MINISTRY OF AGRICULTURE, LIVESTOCK AND IRRIGATION
THE REPUBLIC OF THE UNION OF MYANMAR

DATA COLLECTION SURVEY FOR FOOD VALUE CHAIN DEVELOPMENT ASSISTANCE IN THE REPUBLIC OF THE UNION OF MYANMAR

FINAL REPORT

November 2018

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
SANYU CONSULTANTS INC.(SCI)

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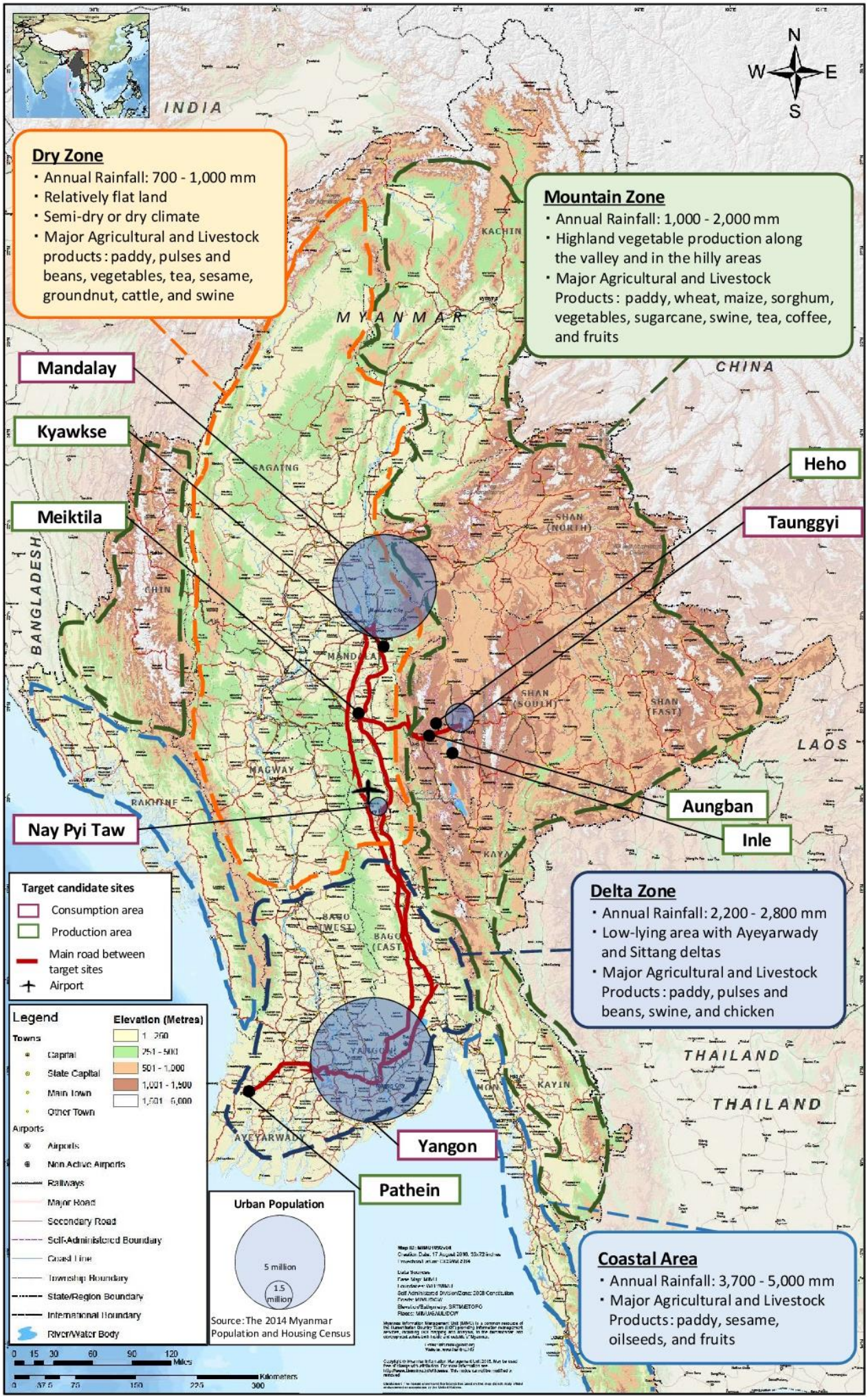
Location Map: Data Collection Survey for Development Assistance of Food Value Chain



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LIST OF ACRONYMS

AAS	Atomic Absorption Spectrometry
ADB	Asian Development Bank
ADS	Agriculture Development Strategy
AI	Artificial Insemination
AIs	Active Ingredients
AMD	Agricultural Mechanization Department
AnGR	Animal Generic Resources
ASEAN	Association of Southeast Asian Nations
ASO	Assistant Staff Officer
AVRDC	Asian Vegetable Research and Development Center
BOT	Build-Operation-Transfer
CABI	Center for Agricultural and Bioscience International
CAHW	Community Animal Health Workers
CDC	City Development Committee
CDZ	Central Dry Zone
CFF	Commercialized confined system with Formula Feed
CFU	Colony Forming Unit
CFW	Commercialized confined system with Food Waste
C.I.F	Cost Insurance and Freight
CPD	Cooperative Promotion Department (Thailand)
CTQM	Commodity Testing and Quality Management Center
DABMI	Department of Agribusiness and Market Information
DALMS	Department of Agricultural Land Management and Statistics
DAR	Department of Agricultural Research
DG	Director General
DICA	Directorate of Investment and Company Administration
DISI	Directorate of Industrial Supervision and Inspection
DOA	Department of Agriculture
DOC	Day Old Chick
DOCA	Department of Consumer Affairs
DOD	Day Old Duck
DOF	Department of Fisheries
DOP	Department of Planning
DOT	Department of Trade
DRD	Department of Rural Development
DRRD	Department of Rural Road Development
ECC	Environmental Compliance Certificate
ECD	Environmental Conservation Department
EIA	Environmental Impact Assessment
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FDA	Department Of Food and Drug Administration

FDC	Food Distribution Centers
FDI	Foreign Direct Investment
FIDSL	Food Industries Development Supporting Laboratory
FLD	Flame Lionization Detector
FMD	Foot and Mouth Disease
FPD	Flame Photometer Detector
FSC	Food Supply Chain
FSTLAP	Food Safety Testing Laboratory for Agriculture Product
FVC	Food Value Chain
GAHP	Good Animal Husbandry Practices
GAP	Good Agricultural Practice
GAqP	Good Aquaculture Practices
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GMP	Good Manufacturing Practice
GOM	Government of Myanmar
GS	Gas Chromatographer
HE	Hatching Egg
HPLC	High Performance Liquid Chromatography
HS	Harmonized System
ICT	Information and Communication Technology
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IP	Investment Plan
IPM	Integrated Pest Management
IRRI	International Rice Research Institute
ISO	International Organization for Standardization
IWUMD	Irrigation and Water Utilization Management Department
JETRO	Japan External Trade Organization
JA	.Japan Agricultural cooperatives
JICA	Japan International Cooperation Agency
KOICA	Korea International Cooperation Agency
LBVD	Livestock Breeding and Veterinary Department
LIFT	Livelihoods and Food Security Trust Fund (A Multi-Donor Financing Facility)
MADB	Myanmar Agriculture Development Bank
M&E	Monitoring and Evaluation
MAFF	Ministry of Agriculture, Forestry and Fisheries (Japan Ministry)
MCDC	Mandalay City Development Committee
MFPEA	Myanmar Food Processors and Exporters Association
MFSPEA	Myanmar Fertilizer, Seed and Pesticide Entrepreneurs Association
MFVP	Myanmar Fruit, Flower and Vegetable Producers and Exporters Association
MIC	Myanmar Investment Commission
MIL	Myanmar Investment Law

MIS	Management Information System
MITS	Myanmar Inspection & Testing Service Ltd
MLF	Myanmar Livestock Federation
MOAC	Minister of Agriculture and Cooperatives (Thailand)
MOALI	Ministry of Agriculture, Livestock and Irrigation
MOC	Ministry of Commerce
MOHS	Ministry of Health and Sports
MOI	Ministry of Industry
MONREC	Ministry of Natural Resources and Environmental Conservation
MOPF	Ministry of Planning and Finance
MRL	Maximum Residue Limit
MS	Mass Spectrometer
MSG	MonoSodium Glutamate
MT	Metric Ton
MTPO	Myanmar Trade Promotion Organization
NES	National Export Strategy
NGO	Non-Government Organization
NLD	National League for Democracy
NWP	National Water Policy
OA	Organic Agriculture
ODA	Official Development Assistance
OIE	World Organization for Animal Health
OSS	One-Stop Service
PAL	Pesticide Analytical Laboratory
PAPs	project affected persons
PHI	Pre Harvest Interval
PPD	Plant Protection Division
PPP	Public Private Partnership
PRA	Pest Risk Analysis
PROFIA	Project for Profitable Irrigated Agriculture in Western Bago Region
PSN	Person(s)
SAI	State Agriculture Institute
SDGs	Sustainable Development Goals
SMI	Small and Medium scale Industry
SNS	Social Networking Service
SPS	Sanitary and Phytosanitary
SSID	Small Scale Industries Department
TOR	Terms of Reference
TOT	Training Of Trainers
TSL	Two Step Loan
TVS	Traditional Village System of Scavenging with Supplemental Feed
UMFCCI	Union of Myanmar Federation of Chambers of Commerce and Industry
UNOPS	United Nations Office for Project Services

USAID	United States Agency for International Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
USD	United States Dollar
UV	Ultra Violet
UVS	University Of Veterinary Science
VC	Value Chain
VFRDC	Vegetables and Fruit Research and Development Centre
WSAT	Water Saving Agriculture Technology
WHO	World Health Organization Of The United Nations
YAU	Yezin Agricultural University
YCDC	Yangon City Development Committee

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WEIGHT CONVERSION

1 basket	Paddy	20.9 kg
1 basket	Wheat	32.7 kg
1 basket	Maize (seed)	24.9 kg
1 basket	Sorghum	28.1 kg
1 basket	Sesame	24.5 kg
1 basket	Mustard	26.1 kg
1 basket	Sunflower	14.5 kg
1 basket	Groundnut	11.4 kg
1 basket	Butter Bean	31.3 kg
1 basket	Sultani	31.3 kg
1 basket	Sultapya	31.3 kg
1 basket	Chick Pea	31.3 kg
1 basket	Duffin Bean	31.3 kg
1 basket	Lablab Bean	31.3 kg
1 basket	Lima bean	31.3 kg
1 basket	Pigeon Pea	32.7 kg
1 basket	Black Gram	32.7 kg
1 basket	Green Gram	32.7 kg
1 basket	Bocate	32.7 kg
1 basket	Soybean	32.7 kg
1 basket	Cowpea	32.7 kg
1 basket	Rice Bean	32.7 kg
1 basket	Garden Pea	32.7 kg
1 basket	Lentil	32.7 kg
1 basket	Krishna Mung	32.7 kg
1 basket	Other Pulses	31.7 kg

FRUITS AND VEGETABLES

Fruits are expressed by Viss and Number, while vegetables are measured by viss in Myanmar Agricultural Statistics. 1 Viss=1.633kg

CONVERSION

1 pyi	2.55718 liter
1 basket	16 pyi
1 viss	1.64 kg
1 lb (pound)	0.453 592 kg
1 inch (in.)	2.54 cm
1 feet (ft.)	30.5 cm
1 acre (ac)	0.405 ha
1 hectare (ha)	2.47 ac

EXCHANGE RATE（Jun 2018, JICA rate）

1 US$	=	108.8120 Yen
1 Kyat	=	0.080970 Yen
1 Lakh	=	100,000 Kyats

FISCAL YEAR

1st of April to 31st of March

CHAPTER 1 INTRODUCTION

1.1 Background of the Survey

In Myanmar, about 60% of the national labor force is engaged in agriculture, and the production of agriculture, forestry and fishery accounts for 29.8% of the Gross Domestic Product (GDP)[1]. However, the poverty rate in rural areas where agriculture is a major industry is 29%, which is nearly twice as high as that in urban areas. To address this problem, it will be necessary to improve agricultural productivity in rural areas. The National League for Democracy (NLD) administration, who came to power in March 2016, set employment creation and farmers' income improvement as an important policy agenda. Moreover, the NLD aims to double the agricultural income within a five-year development plan (2016 to 2020).

The Ministry of Agriculture, Livestock and Irrigation (MOALI) of Myanmar prepared the "Food Value Chain Road Map (2016 to 2020) in Myanmar" (hereinafter referred to as "Road Map") involving related ministries of Myanmar, Japanese Ministry of Agriculture, Forestry and Fisheries (MAFF), Japan International Cooperation Agency (JICA) etc. MOALI and MAFF signed the agreement in March 2017. JICA dispatched an Agricultural Policy Advisor from September 2017 to provide advice and recommendations on the development of agriculture and rural sectors in Myanmar, particularly on the establishment of a functional agricultural extension system and the implementation of an agricultural VC strategy, and to further enhance the capacity of MOALI staff who are in charge of agriculture and rural development.

In the Road Map, issues and challenges in the VC of each agricultural product are listed, which includes, i) unequal distribution of profits, especially to the farmers, ii) room for further strengthening the efforts to ensure the safety of agricultural products, and iii) food processing industry to step in to the next stage for further development. As understanding that farmers could gain an appropriate income to improve their livelihood by addressing these issues and challenges, which is in line with the five-year plan, the Road Map concluded that there is a necessity to i) analyze VCs for specific agricultural products to understand those factors which reduce farmers' profits, and identify countermeasures, and ii) examine systems and technical support which could improve the income of the farmers. The content of i) links to the Expected Outcome of the projects, mentioned in the next paragraph. Then, the content of ii) becomes the Objective of the projects.

1.2 Objective of the Survey

"Data Collection Survey for Food Value Chain Development Assistance in the Republic of the Union of Myanmar" (hereinafter referred to as "the Survey"), aims to formulate several new project plans which could strengthen the development of the food value chain (FVC) in Myanmar.

The Survey focused on i) agriculture and livestock products; ii) distribution, market demand and consumption; iii) agricultural input/material distribution: and iv) trends in agriculture and food productions. The Survey team combined the findings of the preceding survey by the MOALI with JICA which focused on horticulture crop production and market distribution, to understand the latest situation of the FVC in Myanmar. With this exercise and the strategies of the Agriculture Development Strategies (ADS[2]), potential areas that could be further developed and strengthen in the FVC in Myanmar were identified, and this could also lead to formulate tangible

[1] The data is quoted from the Ministry of National Planning and Economic Development, which is the current Ministry of Planning and Finance (MOPF), 2014

[2] Agriculture Development Strategies (ADS[2]) is explained in Chapter 2.

projects with concrete objectives and challenges for consideration while implementing the projects.

The objective and expected outcome of this Survey are as follows;

Objective: Formulate several new project plans for the development of the FVC in Myanmar.

Expected Outcome: Basic information on the FVC in Myanmar is collected and analyzed.

1.3 Area

The Survey covered parts of Myanmar agriculturally and ecologically. Myanmar is generally divided into four zones such as delta zone, dry zone, mountain zone, and coastal zone, as illustrated in Figure 1.3.1. The Survey team selected four sites as production sites and consumption sites from the area of dry zone, mountain zone and delta zone (one or two places per zone as shown in Table 1.3.1).

Table 1.3.1 Survey Sites per Zone

Zone	Production Sites	Consumption Site
Dry Zone	Surroundings of Mandalay	Mandalay
Mountain Zone	Surroundings of Taunggyi	Taunggyi
Delta Zone	Surroundings of Yangon and Pathein	Yangon and Pathein

Source: JICA Survey Team

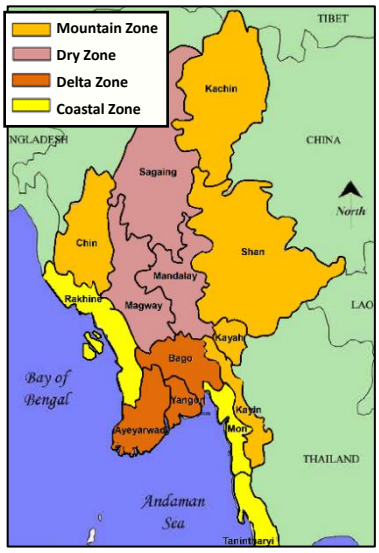


Figure 1.3.1 Agricultural and Ecological Zone of Myanmar

Source: "The Data Collection Survey in Agricultural Sector in the Republic of the Union of Myanmar" (JICA, 2013)

1.4 Relevant Agencies

The relevant agencies involved in the FVC are the MOALI, the Ministry of Planning and Finance (MOPF), Ministry of Industry (MOI), Ministry of Commerce (MOC), Ministry of Health and Sports (MOHS), Ministry of Construction, Ministry of Transportation and Communications (MOTC), the Republic of the Union of Myanmar Federation of Chambers of Commerce and Industry (UMFCCI), City Development Committee (CDC), and Myanmar Restaurant Association (MRA). The sphere of administration in the FVC is shown in Table 1.4.1.

Table 1.4.1 Relevant Agencies and Their Sphere of Administration in the FVC

Agency	Sphere of Administration in the Value Chain	Characteristics of Agency
Governmental Agencies		
MOALI	From production to retailing	Ministry, which is especially related to productions of agricultural produce, and livestock and fishery products. There are 12 departments in the MOALI, and each department supports farmers/producers including technical support to develop agriculture, livesock and fishery industries.
MOPF	The Myanmar Agricultural Development Bank (MADB): Mainly production	The MADB offers financial services to farmers
MOI	Mainly processing	Ministry, which is involved in the processing stage of the FVC
MOC	Mainly marketing	Ministry, which is especially related to consumption stage and

	and consumption	overseas trade
MOHS	The Department of Food and Drug Administration (FDA): retailing (marketing), consumption	Ministry, which is especially related to retail, marketing and consumption
Ministry of Construction	Mainly distribution	Ministry, which is involved in the distribution stage of the FVC. For example, the Ministry construct and maintain the logistics roads
MOTC	Mainly distribution	Ministry, which is involved in the distribution stage of the FVC
MOHT	Consumption, especially restaurants and hotels for the tourists	Ministry, which is involved in the consumption stage of the FVC. (restaurants and hotels)
The Other Agencies		
UMFCCI	From production to retailing	The UMFCCI is formed of 25 regional/state/border area Chambers of Commerce and Industry, 51 affiliated federations and associations, including The Myanmar Fruits, Flowers & Vegetables Producer and Exporter Association (MFVP）.
CDC	Slaughtering、retail, marketing	Each city's CDC maintains the slaughtering houses and the markets
MRA	Consumption (Restaurants)	The association is related to the consumption stage

Source: JICA Survey Team

1.5 Scope of the Survey

The scope of the survey is to understand the latest situation of FVC in Myanmar, and so the Survey included an interview survey, workshop and two kinds of surveys with questionnaires.

- Interview Survey

  The Survey team conducted an interview survey for stakeholders of the FVC (ex. Input wholesalers/retailers; agricultural producers, collectors, processors and agri-food companies; wholesalers and retailers; hotels and restaurants and so on). Furthermore, the interview with the traders in/near the border areas was carried out to recognize the situation of trading in boarder areas such as Tamu on the Indian border; Muse[3] on the Chinese border; and Myawaddy and Tachileik on the Thailand border.

- Value Chain Workshops

  The Survey team also conducted "Value Chain Workshops" for 12 crops, which were selected as major production and distribution commodities in the horticulture sector and the livestock sector. They are also potential export commodities. The objective of this workshop was to identify the main VC for the major crops. The schedule and target crops are described in following table.

[3] Due to security reason, the survey team could not have visited Muse and the interview survey was conducted in Mandalay. The local staff of the survey team visited Tachileik

Table 1.5.1 The Schedule and Target Crops of the Value Chain Workshop

Township	Date	Target Crops (No. of Participants)
Mandalay	4.5.2018	Beef (4), Milk (6), Processed Milk (6), Mango (8)
Taunggyi	15.5.2018	Carrot (5), Tomato (9), Cabbage (6), Potato (8)
Yangon	18.5.2018	Pork (3), Egg (1), Chicken (1), Maize (1)[4]

Source: JICA Survey Team

- Questionnaire Surveys

The Survey also included two kinds of surveys with questionnaires as shown in Table 1.5.2. These objectives were to identify the situation of fertilizer and pesticide utilization and the trend of agri-food business, respectively.

Table 1.5.2 The Target Area and Respondents of Questionnaire Surveys

Name of Survey	Date	Target Area	Target Respondents
Agricultural Input Survey	8.5.2018~30.5.2018	Mandalay, Taunggyi, Pathein	Farmers
Agri-Food Business Survey	8.5.2018~15.7.2018	Mandalay, Yangon	Agri-food business company

Source: JICA Survey Team

[4] The team conducted interview survey to maize farmer and wholesaler to fill out Value Chain Map of maize for livestock feed on the other day.

CHAPTER 2 POLICIES AND PLANS IN HORTICULTURE AND LIVESTOCK SECTORS

2.1 Policy, Plan, Laws and Bylaws in the Horticulture Sector

2.1.1 National Policy and Development Plan in the Horticulture Sector

This Chapter provides an overview of policies, strategies, and programs established in recent years.

A structural framework from agricultural policy to individual activities are shown in Figure 2.1.1. A long/short-term agricultural policy is formulated to address not only general issues but also some important implications for agricultural development. In line with agricultural policies, many strategies have been formulated in recent years. Many of them include potential programs/projects/activities in the sector. However, they have different approaches to specific issues, and they sometimes overlook essential components such as investment plan, monitoring and evaluation framework. To consolidate and integrate several strategies and plans, MOALI established Agriculture Development Strategies and Investment Plan (hereinafter ADS and IP) with the support of development partners.

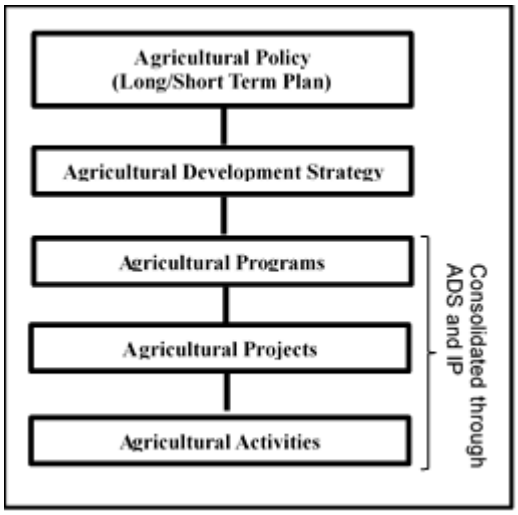


Figure 2.1.1 Framework from Policy to Activity

Source: JICA Survey Team based on ADS and IP (2018)

(1) 20-Year Development Plan in Agriculture Sector (2011/12 to 2030/31)

As a long-term national development policy the 20-Year Development Plan in the Agriculture Sector (2011/12 to 2030/31) was established in 2012, under the former government. It is one of several development policies forming the National Comprehensive Development Plan (2011/12 to 2030/31). According to the interview of the Department of Planning (DOP), there is no further long-term policy for the agricultural sector at the moment prepared by NLD regime. The vision and mission mentioned in the long-term plan are as follows;

Sustainable Agricultural Development Mission

i) To get the most of the market share at regional and global markets for important crops and agro-based, value-added products
ii) To promote the food security for rural people
iii) To increase green-growth production in conformity with natural environment

Sustainable Agricultural Development Vision

i) To keep a better competitive advantage than the developed neighboring countries
ii) To provide knowledge and technology know-how for rural people, being equal to the developed neighboring countries in ability
iii) To increase rural industrial and social infrastructures just as neighboring countries do.

(2) Agricultural Sector Policies and Thrusts for the Second Five Year Short Term Plan (2016/17 to 2020/21)

The MOALI has formulated agricultural sector policies and thrusts for the second five-year short-term plan in January 2017. The new policies and strategic thrusts superseded the agriculture policy of 2016 that aims to take advantage of the prevailing favorable conditions in the agriculture sector to satisfy the fast increasing needs of local as well as external consumers, and to create an enabling environment for agriculture, livestock, and fishery sub-sectors expand and to synergize and improve each other's performance.

The vision statement of the agriculture policy reads as follows "by 2030, Myanmar achieves inclusive, competitive, food and nutrition security, climate change resiliency, and a sustainable agricultural system contributing to the socioeconomic well-being of farmers and rural people and further development of the national economy".

According to the short-term plan, there are several goals of the Ministry;

i) To improve food security, nutritional status of food and food safety of the people
ii) To enhance agricultural diversification programs in compliance with the changing market and the prevailing agri-climatic conditions
iii) To satisfy specified quality and standard of agriculture, livestock and fishery products in the market
iv) To improve dissemination of markets and price information
v) To conduct sanitary and phytosanitary (SPS) measures to develop and to adopt Good Agriculture Practices (GAP), Good Animal Husbandry Practices (GAHP) and Good Aquaculture Practices (GAqP)
vi) To merge, crop, livestock and fishery producer groups and cooperative societies aiming at sustaining the development of the agriculture sector
vii) To develop a seed industry, and highly performing pure animal breeds and fish species, and conserve native breeds/species
viii) To develop and enhance agri-based industries, small scale industries, traditional weaving, and handicraft including 10 traditional artwork and crafts vocational education, and rural infrastructure
ix) To improve and enhance research and extension services, and human resource programs

(3) Myanmar Agriculture Development Strategy (ADS) and Investment Plan (IP)

There are many plans and strategies prepared in recent years by the Government of Myanmar (GOM) and its development partners. Given such a national environment of rapidly emerging policies, plans, and priorities, the MOALI has led the preparation of the ADS and IP for the five-year period 2018/19 to 2022/23, with the following development partners; Asian Development Bank (ADB), Food and Agriculture Organization of the United Nations (FAO), and Livelihoods and Food Security Trust Fund (LIFT).

The ADS is an integrated and shared strategic document which builds on the recently developed Agriculture Policy and aims at setting short, medium, and the long-term clear priorities. The IP defines the results to be achieved by different stakeholders and their timeline.

The ADS has three objectives corresponding to the three strategic pillars of governance, productivity, and competitiveness:

Objective1 – To enhance governance and capacity of institutions responsible for agricultural development.

Objective2 – To increase productivity and farmers' income.

Objective3 – To enhance market linkages and competitiveness.

The outcomes of three pillars include a mix of policy, institutional, and investment measures that are detailed in Table 2.1.1

Table 2.1.1 ADS Pillars, Objectives and Outcomes

Pillars		
Governance	Productivity	Competitiveness
Governance and capacity of institutions responsible for agricultural development enhanced	Productivity and farmers' Income increased	Market linkages and competitiveness improved
Outcomes		
1.1 Planning. Effective integrated planning based on participatory processes both at the union and at the state/region level.	2.1. Agricultural research - Improved research system for crop, livestock, and fisheries and improved research-extension coordination systems with participation of farmers and private sectors.	3.1. Business Environment - Improved business environment, information and investment along the agri-food supply chain.
1.2 Policy Capacity. Improved capacity for policy formulation and analysis	2.2. Agricultural extension – Transformed public-private agricultural extension system delivering improved products (crop, livestock, fisheries) and technology for adoption and adaptation, better linked to agriculture research.	3.2. Intellectual Property Rights. Protected intellectual property rights for the agricultural and food sector.
1.3 Monitoring & Evaluation (M&E). Timely and Effective Monitoring and Evaluation processes that inform a web-based Management Information System (MIS).	2.3. Education and Training - Develop (or revive) effective education and training to build "human capital" in the agricultural and food sector responding to the evolving needs of farmers and the private sector in rural areas.	3.3. Quality. Reliable quality system developed that helps farmers and food processors get higher prices for higher quality goods, incentivizing quality upgrading developed.
1.4 Statistics. Sound statistical systems for evidence based decisions.	2.4. Irrigation and water management - More responsive and reliable irrigation and drainage services and more efficient and sustainable water management systems.	3.4. Rural Development Planning - Enhanced framework for gender-equitable and participatory planning and implementation of rural development programs institutionalized.
1.5 Associations. Strong farmer and industry associations and federations. Triangular action of government, farmers and entrepreneurs, millers for agribusiness development	2.5. Crop inputs - Increased use of improved farm production inputs and technologies by crop growers	3.5. Rural Infrastructure. Rural infrastructure improves smallholder agriculture efficiency and profitability.
1.6 Land. Strengthened farmers' land rights and enhanced capacity of institutions involved in agricultural land.	2.6. Mechanization - Increased application of appropriate mechanization in the agricultural VC	3.6. VCs. Increased competitiveness and stakeholder participation in agricultural VCs engaged with prioritized commodities.

Pillars		
Governance	Productivity	Competitiveness
Governance and capacity of institutions responsible for agricultural development enhanced	Productivity and farmers' Income increased	Market linkages and competitiveness improved
Outcomes		
1.7 Coordination. MOALI capacity for ADS coordination and implementation enhanced and guided by democratically appointed, gender equitable civil society representation.	2.7. Livestock and fish -Increased use of improved livestock and fish breeding, health and husbandry service and technologies by livestock and fish producers.	3.7. Food Safety. Enhanced food quality and safety.
1.8 Food and nutrition security. Improved food and nutrition security of most	2.8. Sustainable Practices - Sustainable Farming, GAP,GAHP, GAqP, and Organic Agriculture (OA) practices are established and adopted.	3.8. Financial Services. Improved access to a range of financial services for farmers and agribusiness enterprises.
1.9 Restructuring. MOALI restructured to better integrated existing units and become more responsive to farmers enterprises, and civil society.	2.9. Resilience - Resilience of Farmers to Climate Change and Disasters improved.	3.9. Trade and Exports. Trade facilitated agri-food and agricultural products export growth

Source: ADS and IP (2018)

(4) Other Important Plans and Strategies

The remaining part of this chapter provides short briefings of some important plans and strategies.

The FVC Road Map is a consensus scope by the GOM and the Government of Japan, initiated by a high level dialogue on Agriculture, Forestry and Fisheries that was held in September 2014 in Nay Pyi Taw. The Road Map aims to be used as the guideline for the formulation of measures to be taken by the Government with the assistance of Japanese Government and other development partners including the private sector relating to investment in agriculture, livestock and fisheries development within Myanmar.

Preparation of the Road Map was a collaborative action of both the Myanmar and Japanese Governments. A working group was organized with Myanmar and Japan Government members. The MOALI and the Japanese MAFF acted as co-chairs of the working group. In addition, MOPF, MOC and MOI participated as members of working group.

The Road Map is composed of two parts; "Measures to be taken for individual products" with five sections and Horizontal measures" with eight sections. Each section consists of two subsections: "Measures to be taken" and "five-year Road Map Tables". In the reference section, "Analysis of the Actual Situation" of each sub-sector is listed. Proposed measures for horticulture crops and livestock in the Road Map are listed below.

Table 2.1.2 Medium Term Measures for Horticulture Crops

		2016	2017	2018	2019	2020
Government of Myanmar (ODA)	Development of varieties	On-going project to select vegetable varieties adopted to tropical climate conditions (Vegetables and Fruit Research and Development Centre (VFRDC), the Asian Vegetable Research and Development Center (AVRDC)) (M/J)			-	
	Seed multiplication	BOP/FS Investigation, Introduction of nurseries for medicinal plants (OJ).				
	Production	-Functional Extension System (OJ) -Protected Horticulture System (Department of Agricultural Research (DAR)) (M) -Protected Horticulture System (State Agriculture Institute (SAI) of the Netherlands, Pyimana) (D)				
	Land Management	Support to management environment such as land use (M)				
	Prost-Harvest	-Post-Harvest Technology Training Center for Horticultural Crops (Korea International Cooperation Agency (KOICA)) (D) -Post-Harvest and Processing of Horticultural Crops (Mokpo National University, Korea at Yezin Agricultural University (YAU))(D) -Postharvest Research Institute (opened in May 2018 at Yezin, KOICA) (D)				
	Scientist/Students Exchange Program	(JICA/Mokpo National University, Korea) (OJ/D)				
	Distribution	Market Study (M)				
Private Sector	Production	Construction of perilla fields (under consideration), protected cultivation of strawberries, cultivation under contract				
		Vegetable seed production and marketing				
		Cultivation crops for high-value functional foods				
	Distribution	Cold chain, low temperature for high-value functional foods (starting in 2015, services are being expanded)				
		Introduction of a modernized wholesale market (Mandalay)				
	Processing	(Foreign investment + joint venture), processing of vegetables in the Shan State (frozen vegetables, factory in Nay Pyi Taw (in operation since July 2016)				
		Introduction of facilities for high-value functional foods made from medicinal plants				

Source: FVC Road Map (2016-2020) in Myanmar

Table 2.1.3 Medium Term Measures for Livestock Sector

		2016	2017	2018	2019	2020
Government of Myanmar (ODA)	Animal feeding	Establishment of a system for the supply of high productive animal breeds through the use of Artificial Insemination(AI) techniques (supply of liquid nitrogen and frozen semen straw), training for AI, animal feeding (M)				
		Improvement of productivity of feed stock such as maize, grass and legumes (M)				

<table>
<tr><th></th><th></th><th>2016</th><th>2017</th><th>2018</th><th>2019</th><th>2020</th></tr>
<tr><td rowspan="4">Government of Myanmar (ODA)</td><td>Processing and Distribution</td><td colspan="5">-Functional Extension System (OJ)
-Protected Horticulture System (DAR) (M)
-Protected Horticulture System (the Netherlands-SAI , Pyinmana) (D)</td></tr>
<tr><td rowspan="2">Animal Health</td><td colspan="2">Strengthening the capacity of diagnosis and vaccine production for various animal disease including Foot and Mouth Disease (FMD)
Having the adequate number of veterinary officials producing vaccine at a sufficient scale to control the spread of FMD at specific areas (OJ)</td><td colspan="3">Technical Cooperation Project for Diagnostic Capacity Development (OJ)</td></tr>
<tr><td colspan="5">Strengthening the implementation of the Animal Husbandry and Animal Health Law (Management of slaughterhouses, meat quality and hygiene control) (M)</td></tr>
<tr><td rowspan="4">Private Sector</td><td rowspan="2">Animal Feeding</td><td colspan="5">Introduction of improved maize varieties, pasture grasses and legumes, extension and training for pasture development</td></tr>
<tr><td colspan="5">Vegetable seed production and marketing</td></tr>
<tr><td>Processing and Distribution</td><td colspan="5">Introduction of the cold chain, production and marketing of processed meat and milk products</td></tr>
<tr><td>Animal Health</td><td colspan="5">Cooperation with the private sector (Private veterinarians)</td></tr>
</table>

Source: FVC Road Map (2016-2020) in Myanmar

National Export Strategy (NES) was approved by the MOC in 2015, to guide the country's trade development and boost its export competitiveness. The NES provides a targeted plan for Myanmar to effectively allocate resource (financial, technical and institutional) to specific trade development priorities. The NES goals are guided by the following objectives:

i) To foster sustainable, inclusive and equitable export-led growth
ii) To ensure a consistent, predictable and transparent policy, legal and regulatory framework
iii) To develop competitive, diversified and branded exports
iv) To build modern, enabled and supportive institutions to respond to exporters' diverse needs
v) To build physical trade infrastructure

In NES, eight priority sectors are selected considering the potential to contribute to Myanmar's economic and social development, including i) beans; ii) pulses and oilseeds; iii) fisheries; iv) forestry products; v) textiles and garments; vi) rice; vii) rubber; and viii) tourism. Half of the priority sectors are related to agri-commodities: beans, pulses/oilseeds, fisheries and rice.

