mout Su	326
5	U Kyaw naing oo	Ka Mout Su	Ka Mout Su	163
6	U Soe Myint	Ka Mout Su	Ka Mout Su	326
7	U Shwe Lwin	Ka Mout Su	Ka Mout Su	326
8	U Htay Aung	Ka Mout Su	Ka Mout Su	326
9	U Kyaw Min Oo	Ka Mout Su	Ka Mout Su	326
10	U Kyaw Yin	Ka Mout Su	Ka Mout Su	326
11	U Bo Thi	Ka Mout Su	Ka Mout Su	163
12	U Han Win Oo	Ka Mout Su	Ka Mout Su	326
13	U Myo Aung	Ka Mout Su	Ka Mout Su	490
14	U Than Htut	Ka Mout Su	Ka Mout Su	326
15	U Aung Myo Min	Ka Mout Su	Ka Mout Su	326
16	U Than Win	Ka Mout Su	Ka Mout Su	326
17	U Han Kyi	Ka Mout Su	Ka Mout Su	163
18	U Myint Ko	Ka Mout Su	Ka Mout Su	326
19	U Tin Oo	Ka Mout Su	Ka Mout Su	326
20	U Kyaw Kyaw	Ka Mout Su	Ka Mout Su	326
Total				6195

C. List of registered cassava processors in Hinthada Township

No.	Owner name	Plant Location	Village Tract	Capacity (ton/year)
1	U Tin Win	Yon Tha Lin	Yon Tha Lin	1143
2	U Than Tun	Yon Tha Lin	Yon Tha Lin	816
3	U Mya San	Yon Tha Lin	Yon Tha Lin	326
4	U Aung Naing	Yon Tha Lin	Yon Tha Lin	326
5	U Thi Ha Swe	Yon Tha Lin	Yon Tha Lin	326
6	U Kyi San	Yon Tha Lin	Yon Tha Lin	326
7	U Kyaw Kyaw	Yon Tha Lin	Yon Tha Lin	163
8	U Tin Oo	Yon Tha Lin	Yon Tha Lin	163
9	U Yon Kyut	Yon Tha Lin	Yon Tha Lin	816
10	U Aye Maung	Yon Tha Lin	Yon Tha Lin	4490
Total				8895