Other agriculture related strategies and plans have been formulated in recent years and include: i) Myanmar National Action Plan for Food and Nutrition Strategy; ii) Myanmar Climate Smart Agricultural Strategy; iii) Myanmar Rice Sector Development Strategy; iv) White Paper on Rice Bowl to Food Basket; v) White Paper on Vegetables; and vi) The 2014 National Water Policy (NWP) of Myanmar.

2.1.2 Current Laws and Bylaws in Horticulture Sector

There are several laws and bylaws in horticulture sector, as written below.

Table 2.1.4 Current Laws and Bylaws in Horticulture Sector

	Name of Law and By-Law	Year	Number
1	The Law Amending the Seed Law ・The Seed Law ・Regulations Relating to the Seed Law	2015 2011 2016	The Pyidaungsu Hluttaw Law No.5/2015 The State Peace & Development Council Law No.1/2011 Ministry of Agriculture and Irrigation No.6/2016
2	The Law Amending the Fertilizer Law ・The Fertilizer Law	2015 2002	The Pyidaungsu Hluttaw Law No.15/2015 The State Peace & Development Council Law No.7/2002
3	The Law Amending the Protection of the Farmers' Rights and Enhancement of their Benefits Law ・The Law of Protection of the Farmers' Rights and Enhancement of their Benefits	2014 2013	The Pyidaungsu Hluttaw Law No.47/2014 The Pyidaungsu Hluttaw Law No.32/2013
4	The Pesticide Law	2016	The Pyidaungsu Hluttaw Law No. 14/2016
5	The Vacant Fallow and Virgin Lands Management Law	2012	The Pyidaungsu Hluttaw Law No.10/2012
6	The Farmland Law	2012	The Pyidaungsu Hluttaw Law No.11/2012
7	The Co-operative Society Law ・The Co-operative Society Rules	1992 2013	The State Law and Order Restoration Council Law No. 9/92
8	The National Food Law	1997	The State Law and Order Restoration Council Law No. 5/97
9	The Consumer Protection Law	2014	The Pyidaungsu Hluttaw Law No.10/2014
10	Financial Institutions Law	2016	The Pyidaungsu Hluttaw Law No. 20/2016

(1) The Law Amending the Seed Law (2015)

The Law Amending the Seed Law was promulgated in February 2015. The rules to import seeds are provided additionally. The Seed Law was promulgated in January 2011. The objectives of the law are i) to assist the development of the agricultural sector by using pure seeds, ii) to make the seed business commercial and regulated, iii) to encourage seed production and seed research, and iv) to encourage cooperation for the development of the seed business.

In addition, "Regulations Relating to the Seed Law" was promulgated in February 2016. It provides introduction of new plant varieties, seed testing laboratories, seed business, regulations for license holders and so on.

(2) The Law Amending the Fertilizer Law (2015)

The Law Amending the Fertilizer Law was promulgated in March 2015. The term "Standard", and the rules of business licenses became clearly outlined. Additionally, the people dealing with fertilizer are required by the law to describe i) the import and manufacture registration certificate numbers; ii) label; iii) net weight; iv) quality assurance; v) percentage of plant nutrient contained in the product; vi) name of company and/or association, place of manufacture, date of manufactured, expiry date, and storage system; and vii) the prescription for use and cautions in the Myanmar language on the fertilizer package.

(3) The Law Amending the Protection of the Farmer Rights and Enhancement of their Benefits Law (2014)

The original law was promulgated in October, 2013. This law was amended and promulgated in November 2014, and only minor changes were made. The objectives of the law are i) to support farmers through suitable loans

and investment assistance; ii) to manage the provision of technology, input and facilitate the improvement of production; iii) to assist farmers to sell their produce at a reasonable price; iv) to protect farmers' rights to enhance their benefits; and v) to provide aid to remedy the damage caused by any natural disasters

(4) The Pesticide Law (2016)

The Pesticide Law was promulgated in January 2016. The law contains articles about the formation of a registration board, duties and powers of the registration board, an application for registration and license, their fee payment, duties and powers of officers, inspectors, registrars, and license holders. This is not only for formulating, repacking and selling pesticides, but also for retail and wholesale of pesticides, conditions for compliance by pesticide users, prohibition, offences and penalties.

(5) The Vacant Fallow and Virgin Lands Management Law (2012)

This law was promulgated in March 2012. The objectives of the law are to create job opportunities through gaining permission for implementing agriculture, livestock breeding, mining and other legal industries to exploit vacant, fallow, and virgin lands for the practical development of the national economy. It also provides rules for the formation of a central committee, a right to cultivate/utilize the land, its stipulations, administrations, security fees, land revenue, offences, penalties and so on.

(6) The Farmland Law (2012)

Farmland in Myanmar is regulated by the Farmland Law. The Farmland Law was promulgated in March 2012. The law aims to assist peasants to obtain the opportunities and rights to use permitted land from generation to generation. It also provides articles for permission and rights to use the land, formation of various levels of the body administrating farmland, duties and powers of the central administrative body, settlement of disputes of their right, indemnities, compensations, administration, offences and penalties.

According to the Law, when a person would like to start livestock production on farmland, the person is required to get permission from the administrative body concerned with farmland.

If a person needs to convert their farmland to less than or equal to 50 acres for another use, the person must apply to get permission from relevant State/Region Department of Agricultural Land Management and Statistics (DALMS) with the appropriate application form. The permission of the farmland owner with his/her signature, the target land map which includes signature and recommendation of one staff in the DALMS, and the signature of the relevant general administrator must be included in the application form. In addition, the person needs to apply to get the recommendation of the relevant State/Region's farmland administrative body.

If a person needs to convert more than 50 acres of their farmland for another use, the person must apply to get permission from the relevant state/region DALMS by submitting an application form. The permission of the farmland owner with his/her signature, the target land map which includes signature and recommendation of one staff in the DALMS, and the signature of the relevant general administrator must be included in the application form. In addition, the person needs to apply again to get permission from the central farmland administrative body.

The necessary period of time for the process to get permissions depends on the location and characteristics of the land. In general, it supposedly takes 2, 3 months for less than or equal to 50 acres and 4, 5 months for more than 50 acres.

(7) The Co-operative Society Law (1992)

This law was promulgated in December 1992. In the law, articles are provided for the basic principles and formulation of societies, memberships, duties and rights of members, cessation of membership, and finance of societies. A primary cooperative society can be formed with at least five persons. The members must be citizens of Myanmar and over 18 years old, and subscribe to the value of one share determined under the bylaw of society.

Related to the law, "The Co-operative Society Rules" was promulgated in September 2013. It stipulates rules for election, connection among primary cooperative societies, cooperative syndicates, union of cooperative syndicates and central cooperative societies, meetings, insurance and business of the societies, statistics, auditing, supervision, and so on.

(8) The National Food Law (1997)

The National Food Law, which was promulgated in 1997, is the most important law to gaining food safety. The aims of the law are i) to enable the public to consume food of genuine quality, safe to consume; ii) to prevent the public from consuming food that may cause danger or is injurious to health; iii) to systematically supervise and control production of food; and iv) to systematically control and regulate the production, import, export, storage, distribution and sale of food.

However, the new National Food Law is currently being amended with the support of the United States Agency for International Development (USAID), and will be promulgated in the near future, according to the interview survey.

(9) The Consumer Protection Law (2014)

The consumers are protected by the Consumer Protection Law, which was promulgated in 2014. The objectives are i) to protect and to assist with consumer rights claims; ii) to make the system effective; iii) to relay the appropriate information to the consumers; iv) to take action for the protection of consumers; and v) to ensure the high quality for safety, health, and satisfaction of the consumer. It contains formation, functions, and duties of the central committee, rights and duties of consumers and entrepreneurs, and ways in which they are prohibited. The target commodities are not only agriculture produce, but also general commodities.

(10) Financial Institutions Law (2016)

The banks in Myanmar follow the instructions provided by the Central Bank of Myanmar and the instructions outlined in Financial Institutions Law, which was promulgated in 2016. This law contains the articles of license, deposit, capital, audit, financial statement, e-bank, credit information, penalties and so on.

2.2 Policy, Plan, Laws and Bylaws in the Livestock Sector

2.2.1 National Policy and Development Plan in the Livestock Sector

According to the Livestock Breeding and Veterinary Department (LBVD), the livestock sector still does not have its own policy and development plan. In the Myanmar ADS and IP 2018/19 to 2022/23, there are descriptions relating to the livestock sector.

Under the pillar of "Productivity," outcome number 2.6 addresses livestock and fish with the goal to increase use of improved livestock and fish breeding, health and husbandry services and technologies by livestock and fish producers.

Firstly, in the paragraph 163 of the ADS, it (ADS) states that the ADS will systematically improve the genetic composition of livestock and fish stock, while protecting biodiversity. To realize the objective, a national strategy and action plan for Animal Genetic Resources (AnGR) will be prepared, with supporting legislation, regulations, and guidelines, ADS says. For instance, in Myanmar, since cattle have been traditionally reared for draft power and not for beef, high quality strains of beef have not been developed yet. Recently the beef market seems to be expanding nationally and internationally. Thus the genetic improvement of cattle needs to be accelerated.

Secondly, the ADS emphasizes the necessity of disease control, mentioning, "where private livestock and fish services cannot be profitably provided, the government would either subsidize their delivery (preferred option) or provide an alternative public service." The ADS refers to four points as follows:

i) To strengthen the animal and aquaculture health information system, including developing and implementing a national animal health and disease surveillance plan.
ii) To secure reliable access to vaccines both locally prepared and imported.
iii) To expand a community animal health worker program.
iv) To develop contingency planning and action for existing and emerging animal disease threats.

Thirdly, the ADS raises the issue of forage production, pointing out "the ADS will support the development of a national forage strategy and plan to 2030, which will identify the location of a new MOALI feed and forage division, guide applied research in animal nutrition and improve pasture, fodder and grazing and feeding practices." Cattle nutrition can be focused on these forage production and grazing issues. Considering not only ruminant but also monogastrics, the ADS also says, “it (ADS) will strengthen the capacity of the Feed Testing Laboratory and support the testing/registration of quality fodder and feed genetic material, its private multiplication, and its demonstration in farming systems. "

Moreover, the ADS describes the outcome on land rights in the paragraph 128, as follows:

To achieve the proposed outcome of strengthened farmers’ land rights and enhanced capacity of institutions involved in agricultural land management, several activities need to be implemented. This includes the removal of restrictions that require securing a tenure through land titling over land held by smallholders. This is achieved by:

i) the coverage of the land use categories over which the tenure can be secured can be increased by extending the narrow concept of farmlands under the Farmland law, to lands that are used for any agricultural activity. This includes aquaculture, livestock grazing, shifting cultivation with a focus on community land right, agri-forestry, rotating agriculture, and industrial crops.

This is an issue many interviewees in the Survey pointed out. Land utilization is strictly regulated by law, but this restriction seems to be hindering development of livestock production and marketing. In many cases it is regarded as illegal when someone starts livestock production and processing, including pasture cropping on land that has a different land objective, such as paddy fields. It takes a long period of time and certain procedures to

change the objective of land use. The statements in the paragraph 128 of the ADS above are trying to address the difficulties of the flexibility of land use.

2.2.2 Current Laws and Bylaws in Livestock Sector

The current law in the livestock sector is the Animal Health and Development Law, issued in 1993. The stipulated objectives in the law are listed as follows:

i) To carry out animal health and development work (Chapter III, Chapter IV)
ii) To promote livestock development (Chapter III, IV)
iii) To prevent outbreak of contagious disease in animals and to control an outbreak systematically when it occurs (Chapter VII)
iv) To inspect imported animal, animal products and animal feed (Chapter VI)
v) To issue recommendation certificates concerning animals, animal products and animal feed for export (Chapter V), and
vi) To protect animals from being ill-treated (Chapter VIII)

The objectives i) and ii) seem to be general issues related to livestock production.

As ways to implement objective i), "to carry out animal health and development work," the Law sets out the following items in Chapter III.

- Disseminating technical know-how to those desiring to raise animals by using modern technology
- Carrying out works for obtaining improved breeds of animals suitable for Myanmar;
- Supervising importation of improved breeds of animals
- Carrying out research on vaccines that protect animals from contagious diseases, and producing the vaccines
- Carrying out research on utilizing natural vegetation crops in the country for use as animal feed
- Inspecting imported animal products and animal feed to ensure a standard quality is maintained, and to check for the presence of harmful pathogens or toxins.

The role of government defined in the Law can be summarized as: i) livestock production technology dissemination in general; ii) animal breed development; iii) animal feed quality control; iv) disease control; and v) the inspection of import and export of animal related products.

The GOM is now discussing the draft bill of the new livestock related law, which is a revision of the current one. The draft bill is titled "The Animal Health and Livestock Production Development Law." While present law is focused on breeding and disease control as well as import and export inspection, the new law emphasizes the governmental support function on production as indicated in the title.

The objectives of the new law are as follows:

i) To develop the animal health and livestock enterprises, animal health services, production of standard quality animal feed, animal medicine and animal utensil production enterprise, research and educative measures.
ii) To produce nutritious, high-quality, safe and edible animals and animal products to adequately meet domestic food needs and exports
iii) To cooperate with relevant government departments and organizations to protect and maintain animal

genetic sources and to gain good animal breeds

iv) To implement prevention, and offer research and systematic counter control measures relating to animal infectious diseases when outbreaks occurs

v) To connect services on livestock breeding, production, distribution and sales of animals and animal products.

vi) To support the necessary finance, and technical know-how to carry out systematic livestock land, livestock farm and market development of the animal livestock production industry.

The objective ii) declares the production of good quality animal products both for domestic use and export markets. The objective v) is a totally new stipulation on the whole VC, i.e. not only production but also distribution and sales.

Another characteristic of the draft bill is to form the Central Committee consisting not only of the MOALI, but also other related Ministries and organizations including those from the private sector. For instance, the draft bill appoints the Department of Food and Drug Administration (FDA) under the MOHS, as members. The bill describes one of the functions of the Committee as "coordination with relevant government departments and organizations to gain markets for safe and standard quality animals and animal products." Or the Representative from the Myanmar League of Livestock Enterprise is appointed as a member, and their duty is defined as "coordination with relevant government departments and organizations to set suitable prices for people regarding meat products and sales service."

Although the draft might be changed during discussion process, the bill seems to intend to expand the governmental duties in the livestock sector from just breeding and disease control with import-export inspections to the overall facilitation of developing whole VC of livestock sector, i.e. production, distribution and marketing. It seems to include animal product quality control not only for importation and exportation but also in domestic markets. These directions coincide with the emphasis placed in the Myanmar ADS and IP 2018/19 to 2022/23 as discussed in section 2.2.

2.3 Economic Policy and Tax System Related to the FVC

2.3.1 Government Support System Related to the FVC

(1) Government Support for farmers

There are many support systems available to farmers under the MOALI. For example, the Irrigation and Water Utilization Management Department (IWUMD) provides water to certain farmers by constructing and maintaining the irrigation system. The Department of Agriculture (DOA) organizes training in agricultural technologies and cultural practices such as Integrated Pest Management (IPM) and GAP, and produces and sells good quality seed varieties for selected crops, especially rice.

The Agriculture Mechanization Department (AMD) implements a tilling and harvesting service for a price upon request from their farmer clientele. The AMD also sells certain agricultural machinery. On the other hand, the rental service of agricultural machinery is increasingly provided by the private sector. Thus, in the near future, the role of the AMD will be shifted to fixing and mainating the machinery and to check the functions of imported agricultural machinery. The agricultural machinery testing center will be built with JICA support. The LBVD

provides vaccinations and AI service.

Regarding government subsidies, the government previously supported farmers by selling agricultural inputs at lower prices than the market price, until its abolishment in 2005/06. As such, it could be regarded as a kind of government subsidy to farmers. Aside from this, the MOALI has not supported farmers through subsidization. However, the MOALI strategically supports the farmers to ensure their profitability through setting the minimum selling price of rice for 2018.

Regarding agricultural loans, the Myanmar Agricultural Development Bank (MADB), a government-affiliated financial institution under the MOPF, has provisioned various loans for farmers by following the MADB Law. One is a seasonal loan for different cultivation seasons i.e pre-monsoon, monsoon, and winter season. The target farmers are small-scale farmers whose land is 1-10 acres in size. The maximum loan is 150,000 kyats/season/acre for rice, and the loan for the other crops is 50,000 kyats/season/acre. The interest rate is 8%/year (0.6%/month)[5].

The MADB provides another type of loan, "Two-Step Loan" (TSL) starting from the 2017 fiscal year with financial assistance of the JICA. This aims to improve the accessibility of loans for medium to long-term financing purposes, not only for farmers and farmer's groups, but also for agribusiness companies. The terms and conditions of the loans to farmers under TSL are as follows:

i) Types of investment to be financed: purchasing of farming machinery, capital investments for Agri-related business (e.g. agricultural machinery, food processing machines, and warehouses).
ii) Maximum financing:
Farmer, whose farmland is less than or equal to 50acres: 50 million kyats
Group[6]: 500 million kyats
iii) Approval authority for each sub-loan: Loan Department of the MADB
iv) Currency: Myanmar Kyat (MMK)
v) Interest rates: 8.0% per annum
vi) Repayment schedule: Principal repayment is annual, but interest payment is twice a year
vii) Collateral and guarantor: Saving deposit (amounting to 30% of sub-loan amount), land usage right (issued by the MOALI-DALMS (Department of Agriculture Land Management and Statistics), purchased asset, two guarantors, fixed assets (if credibility of end-borrowers is not enough)
viii) Appraisal period: Typically 3-6 weeks from the date of application submission (it depends on application quality)
ix) Regions: Nationwide
x) Refund period:1-5 years

2.3.2 Rules and Regulations for Import/Export

The GOM is currently liberalizing requirements for obtaining an import/export license, which are precondition for importing or exporting any goods. However, 4,405 tariff items still require an import licenses (out of 9,558 tariff items at the 8-digit level of Harmonized System (HS) Code and an additional 418 items at the 10-digit

[5] From 2018, the farmers do not have to deposit in advance, but need to deposit 1% when they refund.
[6] 3-10 persons are required to form a group, and the maximum cultivation area is 50 acres/person. However, it is also permitted to include only one person whose cultivation is over 50 acres as well as business people who do not hold theirr own farmland, in a group.

level). Export licenses are issued based upon the recommendations by relevant ministries, agencies and business associations. For example;

i) Agricultural seeds – The DOA
ii) Teak scantlings and forest products – The Forest Department
iii) Shrimp bran (prawn shell dust), fish bran – The LBVD
iv) Animals, animal products and animals feed – The LBVD
v) Materials related to food and drugs – The FDA
vi) Seeds and vegetable roots – The DOA

The supervising departments are shown as following Table 2.3.1.

(1) The Plant Protection Division (PPD)

The PPD is in charge of importation/exportation of plants and plant processing products. Importers should send necessary documents, attachments and samples to the PPD. The PPD analyzes the sample in the PPD laboratory. If harmful insects are found, it will be rejected, otherwise an import license will be issued. In almost the same process that applies to exportation, if samples pass laboratory analysis, an SPS certificate will be obtained.

(2) The Livestock Breeding and Veterinary Department (LBVD)

For livestock products, a recommendation letter from Director General (DG) of the LBVD is necessary. Importers should submit necessary documents, their attachments, and samples for analysis to the LBVD. After document inspection and sample analysis, the importers will be notified of the result. If there are no problems with the result, then a recommendation letter will be issued.

Similarly, the exporter should also submit application documents and samples to the LBVD. If the submitted documents passed investigation procedures, the LBVD will issue a recommendation letter.

(3) The Department of Food and Drug Administration (FDA)

For all processed foods, importers shall obtain a recommendation letter from the FDA to receive an import license. It will be issued based on inspection results that check submitted application documents, other necessary attachments, and samples. Issuance procedures of export licenses are almost the same as the import procedures.

Table 2.3.1 Necessary Documents for Import/Export Permissions and its Supervising Ministries

Items	Import		Export		Supervising Ministry
	Recommendation Letters	Certificates	Recommendation Letters	Certificates	
Processed Food	Import Recommendation	Result Certificate	Export Recommendation	Sanitary and Phytosanitary Requirements Certificate	FDA
Animal, Processed Animal, Feeds, Drags for animals	Recommendation Letter	Health Certificate	n.a	Health Certificate	LBVD
Plant and Processed Plant	Import Certificate	Result Certificate	Approval Letter	Phytosanitary Certificate	PPD

Source: Daiwa Research Institute, 2016

2.3.3 Tax System Related to Agriculture Sector

The GOM has several tax systems related to the agriculture sector as listed below;

(1) Corporate Income Tax

An enterprise established under the Myanmar Companies Act, an entity established under the Myanmar Investment Law (MIL) and a registered branch of a foreign entity that enjoys incentives under the MIL are subject to an income tax of 25 %.

(2) Commercial Tax

The commercial tax rate is 5% for ordinary goods. The tax exemption rule is applied for specific goods. For example, commercial tax does not apply to fertilizers, pesticides/fungicides, agri-materials/machinery (including spare parts), feeds for livestock/fisheries, and livestock for breeding.

(3) Export Tax and Tariff

At present, export tax is imposed only on a few commodities (i.e. petroleum crude, natural gas, jade and other precious stone, teak log and teak conversion; and hardwood logs and hardwood conversion). Customs currently collects 2% in advance as income tax on exports.

Myanmar has relaxed many import restrictions, including the abolishment of import taxes from 2011 to 2015.The rate of duty payable on goods imported into Myanmar varies according to the commodity and the country of origin. Commodities are classified using the 8-digit HS Code. The Myanmar tariff rates are updated every five years, and the latest ongoing tariff rate is listed on Customs Tariff of Myanmar (2017) at rates ranging from 0% to 40%.

The import duty is levied on the tax base, assessable value, which is the sum of the Cost Insurance and Freight (C.l.F) value and landing charges of 0.5% of the C.I.F. value. These taxes are collected at the point of entry and the time of clearance.

(4) Agricultural Land Tax

In line with the Virgin, Fallow and Vacant Lands Management Law, the land tax value is 8.5 USD per ha for perennial crops and aquaculture; 5.7 USD per ha for horticulture crops; and 2.8 USD per ha for seasonal crops and livestock.

(5) Water Tax and Embankment Tax

Water Tax and Embankment Tax Law was updated in May 2017. For the areas that will benefit from the irrigation system constructed and maintained by the state water tax is as follow:

i) If it is fully irrigated from land preparation to the heading stage in paddy cultivation areas, the water tax is 2,000 kyats/acre/season.
ii) For any other crops except paddies, the water tax for use in irrigation water for crop cultivation is 1,000 kyats/acre/season.
iii) In the paddy cultivation areas, if it is irrigated only for land preparation (or) transplanting (or) seeding (or) reproduction (or) heading (or) partial irrigation, the water tax is the same as the other crops at the rate of 1,000 kyats/acre/season.

iv) For areas that will benefit by being protected from floods by the embankments and drainages constructed under the Embankment Tax Law, it will be 500 kyats/acre/season.

2.3.4 Rules and Regulations for Foreign Investment

(1) Myanmar Investment Law (MIL)

The Myanmar Investment Law (MIL) was enacted in October 2016. It consolidates and replaces the previous Foreign Investment Law of 2012 and the Citizens Investment Law of 2013. This MIL provides the overall legal framework and was followed by the more detailed Myanmar Investment Rules 2017 enacted on the 30th of March 2017.

The Myanmar Investment Commission (MIC) is responsible for verifying and approving investment proposals and regularly issues notifications. The MIC is a government-appointed body that comes under the MOPF, being composed of representatives and experts from government ministries, department and governmental and nongovernmental bodies. Regarding company registration for local and foreign issues under the Myanmar Companies Law, the Directorate of Investment and Company Administration (DICA) under the MOPF is in charge of handling such procedures. The DICA also has a function as the secretariat of the MIC[7].

There are two types of processes to obtain approval from the MIC, namely, the permission application process and the endorsement application process. A potential investor must submit a proposal to the MIC for a permit for certain types of important businesses[8]. Investors who would like to enjoy land use rights and other exemptions and relief such as customs fee duty and income tax exemptions are required to submit a proposal for a permit or application for endorsement.

Hereinafter, recent important notification are reviewed;

i) MOC (Ministry of Commerce) notification No.36/2017 was enacted on the12th of June 2017. The notification confirmed that foreign companies are allowed to trade in fertilizer, seeds, pesticides, hospital equipment and construction materials.

ii) MOC notification No.55/2017 was enacted on the 17th of November 2017. Since enactment of the notification, foreign joint venture companies are allowed to import and sell (trade) agricultural machines listed in the notification.

iii) MOC notification No.25/2018 was enacted on the 9th of May 2018. After enactment of the notification, any fully Myanmar citizen-owned company, any fully foreigner owned company, or any joint venture company are allowed to operate domestic retail and wholesale business by complying and performing according to the terms and condition attached in the notification.

iv) MIC (The Myanmar Investment Commission) Notification No. 13/2017 enacted on the 1st of April 2017, which describes 20 sectors and their 122 sub-sectors as promoted sectors, which can enjoy the taxation

[7] Note that there is Japan desk in DICA with full-time Japanese advisers since March 2014. The advisors provide consultancy services to Japanese private companies which are willing to start business in Myanmar.

[8] The types of business are following; (a) investment business aligned to Myanmar' strategy, (b) large capital intensive investment projects, (c) projects which are likely to have a large impact on the environment and the local community, (d) investment businesses which use state-owned land and buildings, and (e) investment businesses which are designated by the government to require the submission of a proposal to the MIC

incentives as income tax exemptions upon the investor's application (See Myanmar Investment Law 77 i) – iv))[9].

v) MIC Notification No.15/2017 enacted on the 10th April 2017 describes the list of restricted investment activities. Restricted Investment Activities are classified into four categories; (a) Investment activities allowed to be carried out only by the Union (9 types of investment businesses); (b) Investment activities that are not allowed to be carried out by foreign investor (12 types of investment businesses); (c) Investment activities allowed only in the form of a joint venture with any citizen owned entity or any Myanmar citizen (22 types of investment businesses); and (d) Investment activities to be carried out with the approval of the relevant ministries (126 types of investment businesses). Activities related agriculture sectors are classified as followed;

Table 2.3.2 The list of restricted investment activities under MIC notification No.15/2017

S/N[1)]	Import		
	Type of Investment Business	Restriction	Industrial Code
(a) Investment activities allowed to be carried out only by the Union			
7	Management of natural forest and forest area except the business relating to reduction of carbon emission	-	CPC 7221/72212
(b) Investment activities that are not allowed to be carried out by foreign investor			
2	Fresh water fisheries and relevant services	-	ISIC 0312, CPC 0421, 8615
3	Establishment of quarantine station for exportation and importation of animals (Livestock Breeding and Veterinary Department shall undertake to inspect animals and to issue permits)	-	CPC 8352, 8359, 8612
5	Manufacturing of forest products from forest area and government administered natural forest	-	ISIC 0220, 0230
(c) Investment activities allowed only in the form of a joint venture with any citizen owned entity or any Myanmar citizen			
1	Construction for Fish Landing Site/Fishing Harbor and Fish Auction Market	This shall be carried out in accord with the law, procedure, directive and regulation of the Fishery Department	ISIC 5210
2	Research Activities related with fishery	This shall be carried out in accord with the law, procedure, directive and regulation of the Fishery Department	CPC 8114
3	Veterinary clinic	This shall be carried out in accord with the law, procedure, directive and regulation of the Livestock Breeding and Veterinary Department	CPC 8351, 8352, 8559
4	Cultivation of crops in agriculture land,	-	ISIC 011/0111,

[9] Note that Agriculture and its related service (except the cultivation and production of tobacco) with its subordinated 30 sub-sectors listed at the top of the list. In 2016/17 fiscal years, investment inflows equaled 6.8 billion USD, of which less than 1% was channeled to agriculture. It is expected that it stimulates foreign investment in the agriculture sector by prioritizing them.

S/N[1)]	Import		
	Type of Investment Business	Restriction	Industrial Code
	distribution them to the local market and exporting them		0112, 4631, 46312, 4759, 47593
11	Value added manufacturing and domestic distribution of cereal products such as biscuits, wafers, all kinds of noodles and vermicelli.	-	ISIC 1074m 46312, 4759, 47593
	Manufacturing and domestic distribution of all kinds of confectionery including those of sweet, cocoa and chocolate.	-	ISIC 1075, 46312, 4759, 47593
	Manufacturing, preserving, canning, processing and domestic distribution of food products except milk and dairy products.	-	ISIC 1075, 46312, 4759, 47593
	Manufacturing and domestic distribution of malt and malt liquor and non-aerated products.	-	ISIC 1103, 46312, 4759, 47593
	Manufacturing, distilling, blending, rectifying, bottling, and domestic distribution of all kinds of spirits, alcohol, alcoholic beverages and non-alcoholic beverages.	-	ISIC 1101, 1102, 46312, 4759, 47593
	Manufacturing and domestic distribution of all kinds of purified ice.	-	ISIC 1079, 46312, 4759, 47593
	Manufacturing and distribution of purified drinking water.	-	ISIC 1105
(d) Investment activities to be carried out with the approval of the relevant ministries			
3. Investment activities to obtain the approval of the Ministry of Agriculture, Livestock and Irrigation			
1	Investment relation to fisheries resources and fish species	-	ISIC 03
2	Marine fishing	-	ISIC 0311
3	Manufacturing and distribution of veterinary biological products	This shall be carried out in accord with the law, procedure, directive and regulation of the Livestock Breeding and Veterinary Department	ISIC 2100
4	Manufacturing and distribution of veterinary medicines	Ditto	ISIC 2100
5	Commercial Livestock Farming	Ditto	ISIC 014/0141, 0142, 0143, 0144, 0145, 0146
6	Breeder farm and hatchery (poultry)	Ditto	ISIC 0146
7	Genetic research genetic conservation and distribution of animal breeds	Ditto	ISIC 014, 0162 (01620), 7500
8	Importation, production and marketing of the animal breeds (breeding animals, frozen semen straw and embryos)	Ditto	ISIC 014, 0162
9	Laboratory Services for the safety of animal feeds and animal products	Ditto	CPC 8112 (81121), 8351, 83520
10	Laboratory services for the animal disease diagnosis	Ditto	CPC 8351, 83520
11	Services on research and surveillance for animal health	Ditto	CPC 8351, 8352

S/N[1)]	Import		
	Type of Investment Business	Restriction	Industrial Code
12	Importing, production, domestic marketing and re-exporting of seed	-	ISIC 0164, 46312, 4759, 47593
13	Importing, production and distribution of varieties of plant	-	ISIC 0130, 46312, 4759, 47593
14	Manufacturing, storage, distribution and exporting of agricultural pesticide, fertilizer, hormone, etc.	-	ISIC 2021, 2012, 46312, 4759, 47593
14	Production and exporting of hybrid seeds	-	ISIC 0164
16	Laboratory services for agriculture	-	CPC 0161
17	Research on agriculture and agricultural products	-	CPC 8114
18	Production of seasonal crops	-	ISIC 01/011
5. Investment activities to obtain the approval of Ministry of Natural Resources and Environmental Conservation			
1	Extraction of wood in forest land and forest covered land at the disposal of the government	-	ISIC 0220
2	Establishment of forest plantations for the production purpose in forest lands (reserve forests and protected public forest) with long term leases	-	ISIC 02101, 02102
3	Wood-based industries and related services (Restriction-must establish the forest plantations)	-	ISIC 02101, 02012, 16
4	Ecotourism	-	ISIC 701, CPC 855
5	Import, multiplication and sale genetically modified organism and living modified organism	-	ISIC 0164
6	High technology research and business related to breeding, culture and production of genetically superior quality seeds, propagules, tissues etc., of valuable and rare flora species	-	ISIC 7210
7	Development of high technology, research and human resources in forestry sector	-	ISIC 024, 7210, CPC, 7210, CPC, 8140
8. Investment activities to obtain the approval of Ministry of Natural Resources and Environmental Conservation			
1	Retailing Services	-	CPC 62
2	Wholesale Services	-	CPC 61

Source: MIC Notification No.15/2017

1): Serial numbers are in line with the notification.

(2) New Company Law[10]

The major revised contents of the new Company Law, which was promulgated in December 2017 and enforced

[10] This part is quoted from "New Corporation Law is enacted. Expectation of foreign capital advance in Myanmar" on August 6th, 2018, Short Business News, JETRO https://www.jetro.go.jp/biznews/2018/08/826fb60b934ce4e5.html

on August 1st, 2018, are as follows:

i) Enterprises whose foreign capital ratio is 35% or less are considered as Myanmar enterprises/domestic capital enterprises.
ii) A Minimum one stock of a company is allowed to be issued.
iii) Shares with a face value and authorized capital are repealed.
iv) There must be one or more members on board of directors. A minimum of one member has to be a resident Myanmar who stays there for 183 days or more in a year.
v) Statutes of a company have to be prepared.
vi) When a branch office of a foreign company operates a business in Myanmar, the company has to register the branch office/business based on the New Company Law.
vii) Company registration is conducted through the on-line system of the DICA.

An overseas affiliated company established in Mynmar under the old company law has to reregister the business within six months after the required date as established under the new Company Law; in other words, it is required to be reregistered until the end of January 2019. Though a company whose foreign capital ratio is 35% or less is regarded as a domestic capital company under the new Company Law, it is necessary to confirm with the relevant authorities whether a foreign capital company can run a regulated business.

Since the investment environment is steadily prepared in Myanmar through the application of the new Investment Law in April 2017 and the enforcement of the new company law in August 2018, it is expected that the preparations would bring greater foreign capital into Myanmar.

CHAPTER 3 ADMINISTRATIVE ORGANIZATIONS IN THE HORTICULTURE AND LIVESTOCK SECTORS

3.1 Organizations Related to Horticulture and Livestock Sectors

3.1.1 Ministry of Agriculture, Livestock and Irrigation (MOALI)

The MOALI includes both the horticulture and livestock sectors. According to the ADS, the MOALI consists of twelve departments; the DOP, DOA, IWUMD, DALMS, AMD, DAR, LBVD, Department of Fisheries (DOF), Department of Rural Development (DRD), Department of Cooperatives, Small Scale Industries Department (SSID) and Department of Agribusiness and Market Information (DABMI)[11], and two Universities: YAU and University of Veterinary Science (UVS) (2018).

The DOP, DOA and LBVD are key departments in implementing proposed projects through the Survey, and to the development of the FVC in Myanmar. At the beginning of the project promotion stage, the DOP shall play an important role in harmonizing several related departments and conducting task allocation for the project. The DOA shall be in charge of improving horticulture produce, GAP, the extension service to farmers and so on. The LBVD will mainly be in charge of livestock products, including the introduction of a Livestock Breeding and Research Center.

Other than the main departments in the FVC mentioned above, the Department of Cooperatives and the new department DABMI will also play a part in the development of the FVC in Myanmar. Regarding cooperative activities involved in the proposed project, the Department of Cooperatives will play an important role. The DABMI may also play an important role collecting market information and statistic information, and to consider potential financial support. However, at this moment more detailed information of the DABMI is not yet available.

The organizational charts of the DOP, DOA, LBVD and Department of Cooperatives are shown respectively in the following figures.

Under the DOP, there are seven different divisions. Although the discussion of any proposed projects may start with the “Policy and Planning Division”, other divisions will also be involved, such as “Cooperative Division”, “Livestock, Fishery and Rural Development Division”, and “Project Monitoring and Evaluation Division”.

Under the DOA, there are mainly four different sections: the extension for industrial crops, administration/planning/accounting, technology and Region/State. Of note, it may be necessary to discuss with and to gain advice from each appropriate division for activities of potential project related to the improvement of the horticulture VC.

The LBVD consists of three main groups: “administration”, “research and health”, and “livestock resources development”. Except for the administration group, the two other groups seem to be related to proposed potential projects. It will be necessary to have a discussion with the LBVD before proceeding with the appropriate activities of any potential projects.

[11] The DABMI has not yet organized (as of July 2018), and so detailed information of the DABMI is not yet available.

The Department of Cooperatives has three main roles: organizing, educating and regulating cooperative society. Therefore, the major activities of the Department of Cooperatives are to establish the Agri-Support Service Cooperative Society and to organize the Cooperative Societies. Additionally, establishment of farmers' cooperatives has been an important activity of the Department of Cooperatives. Currently, the microfinance business has become a main task of the Department of Cooperatives.

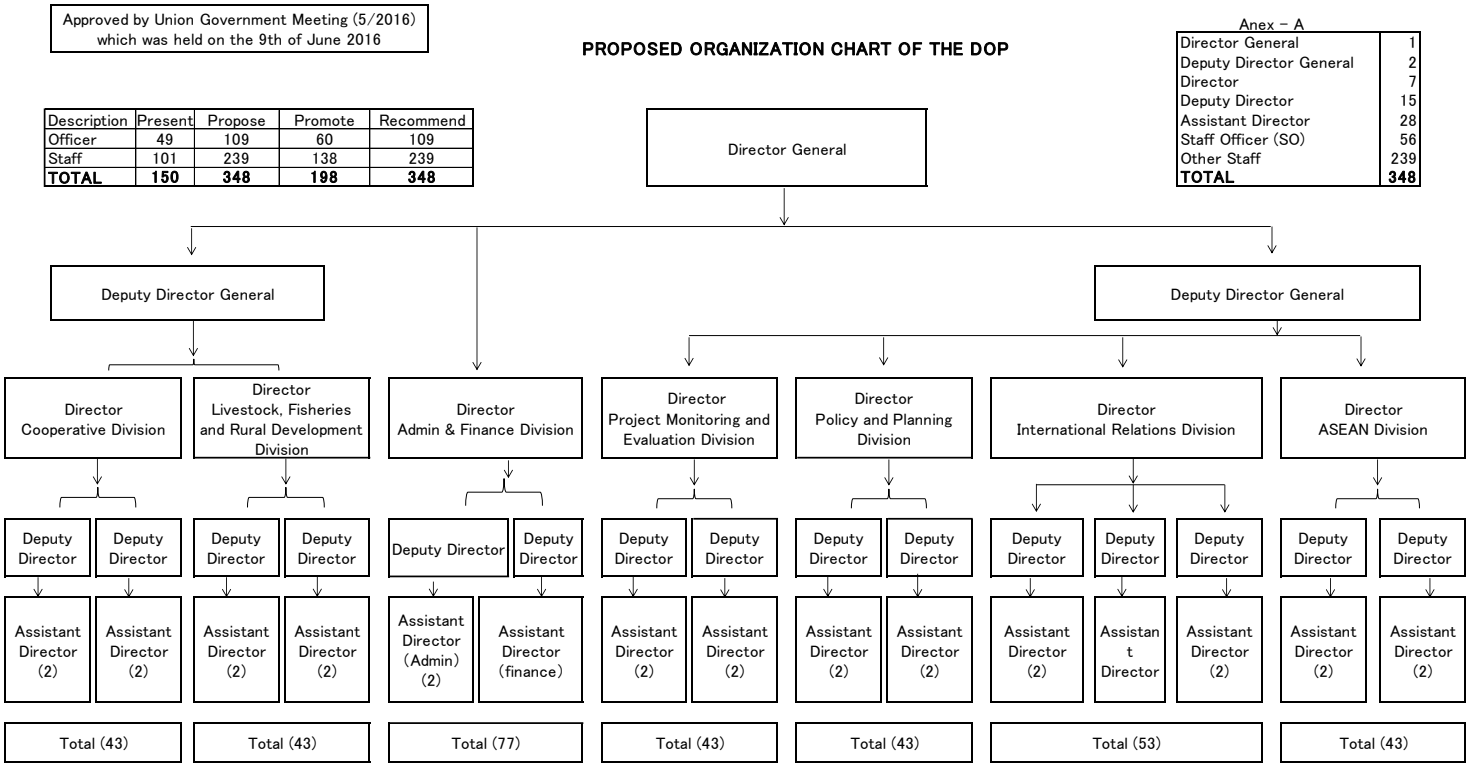


Figure 3.1.1 Organizational Chart of the DOP
Source: The DOP, 2018

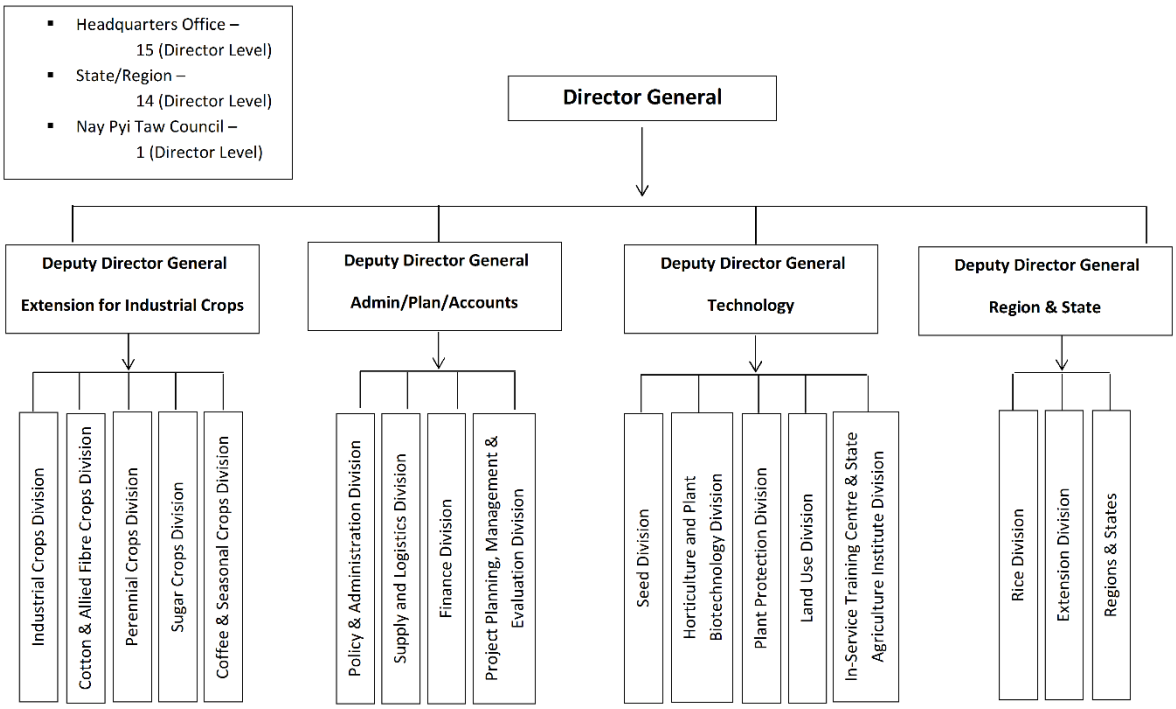


Figure 3.1.2 Organizational Chart of the DOA

Source:The DOA, 2015

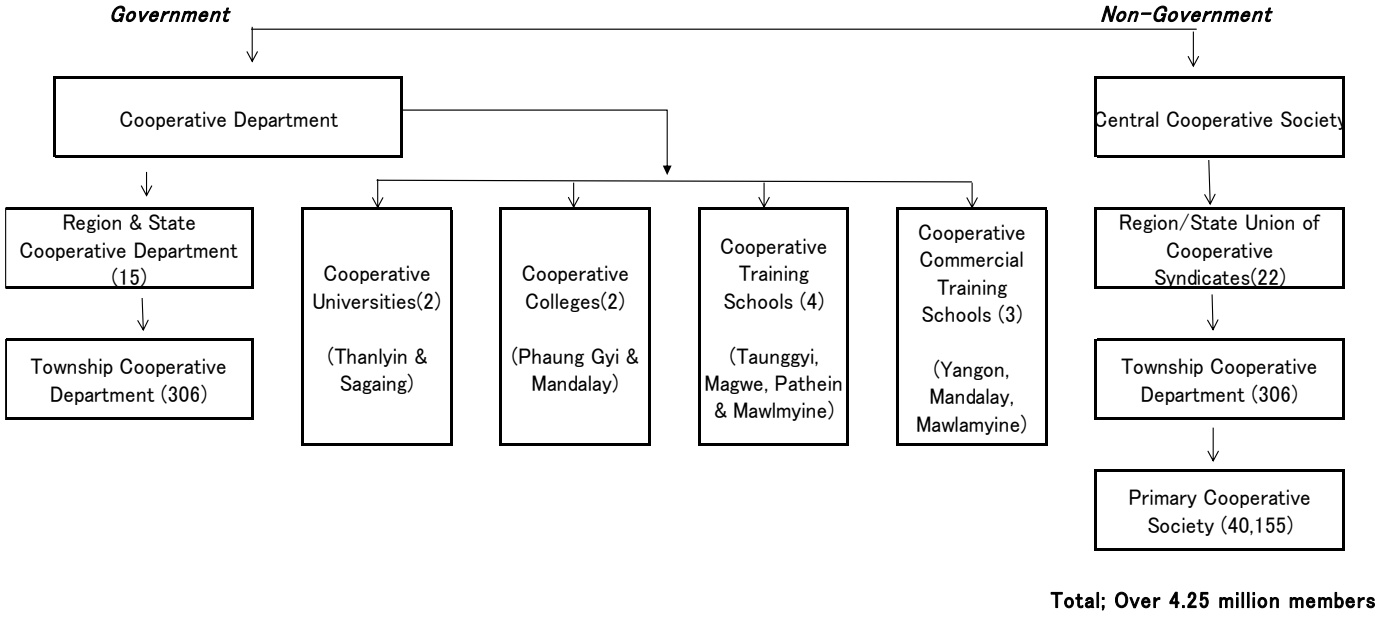


Figure 3.1.3 Organizational Chart of the Department of Cooperatives

Source:The Department of Cooperatives, 2018

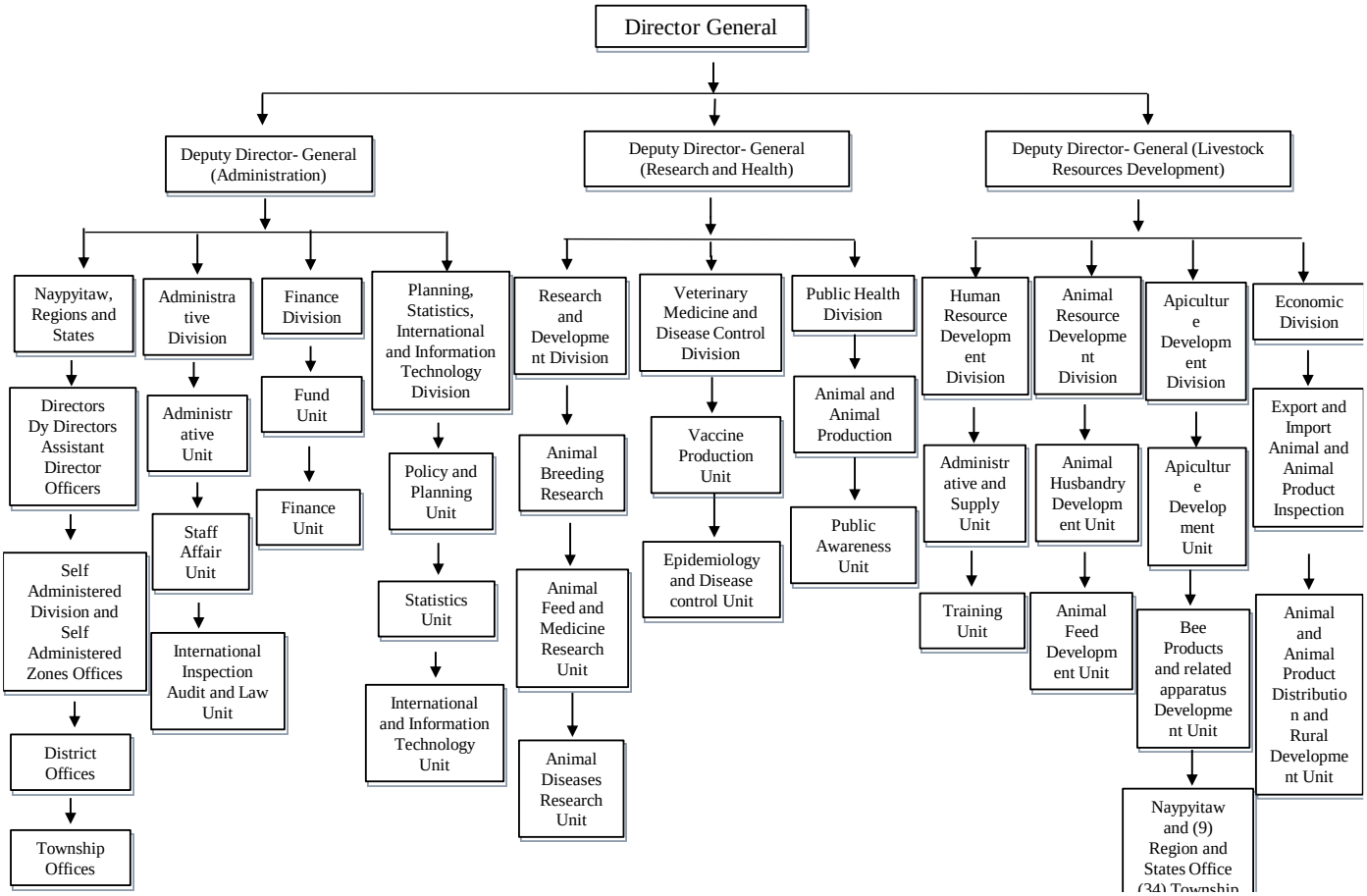


Figure 3.1.4 Organizational Chart of the LBVD

Source: The LBVD, 2018

3.1.2 Other Ministries Related to the Development of the FVC in Myanmar

Other than the MOALI, there are several ministries related to the FVC development, such as the MOC for export products, MOI for private agri-food companies, the FDA under MOHS for food safety, Ministry of Construction for road improvement relating to logistics, the MADB of MOPF for financial support, the MOHT for the services and meals offered to visitors, and the MOTC for planning and registration of transportation.

(1) The Ministry of Commerce (MOC)

There are three divisions in the MOC: the Department of Trade (DOT), Department of Consumer Affairs (DOCA), and the Myanmar Trade Promotion Organization (MTPO). Specifically, the MTPO is not one of the official departments of the MOC. However, the MTPO comes under the MOC, and the manager of MTPO is taken as the Director General of the MTPO. Consequently, the MTPO is frequently treated as one of the departments.

In terms of international trade, the DOT acts as a third-party of trading, and promotes international trade with appropriate prices set for buyers and sellers. The DOT also places regulations on any existing bank accounts related to gamblers and drug dealers, and provides a One-Stop Service (OSS) at trade zones in border areas. The DOCA monitors if the labels and descriptions on commodities are appropriate or not, and provides awareness

workshops of such labeling to private companies. The MTPO is in charge of international marketing, holds any exhibitions and provides SPS workshops to traders and middlemen. The workshops are supported by the MOALI and International Trade Center.

(2) Ministry of Industry (MOI)

The MOI is in charge of the food safety of processing companies; all food processing companies must be registered with the MOI. On the other hand, food retailers must be registered with each city's development committees and the committees are in charge of food safety of food retailers.

(3) The Department of Food and Drug Administration (FDA) under Ministry of Health and Sports (MOHS)

The FDA has 12 State/regional offices and 24 district offices. There are a total of 1,200 staffs, and around 200 – 300 analysis technicians under the FDA.

Based on the National Food Law (1997), the FDA has been in charge of analyzing processed foods for food safety, while the PPD has been in charge of fresh produce such as horticultural produce. However, based on the new National Food Law, which the USAID is helping to formulate, not only the PPD but also the FDA will analyze fresh produce for food safety.

The capacity of food test at the FDA's laboratory has been improved with the aid of the European Union (EU) and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). At the laboratory, several items can be analyzed such as Salmonella and Coliform, aflatoxin, heavy metals, fatty acid, food coloring, formalin, and antibacterial agents. To develop the laboratory capacity to analyze pesticide residue, specific equipment has already been prepared. However, Maximum Residue Limits (MRLs) is not yet determined in Myanmar.

Post marketing surveillance is carried out at randomly chosen markets and supermarkets. In particular, food coloring, formalin and expiry dates are checked.

(4) The Ministry of Construction

The Ministry of Construction is in charge of the improvement of roads for logistical purposes. For example, the Department of Highways is in charge of the highways, including both the new and old highways from Yangon to Mandalay. Those highways are repaired and managed by a type of Private and Public Partnership (PPP). The Department of Rural Road Development is in charge of the roads in rural areas. Although each department has their own plan to develop and maintain the roads, the plans cannot be achieved without other donors' financial support, according to the interview survey.

(5) The Myanmar Agriculture Development Bank (MADB), The Ministry of Planning and Finance (MOPF)

The MADB has been transferred from the MOALI to MOPF. In terms of financial service, the MADB will be an essential organization. As mentioned in section 2.3.1, the MADB has provided financial services to farmers. The organization chart of the MADB is shown in the next figure.

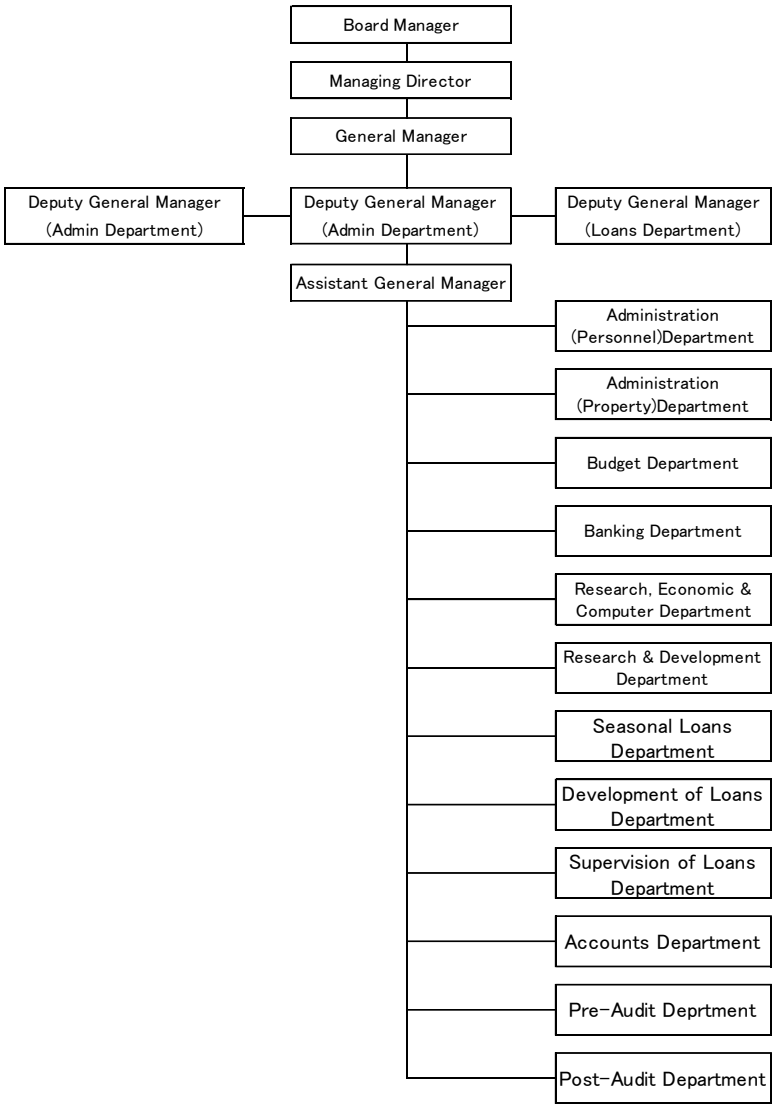


Figure 3.1.5 Organization Chart of the MADB

Source: The MADB, 2018

(6) The Ministry of Hotels and Tourism (MOHT)

There is a huge potential for tourism to grow in Myanmar, and the MOHT is working on the expansion of the tourism industry. The MOHT reviews relevant laws and promulgates necessary policies, On the MOHT website, beneficial information is available for tourists, such as events, ecotourism options, tour companies, transportation companies, hotels and so on. Furthermore, the tourism and hospitality training courses are offered to the tour guides, managers and employees. According to the MOHT, the tourism expenditure was more than doubled from 926 million USD in 2013 to 1,969 million USD in 2017. The number of visitors was also increased by around 1.7times from around two million in 2013 to 3.4 million in 2017. Along with the development of tourism, the

FVC plays an important role. For example, it will be required to supply good quality food to restaurants, hotels and sightseeing places.

(7) The Ministry of Transportation and Communication (MOTC)

The MOTC is in charge of planning any development or redevelopment and the construction of all air, railway and water transportation. For instance, the MOTC states that 166 mile section of railway from Yangon toTaungoo will be completed by 2021, and upgrading the Yangon circular rail line will be completed in 2021 with the assistance of Japanese loan support. According to the MOTC, a National Logistic Master Plan - which is expected to reduce the urban-rural gap and poverty - will be completed in March 2018. Other ministries are in charge of the construction and maintenance of the relevant transportation systems. For example, the highways and rural roads of Myanmar have been constructed by the Ministry of Construction, as mentioned above. The MOTC is also in charge of communications. For instance, according to the MOTC, 80 sets of the Automatic Weather Observation System (AWOS) and ten automatic water level measuring machines were installed in six States and Regions.

3.1.3 Other Organizations Related to the Development of the FVC in Myanmar

(1) City Development Committee (CDC)

Each CDC is in charge of managing slaughterhouses and traditional markets. Each CDC is an essential organization for the improvement of environments concerned with food safety and food sanitation. Yangon and Mandalay are two big consumption cities in Myanmar, and their CDCs are the Yangon City Development Committee (YCDC) and the Mandalay City Development Committee (MCDC). The department lists of the YCDC and MCDC are shown in Table 3.1.1. According to the interview survey, both YCDC and MCDC already have their own feasible plans to improve the slaughterhouses. On the other hand, regarding traditional markets, even though they have their own plans, they haven't initiated any specific projects yet.

Table 3.1.1 Departments of YCDC and MCDC

	YCDC Departments	MCDC Departments
1	The Administration Department	Administration Department
2	Budget & Accounts Department	Motor Transport & Workshop Department
3	Work Inspection Department	Market and Slaughterhouse Department
4	Coordination Department	Finance Department
5	Assessors Department	Revenue Department
6	Revenue Department	Cleaning Department
7	Markets Department	Playgrounds, Parks and Gardens Department
8	Veterinary & Slaughterhouse Department	Building and Central Stores Department
9	Pollution Control & Cleansing Department	Roads and Bridges Department
10	Engineering Department (Roads & Bridges)	Water and Sanitation Department
11	Engineering Department (Buildings)	Urban Planning and Land Administration Department
12	Engineering Department (Water & Sanitation)	Public Relations and Information Department
13	Motor Transport & Workshop Department	Inspection Department
14	Central Stores Department	Agriculture and Livestock Breeding Department
15	Playgrounds, Parks & Gardens Department	-
16	Security & Disciplinary Department	-
17	City Planning and Land Administration Department	-
18	Health Department	-
19	Public Relations and Information Department	-
20	Production Department	-

Source: The YCDC and MCDC, 2018

(2) The Republic of the Union of Myanmar Federation of Chambers of Commerce and Industry (UMFCCI)

The UMFCCI is a non-governmental organization, representing the private sector, and safeguards their benefits at the national level. There are 16 regional and State chambers of commerce and industry, nine border area chambers of commerce and industry, as well as 51 affiliated national level federations and associations (Table 3.1.2). The UMFCCI provides several services to the business communities, such as trainings and seminars related to human resource development and business, trade information and business matchings. In particular, the UMFCCI encourages small and medium enterprises to develop, and enables Myanmar's companies to export their commodities.

Table 3.1.2 Affiliated Federations and Associations of the UMFCCI

Arts & Crafts Association	Highway Freight Transportation Services Association	Pulses, Beans & Sesame Seeds Merchants Association
Automobile Manufacturer and Distributor Association	Hotelier Association	Rattan and Bamboo Entrepreneurs Association
Computer Industry Association	Industries Association	Real Estate Services Association
Construction Entrepreneurs Association	International Freight Forwarders' Association	Retailers Association
Container Trucks Association	Liquor Association	Rice & Paddy Traders Association
Cosmetics Association	Livestock Federation	Rice Federation
Customs Brokers Association	Marine Engineers Association	Rice Millers Association
Edible Oil Dealers Association	Mercantile Marine Development Association	Rubber Planters and Producers' Association
Edible Oil Millers Association	Oil Palm Producers' Association	Salt Industry Association
Federation of Mining Association	Onion, Garlic and Culinary Crops Production and Exporting Association	Seafarer Employment Services Federation
Fertilizer Seed and Pesticides Entrepreneurs Association	Paddy Producer Association	Sugar & Cane Related Products Association
Fisheries Federation	Petroleum Trade Association	Gold Entrepreneurs Association
Fishery Products, Processors & Exporters Association	Pharmaceuticals & Medical Equipment Entrepreneurs Association	Tourism Federation
Food Processors and Exporters Association	Plastic Industries Association	Travel Association
Fruit, Flower and Vegetable Producer and Exporter Association	Printers and Publishers Association	Wheat Association
Garment Manufacturers Association	Publishers & Booksellers Association	Women Entrepreneurs Association
Gems & Jewelry Entrepreneurs Association	Pulp and Paper Industry Association	Young Entrepreneurs Association

Source: The UMFCCI, 2018

(3) The Myanmar Fruits, Flowers & Vegetables Producer and Exporter Association (MFVP)

The MFVP is one of the affiliated associations of the UMFCCI. The MFVP works as intermediary between the government and private sector. The MFVP conducts trade negotiation and market research, develops standards and quality of produce, organizes workshop and training for members, and provides information including business matching. The organization chart of the MFVP is shown in the next figure.

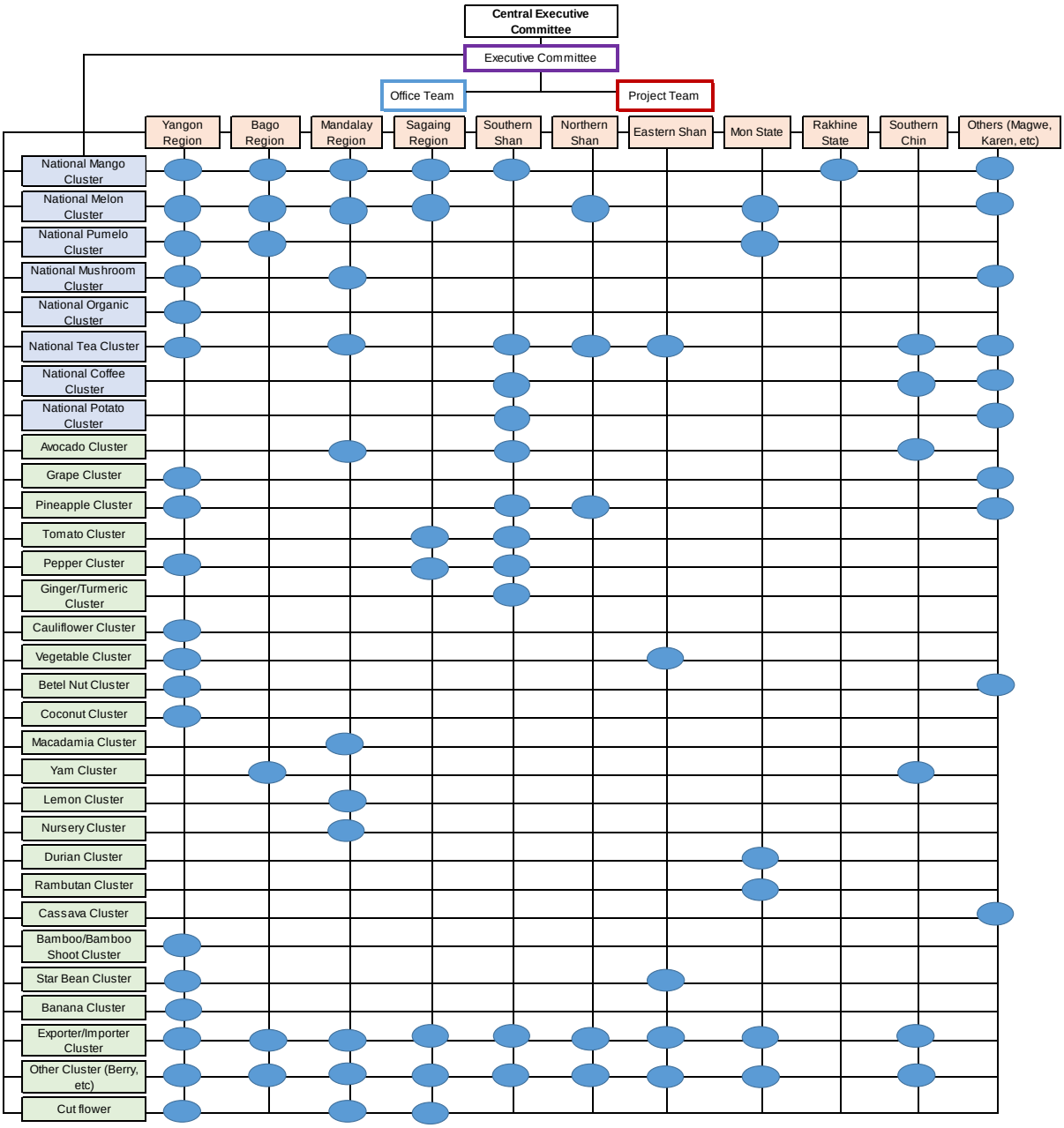


Figure 3.1.6 Organization Chart of MFVP

Source: The MFVP, 2018

(4) The Myanmar Hotelier Association (MHA)

The MHA is one of the affiliated associations of the UMFCCI. The MHA holds hospitality training programs, and supports member hotels and motels to develop and to competitive at an international standards. There are

19 Hotelier Associations in Myanmar. The MHA has more than 800 members, and 101 members across the nation are assigned to the executive committee (2017-2019). According to the interview survey, many member hotels have begun to take into account food safety. Moreover, the MHA is a member of the Myanmar Tourism Federation, which is another affiliated Federation/Association of the UMFCCI. According to the interview survey, the diversity of foods and increasing imported dairy products are stressed as recent trends.

(5) The Myanmar Restaurants Association (MRA)

There are 11 MRA regional and State offices in Myanmar. 525 restaurants have registered to the MRA (June 2018), and the number of members is increasing year on year. Out of 525 member restaurants, 250-300 restaurants are located in Yangon. The main activities of the MRA are sharing useful information in the restaurants industry, submitting the statements/comments to the MOHT, and introducing Myanmar foodstuffs overseas. According to the interview survey, luxurious restaurants are more likely to use imported vegetables, fruits and meats than domestic agricultural produce. With the cooperation of a Japanese organization in 2017, the MRA held several workshops relating to restaurant management including food safety aspect.

3.2 Governmental Budget Allocation to Related Departments in the MOALI

3.2.1 The Past Expenditure Trend and Future Plan of the MOALI

The expenditure of the MOALI from 2009/10 to 2016/17 by category is shown in Figure 3.2.1. Although the contributions and non-wage recurrent are more likely stable, the wages and the payment of interest are gradually increased. Regarding the capital, it had been increased from 2009/10 to 2015/16. However, in 2016/17, it was suddenly dropped by around 100,000 million kyats.

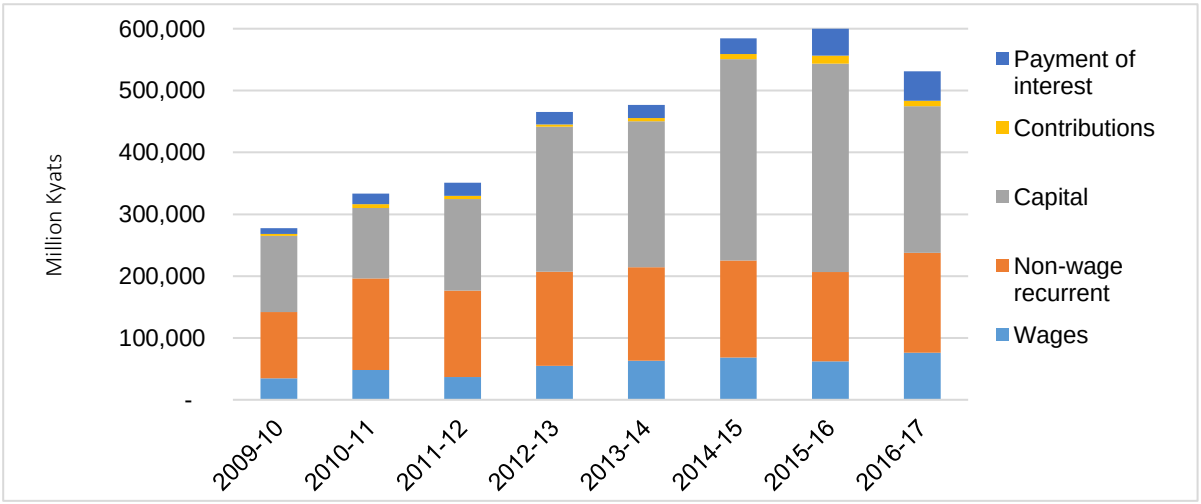


Figure 3.2.1 Breakdown of MOALI's Expenditure (2009/10 to 2016/17)

Source: The data is provided by the DOP

According to the ADS, the assumed available funds for the MOALI budget are 6,153 billion kyats (approximately 4.5 billion USD in 2016/17 prices, an average of 900 million USD/year) from 2018/19 to 2022/23 based on an estimated national growth of the GDP. The MOALI capital budget is assumed to occupy

around 56% of the total MOALI budget. Therefore, according to the ADS, the estimated available capital budget of the MOALI will be 3,445 billion kyats (about 2.5billion USD in 2017/17 prices, an average of 500 million USD/year) from 2018/19 to 2022/23. In addition, donor funds for agriculture are forecast to be 1,108 billion kyats (about 812 million USD in 2016/17 prices, an average of 160 million USD/year) for the next five years from 2018/19 (ADS p.97). The planned investment amount with the ADS pillars and years is shown in Table 3.2.1.

Table 3.2.1 The Planned Investment Amout by the ADS Pillars (Unit; Million Kyats)

Pillar/Output	2018-19	2019-20	2020-21	2021-22	2022-23	Total	%
Pillar1.Governance	38,558	67,284	81,039	79,283	65,453	331,617	10.6
Pillar2.Productivity	277,527	323,793	351,718	347,575	349,961	1,650,574	52.7
Pillar3.Competitiveness	173,446	190,196	237,431	280,652	270,526	1,152,253	36.8
Total	489,531	579,274	672,188	707,511	685,940	3,134,444	100.0

Source: ADS p.97

Moreover, the breakdowns of each of the ADS pillar's investment are demonstrated by their outputs in Figure 3.2.2, Figure 3.2.3 and Figure 3.2.4.

Regarding pillar 1: Governance, the largest portion of total investment for pillars 1, is around 30%, and it is concerned with "the restructure of the MOALI". In addition, three components/outputs related to the FVC; "improved food and nutrition security", "strengthening associations" and "strengthening farmers land rights" account for around 15%, respectively. Although it accounts for only 5% of the investment, the capacity for policy development is also included as one of outcomes of pillar 1.

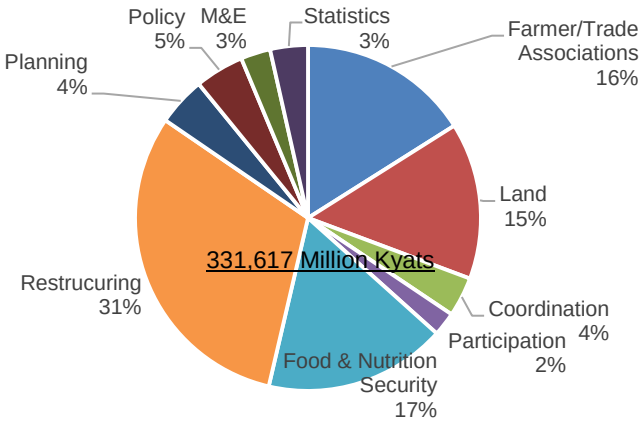


Figure 3.2.2 Distribution of Investment by Output in Pillar 1: Governance

Source: The ADS p.103

In terms of pillar 2: Productivity, over a half of the total investment is allocated to irrigation and water management. Next to it, around 13% of the investment is provided not for horticulture but for livestock and fishery sectors, such as growth of improved breeding and systems. Following it, mechanization in agricultural VC occupies around 11.4%, improvement of crop inputs accounts for around 8%. While approximately 6% of the investment is for research including crops, livestock and fish, only 2% is allocated for agriculture extension and less than 1% is for the GAP, GAHP and GAqP.

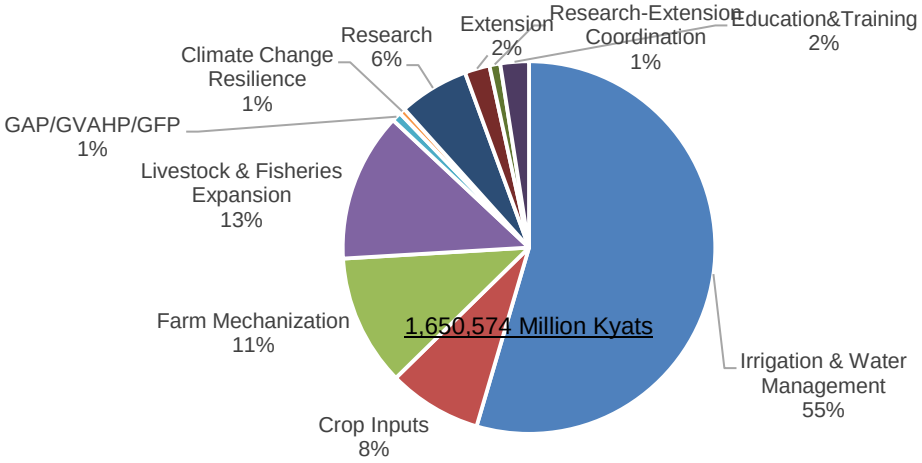


Figure 3.2.3 Distribution of Investment by Output in Pillar 2: Productivity

Source: The ADS p.105

With respect to pillar 3: Competitiveness, around a half of the investment is allocated to rural development planning, including an aspect of gender equality. The second largest percentage of the investment of pillar 3 is approximately 15%, and it is for VC. In addition, related to the FVC, food safety and food quality are essential, and they occupy around 2% and 3% of the investment plan of pillar 3, respectively. Furthermore, the financial service is also involved in pillar 3, with a total of around 15% of the investment plan.

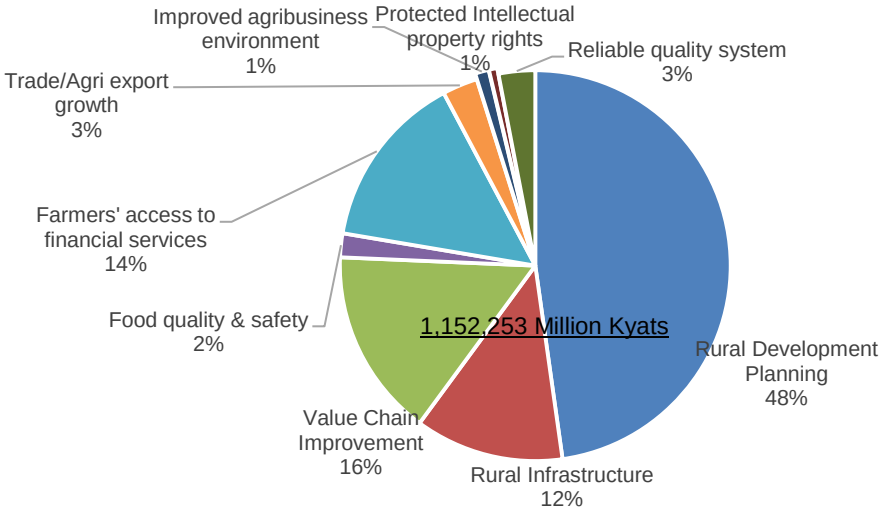


Figure 3.2.4 Distribution of Investment by Output in Pillar 3: Competitiveness

Source: The ADS p.106

3.2.2 Governmental Budget Allocation to Related Departments in the MOALI

Capital budget of the MOALI from 2012/13 to 2017/18 and the planned investment amount of the MOALI from 2018/19 to 2022/23 is available, and shown in Figure 3.2.5 and Figure 3.2.6, respectively.

Regarding capital budget share of related departments, such as the DOP, DOA and LBVD, it has increased in comparison with the previous period; from 2012/13 to 2017/18. According to the ADS, the DOP budget share is dramatically increased by 25 times; from 0.1 % to 2.5%. The DOA budget share almost doubled from around 6% to 12%. The budget share of the LBVD has increased by three times from 2% to 6%. This is because the budget shares of the departments should be fair and the shares of the departments related to hardware decreased. It is stated in the ADS that the development of "hardware" and "software", such as extension, education and statistics, should be integrated to achieve the objectives of the ADS.

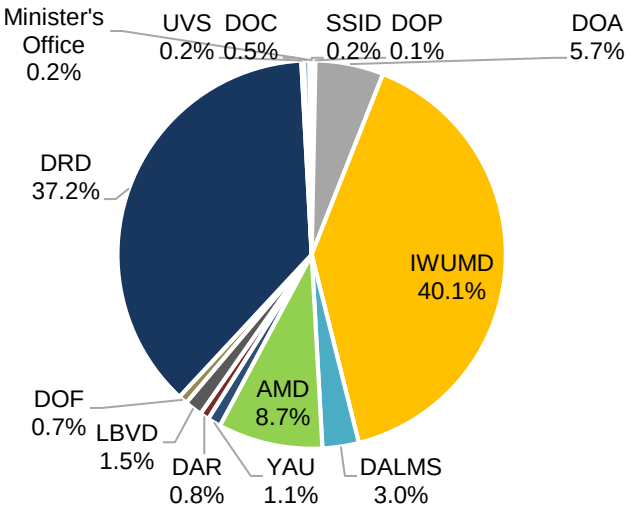


Figure 3.2.5 Budget Share of the Departments of the MOALI (2012/13 to 2017/18)

Source: The ADS p.91

The top three departments, which accounted for the largest share of MOALI's capital budget in the past; the IWUMD (40%), DRD (37%) and AMD (9%), are related to hardware. The expenditure for hardware, such as rural roads, irrigation systems, facilities and machinery, occupied more than 80% of the MOALI's capital. However, the shares of the IWUMD, DRD and AMD decreased to 29%, 20% and 6%, respectively in the planned investment amount of the MOALI from 2017/18 to 2021/22. In particular, the largest decrease of the DRD is because Department of Roads and Bridges of the DRD transferred from the DRD to the Ministry of Construction.

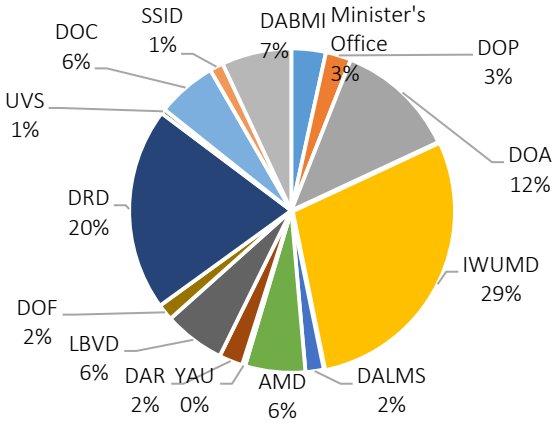


Figure 3.2.6 Share of Planned Investment Amount by Department of the MOALI (2018/19 to 2022/23)

Source: The ADS p.99

The planned investment amount of the DOP, DOA, LBVD and total by years from 2018/19 to 2022/23 has been made available and is shown in Figure 3.2.7. The left axis refers to the investments of the DOP, DOA and LBVD. The right axis refers to the whole investment of the MOALI.

According to the ADS, as a whole, the mount of investment will increase gradually by year. Although the investment of the DOP will be stable for the next five years, the investment of the DOA will be increased similarly to the whole IP. Annual planned investment amounts of the DOA are larger than the LBVD for the next five years, but the peak of the LBVD investment is earlier than that of the DOA. Based on the ADS and IP, improvements of breeding, AI services and liquid nitrogen plants seem to be prioritized, and the planned investment is allocated accordingly.

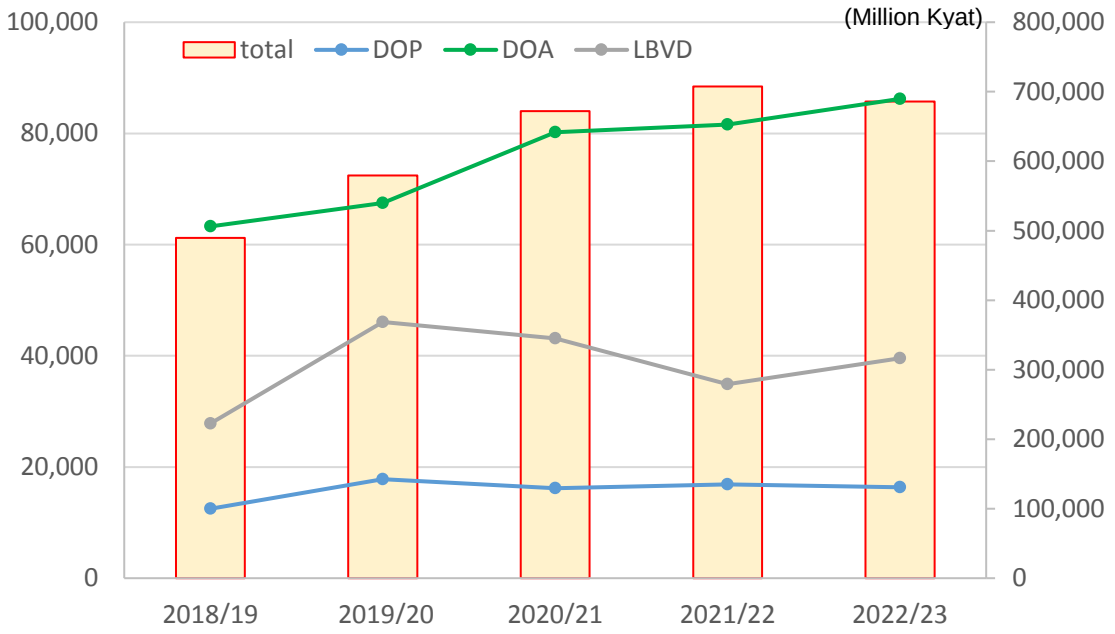


Figure 3.2.7 Planed Investment Amount of the DOP, DOA, LBVD and Total (2018/19 to 2022/23)

Source:The ADS p.99[12]

Note: The left axis refers to the investments of the DOP, DOA and LBVD.
The right axis refers to the whole investment of the MOALI.

[12] The years of original data; Table 45 (ADS p.99) seem to have an error, and so are shifted by a year.

CHAPTER 4 THE FVC IN HORTICULTURE SECTOR

4.1 Outline of Production/Consumption and Import/Export in the Sector

4.1.1 Production

Vegetable production has been increasing nationwide, especially in Shan and Central Dry Zone (CDZ). Potential for horticulture development in Myanmar seems to be large in terms of climate condition, with not only hot lowland represented by Chaung Oo (50-100m altitude), but also the vast highland represented by Shan hills (1000-1500m altitude). The latter condition is rare in South East Asia. In both areas, intensive cultivation is carried out.

The production scale of most individual farmers is small, from home garden scale (0.1-0.5 acre) to 10 acre in those aforementioned areas. Regarding horticulture crops experiencing intensive cultivation practiced at a small scale, the quality of crops affects the farmers' income more than quantity. On the other hand, quantity is more important than quality in cereal crops that are extensively cultivated.

The most important production area of vegetables in Myanmar is Shan State located on Shan Hills. The area can produce various vegetables such as potatoes, carrots, tomatoes, cabbages, and other leafy and highland vegetables. The produce is marketed nationwide. Sagaing Region, Bago Region, and Ayeyarwaddy Region are also important producing areas of vegetable, though most of the farmers are self-sufficient producers and so cannot sell to other Regions.

In Myanmar, various fruits are cultivatable in four ecological zones (Figure 1.3.1). Thus, many kinds of fruits are available all year round, including papayas, bananas, coconuts, guavas, limes, lemons, grapes, watermelons, musk melons, jack fruits, and pineapples. Seasonal fruits are also available in Myanmar. Summer fruit includes durian, mangosteen, rambutan, marian and mango, while apples, oranges, pears are winter season fruits. The production volumes of some selected horticultural crops are shown in Table 4.1.1.

Table 4.1.1 Production of Major Horticultural Crops (by Region, 2015/16)

(Unit; '000 MT)

Crops	Mandalay	Sagaing	Shan	Magway	Bago	Others	Total
Potato	8.87	57.77	365.50	54.20	3.40	79.25	569.0
Onion	424.18	274.83	27.38	486.99	13.29	37.33	1264.0
Garlic	5.47	45.28	130.88	11.86	0.03	18.48	212.0
Chili (dried)	40.16	2.75	3.23	13.51	3.06	66.31	129.0
Cauliflower	41.17	99.21	95.52	21.09	24.56	113.45	395.0
Cabbage	33.10	79.80	174.10	30.10	33.20	138.70	489.0
Lettuce	2.73	12.37	10.86	6.25	12.88	44.92	90.0
Mustard	8.08	79.59	92.82	9.03	6.20	78.27	274.0
Tomato	176.90	368.83	186.51	327.52	98.43	161.82	1320.0
Beet	2.25	3.77	7.63	0.00	0.00	1.35	15.0
Radish	9.18	38.04	6.87	25.41	27.36	166.13	273.0
Watermelon	44.34	55.06	19.69	36.99	27.95	86.97	271.0
Bottle Gourd	9.97	37.10	7.09	30.68	42.05	144.12	271.0
Asparagus	0.12	0.00	0.75	0.62	0.49	1.21	3.2
Mango	39.94	53.37	49.68	19.75	76.62	255.64	495.0
Pineapple	5.50	26.57	48.18	0.51	48.49	124.75	254.0
Orange	9.53	35.43	254.08	0.04	0.00	52.92	352.0
Jujube, Plum	65.24	195.82	0.12	48.91	9.50	8.42	328.0
Strawberry	1.28	0.00	0.21	0.00	0.00	0.11	1.6

Source: The DOA, 2017

Cereal crop production has an advantage based on favorable agricultural conditions in Myanmar, but the production of horticulture crops, which requires sophisticated techniques, has a small capacity and low productivity due to the farmer's limited experience and techniques with such crops. Such challenges are reflected in the low yield and low quality of horticulture crops. However, the horticulture farmers' capacity as cultivators could be developed to a large extent, based on their strong desire for learning knowledge and technology.

The production of most vegetables is still increasing, but some kind of fruit have plateaued in this regard because almost all suitable areas have already been planted out. In order to expand fruit areas, it is necessary to put in additional investment.

Table 4.1.2 Production of Major Horticultural Crops (by Year, 2005 to 2016)

(Unit: '000 MT)

	2005/06	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Potato	478.0	573.0	565.0	560.0	549.0	551.0	569.0
Onion	1,015.0	1,131.0	1,143.0	1,161.0	1,224.0	1,265.0	1,264.0
Garlic	149.0	209.0	213.0	212.0	215.0	212.0	212.0
Chili (dried)	110.0	130.0	118.0	119.0	117.0	123.0	129.0
	2008/09	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Cauliflower	315.0	343.0	334.0	377.0	370.0	388.0	395.0
Cabbage	449.0	453.0	471.0	475.0	472.0	477.0	489.0
Lettuce	57.0	70.0	74.0	77.0	79.0	74.0	90.0
Mustard	238.0	279.0	296.0	281.0	300.0	240.0	274.0
Tomato	1,291.0	1,324.0	1,284.0	1,381.0	1,380.0	1,343.0	1,320.0
Beet	25.0	20.0	26.0	24.0	22.0	17.0	15.0
Radish	272.0	295.0	280.0	259.0	253.0	273.0	273.0
Watermelon	229.0	247.0	215.0	186.0	231.0	236.0	271.0
Bottle Gourd	219.0	251.0	254.0	264.0	282.0	267.0	271.0
Asparagus	1.4	3.3	2.3	2.5	3.7	3.3	3.2.
Mango	435.0	504.0	492.0	525.0	530.0	557.0	495.0
Pineapple	215.0	249.0	254.0	252.0	245.0	250.0	254.0
Orange	298.0	333.0	350.0	316.0	341.0	353.0	352.0
Jujube, Plum	472.0	321.0	312.0	307.0	311.0	307.0	328.0
Strawberry	1.4	1.4	1.6	1.6	1.4	1.6	1.6

Source: The DOA, 2017

4.1.2 Consumption

The consumption of horticulture crops has been increasing in these years in accordance with the economic growth of Myanmar. Several collectors visit farmers' fields, not only in the vicinity where there is food consumption, but also remote production places, such as villages in South Sagaing and eastern border areas where lowland vegetables are produced, and their collecting volume is increasing.

(Unit; kg/year/capital)

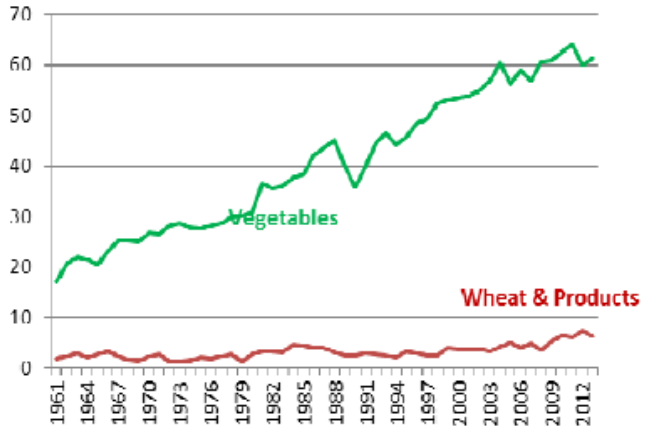


Figure 4.1.1 Consumption Trends of Selected Products in Myanmar

Source: FAOSTAT

Of the vegetables listed above, the ones most frequently purchased and consumed in Myanmar are onions, garlic and tomatoes, beans and water spinach. As for fruit, mango is the most popular in Myanmar, and customers consume it on a daily basis during the mango season. Bananas are also a familiar and popular fruit frequently eaten by customers, followed by other

fruits such as watermelon, jujube, avocado and guava. Bananas and coconuts are also used for traditional cultural event purposes and the demand increases during seasons of some important religious festivals like Taung Pyone Festival in July. Many festivals and donation ceremonies are held year around in Myanmar, especially from November to December.

Vegetable and fruit consumption per capital in Myanmar is about 81 kg and 39 kg per year respectively based on FAO's estimation in 2013. Although fruit and vegetable consumption is not much smaller than that of neighboring counties, FAO/WHO recommends that a minimum of 400 grams of fruits and vegetables are consumed per person per day (approximately 146 kg per capital per year = 0.4kg x 365 days, excluding starchy root crops) for the prevention of chronic diseases such as heart disease, cancer, diabetes and obesity, and for the prevention and alleviation of several micronutrient deficiencies. In other words, it implies that there is further potential for market growth to improve public health.

Concerns for the safety of vegetables are now growing due to insufficient information on chemical usage. Customers are not fully aware of the additional cost for chemical-free and organic production of vegetables and fruits. Development of an organic vegetable market in Myanmar.is still in its early stages.

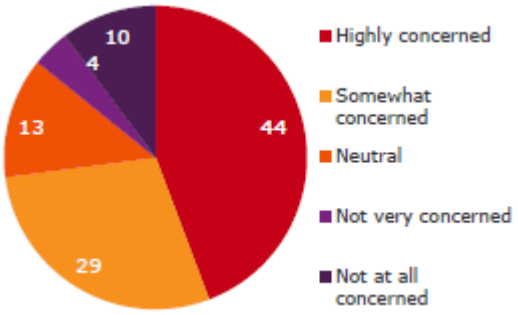
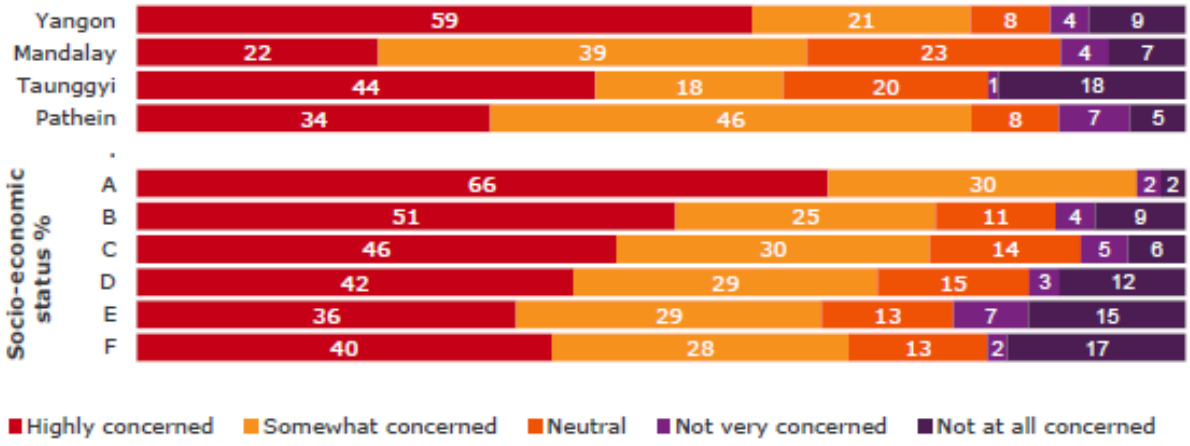


Figure 4.1.2 Concerns about Chemicals Used in Vegetable Harvesting

Source: "Vegetable Consumption, Preferences and Supply Chain Myanmar" (Taylor Nelson Sofres (TNS) Myanmar, 2015)

As indicated by Figure 4.1.2 about 44% of consumers replied that they were "highly concerned" about chemicals, and 29% replied "somewhat concerned". This concern is more widespread in Yangon and amongst wealthier consumers (Figure 4.1.3). Concerns about chemical residue on vegetables are also high in Taunggyi, where people are closer to the farms, and have more knowledge about agricultural processes.



*A) indicates the most wealthy, and F) indicates the least wealthy.

Figure 4.1.3 Concerns by Locations and Socioeconomic Classification (%)

Source: "Vegetable Consumption, Preferences and Supply Chain Myanmar" (TNS Myanmar, 2015)

According to the survey, across the consumer and supplier levels, many respondent undertaking specific measures to purchase or prepare vegetables so they are "safe" for consumption (Figure 4.1.4). However, in most

circumstances these strategies are based on a flawed understanding of the nature of chemical uptake by the produce the respondents are consuming. Most of the people assume that simply washing vegetables will render their purchases safe for consumption.

Several challenges need be addressed, and information circulated about pesticide usage that addresses misconceptions about how to tell if produce is affected, and how to safely wash produce. Such measures may lay the groundwork for establishing markets for chemical-free/organic produce in the future.

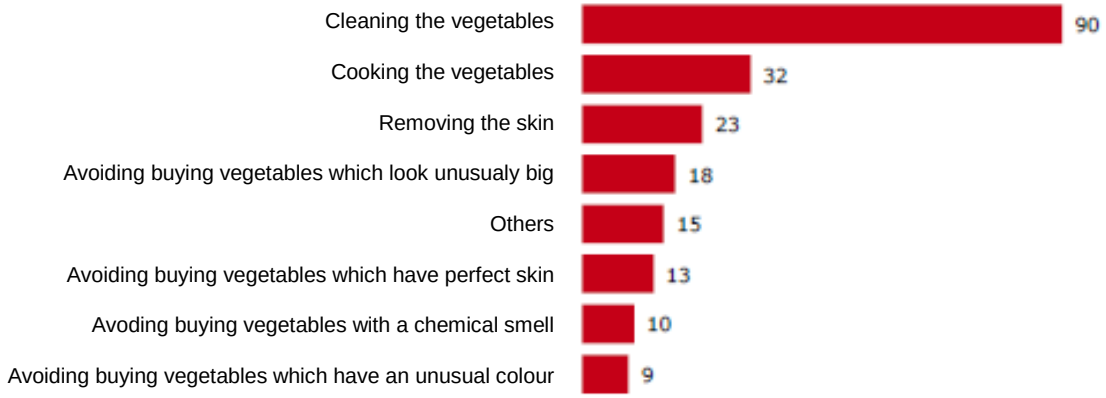


Figure 4.1.4 Measures to avoid/remove chemicals amongst household consumers (%)

Source: "Vegetable Consumption, Preferences and Supply Chain Myanmar" (TNS Myanmar, 2015)

4.1.3 Exports/Imports

(1) Exports

i) An Overview of Exports in the Agricultural Sector

Myanmar trades is divided into "normal trade" and "border trade". According to the MOC's definition, normal trade is the "selling or buying of commodities through shipping or air freight" and border trade is the "selling or buying commodities with local currencies or the currencies accepted by both sides". For agricultural and animal products, both types of trades are important in their export value.

Out of agriculture products, rice, pulses, beans, and sesame are major export commodities in terms of volume. These crops are in fact selected as ones of seven priority sectors for export development in the National Development Strategy in Myanmar. Firstly, this chapter provides short reviews about each product.

Rice is the country's most important agricultural product, accounting for roughly half of all cultivated land and an estimated 13% of GDP. Historically, Myanmar was once the world's largest exporter until the sharp decline in exports in the 1950s as the Myanmar's role in the global rice market shrank. In recent years, rice exports from Myanmar have been increasing again to over 1 million tons, and once reached about 1.4 million tons in the period of 2012/13. The Myanmar Rice Sector Development Strategy (2015) analyzed this tendency as a result of increasing trends in the global demand for rice, especially low quality rice destined for African countries.

The second important export commodity is pulses and beans. The production and trading of pulses and beans has its roots in the early periods of British rule, which catalyzed the migration of Indian growers to Burma. These farmers brought with them not only the tradition of pulses and bean production but also a connection to the

Indian market. The tradition of export-oriented pulses and bean production continued untill after Myanmar's independence in 1948.

Pulses exports rely heavily upon black gram and green gram destined for neighboring countries. 70% of them are exported to India. In 2013/14, Myanmar exported 644.2 thousand tons of black gram, 339.9 thousand tons of green gram, and 316.8 thousand tons of other pulses. Other than pulses, sesame is also a major export crop. Sesame exports rely heavily upon three key markets including Japan, China and Chinese Taipei. Over 90% of total exports are destined for these three markets.

Table 4.1.3 Export Volume of Major Crops (by Year, 2005 to 2016)

(Unit: '000 MT)

	2010/11	2011/12	2012/13	2013/14
Rice	536.4	707.2	1,396.8	1,192.3
Maize	44.8	166.5	566.2	933.6
Black gram	456.5	598.1	657.8	644.2
Green gram	166.3	229.0	360.1	339.9
Other pulses	206.6	469.3	465.8	316.8
Sesame	29.5	35.5	182.8	172.3
Groundnuts	n.a.	12.2	62.4	47.6

Source: The DOA, 2014

Vegetable exports increased dramatically from 2003 until around 2009. One reason of the increase is that farmers who had once planted many crop items instead chosed to plant horticultural crops from 2003. This was because farmers were instructed to prioritize planting rice crops to ensure food security. Another reason might be due to the increasing population and demands of neighboring countries such as China, India and Thailand.

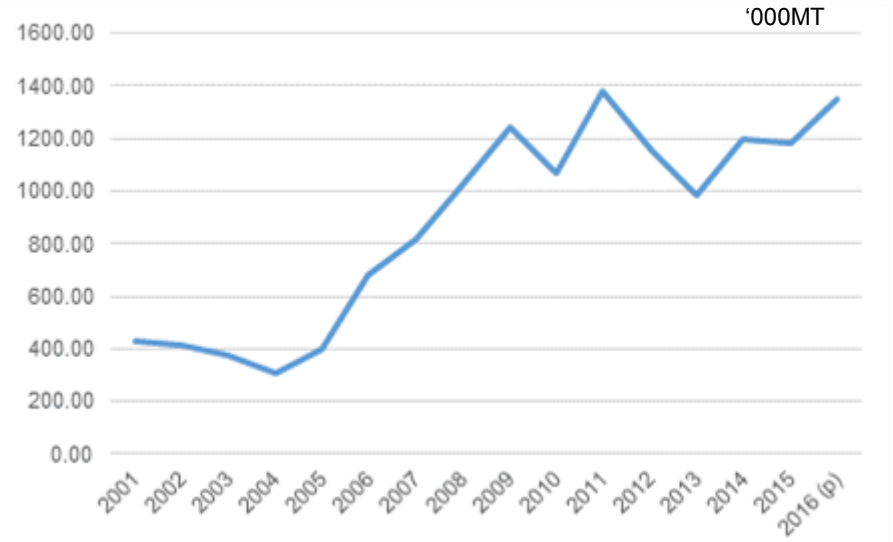


Figure 4.1.5 Export Volume of Myanmar Vegetables (by Year, 2001 to 2016)

Table 4.1.4 and Table 4.1.5 show export volume and the value of Myanmar vegetables from 2010 to 2016. The data is sourced from counterpart (importing) countries. Depending on the country's statistics, there might be bias or missing data. Roughly speaking, important export products within the horticulture sector in Myanmar are maize, onions and bananas. Although it seems rather small in the table, according to our market survey and interview, mangos and plums are important exporting crops.

Table 4.1.4 Export Volume of Myanmar Vegetables (by Year, 2010 to 2016)

(Unit MT)

	2010	2011	2012	2013	2014	2015	2016
Maize	31,061	142,119	31,743	35,273	45,492	50,777	86,923
Starch, Cassava	141	11,927	16,096	4,756	4,279	4,034	2,905
Ginger	8,064	611	484	935	615	6,021	473
Onions, Shallots (green)	56	0	538	228	12,984	0	0
Chilies, Peppers (dry)	384	256	1,896	3,276	2,106	1,693	4,133
Pumpkins, Squash, Gourds	0	0	0	760	1,052	2,000	1,500
Garlic	2,210	724	0	39	27	1,092	208
Potatoes	0	0	0	89	464	693	1,950
Cabbages, Other brassicas	0	125	0	9	0	0	121
Chilies, Peppers (green)	0	0	26	59	49	96	4
Bananas	176,992	54,912	44,444	45,118	53,887	55,902	50,777
Oranges	3,279	2,671	2,051	1,713	1,500	1,433	2,379
Melons, Other (inc.Cantaloupes)	2,018	3,507	3,691	3,011	74	36	62
Mangoes, Mangosteens, Guavas	5	20	30	92	184	208	91

Source: The Survey Team based on FAOSTAT, the data is an estimation sourced from countries that import these crops.

Note: The statistics might have some missing data. For example, the data of the export of mangoes, mangosteens guava to China is missing in the source data. Therefore, it should be underestimated.

Table 4.1.5 Export Value of Myanmar Vegetables (by Year, 2001 to 2016), '000 USD

(Unit: '000 USD)

	2010	2011	2012	2013	2014	2015	2016
Maize	6,737	41,394	9,122	10,625	12,759	13,266	20,424
Starch, Cassava	42	5,278	6,815	2,056	1,748	1,630	1,065
Ginger	4,939	1,040	940	672	1,162	4,250	1,628
Onions, Shallots (green)	23	0	214	109	3,028	0	0
Chilies, Peppers (dry)	241	182	3,629	6,021	3,538	3,520	8,826
Pumpkins, Squash, Gourds	0	0	1	121	172	325	229
Garlic	1,252	552	0	11	7	518	106
Potatoes	0	0	0	51	288	365	1,053
Cabbages, Other brassicas	0	35	0	1	0	0	117
Chilies, Peppers (green)	0	0	20	49	39	138	4
Bananas	24,383	8,069	8,126	7,232	9,873	11,753	9,889
Oranges	1,085	1,050	806	1,121	917	859	1,334
Melons, Other (inc.Cantaloupes)	1,184	2,143	2,527	2,529	78	28	48
Mangoes, Mangosteens, Guavas	5	22	57	179	473	329	223

Source: The Survey Team based on FAOSTAT, the data is an estimation sourced from countries that import these crops.

Note: The statistics might have some missing data. For example, the data of the export of mangoes, mangosteens guava to China is missing in the source data. Therefore, it should be underestimated.

ii) Outline and Specific Issues on Boarder Trade

The Survey team conducted a border trade survey[13] and visited Tamu on the Indian border, and Myawaddy on the Thailand border.

The locations of checkpoints and quarantine stations are as shown Figure 4.1.4. Hereinafter, outlines and specific issues regarding border trade re reported.

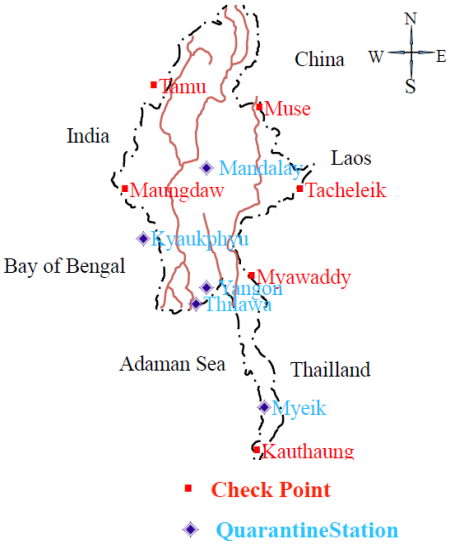


Figure 4.1.5 Checkpoints and Quarantine Stations

Source: The LBVD

A. Chinese Border (Muse)

Table 4.1.6 shows the volume of major exported agriculture commodities through Muse at the Chinese border trade zone. According to the Chairman of the MFVP in the Mandalay Region, few types of vegetables like onions are exported to China. Regarding fruits, the country exports watermelon, muskmelon, papaya and plum and sometimes dragon fruits. These fruits are in constant demand in China year around. Mangoes, especially the famous Sein Ta Lone varieties, can be said to represent the most successful export horticulture crops in Myanmar. From Myanmar to China, about 116 thousand tons of mangoes were exported in the 2017/18 fiscal year[14]. Watermelon cultivation has been growing as China's import demand increases. In the fiscal year 2017/18, 652.6 thousand tons of watermelon were exported.

Table 4.1.4 Major Export Horticulture Crop through Muse (2017/18 Fiscal Year)

Commodities	Amount (Ton)	Value (000' USD)
Mango (fresh)	115,906.0	23,613.0
Muskmelon	28,182.0	9,628.5
Watermelon	652,614.9	62,788.0

Source: The Custom Department, the MOFP, 2018

A typical operation in the border area is as follows: firstly a trader/transporter brings commodities to the Trade Zone located on Mile 105, a trade area located 12 km from the border. Several ministry offices are located in the trade zone to provide an OSS for i) custom clearance; ii) tax payment; iii) immigration procedure; iv) license checking, and v) disbursement from a bank account. The construction and management of OSS stations is financially provided by the MOC. Next to Mile 105, there is an auction center where importers and exporters buyers meet. Importers can inspect the samples there. Buyers can freely request a sample inspection, for example, taking some samples from the bottom of the cargo. A mutually acceptable price is determined through face-to-face negotiation at the trading place. Deals are often conducted by shaking hands without any contract, in that case, Myanmar traders are exposed to the

[13] Note that Muse on the Chinese border is also an important in terms of its scale, but due to security reasons, the Team collected relevant information through interviewing at Mandalay. In fact, on the 12th of May 2018, there was a conflict between the National Army and Ta'ang National Leberation Army (TNLA). The incident forced us to refrain from visiting the fields.

[14] Note that according to the report, "Business Process Analysis: Export of Rice and Mango, and Import of Palm oil in Myanmar", during the peak season (May to July) the volume of fruit increased to 100-150 trucks per day. For a 12-wheeler truck, the average load factor is 10-14 tons, making the average value of a shipment from USD 4,500 – 15,500 depending on the mango variety and size of truck.

risk of non-settlement because payment is usually given one or two weeks after dealing is made.

Exporters usually use agents, who can provide a wide range of services from applying for an export license to the arrangement of transport of goods to China. Such agents have a strong relationship with related government agencies both on the Myanmar and China side of the border, and are able to ensure a seamless export process. It is important because the export process is relatively unpredictable and can be interrupted at any step.

B. Thailand Border (Myawaddy and Tachileik)

There are two checkpoints along the Thailand border. There are at the Myawaddy border in Kayin State and the Tachileik border in Shan State. In terms of transaction volume, the trade at the Myawaddy border is overwhelmingly larger than that of the Tachileik border.

Myawaddy also has a Border Trade Zone, which provides an OSS located 11km from the border gate. In the trade zone, there are loading/unloading space, X-ray devices, import declaration offices, custom clearance offices and extension offices of the PPD, LBVD, MOC for document inspection related to quarantine. Such extension offices, however, have no capability and facilities for laboratory testing. At the Myawaddy district office of the LBVD, for example, the H5N1 virus is analyzed using a rapid test kit, but other viruses are not analyzed there. As for other testing items that require a Result Certificate/Health Certificate from the relevant organizations, an exporter has to send samples to laboratories in Nay Pyi Taw or Yangon that usually takes 2 to 3 days. If every necessary documents has already been prepared, generally it requires only 45 minutes to complete every procedures[15].

C. Indian Border (Tamu)

There are three checkpoints along the Indian border, Tamu in Sagaing State, Rikhawdar and Thantlang in Chin State. Despite this, there is no official trading in Tantlang as of May 2018. There is an ASEAN plan for a highway that will connect Mandalay city and Tamu. If these two locations are connected, a dramatic logistical improvement may occur in the future. Therefore, the Survey team investigated the current situation of the Tamu border checkpoint.

The operation in the border area is similar to other areas. There is an OSS station to complete every required administration process. However, there are very few staff members from each government organization assigned to the station. The services that they can provide are limited. For example, the FDA is responsible for sampling imported processed-foods and drugs in the market. However, they cannot visit the market frequently because of the aforementioned manpower shortage.

Table 4.1.7 shows major export commodities through the Tamu gate in the 2017/18 fiscal year. Except for areca nuts, known as betel nuts and commonly consumed as chewing tobacco, the major export commodities are pulses (e.g. soya beans, chick peas, ground nuts) and fruit (e.g. apple, coconuts, mangoes). Most fruit is locally produced around Tamu and some of this are distributed from China via Muse and

[15] Note that to shorten custom procedure, the Custom Department of Myanmar has installed new electric custom clearance system with assistance of JICA, called MACCS (Myanmar Automated Cargo Clearance System). Among the border checkpoints, only Myawaddy checkpoint has already started its operation since June 2018. After starting operation, it is expected that every process such as declaration, inspection, tariff payment, and permission will be digitalized and fasten.

Mandalay to Tamu.

Table 4.1.7 Major Export Commodities through Tamu (2017/18 Fiscal Year)

No	Commodity	Amount (Kg)
1	Dry Areca Nuts	8,306,785
2	Tobacco	478,640
3	Soya Beans	37,700
4	Apples	115,000
5	Coconuts	380,125
6	Mangos	105,000
7	Garlic	19,900
8	Pepper	161,250
9	Areca Nuts (Fresh)	176,000
10	Toorwholes	37,170
11	Chick Peas	37,000
12	Dry Small Fish	30,000
13	Cement	450,000
14	Ground Nuts	15,750

Source: The Custom Department at Tamu Extension Office

(2) Imports

Table 4.1.8 shows major horticulture crops imported from other countries. Dry vegetables (e.g. chilies, potatoes, tomatoes, garlic, carrots) and fruit that is not produced in large quantities in Myanmar (e.g. apples, pears, mangoes, grapes, oranges, grapefruits) are mainly imported. The imported products mainly originate from neighboring countries such as China and Thailand.

Table 4.1.8 Import Volume of Major Horticulture Crops of Myanmar (2010-2016)

(Unit: MT)

	2010	2011	2012	2013	2014	2015	2016
Maize	112	928	399	1,547	4,672	10,833	7,108
Chilies, Peppers (dry)	48	233	52	515	7,122	8,854	3,653
Carrots, Turnips	4	3	5	92	1,888	2,499	4,044
Chilies, Peppers (green)	2	546	1,511	878	829	1,197	58
Starch, Cassava	24	55	147	150	25	36	2,621
Potatoes	9	9	104	300	570	781	569
Tomatoes	1	7	176	33	9	268	341
Garlic	73	115	0	1	1	23	166
Apples	1,751	1,192	2,895	5,167	30,978	42,126	87,147
Pears	57	12	61	1,079	2,682	6,811	9,567
Mangoes, Mangosteens, Guavas	2,461	1,229	830	5,210	3,080	2,900	3,700
Grapes	44	47	115	156	1,404	3,381	4,951
Oranges	392	117	195	194	255	499	512
Grapefruit (inc. Pomelos)	79	26	48	594	106	58	57

Source: The Survey Team based on FAOSTAT, and the data is an estimation sourced from countries that are importers

Table 4.1.9 Import Volume of Major Horticulture Crops of Myanmar (2010-2016)

('000 USD)

	2010	2011	2012	2013	2014	2015	2016
Maize	1,486	3,604	2,411	6,231	11,643	14,318	13,437
Chilies, Peppers (dry)	24	141	70	352	5,373	6,204	6,153
Carrots, Turnips	4	4	9	130	416	489	796
Chilies, Peppers (green)	4	342	747	507	715	975	73
Starch, Cassava	19	48	63	65	24	16	797

	2010	2011	2012	2013	2014	2015	2016
Potatoes	5	32	81	214	482	393	343
Tomatoes	1	3	111	47	14	246	413
Garlic	27	58	1	2	1	21	387
Apples	1,454	1,045	2,498	4,886	44,299	51,841	94,171
Pears	42	18	81	1,025	3,674	9,256	11,264
Mangoes, Mangosteens, Guavas	778	555	321	2,249	1,931	2,062	2,581
Grapes	102	100	347	460	3,676	9,890	10,398
Oranges	274	114	199	226	285	429	448
Grapefruit (inc. Pomelos)	38	21	44	232	136	65	67

Source: The Survey Team based on FAOSTAT, and the data is an estimation sourced from countries that are importers

Imported horticulture crops are strong competitors for local products. A Chinese tomato is usually covered by a plastic container which makes it cleaner and less susceptible to damage than local varieties. In addition, the selling price is normally cheaper than local varieties. A tomato retailer in Mandalay said that the ordinary wholesale price of a Chinese variety is 5,000 kyats per box, while it is 9,000 - 19,000 kyats per box for the local variety (Note that a box can carry 20 - 30 kg of tomatoes). Several farmers in Southern Shan state said that the tomato price is decreased after many imported tomatoes from neighboring countries came on to the market.

Figure 4.1.6 Chinese Tomatoes
Source: JICA Former Survey Team

To illustrate it, the Team analyzed the relationship between market price and import quantity using an example of tomatoes distributed in Mandalay. The blue line in Figure 4.1.8 shows the monthly average market price of tomatoes produced in lowland areas, and orange line in the same figure shows the import quantity from Thailand at the Myawaddy border checkpoint. Although it shows a different trend year by year, roughly speaking, the importation of tomatoes has two peak seasons per year: July - September and January - February. When the prices are high in Mandalay, it seems that the peak seasons coincide with these months.

Figure 4.1.7 Local Tomatoes
Source: JICA Former Survey Team

If imported tomatoes have a strong influence on the market price, then a large volume of imported tomatoes should trigger a market price decrease. As a result, a large import volume might correlate with a low market price. However, such a negative relationship was not found in this figure regarding tomatoes imported from Thailand. Rather, the correlation coefficient was calculated at 0.465,[16] which can be interpreted as a positive and moderate correlation. From this simple analysis, one of the possible conclusions is that the tomatoes

[16] $r = \frac{1}{n}\sum_{t=1}^{n}(WP_t - \overline{WP})(IQ_t - \overline{IQ}) \Big/ \sqrt{\frac{1}{n}\sum_{t=1}^{n}(WP_t - \overline{WP})(IQ_t - \overline{IQ})}\sqrt{\frac{1}{n}\sum_{t=1}^{1}(IP_{ym} - \overline{IP})(IQ_{ym} - \overline{IQ})}$, *where* t= {1, 2, ・・・, n} = {Apr 2015, May 2015, ・・・, Dec 2017 }

Note: WP means average Wholesale Price at Mandalay Market and IQ means monthly Imported Quantity from Thailand

imported from Thailand have little influence on the market price in Mandalay. Rather, the imported tomatoes are being sold at the market price, and there may be an opportunity to get a better price if there is an effort made to adjust cropping and harvesting seasons, or by preserving the product in cold storage during peak seasons.

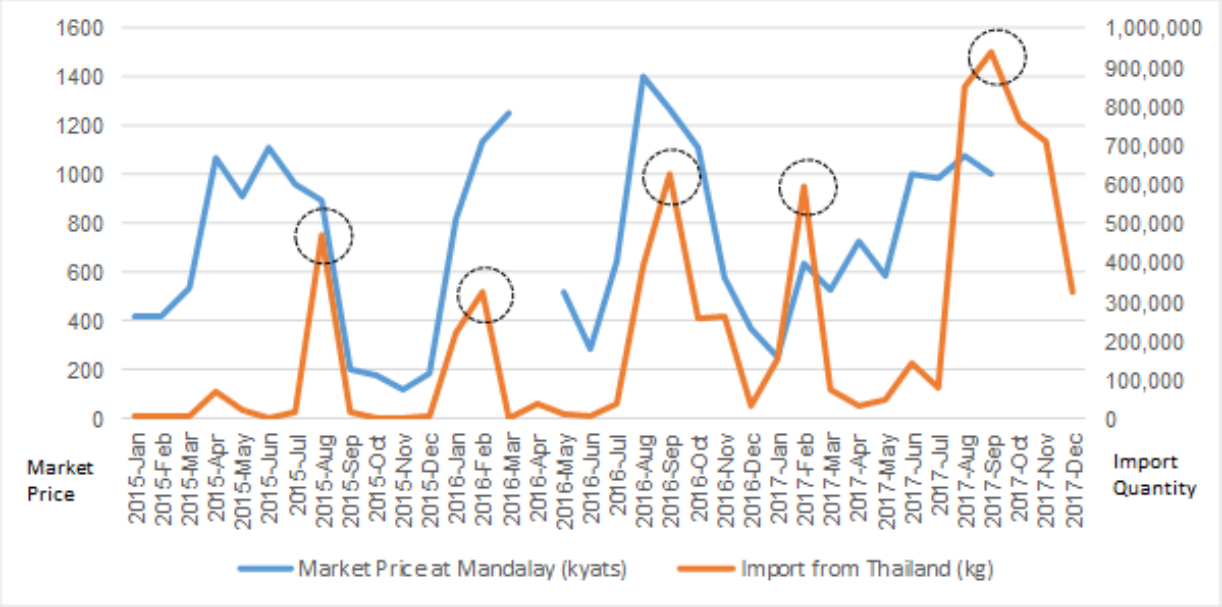


Figure 4.1.8 Tomato Market Price at Mandalay and Import Quantity from Thailand at Myawaddy Border (2015 to 2017)

Source: The MOC and edited by JICA Survey Team

4.2 FVC Analysis in the Horticulture Sector

The Team conducted FVC analysis workshops in May 2018. The Team invited participants from several key organizations or groups of FVC such as input suppliers, producers (farmers), processors, wholesalers, market retailers, exporters, and government agencies[17]. The Team asked the chamber of commerce, the MOALI, and the Myanmar Livestock Federation (MLF) to introduce these key organizations or groups for involving various important actors to this Survey.

The covered products are; mango, carrot, tomato, cabbage and potato. Also livestock products such as beef, milk, dairy production (yogurt), pork, egg, chicken and maize for feeding livestock are covered. The results of livestock products are shown in chapter 5, 5.2 in this report.

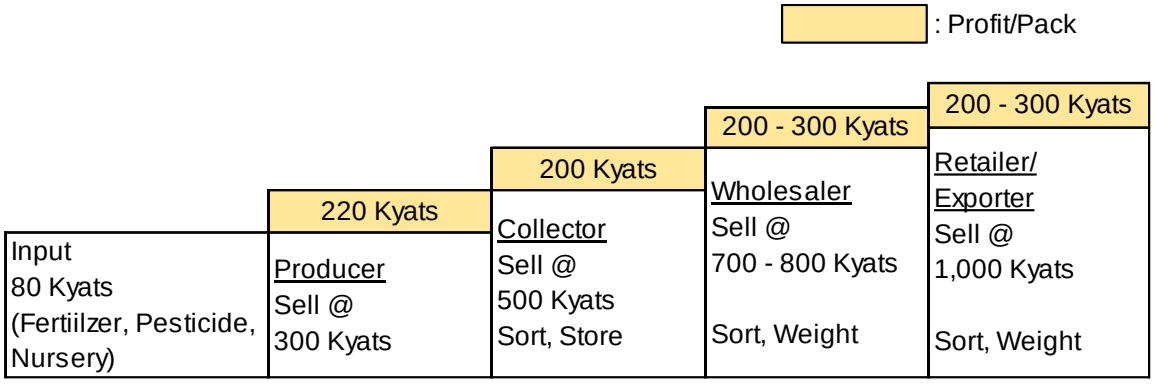
Through the workshop"Food Value Chain Maps (referred to as FVC maps)" were created as a tool for collecting information efficiently in a limited period of time. This FVC map positions the production side at the left end of the horizontal axis, and consumption side at the right end for analyzing the distribution way and relationships between production and consumption. Also, the vertical axis shows i) places of stakeholders (Who, Where), ii) shape of products (What), iii) value in Kyat, iv) source of value (potential ways to increase the value), v) price maker, and vi) issues. Former three items are for observing the current basic situation, and the latter three items should be effective information for analyzing the issues which people are currently facing. The FVC maps are expected to be useful materials to discuss and consider the possible solution to implement higher value‐added

[17] Although the consumers did not join in the workshop, relevant information such as sale prices were obtained from the retailers.

products at the target area. The FVC Maps are shown in the Appendix. In this section, the figures of their estimated profits in each stakeholder created based on the FVC Map are demonstrated.

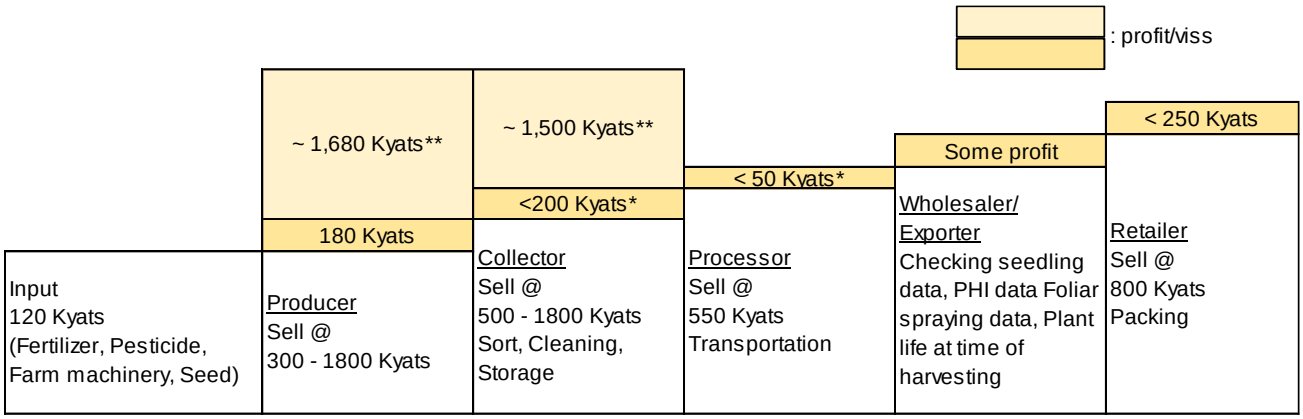
i) Estimated profit from mango sales by each stakeholder

As shown in the following figure, the profit amount of each stakeholderis is almost the same in the mango VC.



ii) Estimated profit from carrot sales by each stakeholder

In the carrot VC, the profits of producers and collectors are not stable due to the price fluctuation when they sell the produce. There can be a loss sometimes.

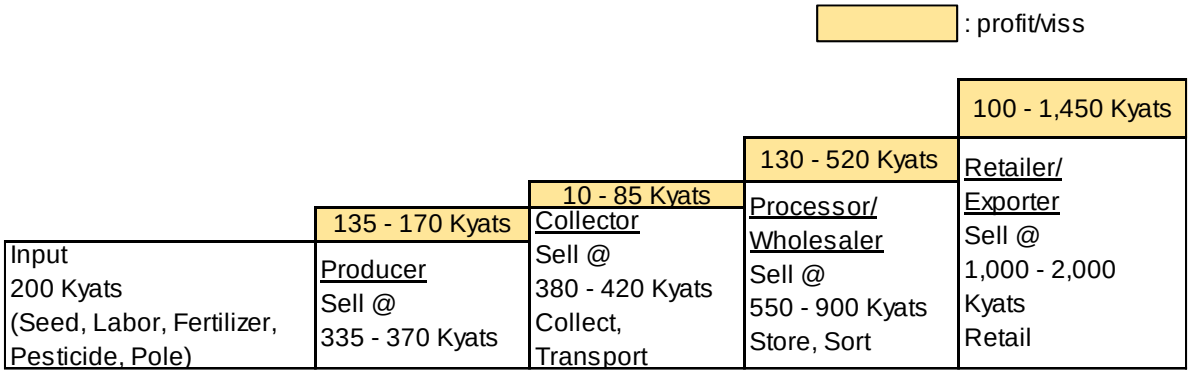


*Sometime profit becomes a loss

**Range of profit is due to price fluctuations

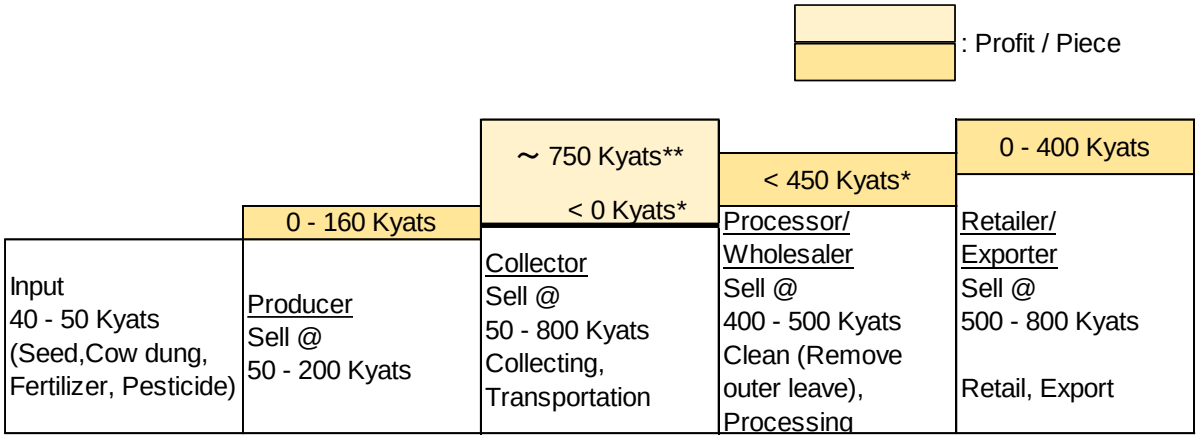
iii) Estimated profit from tomato sales by each stakeholder

In the tomato VC, the profits are significantly changeable for processors, wholesalers, retailers and exporters.



iv) Estimated profit from cabbage sales by each stakeholder

In the cabbage VC, the range of profit is large for collectors,and they can make a loss sometimes.

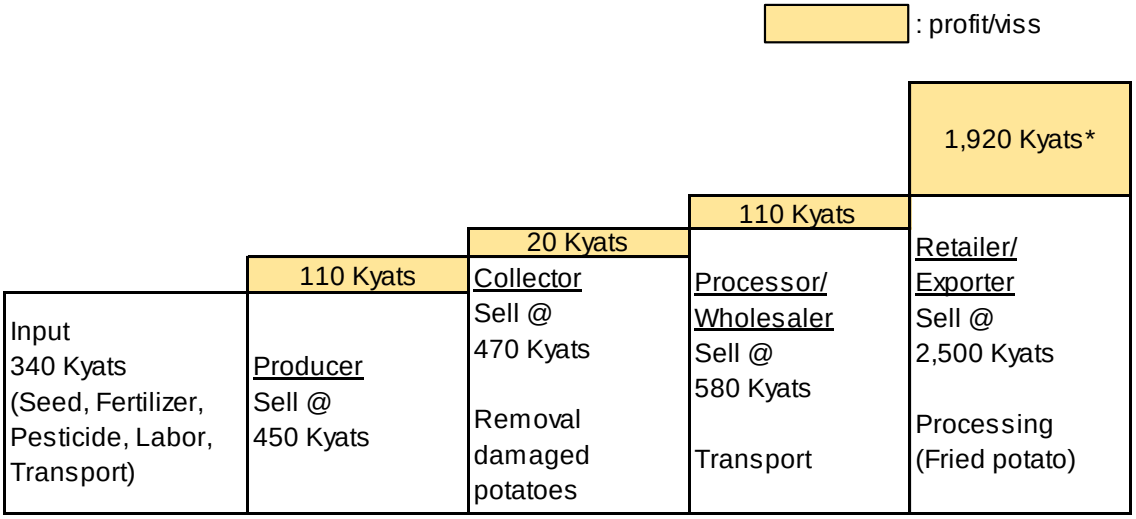


*Sometime profit becomes a loss

**Range of profit is due to price fluctuations

v) Estimated profit from potato sales by each stakeholder

The retailers seem to make a large profir through processing(frying raw potatoes) in the potato VC, although the cost involved with cooking the potatoes needs to be taken into account also.



*In the FVC map, the value is written as 7,500 kyats/viss
However, 3 viss of raw potato will be needed to make 1 viss of fried potato.
Thus, the estimated profit is written as 2,500 kyats/viss
This profit includes the additional costs involved in making frield potatoes, such as the cost of oil.

4.3 Trend Analysis in Horticulture Business

4.3.1 General Trend of the Food Industry

In Myanmar, the most manufacturing activities are related to the agricultural sector. Out of 50,000 registered companies at the Directorate of Industrial Supervision and Inspection (DISI), under the MOI, the number of "food and beverage" companies is 28,795, accounting for 58% in total registered enterprises in 2018.

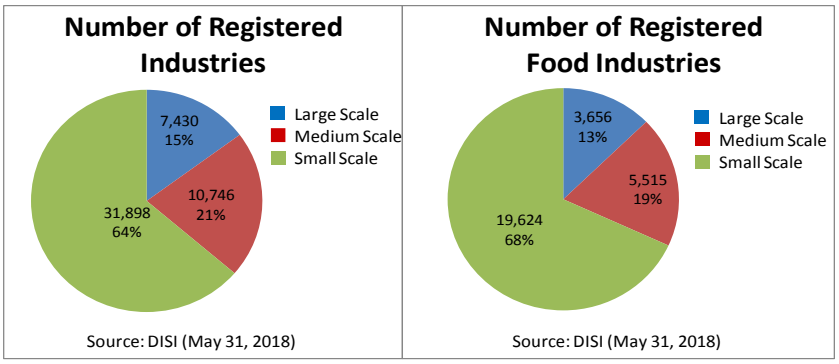


Figure 4.3.1 Number of Registered Industries

Share of the food industry is gradually reducing in the long run. The total number of registered industries was 43,232 in 2012, and that of the food and beverage sub-sector was 27,455, accounting for 64% of the total registered industries (Figure 4.3.1). However, the food related industries are still a big player in Myanmar since the sector holds a large share of small and medium scale industries.

Table 4.3.1 Share of Food and Beverage Industry in Myanmar

	2012					2018				
	Large	Medium	Small	Total	(%)	Large	Medium	Small	Total	(%)
Food and Beverages	2,369 9%	4,110 15%	20,976 76%	27,455 100%	64%	3,656 13%	5,515 19%	19,624 68%	28,795 100%	58%
Total Registered Industries	4,808 11%	7,207 17%	31,210 72%	43,232 100%	100%	7,430 15%	10,746 21%	31,898 64%	50,074 100%	100%

Source: The DISI under the MOI

Small and medium scale enterprises play an important role in Myanmar's industries including food and beverage sub-sectors. Most food industry in Myanmar is small scale with less than 50 employments, accounting for 68% of total food sub-sectors, followed by 19% of medium scale and 13% of large scale, as shown in Figure 4.3.1. Out of the total registered small scale industries in Myanmar, the food sector accounts for 62%, and the sector's share in medium and large scale industries are 51% and 49%, respectively.

In the long run, the share of small scale enterprises is reducing, whereas that of medium and large scale enterprises is increasing. In 2012, share of the small scale enterprises was 76%, while that of medium and large scale enterprises was 15% and 9% respectively (Table 4.3.1).

Among the registered food industries, rice related industries, including rice milling, rice cleaning/grading, processing of rice noodles/vermicelli and steamed rice (e.g. Biryani), are the most dominant sub-sector, accounting for 63% of registered enterprises (Table 4.3.2). The edible oil industry is the second largest industry and its share in the total registered food industries is 11% in 2018. The share of alcohol/beverage industries and horticulture related industries are 6% each as shown in the table below.

Table 4.3.2 Breakdown of the Food and Beverage Industry

Items	Large	Medium	Small	Total	(%)
Rice Industry	1,317	2,806	13,965	18,088	63%
Oil Industry	278	930	2,061	3,269	11%
Alcohol and Beverage Industry	985	463	190	1,638	6%
Beans Industry	196	226	610	1,032	4%
Livestock Industry	179	199	423	801	3%
Horticulture Industry	189	407	1,220	1,816	6%
Other Food Industry	512	484	1,155	2,151	7%
Total	3,656	5,515	19,624	28,795	100%

Source: Created by JICA Survey Team based on DICA's statistical data on May 31, 2018

4.3.2 Trend Analysis of Selected Food Industries

To grasp the business trend of food and agriculture related industries in Myanmar, a questionnaire survey was conducted in Yangon and Mandalay. The survey aims at identifying the VC situation of selected agricultural products, and business trends, particularly before and after democratization. For this purpose, the contents of the questionnaire includes a profile of the company, difference of activity before and after the democratization, target market, business environment, origin of procurement, contract farming, and issues and foresight of their businesses.

The questionnaire was distributed to major agribusiness members of the UMFCCI and the Mandalay Region Chamber of Commerce and Industry (MRCCI), and participants of FVC analysis workshops during the first field survey period. Then, during the second field survey period, 32 questionnaires were collected from agribusiness enterprises which included not only horticulture related businesses but also livestock related businesses (Table 4.3.3).

Table 4.3.3 List of Agri-food Enterprises Responded to the Questionnaire Survey

Location	Field	Name of Enterprises
Yangon	Seed	East West Co., Ltd., Ayeryawady Seed Ltd
	Fertilizers/Pesticide	Shan Maw Myae Co., ltd., Margamin Co., Ltd., Agro Power Co., ltd. Agro Green Land Chemical Co., Ltd
	Machinery	Good Brother Co., Ltd., Fan The Shin Co., Ltd.
	Food Processing	Dream World Company, Yathar Cho Co., Ltd., Htoo Mar and Pop Pop Co.Ltd, Myanmar Golden Produce Co., Ltd, Itsumiya Myanmar Co., Ltd., Myat Myint Moh Co., Ltd.,
	Meat	Yangon Breeders Development Co., ltd., Myanmer CP Livestock Co.,ltd,
	Egg	Oakar Myint Moh Co.,Ltd., Popa Co.,Ltd
	Feed	Green Field Internationoal Co.,ltd, Yin Myint Livestock Co., ltd.
Mandalay	Edible Oil	Asia Thar Co., ltd., Golden Taste
	Pulses & Beans	Nyein Chan Yae, Kyin Kyin Thein
	Meat	American Dressed Chicken, Maung Maung Khin Co., Ltd.
	Raw Milk	Shwe Oh Dairy Farm, Aye Aye Chaing (Dairy Farm)
	Processed Milk	Happy Farm, Mother Milk Production

The sample size of target companies are summarized by categories and showed in the next table. The result of survey is summarized as follows.

Table 4.3.4 Sample Size by Categories

Company Scale	Size	Company Category	Size	Year Experienced	Size
More than 300 employees	3	Myanmar National	28	Since Before 1994	11
Less than 300 employees	16	Foreign Affiliated	4	Since After 2000	6
Less than 30 employees	13	-	-	Since After 2006	6
-	-	-	-	Since After 2012	9
Total	32	Total	32	Total	32

(1) Business Trends Before and After Democratization

The Thein Sein administration commenced in March 2011, with the aim of upholding the shift to civilian rule, and democratization policies including economic reforms had been implementing afterward. The survey team asked the agri-food enterprises how their business had changed before and after the democratization. According to the survey results, among 32 respondents of the questionnaire survey, 17 companies (53%) replied. "Extended" after the democratization, whereas two companies (6%) replied "Shrunk".

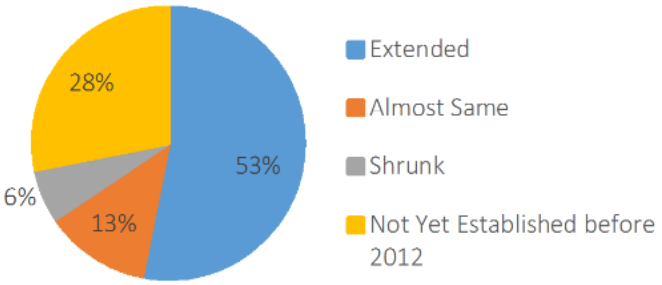


Figure 4.3.2 Change of Business Scale after Democratization (after around 2012)

The main reason for the response 'Extended' is the increase of sales in the domestic markets rather than export expansion. Behind this may lie the lifting of the long-term economic sanctions and the indications of improving consumer confidence particularly in urban areas along with economic growth.

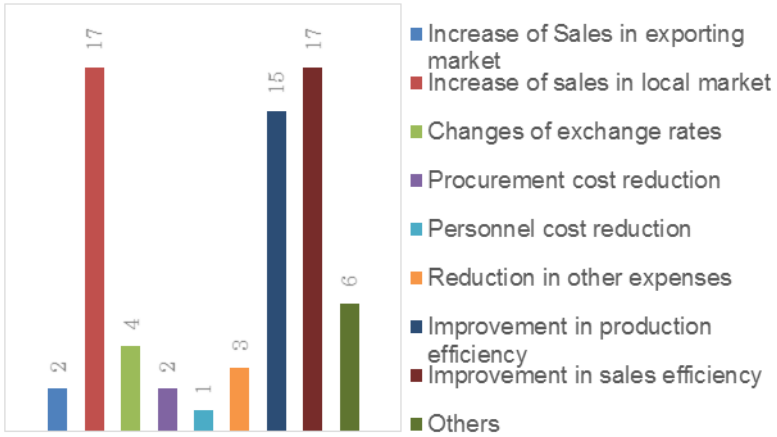


Figure 4.3.3 Changes in Business after Democratization (after around 2012)

Another reason for the 'Extended' response includes improvement in sales efficiency and production efficiency. Even though foreign direct investment in the agriculture sector has been sluggish in comparison to other sectors, penetration of foreign companies, including farm inputs and machinery providers has increased over the decades, resulting in a positive trend in production efficiency.

Only a few company replied that personnel cost reduction and procurment cost reduction were a reason of their 'Extended' conclsion, indicating some conmapies made a great effort to reduce production cost, since our field survey results prove that labor cost and production cost has increased year by year.

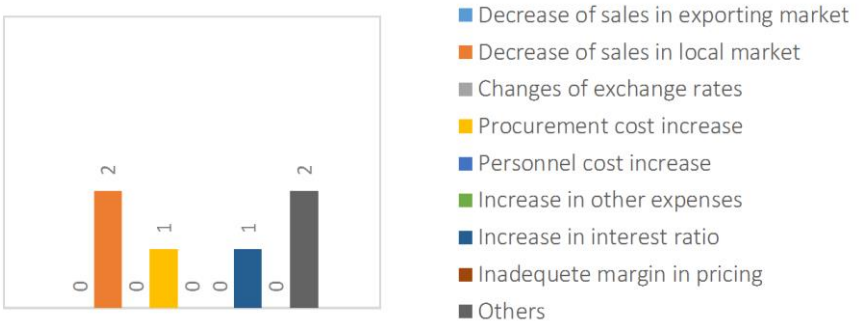


Figure 4.3.4 The Reason of Shrink of Business after Democratization (to the Respondents Whose Business Shrunk after Democratization)

Two companies replied that their business has been shrunk during the democratization period (after around 2012). These two companies are a groundnuts oil company and a beans processing company. Main reason of the shrunk includes decrease of sales in local market, and increase of procurement cost.

The groundnuts oil company cannot compete with the groundnut-flavor palm oil since the mixed oil is three times cheaper than the real groundnut oil. On the other hand, the beans processing company indicated that they hardly catch up with consumers change in life style and consumption style. The company said that, nowadays consumers enjoy readymade food and do not want to spend much time for cooking.

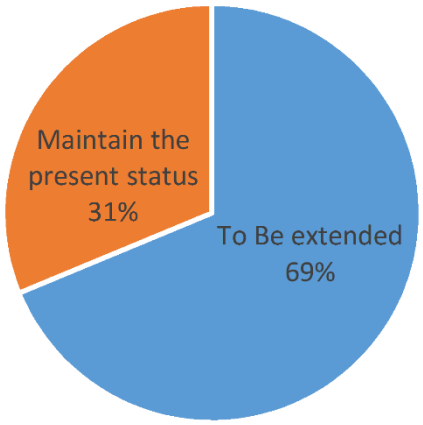


Figure 4.3.5 Future Direction of Business (1-2 years after)

(2) Future Direction and Strategy

The survey team also asked respondents for a future direction plan for their business. As a result, around 70% of respondent replied they have a wish to expand their business in the short-term, (1-2 years) projected plan.

Their basic strategies to expand their business are; i) expansion of market, ii) expansion in production scale by additional investment, iii) expansion of

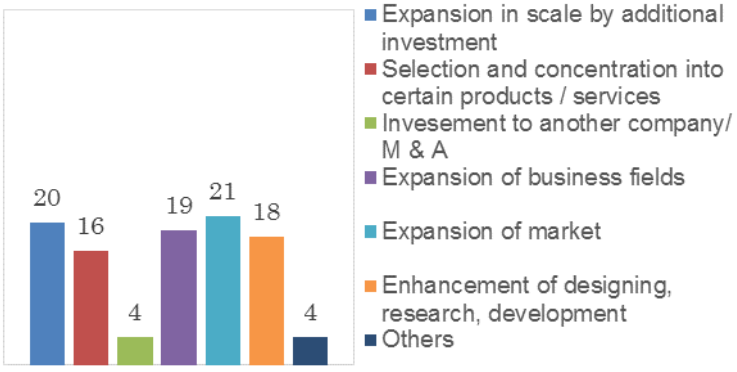


Figure 4.3.6 Concrete Strategy of Business Extension

*Question is for the respondents whose future direction of business is "To Be Extended". Multiple Answers were acceptable

business field, iv) enhancement of designing, research and development, and v) selection and concentration into certain products/services. Only four companies replied that investment to another company/M&A could be a basic strategy for the expansion of their agri-food business.

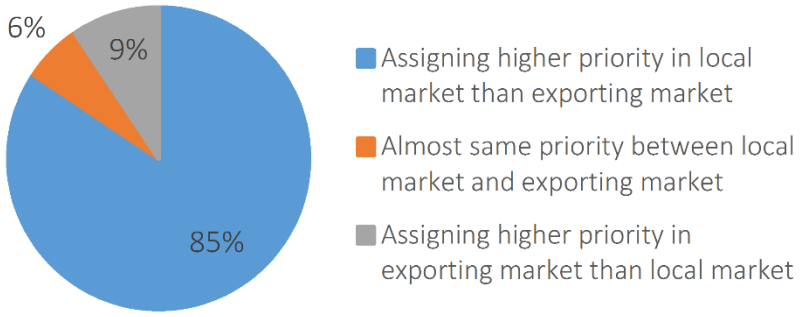


Figure 4.3.7 Local Marketing Strategy in Myanmar (Select Only 1)

(3) Target Market

It becomes clear that, out of 32 respondents of the business trend survey, most agri-food business enterprises put more importance on the domestic markets than the international markets. The response corresponds to another question regarding target market/consumers of their products, and the dominant reply is that a'domestic market with a middle price range is their main target'. However, regarding future direction, it is found that many companies think they want to expand their target to a higher price range in the domestic market in the future.

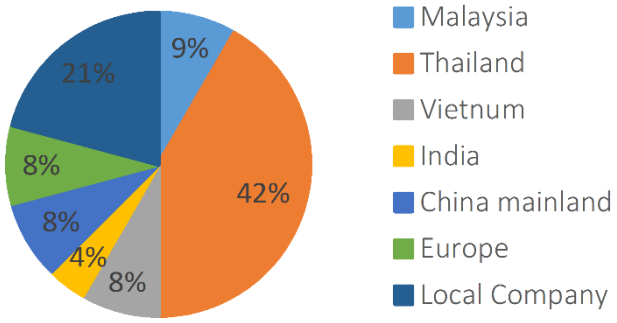


Figure 4.3.8 Country /Region of Strongest Competitors to Promote Middle/Low Price Segment Goods and Services for Local

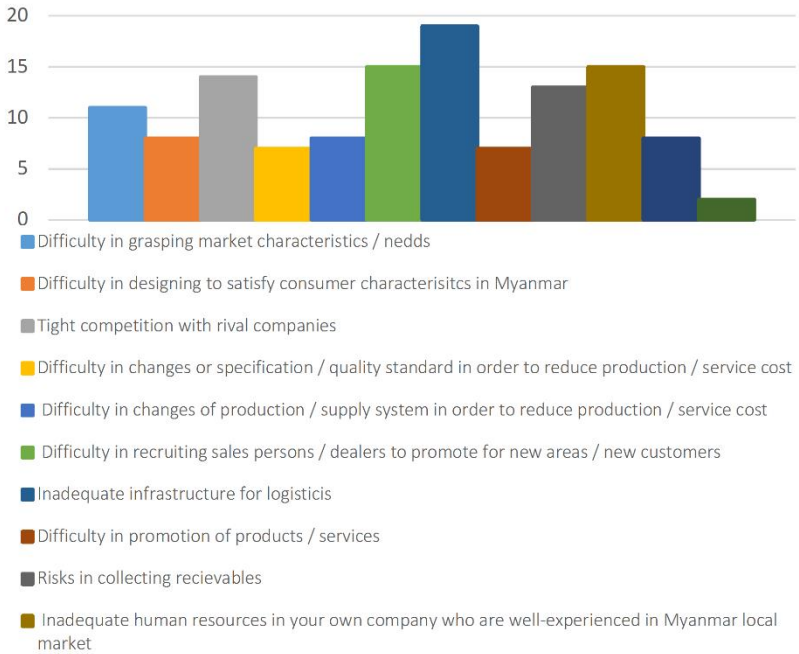


Figure 4.3.9 Facing/to be Facing Issues for Promoting Goods and Services to Middle/Low Price Segments in Myanmar Local Market

Regarding competitors in the market, 42% of respondent think that Thailand is the largest competitor of food products with a middle and low price range, followed by Malaysia, Vietnam, China and the EU. In this question, Southeast Asian countries accounts for around 60%, whereas neighboring countries including China and India account for around 70%. Even though the question is asking about foreign competitors, 21% of respondents replied that local companies are the strongest competitors, indicating local competition of the middle and low price products are also very keen in Myanmar.

(4) Issues on Business Environment

Regarding issues facing or to be facing for promoting goods and services of middle/low price segment in the domestic market, the most common answer is 'inadequate infrastructure for logistics', accounting for around 60% of the total respondentss. Other issues include, 'tight competition with rival companies', 'difficulty in recruiting sales persons/dealers to promote new areas/customers', and 'inadequate human resources who are well-experienced in the Myanmar local market'. The result indicates that, with tightening competition of the prducts with the middle and low price segment, enhancement of efficient and effective logstics is needed since it enables provision of high-quality fresh/processed farm products, to develop new markets, and to reduce transaction costs including transportation fees. In addition, workers who can develop new markets based on proper marketing strategies are also needed to survive current competitive markets.

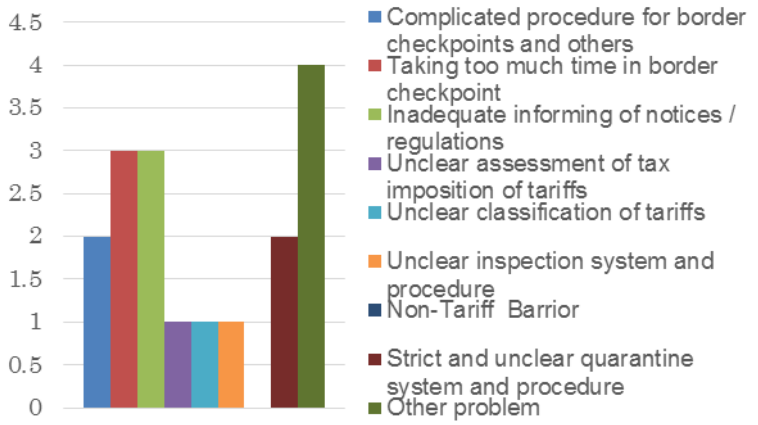


Figure 4.3.10 Issues in Trade Rules

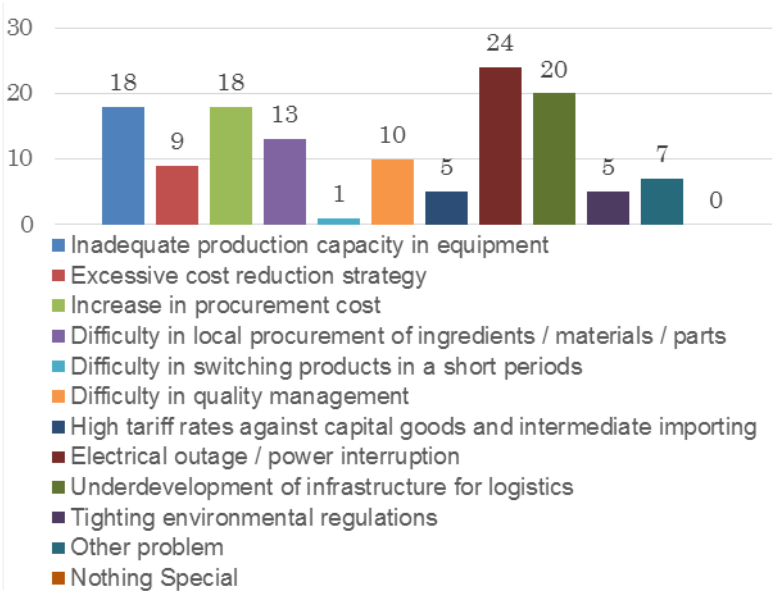


Figure 4.3.11 Issues in Production

*Multiple Answers are acceptable

Regarding issues on trade policy, most companies give us no answer since their main target market are domestic. However, several companies indicate that 'taking too much time in border checkpoint' and 'inadequate information on notice and regulations' are the main obstacles for trading activities.

In addition, it is found that some respondents see the 'delay of documentation by Government' and 'lack of information sharing on Pest Risk Analysis (PRA)' as an additional issue on the border trade. The answers indiacte that improvement of trading procedures, including the introduction of an effective online registering system for example, is needed for smooth transactions at the border areas. Also, the necesssity of Government to Government (G-to-G) information sharing for PRA, and close monitoring of food item at border areas, are necessary for further trade promotion.

The electrical outage/power interruption, and underdevelopement of logistic infrastructure are regarded as major constraints on production environment, followed by inadequate production capacity (eauipment), increase in procurment cost, difficulty in local procurment of ingredients/materials/parts.

(5) Procurement

Regarding procurement origin of low materials and inputs, 52% of respondent reply that they procure from the domestic market, whereas the remaining respondents procure these from foreign countries, including ASEAN countries, China, other Asian countries and the EU. Also, 26% of companies reply that in future they will increase procurement from the domestic market, while 55% of them are thinking that they will increase procurement from foreign countries including China (42%), ASEAN (19%), India (6%) and Japan (4%).

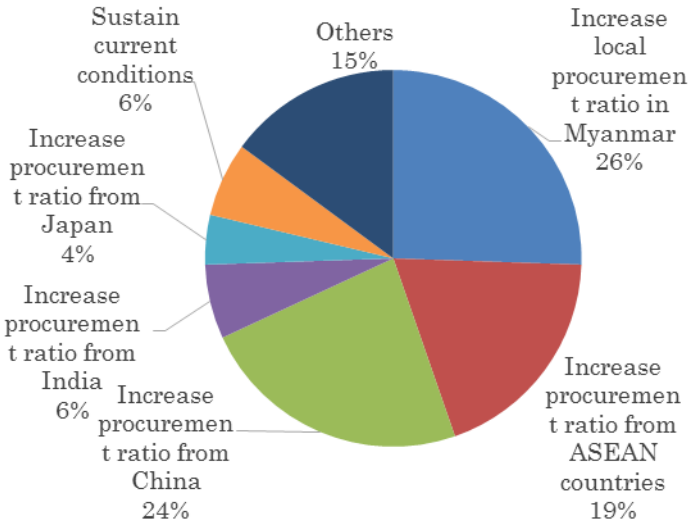


Figure 4.3.12 The Breakdown by Type of Company Out of Local (in Myanmar) Procurement

(6) Contract Farming

The result of the questionnaire survey indicates that 9 companies out of 32 total respondents makes a contract farming with farmers. According to the survey result, condition of the contract with farmers includes provision of technical support, provision of financial support, provision of seed, and provision of fertilizers. Buying all products from farmers is also one of the key conditions under the contract farming.

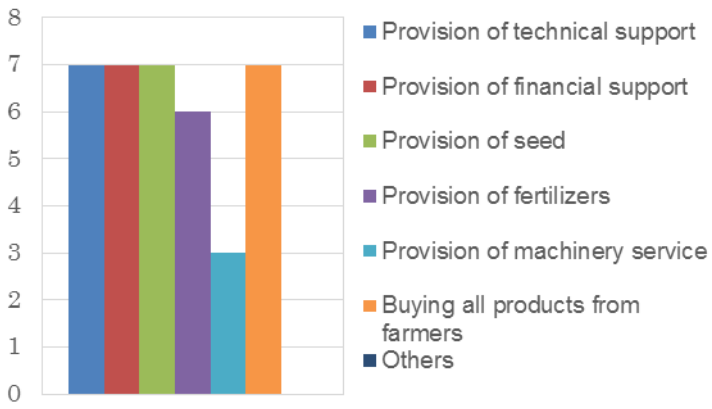


Figure 4.3.13 Support to Farmers When a Company Make a Contract Farming with Farmers

4.3.3 Trend of Horticulture Business by Sub-sector

(1) Vegetable Seed

According to "Road Map for Myanmar's Seed Sector: 2017-2020", out of the 43 companies in seed production and distribution sector in Myanmar, 39 companies are active in the seed business for vegetables and hybrid corn. The majority of these firms are involved in the import and marketing of seeds and agrochemicals, whereas there are only seven companies producing seeds within Myanmar. Also, the Road Map cited that at present, certified vegetable seeds cover only 30-40% of the total vegetable seed market.

The vegetable seed market is basically a sector exclusive to foreign enterprises. According to Myanmar Fertilizer, Seed and Pesticide Entrepreneur Association (MFSPEA), a private company East-West Seed (Myanmar) Co., Ltd. is the sole giant in the market, accounting for approximately 60% of the vegetable seed market, followed by a private company CHIA TAI (12%). Amongst domestic private seed companies, Ayeyarwady Seed and Agro-bio Myanmar are conducting solid business. Consumption of vegetables has been increasing, but demand

for high quality vegetable seed is still low. In fact, most people go to open (traditional) markets to purchase cheaper lower quality vegetables, whereas only few high and middle income earners go to super markets (e.g. 'Market Place', 'City Mart', 'Ocean'), to buy good quality vegetables including "chemical free" products.

(2) Horticulture Processing

According to the DISI's statistics, there are 1,816 horticulture-related enterprises officially registered, and around 90% of them are small and medium-scale enterprises. Comparing to fruit, the processing of vegetables is still not common in Myanmar, and most vegetables sold in market are unprocessed. However, to some extent, powder (chili and turmeric), sauce (chili), and fermented vegetables including vegetables pickles (Shan) and bamboo shoots, can be observed in traditional markets.

Recently, cut vegetables are on display in the supermarkets targeting middle and the higher income earners. Also, new technologies to add value on vegetables have been introduced through foreign investment, including dehydrated vegetables (since 2012 in Heho) and frozen vegetables (since 2015 in Nay Pyi Taw), for example. However, the main markets of dehydrated and frozen vegetables are foreign countries, such as Japan and Korea for instant noodle production. Instant noodles have become popular in Myanmar, but most products are imported from neighboring countries where instant noodle factories are operated.

(3) Horticulture Distribution

Recently, the urbanization of Yangon has been progressing rapidly, and the population of middle income earners is also increasing, and they tend to pay attention to food safety, resulting in a demand increase in fresh produce including perishable vegetables and fruit. To address this situation, several companies have started establishing supply chains of fresh vegetables and fruit utilizing a low temperature logistical network. As a result, the cold chain, from areas of production to urban areas using cold storage and frozen/chilled trucks, has been established in particularly large consumption areas such as Yangon, Mandalay and Nay Pyi Taw.

However, the demand for low-temperature logistics remains limited, due to restricting measures and the low purchasing power of consumers (undeveloped middle class), according to a manager of a foreign logistics company. Most consumers still do not prefer expensive products even if they are clean and safe, but prefer cheaper ones. The cold chain requires consumers who put a value on clean and safe products. Development and/or creation of consumers' sense of "value" on food safety is needed for further expansion of cold-chain logistical business.

For this purpose, a logistics company, Premium Sojitz Logistics Co., Ltd. tries to develop consumers' demand itself. The company supports strawberry farmers in Pyin Oo Lwin, in terms of not only logistics, but also production and marketing. The production support includes a study tour to Japan and introduction of Japanese sweet varieties, and marketing support aspect includes packaging improvements, labeling, and linking supermarkets. Also, another logistics company, KOSPA, suggests the introduction of the "Shoku-iku" concept, targeting all types of consumers including school children, to make them aware of the importance of fresh and safety food.

(4) Consumption

i) Indicators for Consumption

Myanmar's population in 2017 is around 53.4 million, among which 16.7 million are living in urban areas,

accounting for 31.2 % of the total population[18]. The rate is quite high among ASEAN countries, and follows Singapore (100%), Brunei (77.5%), and Cambodia (51.5%). Myanmar's GDP was 69 billion US$ in 2017, which puts it at the lower end of ASEAN economies, but Myanmar's GDP per capita (1,299 US$/year) is the lowest amongst 10 ASEAN countries[19]. The average monthly net salary (after taxes) in Myanmar is estimated at 260 US$ (390,000 kyat), which ranks the third from bottom in ASEAN countries, followed by Cambodia (165 US$) and Laos (248 US$). Of interest is the high Engel's coefficient amongst ASEAN countries, which was 73% in 2011, indicating that the consumers in Myanmar still basically adhere to price-sensitive consumption style.

Table 4.3.5 Comparison of Indicators

Country	Population (million) /a	Population in the largest city (% of urban population) /a	Population in large city (million) /b	GDP (billion USD) /a	GDP per capita (current US$) /a	Average Monthly Net Salary (After Tax) (US$) /c	Engel's Coefficient /d		Meal, Inexpensive Restaurant (US$) /c	Meal for 2 People, Mid-range Restaurant, Three-course (US$) /c
Indonesia	264.0	7.2	19.0	1,016	3,847	319	32%	2016	1.7	9.9
Singapore	5.6	100.0	5.6	324	57,714	2,931	7%	2016	8.7	43.4
Thailand	69.0	29.1	20.1	455	6,594	612	27%	2016	1.8	18.4
Philippines	104.9	27.1	28.4	314	2,989	279	43%	2016	2.8	13.8
Malaysia	31.6	30.7	9.7	315	9,945	849	21%	2016	2.4	13.1
Brunei	0.4	77.5	0.3	12	28,291	1,412	13%	2011	3.5	17.8
Vietnam	95.5	23.4	22.4	224	2,343	388	40%	2016	1.7	17.2
Myanmar	53.4	31.2	16.7	69	1,299	260	73%	2011	2.0	15.0
Laos	6.9	27.9	1.9	17	2,457	248	..	..	2.4	19.7
Cambodia	16.0	51.5	8.2	22	1,384	165	40%	2004	3.0	18.0
Japan	126.8	32.2	40.9	4,872	38,428	2,557	26%	2017	7.0	35.0

Source: a/World Development Indicators, The World Bank
b/Estimated by JICA Survey Team
c/NUMBEO
d/Daiwa Research Institute (Indonesia, Singapore, Thailand, Philippines, Malaysia, Vietnam, Laos, Cambodia), ILO (Myanmar), Brunei Household Expenditure Report 2011 (Brunei), Ministry of Internal Affairs and Communication (Japan).

ii) Supermarket

Over the decades, the food sector in Myanmar has changed, and a variety of foodstuffs and the way of consumption have also changed. The acceleration of urbanization also changes peoples' consumption styles, since the migrants are just the buyer or the consumer of food without producing any farm products. They buy agricultural products at supermarkets or traditional markets.

Modernized supermarkets, restaurants and coffee shops have rapidly increased in urban areas, providing new and greater options for consumers when compared to the traditional tea-shops and market stalls. International food brands have also entered into the food sector, and Myanmar citizen have started to enjoy the diversified

[18] World Development Indicators
[19] World Development Indicators

choice of food in the modernized supermarkets, restaurants and fast food chains. Middle and high income earners are the main beneficiaries of this diversified consumption style. In general, the average meal expense of ordinary Myanmar citizen in urban areas is around 1,000 - 4,000 kyats/meal, whereas middle and high income earners can enjoy more expensive meals (e.g. 7,000 kyats/meal) on several occasions.

However, it is said that the majority of consumers still go to traditional (open) market to buy fresh products, and only 15-17% of citizen go to the modernized supermarkets such as 'City Mart', 'Ocean', 'ProMart' and 'Orange Supermarket'. Furthermore, the customers who come to the supermarkets tend to buy daily necessities only, and seldom have an opportunity to purchase fresh vegetables and fruit. However, demand for fresh vegetables and fruit is increasing gradually, 30% per year according to a procurement manager of 'City Mart'.

City Mart Holdings (CMHL) is the largest retail chain in Myanmar, and has developed a constituency based retail channel. The company operates 43 City Marts in urban areas including Yangon, Mandalay, Taunggyi, Myaungmya and Mawlamyine, targeting urban citizens, whereas 13 Ocean supermarkets targeting families have been established. For high income earners, it operates 5 Market Places in Yangon and sells relatively high quality products including imported food items.

Orange Supermarket is a retail supermarket targeting middle income earners in urban areas. It is operated by AEON Orange Co., Ltd., a joint venture company of Creation Myanmar Group of Companies (CMGC) and AEON, and has 11 shops in Yangon and 3 shops in Mandalay. According to manager of Orange Supermarket in Mandalay, they procure vegetables from local markets, except chemical free vegetables from Fresh Farm (private company). The price of chemical free vegetables is twice as higher as ordinary vegetables. However, comparing to Yangon, the numbers of costumers who are sensitive to chemical free produce is still low, and they generally prefer low price products. 30% to 40% of chemical free vegetables remain unsold and end up on the shelf.

iii) Hotels and Tourist

On one hand, the urban population has increased as the national economy grows. On the other hand, the numbers of visitors from abroad has also increased in the last ten years. According to MOHT, the number of foreign visitors was 220 thousand in 2007; and the number increased to 1,363 thousand in 2017, six times larger than a decade before. Most foreign visitors come from Asian countries, accounting for 70% of total foreign visitors in 2017, followed by Western Europe (18%) and Northern America (6%).

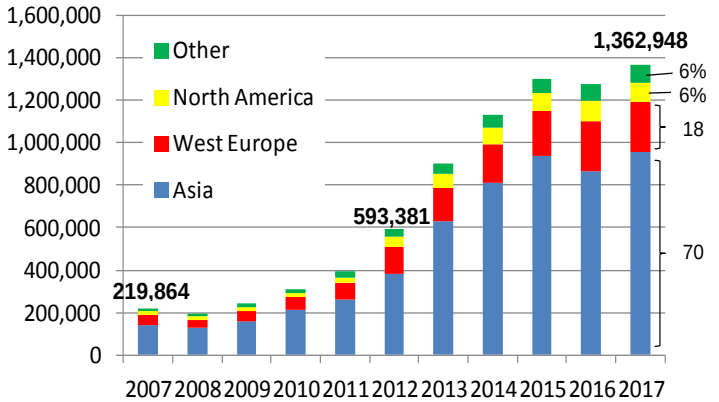


Figure 4.3.14 Number of Foreign Visitors

Source: The MOHT

However, the number has decreased in recent years. The main reason of the decrease is border issue in Rakhine State, in addition to state sluggish growth of national economy, according to Tourism Federation of Myanmar. The number of visitors including Myanmar nationals was 4,681 thousand in 2015, but decreased to 2,907 thousand in 2016, almost a 40% decrease. According to MOHT, visitors through border gateways has decreased dramatically, but visitors numbers through Yangon and Mandalay have not decreased to the same extent, indicating visitors coming for business purposes remains strong.

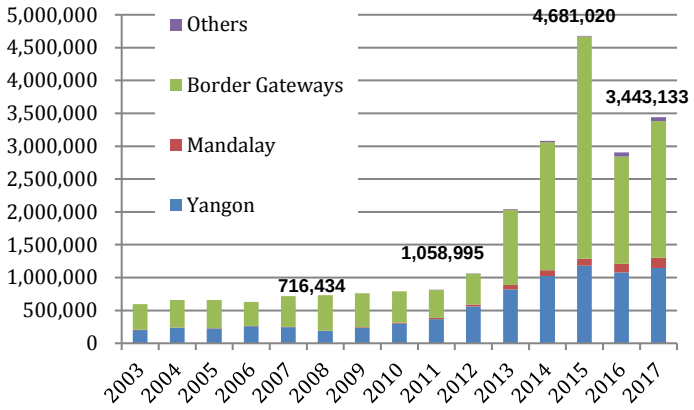


Figure 4.3.15 Number of Visitors by Entry Points

Source: The MOHT

As the number of foreign visitors increases, the number of hotels also increases to accept those visitors. The number of hotels in Myanmar was 619 in 2007, while in 2017 this increased to 1,590 - an increased of 2.5 times within a decade. As the number of hotels increases, the demand for quality food including fresh vegetables also increase.

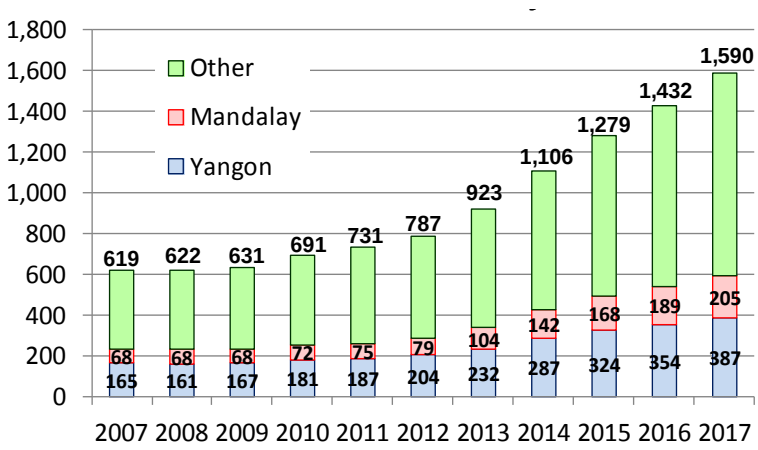


Figure 4.3.16 Number of Hotels in Myanmar

Source: The MOHT

Modern or international hotels provide various types of foods to their guests, and the meals include western and oriental dishes in addition to traditional Myanmar foods. Some hotels change their breakfast menu based on nationality of their guests.

Also, international hotels tend to use high quality vegetables for fresh salads, for example. They prefer bright and colored vegetables, including red-leaf lettuces, violet cabbages, brightly colored bell peppers, cardinal cherry tomatoes etc for decoration purpose of fresh salad. Also, large, bright and aromatic fruit, including apples, oranges and grapes, are also marketable to the hotels since these products are suitable for fruit baskets and fruits platters, and tend to give customers a sense of quality about the products.

According to Tourism Federation of Myanmar, around 5% of food materials are imported from abroad, whereas the rests are procured from local markets. Procurement source of high quality vegetables and fruit etc are different, according to the procurement managers of hotels. Hotels tend to buy cooking vegetables (which are deformed after cooking) at traditional market, and purchase high quality vegetables and fruit at supermarkets or specific markets, the so called rich man's market including Than Market in Yangon and Yadana Pon Market in Mandalay, where imported vegetables and fruits are always available. Import substitute of the high quality vegetables and fruit is an ideal challenge for further agricultural development in Myanmar.

iv) Restaurant

Most eating place in Myanmar are small scale, including small local restaurants, food stalls, and tea shops, located in and surrounding areas of traditional markets, busy streets, downtown areas, shopping district and community centers. They serve traditional meals and recipes, street food, noodles, fried food, snacks, desserts and drinks. The number of local small eating places also increases as the urban population increases, since they can start operation with a small amount of capital and resources. Their customers are basically local workers and families who are strong price-sensitive consumers who make up a great part of the vegetable and fruit consumers in traditional markets.

In recent years, particularly in urban areas, the number of large and modern restaurants has increased, and they target the urban population and visitors from abroad. According to MRA, the number of restaurants with more than 50 seats increased 1.6 times in Yangon, and 2.3 times in Mandalay over the last 5 years.

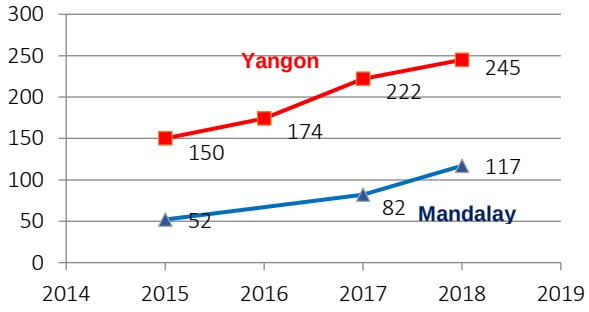


Figure 4.3.17 Number of Restaurants in Yangon and Mandalay

Source: MRA

*The number of restaurants where there are more than 50 seats.

Foreign investment in this field has also increased and foreign fast food chain, including KFC, Lotteria, Piza Hut, Burger King, Chic & Chill, Marry Brown, Swensen's, Pizza Company, Ya Kun Coffee & Yoast, J'Donuts, Gloria Jean's Coffee, and Gong Cha, have started operation in urban areas[20]. The earliest chains, including the CP group (Thailand), Lotteria (Korea), Marrybrown (Malaysia) and BBQ Chicken (Korea) started operation in 2013, whereas many famous foreign franchise started operation in 2015 and 2016. The latter franchises include KFC, Pizza Hut, and Burger King.

The foreign fast food chains provide different menu from traditional Myanmar restaurants, and serve fried chicken, fried or mashed potatoes, hamburgers, salads, hotdogs, pizza, bakery, donuts, cookies, brewed coffee, shakes and ice cream. They are good buyer of Myanmar products, but some of them have difficulties in food material supply. For example, KFC procures chicken meat from local producers, but an underdeveloped infrastructure and cold chain forces operating costs to increase[21]. Also, the limited consumers' purchasing power is another constraint for the foreign franchises.

Traditional Myanmar restaurants also face difficulties in recent year. Feel is an established Myanmar restaurant, and operates 18 restaurants in Yangon, Pyin Oo Lwin, Meiktila, Pyu, Mandalay and Nay Pyi Taw. Originally their target customers were wealthier citizens and foreigners, and they serve fusion cuisine including Chinese, Thai, Western and Japanese dishes. However, they have tried to target middle income earners due to over competition, and so add Myanmar traditional food to their menu. Now they ensure that middle income earners

[20] Fast Food in Myanmar, Myanmar Insider (2018)
[21] Firein Investment in Fast Food, Oxford Business Group.

also often have a lunch and dinner in outside of the house, and that Myanmar traditional food is gaining popularity amongst foreign customers. According to the General Manager of Feel, Myanmar people still prefer meat than vegetables; four meat dishes with one vegetable on average.

Golden Duck (Shwe Bae) is also one of famous traditional restaurants of Myanmar, operating six restaurants in Yangon and two restaurants in Mandalay. Their main customers are Myanmar citizens, and some, though few, foreigners. They buy cooking vegetables (which are deformed after cooking) at traditional market, but buy high quality vegetables and fruits at supermarkets, such as Market Place of City Mart. According to the General Manager of Golden Duck, customers for dinner and party purpose has increased during their 40 years operation. Also they try to reduce oil and salt in their products based on changes in consumers taste.

v) Consumers' Preference

The consumers' preference has also changed over recent decades. As the middle class population grows, particularly in urban areas, the number of people concerned about food consumption also changes. Consumers amongst middle and higher income earners tend to put more importance on the health and safety of foods, and prefer fresher and less chemically-altered food, even though the price of these products is relatively higher. Corresponding to the new trends of food consumption, according to interview survey of restaurant managers, some established/traditional restaurants change their meals to include less oil, less salt, no monosodium glutamate (MSG), and no artificial coloring.

The price of high quality vegetables and fruit is relatively high, but those who consider health and food safety tend to spend more money to this 'value'. However, in most cases, high quality vegetables and fruits are imported from neighboring countries such as Thailand and China, since the quality of domestic vegetables and fruit is still poor and the appearance is considered to be not attractive. Quality improvement through introducing high quality varieties of these products is needed.

Than Zay market in Yangon is known as a market for good quality vegetables and fruit. Many procurement staff/agents of hotels and restaurants in southern Yangon visit the market for daily procurement of fresh products. Imported fresh products are also available on the 17th street of the market. The products are transported from Thailand and China through Aung Mingalar bus station in Yangon. The following table shows imported fresh products sold at Than Zay market.

Table 4.3.6 Imported Vegetables in Than Zay Market

Products	Price	Country of Origin
Chili	8,000 kyats/Viss	Thai
Ginger	4,000 kyats/Viss	Thai
Celery	5,000 kyats/Viss	Not known
Asparagus	6,000 kyats/Viss	China
	12,000 kyats/Viss	Thai
Courgette (zucchini)	3,000 kyats/Viss	China
Bell pepper	6,000 kyats/Viss	Thai
Green onion	5,000 kyats/Viss	China
Parsley	10,000 kyats/Viss	China
Onion (large)	2,000 kyats/Viss	China
Lemmon	300 kyats/piece	China
Radish	2,500 kyats/Viss	China
Violet cabbage	5,000 kyats/Viss	Thai
Lemongrass	3500 kyats/Viss	China

Source: JICA Survey Team

According to the MFVP, the following fruits is mostly imported from Thailand. Thailand is located further south than Myanmar, and can export one or two months ahead of Myanmar when Myanmar products are still immature. For example, Thailand mangos are available in the domestic markets during February and March with higher prices, but go off the market from April when Myanmar mangoes flow into domestic markets. In general, Myanmar products are smaller, flesh is thinner, and the seeds are larger compared to Thai products, and there is a room for quality improvement.

Table 4.3.7 Fruits from Thai and Their Characteristics

Fruits	Local Product	Imported (Thai)	Remarks
Pineapple	200-500 kyat/piece (Jun.-Aug.)	1,000-1,400 kyat/piece (Sep.-May)	Thai pineapples are larger. Local products mainly come from Hsipaw.
Rambutan	80 kyat/piece	120 kyat/piece	Myanmar product is smaller. Thai product is sweeter.
Pomelo	1,200 kyat/piece (Jul.-Feb.)	1,600 kyat/piece (May-Jun.)	Thai product is available two months earlier. People prefer local products taste.
Mangosteen	100 kyat/piece (May-Sep.)	400 kyat/piece (Apr.-May)	Thai product is available one month earlier.
Dragon fruits	700 kyat/piece (May-Jul.)	700-800 kyat/piece (Jul.-Sep.)	Local product is smaller, but sweeter.
Dragon's eyes Fruit (Longan)	800 kyat/kg (July)	1,000 kyat/kg (all year round)	Local product is smaller and flesh is thin, but sweeter.
Litchee	1,000 kyat/kg (May-Jun.)	1,500 kyat/kg (May- Jul.)	Thai product is sweeter and has a nice appearance.
Mango	800 kyat/piece (Apr.-Jun.)	1,200 kyat/piece (Feb.-Mar.)	Thai product is available two months earlier, and can be sold at a higher price. Thai product is brighter, but local product is sweeter and less fiberous.
Dorian	Apr.-Oct.	All year round	Local product is more popular because it is sweeter, but seed is larger and flesh is thin.

Source: JICA Survey Team

vi) Chemical Free and Organic Products

The market for organic products has not yet developed, but the demand for chemical free products is gradually increasing. Advanced supermarkets and health-conscious retail shops provide chemical free vegetables and organic rice and coffee products. According to 'Go Green Myanmar'- a retail shop for fresh fruit and chemical free vegetables in Yangon- most buyers of the chemical free products are still foreigners, returnee from abroad, and highly educated Myanmar citizens who can afford to pay attention to their health and food safety.

Under such circumstances, suppliers of the chemical free products make an effort to diversify their marketing channels. 'Fresco' and 'Mya Chemical Free' have a delivery service of chemical free or less chemically treated vegetables to consumers' houses and residences. For example, Fresco is a producer of vegetables and herbs that are grown naturally using natural fertilizer and respecting the normal life cycle of the plants. Fresco has a delivery service called 'Veggie-Box', which provides seasonal and fresh vegetables to consumers directly, in addition to working with supermarkets, hotels and restaurants.

vii) New Style of Consumption

A new style of food delivery and consumption has recently developed as ICT and SNS becomes common in Myanmar. Online food delivery services targeting internet users are becoming popular particularly in urban areas. Some traditional Myanmar food restaurants including Khaing Khaing Kyaw, have started a delivery service of

their food, including curry and mohingar. Some delivery service providers, including Food-2-U Yangon and Door-2-Door, provide a service to pick-up prepared food from restaurants and and home deliver. It is said that those consumers who are too busy to cook, or do not want to go outside during heavy rain, tend to use online delivery services.

4.4 Production Situation in the Horticulture Sector

In general, two perspectives -quantity and quality, tend to be emphasized in horticulture production. Both perspectives are obviously essential to improving horticulture production as well as the whole FVC. However, according to the interview survey, when it comes to exporting products, many traders and processors in Myanmar are recently more likely to face the problem of product quality. Although it is required to prepare a certain amount of product to trade overseas, the improvement of product quality is also required. To address such a challenge, the Myanmar GAP should be taken into account.

4.4.1 Myanmar GAP

Recently, Myanmar GAP protocol and specific GAP guidelines were established for 15 crops (Table 4.4.1), and the MOALI pays strong attention to the Myanmar GAP. During the survey (March to June 2018), it was found that only several farmers obtained a GAP certificate for mangoes, tomatoes, and muskmelons for export. Generally speaking, objective of the GAP is to ensure sustainable good agriculture practices including food safety, environmental conservation and safe working/farming environment. Some farmers recognize that GAP improves productivity, while the other farmers think the cost to introduce the GAP is high, which makes them reluctant to introduce GAP protocol.

According to the interview survey, in the case of mangoes, inspection cost for the GAP certification is 100,000 kyats per year, and the GAP certificate holders are required to renew their certificate every year.In short, a GAP certificate requires a certain cost every year. However, as the Myanmar GAP has been introduced recently, the cost to obtain the Myanmar GAP certificate dependes on the locations (States/Regions). Some farmers do not have to pay anything for obtaining the certificate. Furthermore, it should be noted that a GAP certificate does not directly guarantee that the pesticide residue level in the produce satisfies the MRLs. One of the reasons causing such a situation is a lack of accredited laboratories in Myanmar.

Table 4.4.1 Selected Crops for Myanmar GAP

Rice	Maize	Pulses(Black Gram, Green Gram)
Sesame	Groundnut	Mango
Pomelo	Watermelon	Muskmelon
Onion	Tomato	Chili
Cabbage	Coffee	Avocado

Source: JICA Survey Team

Furthermore, the Myanmar GAP has not yet fully satisfied the requirements of the Global GAP, and has not yet completely followed ASEAN GAP guidelines (Box 4.1). Compared with the Global GAP and ASEAN GAP (guidelines), the Myanmar GAP focuses especially on the improvement of cultivation/production processes. The Global GAP and ASEAN GAP cover food safety, traceability, environment, workers' health, safety and welfare. On the other hand, the Myanmar GAP, regarding sesame for example, outlines the suitable land and temperature needed to cultivate sesame, use of compost and fertilizer and IPM. In accordance with the recording format of

the Myanmar GAP, the farmers are supposed to record not only use of pesticides, but also sowing date, intercrop, and any fertilizer used. Furthermore, according to the DOA Call Center[22], there are several questions related to the GAP from the farmers, such as a request of GAP guideline and application form, and how to apply GAP. (Four out of the 80 questions in a month were related to the Myanmar GAP.).

4.4.2 Current Situation and Utilization of Agricultural Inputs in Horticulture Production

Box 4.1 Global GAP and ASEAN GAP (Guideline)

Global GAP	ASEAN GAP (guideline)
Contents	Contents
・ Food safety and traceability ・ Environment (including biodiversity) ・ Workers' health, safety and welfare ・ Animal welfare ・ Includes Integrated Crop Management, Integrated Pest Control, Quality Management System, and Hazard Analysis and Critical Control Points	・ Food safety ・ Environmental Management ・ Workers' health, safety and welfare ・ Produce Quality
Established year	Established year
・ 2007, EUREP GAP became Global GAP ・ 1997, EUREP GAP was originally started from European retailers' GAP	・ 2006, ASEAN GAP (guideline) was established
Countries implementing equivalent GAP (requirements and system conformed)	Countries implementing GAP based on ASEAN GAP
・ Australia, Ethiopia, Netherlands, Kenya, Spain, New Zealand, Germany, Switzerland	・ Each national GAP of ASEAN countries is partially based on ASEAN GAP

Source: Global GAP Website (https://www.globalgap.org/uk_en/), ASEAN Website (https://asean.org/?static_post=asean-gap-standard-2), FAO." Training slides on ASEANGAP"

The survey of agricultural inputs utilization was conducted with 75 farmers in five townships; Kyaukse, Meiktila, Taunggyi, Kalaw, and Pathein. Except for Pathein Township, three farmers were selected and interviewed based on the criteria of having a specific crop out of the following five cropping patterns; Paddy, Upland crop, Complex Farming, Horticultural Crop, and Fruit. In Pathein Township, five paddy farmers, five horticultural crop farmers, and five fruit farmers were interviewed.

Table 4.4.2 The Number of Respondents to This Surveys by Cropping Pattern (psn)

Township	No of farmers (psn)					
	Paddy	Upland Crop (Fodder Crop)	Complex Farming (Both Paddy & Upland Crops)	Horticultural Crop (Vegetable & Oil Crops)	Fruit	Total
Kyaukse	3	3	3	3	3	15
Meiktila	3	3	3	3	3	15
Taunggyi	3	3	3	3	3	15
Kalaw	3	3	3	3	3	15
Pathein	5	0	0	5	5	15
Total	17	12	12	17	17	75

Source: JICA Survey Team

Basic information of the respondents is described in the next table. 71 out of the 75 farmers are male, and the average years of farming experience is 23.8 years. The average number of household members is five. The

[22] DOA Call Center; It is established in August 2017. The major function is sharing agricultural techniques and respective contact persons. It has social media such as Viba and facebook page, as well.

average area of ownership of the respondents is 16.1 acre, but it varies by township.

Table 4.4.3 Basic Information of Respondents

Township	Sex of Respondents(psn)		Average Year in Farming(yr)	Average No. of Household Member(psn)			Average Owned Area(acre)
	Male	Female		Adults	Children	Total	
Kyaukse	15	0	28.0	3.5	0.7	4.3	10.5
Meiktila	15	0	18.5	4.7	0.9	5.9	12.8
Taunggyi	15	0	29.0	4.9	1.0	6.1	43.3
Kalaw	15	0	25.3	3.5	1.0	4.6	10.0
Pathein	11	4	18.4	3	0.7	3.9	3.8
Total/ Average	(Ttl) 71	(Ttl) 4	(Ave) 23.8	(Ave) 3.9	(Ave) 0.9	(Ave) 5.0	(Ave) 16.1

Source: JICA Survey Team

(1) Production

The 75 respondents cultivate 48 kinds of crops as shown in the next table. The number of respondents who cultivate rice (Monsoon/Summer), garlic, okra, potato, sesame, mangoes and pineapples is high.

Table 4.4.4 Cultivated Crops by Respondents

Crops	No of farmers (Total Number of cultivating farmers)(psn)					
	Kyaukse	Meiktila	Taunggyi	Kalaw	Pathein	Total
Banana	1	0	0	0	0	1
Butterfly flower	0	0	0	0	1	1
Cabbage	0	0	1	3	0	4
Cabbage (summer)	0	0	0	1	0	1
Cabbage (Winter)	0	0	0	1	0	1
Carrot	0	0	3	0	0	3
Cauliflower	2	0	0	0	1	3
Chickpea	2	2	0	0	0	4
Chilli	3	1	0	0	0	4
Chinese cabbage	0	0	1	0	0	1
Chrysanthemum	0	0	0	2	1	3
Corn	0	0	6	2	0	8
Cotton	1	0	0	0	0	1
Dragon fruit	0	0	0	1	0	1
Eggplant	1	0	0	0	1	2
Garlic	0	0	8	3	0	**11**
Ginger	0	0	0	1	0	1
Grape	0	0	1	0	0	1
Green-gram	1	3	0	0	0	4
Groundnut	0	3	0	2	0	5
Jack fruit	0	0	0	0	1	1
Jasmine	2	0	0	0	0	2
Mango	2	3	3	0	0	**8**
Muskmelon	1	0	0	0	0	1
Morning Glory	0	1	0	0	0	1
Okra	1	3	0	0	2	**6**
Orange	0	0	0	1	0	1
Paddy (Monsoon)	5	8	6	6	5	**30**
Paddy (Summer)	4	4	0	0	5	**13**
Papaya	0	0	0	0	2	2
Pigeon pea	0	1	1	2	0	4
Pineapple *	0	0	0	0	3	3
Pomelo	0	0	1	0	0	1
Potato	0	0	3	6	0	**9**

Crops	No of farmers (Total Number of cultivating farmers)(psn)					
	Kyaukse	Meiktila	Taunggyi	Kalaw	Pathein	Total
Roselle	0	2	0	0	1	3
Sesame	3	6	0	0	0	**9**
Sesame + Pigeon pea (intercropping)	0	1	0	0	0	1
Small Jasmine	1	0	0	0	0	1
Soap pod	0	0	0	0	1	1
Soy bean	0	0	0	1	0	1
Strawberry	0	0	0	1	0	1
Sunflower	2	0	1	0	0	3
Taro	0	0	0	0	1	1
Tomato	0	1	1	0	0	2
Watermelon	1	0	0	0	0	1
Yard Long Bean	0	1	0	0	2	3
Total	33	40	36	33	27	169

Source: JICA Survey Team

The production of 18 crops, cultivation area, yield/acre, production cost/acre and farmer's income in the sale period is summarized in Table 4.4.5. All of the data in the table is derived from the average of more than three farmers. Several farmers answered that they have no net income. As the sample size is limited in this survey, the result should not be taken as general/common trend. Amongst interviewed famers, the farmers growing pineapples, mangoes and potatoes, seem to have higher profits. On the other hand, the farmers growing chick peas, pigeon peas and green grams, tend to have less income. It might be related to the recent suspension of exporting several types of beans from Myanmar to India.

Regarding the cost of pesticides based on the VC workshop, it accounts for approximately 24% of the total production costs of mangoes, 11% of tomatoes, and 26.5% of cabbages. Although these percentages vary amongst those crops, it can be up to approximately 30% of the total costs in mung bean production[23].

Table 4.4.5 Production Area, Unit Yield, Production Cost and Farmer's Income

Crop Name	Production Area (Acre)	Yield/ Acre	(unit)	Production Cost (Kyats/acre)	Farmer's Income in the sale period(Kyats/acre)
Cabbage	5.73	11,333	pieces(head)	766,667	945,000
Carrot	0.83	1,667	Viss	200,000	433,333
Cauliflower	1.50	6,667	pieces(head)	350,000	706,667
Chickpea	3.50	11	Baskets	122,500	95,375
Chili	0.75	233	Baskets	625,000	1,293,750
Corn	10.84	1,174	Viss	215,625	348,613
Garlic	2.86	1,271	Viss	1,482,000	544,909
Green gram	8.13	8	Baskets	116,000	117,000
Groundnut	2.40	49	Baskets	217,400	302,600
Mango	13.50	7,460	fruits	357,438	1,425,000
Okra	1.26	3,175	Viss	1,475,000	960,000
Paddy (Monsoon)	13.16	79	Baskets	312,569	366,328
Paddy (Summer)	6.42	86	Baskets	258,462	304,462
Pigeon pea	5.00	207	Viss	74,667	95,000
Pineapple	0.83	2,067	Fruits	433,333	2,816,667

[23] Floor Peeters, et al., 2015, Crop protection and pesticide risk assessment Myanmar

Crop Name	Production Area (Acre)	Yield/ Acre	(unit)	Production Cost (Kyats/acre)	Farmer's Income in the sale period(Kyats/acre)
Potato	6.49	6,389	Viss	2,035,556	1,915,000
Sesame	7.22	8	Baskets	117,333	226,333
Yard Long Bean	0.33	3,100	Viss	500,000	1,300,000

Source: JICA Survey Team

According to the statistics of the MOALI, several reasons of the low yield of vegetables are pointed out, such as a lack of good seeds and seedlings, poor soil conditions, inadequate knowledge and techniques and so on. Unit yields of major vegetables in Myanmar are less than half of Japanese unit yields (Table 4.4.6). In horticulture production, attentive cares and techniques result in a significant yield difference. The difference sometimes becomes 1ton/10a between neighboring fields, and such difference will bring a greatest impact on a farmer's income.

Table 4.4.6 Unit Yield in Myanmar and in Japan

Crop	Unit Yield (ton/10a) in Myanmar	Unit Yield (ton/10a) in Japan*
Tomato	1.2	6
Cabbage	1.5	4
Lettuce	0.7	1.7
Carrot	0.7	3.2
Watermelon	1.2	3.7
Radish	0.5	4
Potato	1.55	3.17 (planted in spring)

Source: http://www.maff.go.jp/j/tokei/kouhyou/sakumotu/index.html

According to the DOA Call Center, questions related to rice cultivation methods and varieties, and rice plant protection methods were most asked in the period June to August, 2017 (the latest three-month data). The next priorities were questions related to several specific crops such as beans, pulses, sesame, tropical tree, chili and mushroom. Detailed information of those questions is provided in the next table by category, the number of calls, and the contents of the conversations (enquires ets) by the farmers.

Table 4.4.7 Questions Received at DOA Calling Center

No.	Category	Total No. of Enquires	Contents of Questions
1	Rice Cultivation Method and Rice Variety	28	What fertilizers to apply and when; where to get good varieties; methods to breed good cultivars
2	Plant Protection in Rice (pests and diseases)	21	What pesticide to apply; how to control sheath blight disease/rice gall-midge
3	Beans and Pulses	15	Potential pests/disease, cultivation methods, estimated market demand
4	Sesame	8	How to prevent phyllody disease, cultivation method, feriliser
5	Shaw Phyu (*sterculi vermicolor Wall*.) Tropical Tree for medicinal purpose	6	Cultivation methods, suitable soil, market demand
6	Chili	5	How to control shrinking and wilting
7	Mushroom	5	Suitable department to ask, cultivation methods
8	Soil	4	Soil type, contact person to conduct soil test

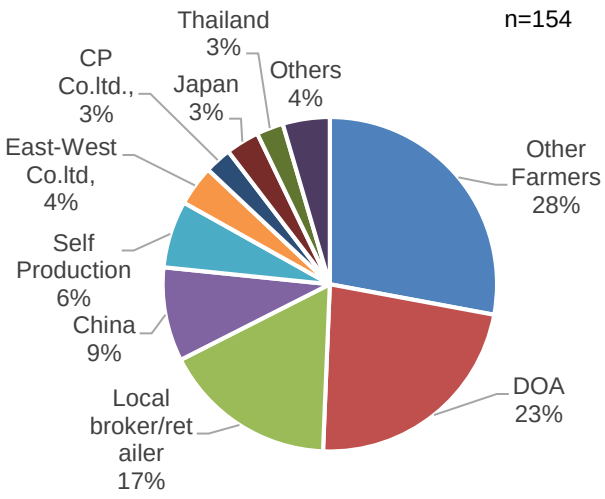
No.	Category	Total No. of Enquires	Contents of Questions
9	Tomato, Banana, Betel, pH Tester	each 3	Cultivation methods, how to control pest and diseases, how to control betel vine, how to use pH Tester
10	Others e.g.General Information of Myanmar	41	Cultivation methods and situation of industrial crops horticulture crops, flowers and fruits, GAP

Source:The DOA Call Center (summarized by JICA Survey team)

(2) Seed and Nursery

The share of seed/seedling providers is shown in Figure 4.4.1, based on the interview survey. Around 30% of farmers buy seeds/seedlings from other farmers, and around a quarter of all the respondents replied that they buy the seeds from the DOA. However, when considering only seed/seedling providers of horticultural crops, and the data without rice is examined, the share of the DOA is dramatically decreased. Over half of seed/seedling for horticultural crops are provided by other farmers or local brokers/retailers.

1) Share of Seed/Seedling Providers in Agriculture Produce



2) Share of Seed/Seedling Providers in Agriculture Produce Excluding Rice

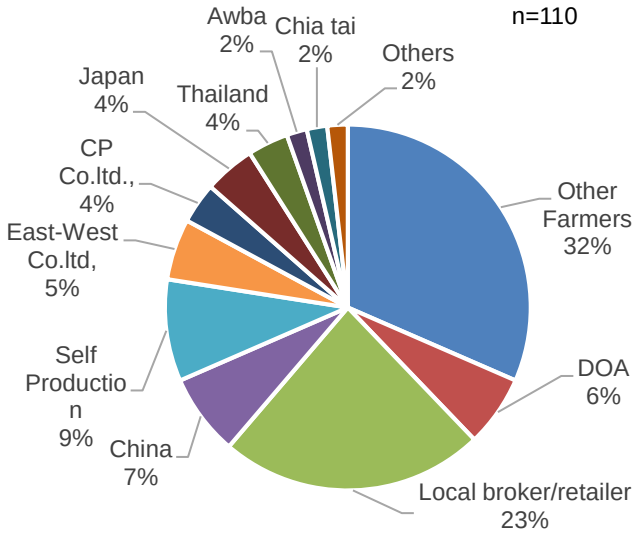


Figure 4.4.1 Seed/Seedling Providers

Source: JICA Survey Team

As there are several characteristics of seed/seedling providers amongst crop types, the shares of six crops; corn, garlic, mangoes, paddy, potatoes, and sesame, are showed in Figure 4.4.2. Those six crops are cultivated by eight or more than eight interviewed farmers. The main provider differs depending on the crops. For example, over half of the seed/seedling of garlic and sesame is mainly provided by other farmers, while over half for mangoes and paddy are mainly provided by the DOA.

Furthermore, there are several characteristics of seed/seedling providers among the townships, as well (Figure 4.4.3). Although the number of the Pathein respondents differs from the others in each cropping pattern, there are still differences among the townships. The significant difference among the townships is found in rice seed providers. In Taunggyi, almost all of the interviewed paddy farmers use the hybrid seed of a Chinese company.

The name of the company is unknown to the farmers. In contrast, most of the paddy farmers purchase the seeds from the DOA in Kyaukse, Meiktila and Kalaw. On the other hand, 70% of the paddy farmers get their seeds from the other farmers in Pathein. Regarding seed/seedling providers of horticulture produce, the majority of the farmers buy the seed/seedlings from the other farmers in all five townships. The next most common process involves many farmers buying the seeds/seedlings from local brokers/retailers in Taunggyi and in Pathein. In comparison, around 20% of seeds/seedlings are taken from their own farms in Mandalay. Although the DOA provides 18% of horticulture seeds/seedlings in Meiktila, the farmers of the other townships purchase more seeds/seedlings from private companies of Myanmar, China and Japan rather than the DOA

Although it is not clear enough, the original providers of other farmers were asked to the farmers, who answered that they gained the seeds from other farmers. In terms of paddy, sesame, green gram and groundnut, good quality seeds are distributed to some selected farmers by the DOA, and then those farmers distribute again to other farmers in next season. Therefore, the largest seed/seedling providers of sesame - other farmers - might be replaced by the DOA (Figure 4.4.2). On the other hand, local varieties of okra, carrot and eggplant are popular, and only a few farmers use hybrid seeds originally provided by private companies. Similarly, regarding roselle, garlic and pineapple, most of the farmers use the local varieties, and the farmers produce the seeds by themselves, and some farmers purchase the seeds from other farmers and local brokers.

As for the major crops, the variety, unit price of seed/seedling, and the required amount of seed/seedling to sow is summarized in Table 4.4.8 (horticulture produce) and Table 4.4.9 (paddy). Regarding horticulture crops, although the unit prices vary depending on the crop, the seed/seedling costs of garlic and potato are higher than any other crops. However, when the farmer's income, demonstrated in Table 4.4.5, is also referred to, higher seed/seedling costs do not always result in lower income.

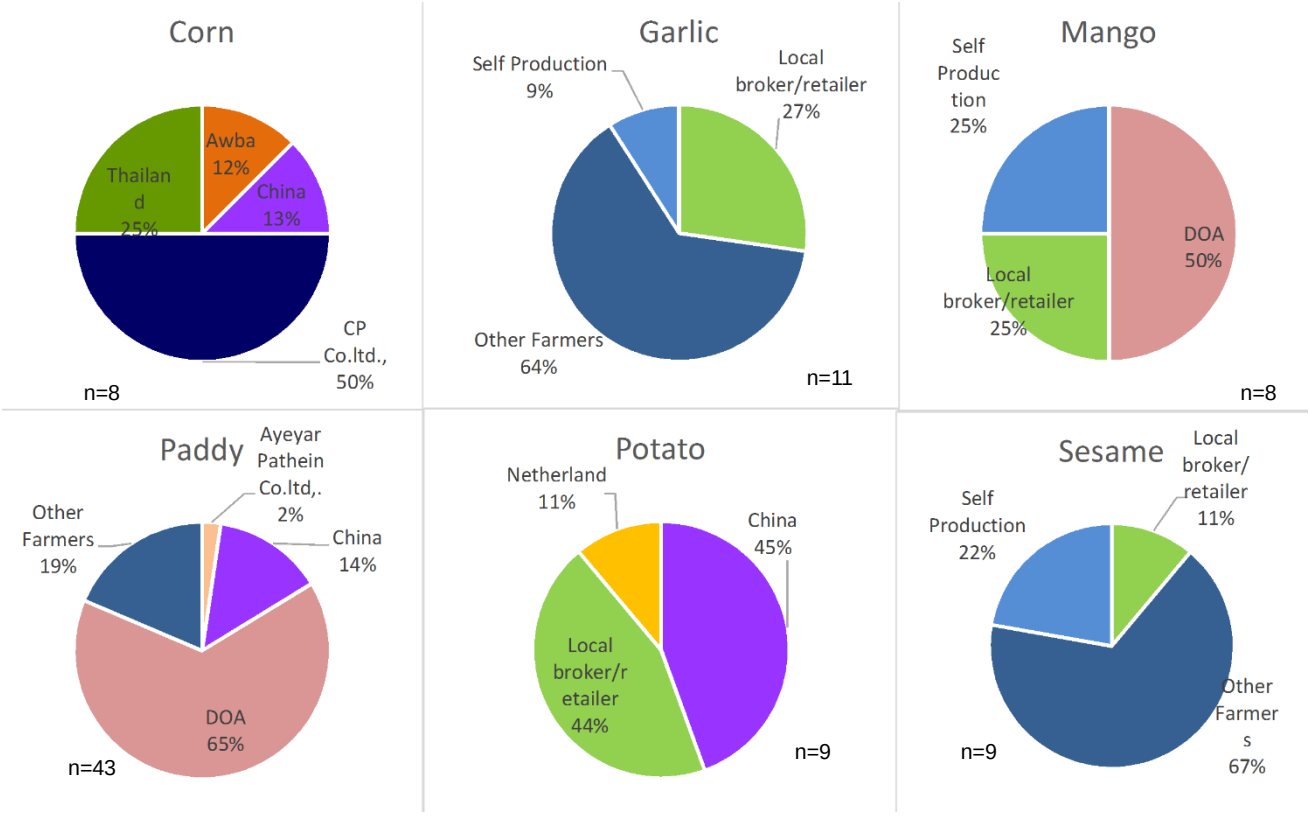
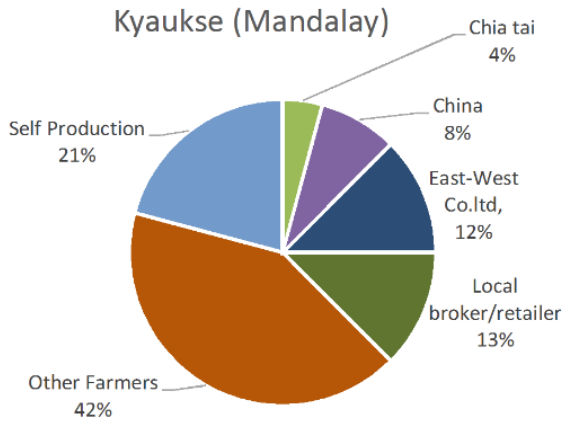


Figure 4.4.2 Seed/Seedling Providers by Crops
Source; JICA Survey Team

1) Share of Horticulture Seed/Seedling Providers Except for Rice



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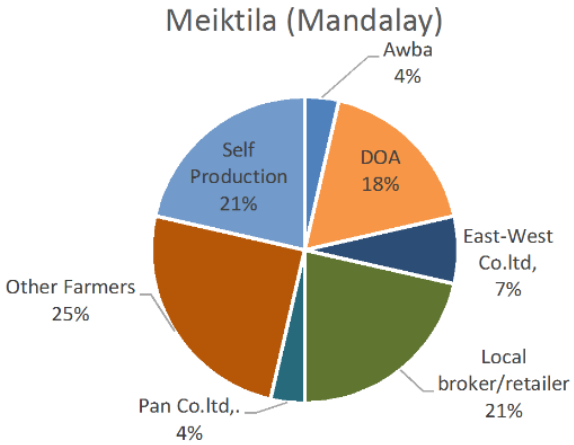

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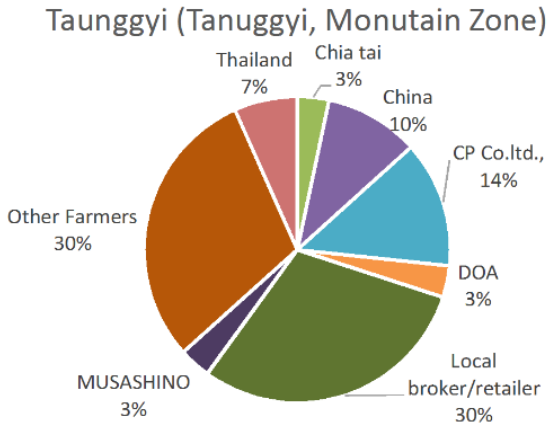

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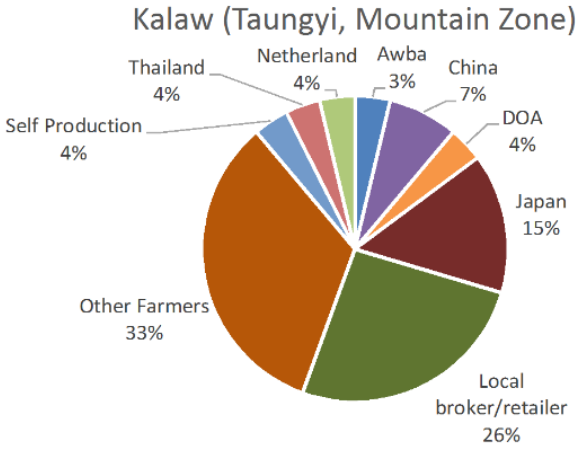

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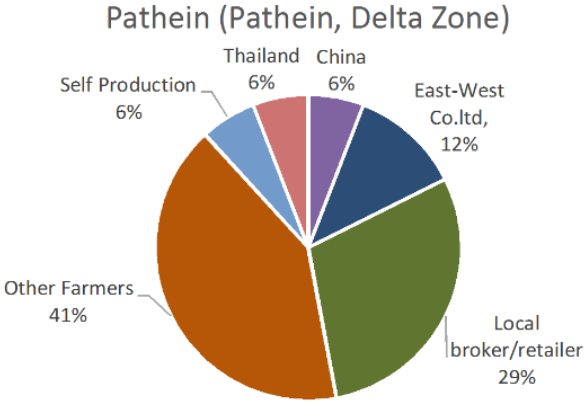


n=17

2) Share of Rice Seed/Seedling Providers

TS	Provider			Sample Size
	1	2	3	
Kyaukse	DOA (100%)	-	-	n=9
Meiktila	DOA (100%)	-	-	n=12
Taunggyi	China (100%)	-	-	n=6
Kalaw	DOA (83%)	Other Farmers (17%)	-	n=6
Pathein	Other Farmers (70%)	DOA (20%)	Others (10%)	n=10

Figure 4.4.3 Seed/Seedling Providers by Townships

Source; JICA Survey Team

Table 4.4.8 Seed/Seedling Providers, Crops, Unit Prices and Sowed Amount except for Paddy

Provider	Crop	Variety	Unit Price (kyat)	Sowed Amount per Acre	Cost per Acre
Other Farmers	Garlic	Local	3,430 /viss	450 viss	1,543,500
	Sesame	Yezin (4)	4,670 /pyi	1.6 pyi	7,472
	Pigeon pea	Shwe Dingar	1,300 /viss	4.2 viss	5,460
	Others; Carrot, Groundnut, Pineapple, Chickpea, Okra, Ginger, Greengram, Mango, Papaya, Strawberry				
DOA	Mango	Sein Talone	2,500 /plant	130 plants	325,000
	Others; Groundnut, Greengram				
Local broker/retailers	Potato	China	700 /viss	960 viss	672,000
	Others; Garlic, Okra, Greengram, Mango, Cabbage, Chickpea, Chili, Dragon fruit, Eggplant, Grape, Orange, Pomelo, Sesame, Soap pod, Soy bean, Taro,				
China	Potato	China	700 /viss	1800 viss	1,260,000
	Others; Cauliflower, Corn, Musk Melon, Water melon				
Self-Production	Mango, Sesame, Banana, Chickpea, Eggplant, Garlic, Jack fruit, Okra				
East-West Co.ltd,	Yard Long Bean	hybrid	3,300 /can	16 cans	52,800
	Chilli, Cauliflower				
Japan	Cabbage	Tharaphu	27,500 /can (100g/can)	1 can	27,500
Thailand	Corn, Papaya, Tomato				
Awba	Corn, Tomato				
Chia tai	Cauliflower, Chinese cabbage				
Other Providers; CP Co.ltd.(Corn), Pan Co.ltd,.(Chilli), Netherland (Potato)					

Source: JICA Survey Team

*The unit price and amount sowed per acre is the average of three or more than three respondents

Table 4.4.9 Provider, Variety, Unit Price, Sowed Amount, Yield, Production Cost and Income of Paddy Farmers

Provider	Variety	Unit Price (kyat/basket)	Sowed Amount per acre	Yield (baskets/acre)	Production Cost (kyat/acre)	Income (kyat/acre)
Other Farmers	Thee Htet Yin	8,200	3.6 baskets	61	222,000	203,600
	Ayeyarmin	6,000	1.1 baskets	50	150,000	285,000
DOA	Manaw Thuka	15,890	1.8 baskets	88	260,727	483,636
	Ayarmin	21,500	2.8 baskets	83	233,333	163,333
	Shwethwel Yin	15,000	1.5 baskets	103	283,333	383,333
China	12, 201, 456	65,367	1.3 baskets	87	466,083	444,750

Source: JICA Survey Team

*The unit price, amount sowed, yield, production cost, and income of seeds/seedlings provided by China is the average of varieties 12, 201 and 456.

Generally, nursery preparation could determine half of total yield of rice in crop production. Accordingly, nursery preparation is exceptionally important to achieve a high yield. However, the importance of knowledge and techniques about nursery preparation is not well recognized by farmers and other government field staff in Myanmar. JICA former survey team[24] identified many miss-planted locations in cabbage, eggplant and Chinese cabbage fields just after transplanting. Such damages are mostly attributed to poor nursery preparation and

[24] JICA former survey team; Several Japanese agricultural experts investigated and collected information in Myanmar before the survey team initiated the survey in Myanmar. During the survey, the information has been shared each other.

careless transplanting works. Similarly, as mentioned above, the yield of expensive rice variety is not always high and various knowledge and technical levels of the farmers seem to create such results. Therefore, it is essential to improve the knowledge and techniques of the farmers from the beginning of the VC.

(3) Soil Management

In tropical countries, it is difficult to manage soil due to fast degradation of organic materials under strong sunshine and heavy rain. Without soil management, the soil will lose its fertility within 5 - 10 years after farmland development. It is difficult to produce any vegetables in such fields. In most areas, cow dung is a common fertilizer, but JICA former survey team identified degradation of the soil and yield reduction in small- scale farmers' fields. It is because the farmers fully use the fields without fallow period and appropriate organic material input (cow dung), and soil fertility is lost. The smaller the farmer's fields are, the more serious the soil degradation, as has been identified.

In general, most farmers in Myanmar recognize the importance of a fallow period and crop rotation, but in fallow land they do not take any measures to improve soil fertility. In tropical upland farms, rain could easily wash away surface soils. This frequently happens in slope land. In some fields, there are no clear ridges. However, JICA former survey team could find a few soil protection measures, such as waterproof huts to protect crops from heavy rain (Figure 4.4.4).

Figure 4.4.4 Water Proof Hut

In some areas in Aungban, JICA former survey team identified very poor Acrisol, and it is very hard due to the presence of rich clay (Figure 4.4.5). The soil sometimes forms large blocks, and requires additional costs to break down such blocks by machinery to prepare the land for cultivation. This cost is such a large burden for small farmers that they cannot improve their soil. This problem seems to be more acute for small-scale farmers than large-scale farmers.

Figure 4.4.5 Poor Acrisol* Soil in Ginger Fields

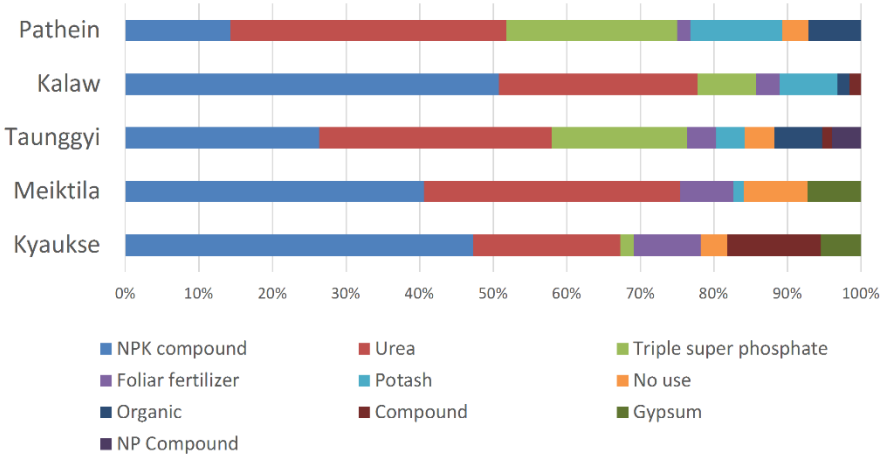
* Acrisol is a type of soil as classified by the FAO

Another issue is shallow ploughing in upland field. Most upland fields are characterized by a very shallow plow layer (around 10cm). Farmers generally have used cattle for ploughing in such circumstances, but in recent years, the mechanization of this and other processes is extending. However, many tractors ploughing services hesitate to plough these fields deeply because diesel is expensive, and the time is limited to plough. Most crops' roots cannot penetrate deeply into the hard soil under the shallow plowing layer. As a result, agriculture produce diminishes, and the yield becomes lower. Poor farm preparation by machinery was also found to exist, such as insufficient soil block clashing, an uneven field surface, and a lower ridge level than the normal level. In the field with uneven surface, the germination rate tends to be low and germination timing is different amongst the seeds, and they result in an unstable harvesting period.

(4) Fertilizer

The types of applied fertilizers by TS are showed in the next Figure. An average of two different types of fertilizers are applied to each crop. The NPK compound and urea are frequently used in all townships.

In Pathein and in Taunggyi, triple super phosphate and organic fertilizers are more frequently used compared with other townships. In terms of organic fertilizers, they include bark compost, cow and chicken manure, and the "Shwe Myay Thee" produced by a Japanese company.

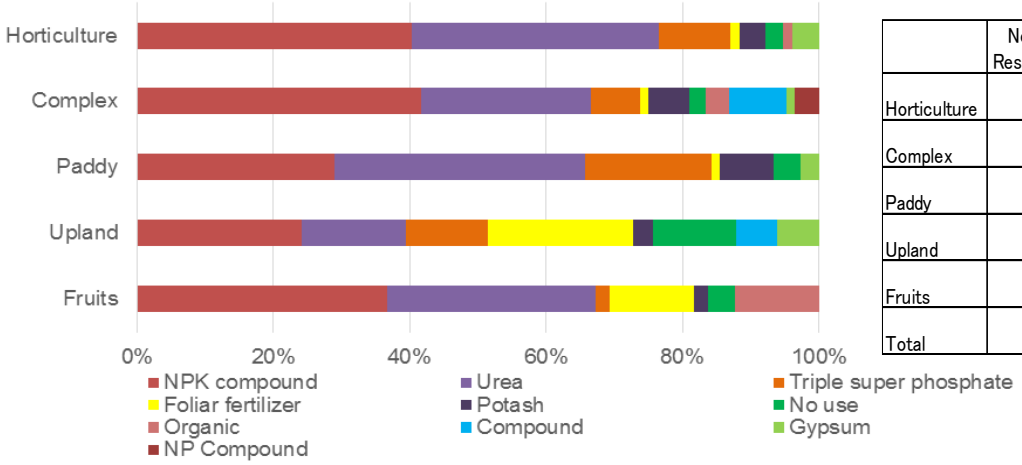


	No. of Response	No.of Crops	Fertilizers /Crop
Pathein	56	24	2.3
Kalaw	63	31	2.0
Taunggyi	76	35	2.2
Meiktila	69	36	1.9
Kyaukse	55	27	2.0
Total	319	153	2.1

Figure 4.4.6 Applied Fertilizers by TS

Source: JICA Survey Team

When the types of applied fertilizers are analyzed by cropping pattern, there are several characteristics. Foliar fertilizers and no fertilizers occupy a relatively large portion in upland farming compared to the other cropping patterns. In fruit farming, organic fertilizer use occupies more than 10%, and it is a larger portion than the other cropping patterns (Figure 4.4.7).



	No. of Response	No.of Crops	Fertilizers/ Crop
Horticulture	77	33	2.3
Complex	84	42	2.0
Paddy	76	32	2.4
Upland	33	22	1.5
Fruits	49	24	2.0
Total	319	153	2.1

Figure 4.4.7 Applied Fertilizers by Cropping Pattern

Source: JICA Survey Team

Regarding 18 crops showed on Table 4.4.5, the amount of three major synthetic fertilizers used for each crop; the NPK compound, triple super phosphate and urea, is summarized in the next figure. According to the survey result, the largest amount of fertilizers were applied to potatoes (Figure 4.4.8). In terms of chickpeas, although the three major fertilizers were not used, two farmers answered that they use foliar fertilizers.

Moreover, the manufactures/importers of fertilizers used for the cultivation of 18 crops, shown in Table 4.4.5,

are summarized in the next figure.

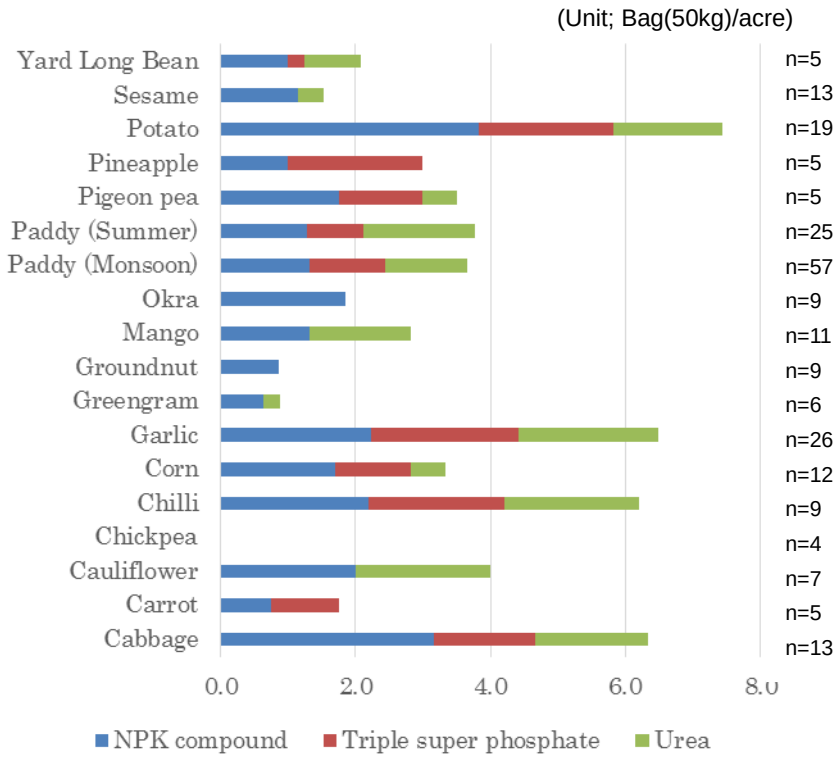
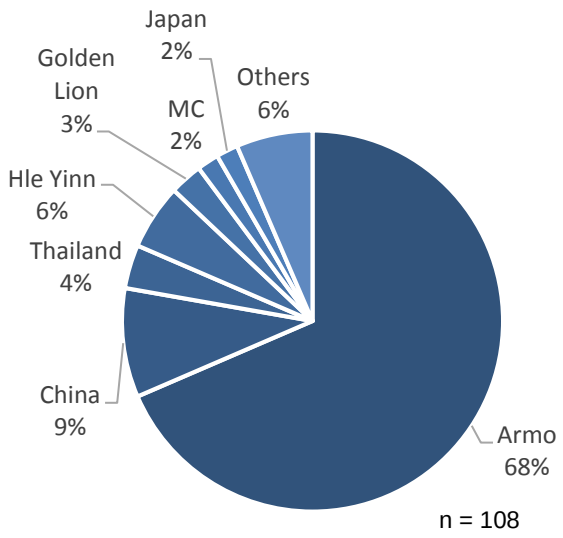


Figure 4.4.8 Amount of Applied Fertilizers by Crops

Source: JICA Survey Team

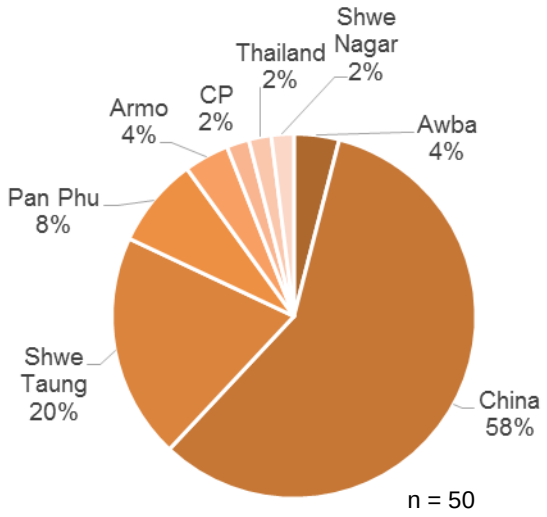
As the NPK compound is the most used fertilizer, many companies sell it with their compositions. However, Armo occupies almost 70% of the overall share. Regarding urea and triple super phosphate, China accounts for the largest portion of these products. Furthermore, the average cost of these fertilizers is summarized in the next table. As the compositions of each product is different amongst the companies/importers, the prices vary. In terms of organic fertilizers, villagers sell bark compost, the DOA provides effective microorganisms, and a Japanese company sells “Shwe Myay Thee”

1) NPK Compound



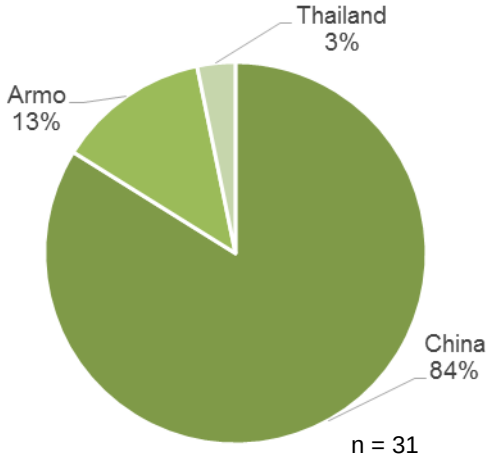
n = 108

2) Urea



n = 50

3) Triple super phosphate



n = 31

4) Other Fertilizers

	Foliar fertilizer	Gypsum	Potash	Organic
Armo	38%	-	38%	-
Awba	38%	29%	6%	-
Thailand	16%	-	-	-
Unknown	8%	-	6%	-
Golden Key	-	14%	-	-
Golden Lion	-	43%	-	-
Wisara	-	14%	-	-
China	-	-	50%	-
DOA	-	-	-	17%
Japan	-	-	-	50%
Villager	-	-	-	33%
Total	100%	100%	100%	100%
(Sample Size)	13	7	16	6

Source: JICA Survey Team

Figure 4.4.9 The Share of Manufacturers/Importers of Major Fertilizers

Table 4.4.10 The Cost of Major Used Fertilizers by Manufactures/Importers (Kyat/Sack)

	NPK compound	Triple super phosphate	Urea	Foliar fertilizer	Gypsum	Potash	Organic
Armo	37,892	27,500	24,500	2,900	n.d.	26,167	n.d.
China	20,850	23,365	25,193	n.d.	n.d.	31,500	n.d.
Thailand	29,000	27,000	25,000	22,250	n.d.	n.d.	n.d.
Hle Yinn	27,500	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Megga	18,000	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Aung Kyar Phue	29,000	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Golden dragon	20,000	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Sein lann	18,500	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Toebwar man	18,000	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Taung Thar Tsp.	15,000	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Myay Kabar	18,000	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.

	NPK compound	Triple super phosphate	Urea	Foliar fertilizer	Gypsum	Potash	Organic
Golden Lion	26,500	n.d.	n.d.	n.d.	6,500	n.d.	n.d.
MC	39,000	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Awba	n.d.	n.d.	23,000	6,000	6,000	40,000	n.d.
Shwe Taung	n.d.	n.d.	24,350	n.d.	n.d.	n.d.	n.d.
Pan Phu	n.d.	n.d.	25,000	n.d.	n.d.	n.d.	n.d.
CP	n.d.	n.d.	26,000	n.d.	n.d.	n.d.	n.d.
Shwe Nagar	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Unknown	n.d.	n.d.	n.d.	5,000	n.d.	27,000	n.d.
Golden Key	n.d.	n.d.	n.d.	n.d.	6,500	n.d.	n.d.
Wisara	n.d.	n.d.	n.d.	n.d.	6,500	n.d.	n.d.
DOA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	500
Japan	30,000	n.d.	n.d.	n.d.	n.d.	n.d.	18,333
Villager	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	465
Average	**24,803**	**25,955**	**24,720**	**9,038**	**6,375**	**31,167**	**6,433**

Source: JICA Survey Team

Generally, soil analysis, such as analyses of the NPK ratios and other components residues in soil, are not carried out before planting. Only some Region/State DOA offices have functional laboratories that have a pH meter, EC meter, and an incinerator of organic matter. However, the remaining Region/State DOA's laboratories have only limited functions due to a lack of EC meters and pH meters. The farmers decide the amount and application timing of fertilizers by their own observation and intuition. Any simple soil analysis kits such as an Acid Test and/or NPK Test Paper will be useful in farms, and their widespread use will be important.

(5) Pesticide

Although the survey results of pesticide use will be explained in Section 6.1, the general findings are stated in this section.

Many farmers are facing difficulties with how to use pesticide appropriately, and how to select appropriate pesticides with a Pre Harvest Interval (PHI[25]). This is due to a lack of knowledge of pesticides, unclear identification of pests and diseases in their fields, and an insufficient explanation on labels of how to use the pesticides. Most labels show pests and diseases affected by the pesticides, dosage and the PHI, but they do not indicate the limit of the total dosage of pesticide during each crop's cultivation. Although the farmers have extensive experience growing vegetables, several farmers use pesticides excessively and use broad spectrum/harmful chemicals. The extension staff and pesticide shops do not have enough knowledge of pesticide usage either. Pesticide sales companies have deployed many staff to villages. For example, Awba has deployed 1,500 staff nationwide. However, their explanation focuses on promotion of their pesticide rather than providing the appropriate explanation on proper use of pesticide.

In contrast, the MOALI has developed the Myanmar Plant Health System Strategy (2016 to 2020) and started implementation of this strategy since August 2017. 45 PPD staff were trained and became plant doctors operating 25 Plant Clinics in eight Regions/States as of the 9th of January 2018.

[25] PHI (Pre Harvest Interval); the interval between the time the pesticides are lastly used and the time of harvest. Determined amount of days must pass before it is harvested

There has been an achievement regarding pest and disease control which has been aided by the Center for Agricultural and Bioscience International (CABI, Headquarters in the UK) through the Plantwise Program (Figure 4.4.10). The Plantwise Program developed a smartphone application to support pest and disease control, including the identification of pests and diseases and applicable pesticides. Updating data and expanding data coverage in the application is key for its effective usage. This CABI application can be used offline for free.

Furthermore, another application "Greenway" produced by "Greenovator" – a local company - provides similar information to farmers for free online (excluding the cost of mobile data usage). Through "Greenway", the farmers can communicate with extension workers and agricultural experts, enabling them to ask questions on cultivation and pesticide use, and market information.

Figure 4.4.10 Center for Agricultural and Bioscience International

(6) Situation of Agricultural Machinery Use

Regarding agricultural machinery use, the numbers of agricultural machinery for each township are shown in Figure 4.4.11. The main machinery is bullock tillage, combine harvesters, hand tractors, thresher, tractors (splay pump, water pump and weed cutter are included in "Other"). The most frequency used agricultural machinery is the hand tractor in every township.

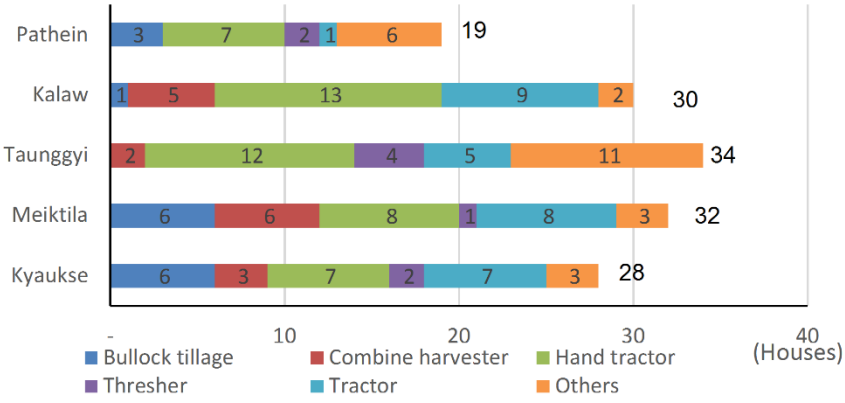


Figure 4.4.11 The Number of Agricultural Machineries for each Township

Source: JICA Survey Team

Figure 4.4.12 shows the number and type of agricultural machinery for each cropping pattern. Paddy and complex farmers have more agricultural machinery than other cropping pattern farmers.

Figure 4.4.13 shows the ownership rate of agricultural machinery for each township. All combine harvesters are leased. Around 70% of hand tractors are owned by farmers.

Table 4.4.11 shows the number of farmers using major agricultural machinery by crop. In this chapter, the survey analyzed seven major crops, and the detailed information of the main machinery utilized for the major crops is summarized in Table 4.4.12 -Table 4.4.18[26].

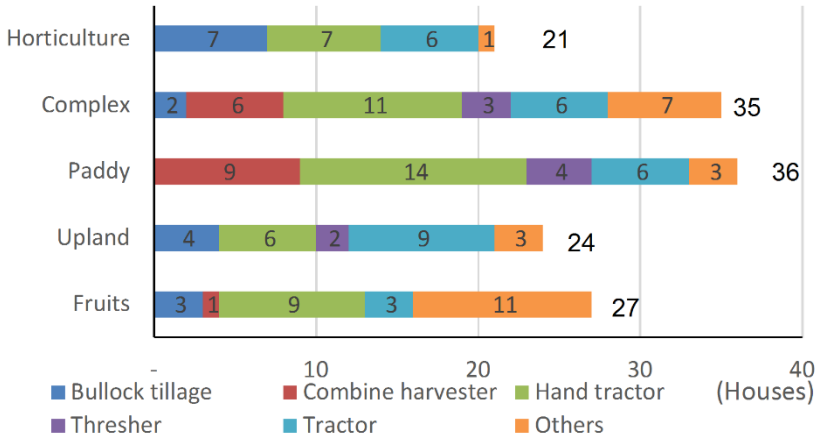


Figure 4.4.12 The Number of Agricultural Machineries for each Cropping Pattern

Source: JICA Survey Team

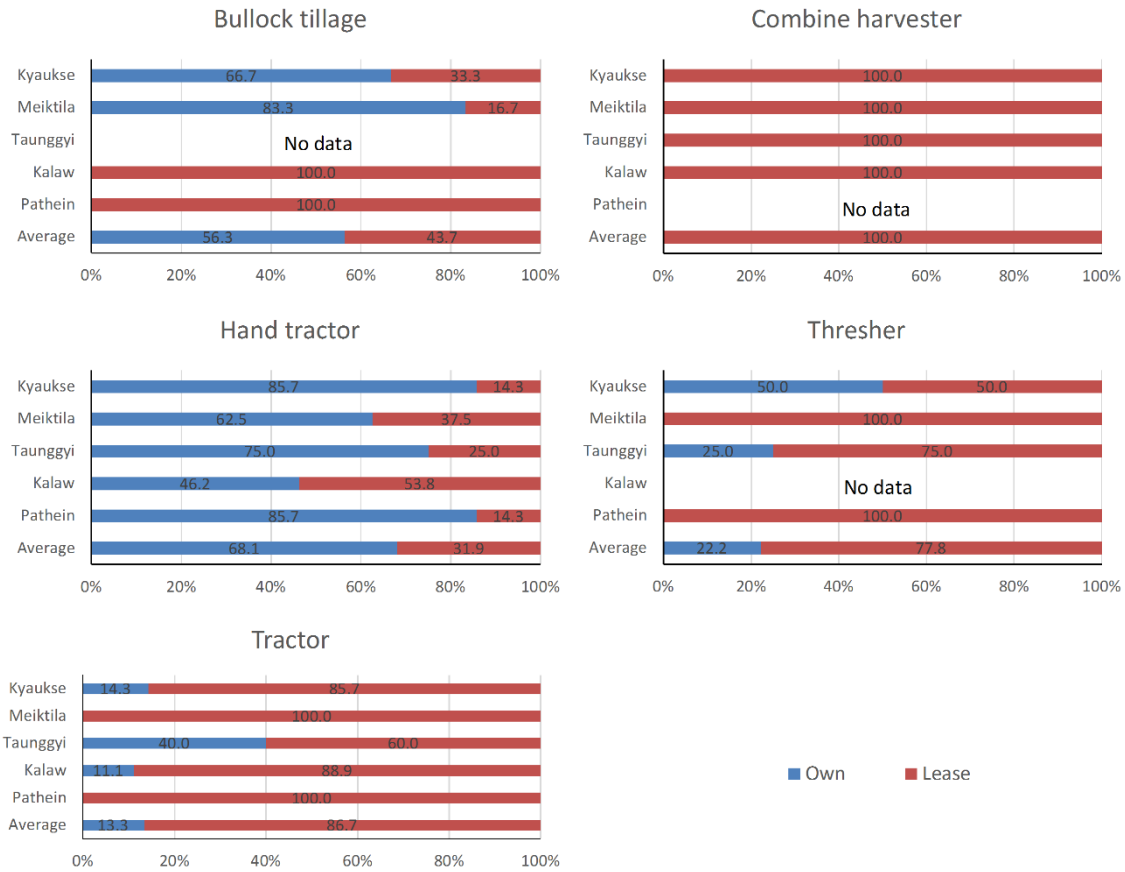


Figure 4.4.13 Ownership Rate of Agricultural Machineries for each Township

Source: JICA Survey Team

[26] The cost for lease includes fuel cost according to the respondents.

Table 4.4.11 The Total Number of Main Agricultural Machineries for each Crops

Crop Name	Total Number of farmers	Total number of main agricultural machineries				
		Bullock Tillage	Combine harvester	Hand tractor	Thresher	Tractor
Banana	1	1	0	1	0	0
Butterfly flower	1	0	0	0	0	0
Cabbage	6	0	0	4	0	3
Carrot	3	0	0	3	0	0
Cauliflower	3	2	0	0	0	1
Chickpea	4	3	0	0	0	3
Chilli	4	2	1	1	0	1
Chinese cabbage	1	0	0	1	0	0
Chrysanthemum	3	0	0	1	0	2
Corn	8	0	0	6	2	4
Cotton	1	1	0	0	0	1
Dragon fruit	1	0	0	0	0	0
Eggplant	2	2	0	0	0	1
Garlic	11	0	0	5	0	3
Ginger	1	0	0	1	0	0
Grape	1	0	0	1	0	0
Greengram	4	2	0	2	0	1
Groundnut	5	2	0	3	0	1
Jack fruit	1	0	0	0	0	0
Jasmine	2	1	0	0	0	0
Mango	8	1	0	5	0	0
Muskmelon	1	0	0	0	0	1
Morning Glory	1	1	0	0	0	1
Okra	6	4	0	2	0	3
Orange	1	0	0	1	0	1
Paddy (Monsoon)	30	1	14	22	7	6
Paddy (Summer)	13	0	7	10	3	4
Papaya	2	1	0	0	0	0
Pigeon pea	4	0	0	2	0	1
Pineapple	3	0	0	1	0	0
Pomelo	1	0	0	0	0	0
Potato	9	0	0	6	0	7
Roselle	3	3	0	0	0	2
Sesame	9	5	0	5	0	3
Sesame + Pigeon pea(intercropping)	1	1	0	0	0	1
Small Jasmine	1	0	0	0	0	0
Soap pod	1	0	0	1	0	0
Soy bean	1	0	0	1	0	0
Strawberry	1	1	0	1	0	0
Sunflower	3	1	0	0	0	2
Taro	1	1	0	0	0	0
Tomato	2	1	0	2	0	0
Watermelon	1	0	0	0	0	1
Yard Long Bean	3	3	0	0	0	1

Source: JICA Survey Team

i) Paddy (Monsoon) (Number of farmers; 30 psn)

Regarding paddy (monsoon) cultivation, 22 and seven farmers used hand tractors and tractors, respectively. Combine harvester is used by 14 farmers. Total cost of combine harvester is the highest in cost of main machineries. Only one farmer uses bullock tillage.

Table 4.4.12 Detailed Information of Main Machineries for Paddy (Monsoon) Cultivation

Machinery	Total Number of farmers	Total Utilization (days /acre)	Total Cost (MMK/acre)
Bullock Tillage	1	2.0	14,000
Combine harvester	14	0.8	57,000
Hand tractor	22	2.3	25,202
Thresher	7	0.6	12,929
Tractor	7	0.7	25,857

Source: JICA Survey Team

ii) Paddy (Summer) (Number of farmers; 13 psn)

Regarding paddy (summer) cultivation, 10 farmers use hand tractors and four farmers use tractors. Combine harvesters cost the most. No farmers use bullock tillage.

Table 4.4.13 Detailed Information of Main Machineries for Paddy (Summer) Cultivation

Machinery	Total Number of farmers	Total Utilization (days /acre)	Total Cost (MMK/acre)
Combine harvester	7	0.8	53,571
Hand tractor	10	1.5	13,150
Thresher	3	0.3	20,167
Tractor	4	1.1	32,000

Source: JICA Survey Team

iii) Garlic (Number of farmers; 11 psn)

Regarding garlic cultivation, five farmers use hand tractors, three use tractors and two use weed cutters.

Table 4.4.14 Detailed Information of Main Machineries for Garlic Cultivation

Machinery	Total Number of farmers	Total Utilization (days /acre)	Total Cost (MMK/acre)
Weed cutter	2	0.9	10,000
Hand tractor	5	2.2	28,900
Water pump	1	3.0	15,000
Tractor	3	1.0	39,667

Source: JICA Survey Team

iv). Potato (Number of farmers; 9 psn)

Regarding potato cultivation, tractors and hand tractors are used by seven and six farmers, respectively. Because the average production area of potatoes (6.49 acres) is larger than other crops', tractors are used by the most number of farmers.

Table 4.4.15 Detailed Information of Main Machineries for Potato Cultivation

Machinery	Total Number of farmers	Total Utilization (days /acre)	Total Cost (MMK/acre)
Weed cutter	1	2.5	20,000
Hand tractor	6	2.8	21,667
Tractor	7	2.0	53,714

Source: JICA Survey Team

v) Sesame (Number of farmers; 9 psn)

The average production area of sesame is relatively large (7.22 acres). Farmers used bullock tillage, hand tractors and tractors for plowing such large production areas. Bullock tillage's costs tend to be higher than other types of machinery.

Table 4.4.16 Detailed Information of Main Machineries for Sesame Cultivation

Machinery	Total Number of farmers	Total Utilization (days /acre)	Total Cost (MMK/acre)
Bullock Tillage	5	3.6	24,300
Plough cart	1	1.0	10,000
Hand tractor	5	1.5	11,400
Tractor	3	1.0	16,000

Source: JICA Survey Team

vi) Mango (Number of farmers; 8 psn)

Regarding mango cultivation, the main machinery are spray machines and pumps for pesticide spraying. Some farmers use hand tractors and bullock tillage for plowing.

Table 4.4.17 Detailed Information of Main Machineries for Mango Cultivation

Machinery	Total Number of farmers	Total Utilization (days /acre)	Total Cost (MMK/acre)
Bullock Tillage	1	1.0	16,000
Spray machine	2	11.5	157,250
Hand tractor	5	2.2	36,400
Spray pump	3	0.8	7,667

Source: JICA Survey Team

vii) Pineapple (Number of farmers; 3 psn)

One of the three farmers does not use machinery for pineapple cultivation. The remaining two farmers use water pumps for pesticide spraying and hand tractors for plowing.

Table 4.4.18 Detailed Information of Main Machineries for Pineapple Cultivation

Machinery	Total Number of farmers	Total Utilization (days /acre)	Total Cost (MMK/acre)
Water pump	1	12.0	96,000
Hand tractor	1	2.0	14,000

Source: JICA Survey Team

(7) Grading

In Myanmar, many farmers are less likely to separate their produce by grade. Through the survey, one example was found that grading was carried out by several collectors at an assembly market. An assembly market is also known as a collective market, and is frequently located close to the production sites. The collectors sell the produce to the markets using their own trading practices.

Figure 4.4.14 Collected Corns at an Assemble Market

Thereby, non-grading at farm gates seems to be beneficial for a certain people including the collectors. Regarding non-grading, several crops, such as cabbage, broccoli and corn, are collected with outer leaves. This is perhaps because the outer leaves help to protect the inner parts of the produce during transportation.

However, such non-graded produce is regarded as lower quality produce than average grade produce, even if high quality produce is included in the mix. This undervaluation of produce makes the farmers lose their incentive to improve the quality of produce, even if they improve the quality of their produce through trainings of proposed potential projects.

In addition, there are not many farmers' collective activities including grading and packing in Myanmar. The farmers individually sell their crops to limited collectors, and the farmers seem to hardly know market information and market demand.

(8) Post-harvest Facilities and Transportation

In terms of post-harvest facilities, 44% of the farmers do not have any facilities. On the other hand, 56% of the farmers have storage/a warehouse, and some of them also have dryers (Figure 4.4.15).

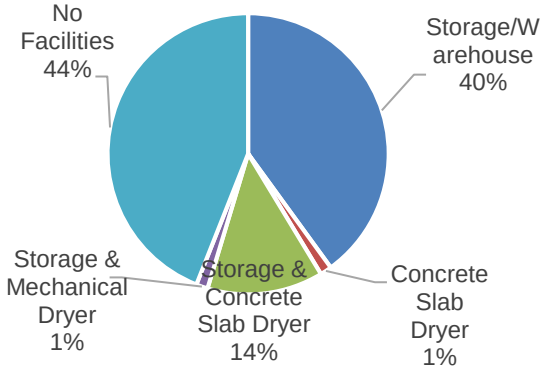


Figure 4.4.15 Owned Post-harvest Facilities
n=75
Source: JICA Survey Team

Regarding owned machinery especially for post-harvest and transportation, a quarter of the farmers answered that they do not own any machinery. However, the rest of the farmers; 75% of all respondents, own some machinery.

Over half of the respondents own hand tractors (Figure 4.4.16). Besides owning hand tractors, around 10% of all the respondents own bullock carts, tractors and/or threshers.

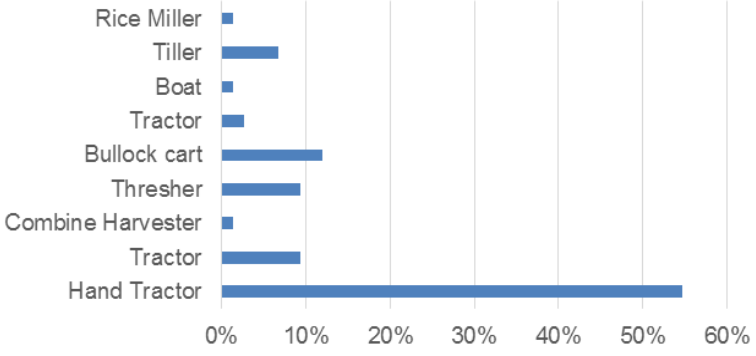


Figure 4.4.16 Owned Machineries for Post-harvest and Transportation
n=75, Multiple answers are allowed per each respondent
Source: JICA Survey Team

After harvesting, farmers go to sell the produce, and so transportation is important, as well. The farmers responded as to their transportation methods from the fields to the collection points. Around 40% of the farmers receive the support of traders to transport their produce, as referred to in Figure 4.4.17. Around 40% of the farmers rent/lease vehicles, such as tractors, when they need to transport produce. Some farmers use their own car, truck or motor bikes as their transportation.

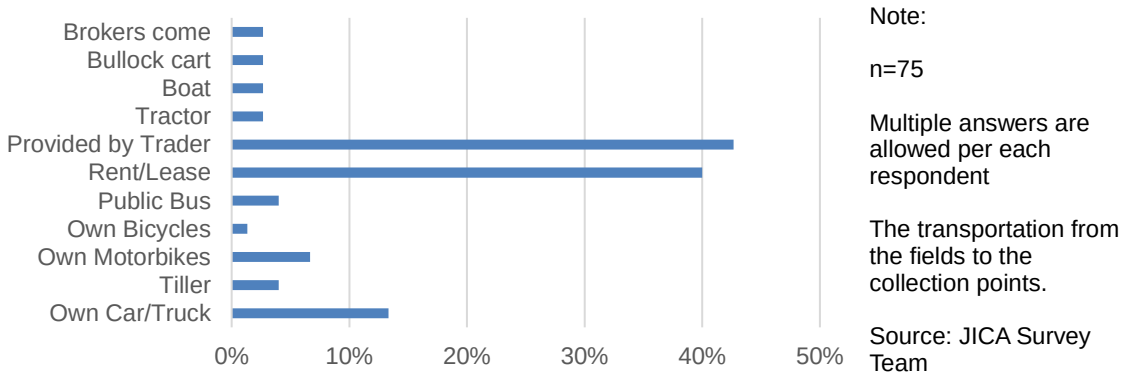


Figure 4.4.17 Transportation

4.4.3 Agricultural Extension Services

In the public sector, the DOA plays a major role in agricultural extension services. The DOA focuses on four domains: i) Quality Seed Production; ii) Technology Development; iii) GAP and Food Safety; and iv) Legislation. There are currently 8,195 agricultural technicians who provide extension services for about 4.4 million farmer households (DOA, 2018). One extension staff deals with 536 farmer households on average.

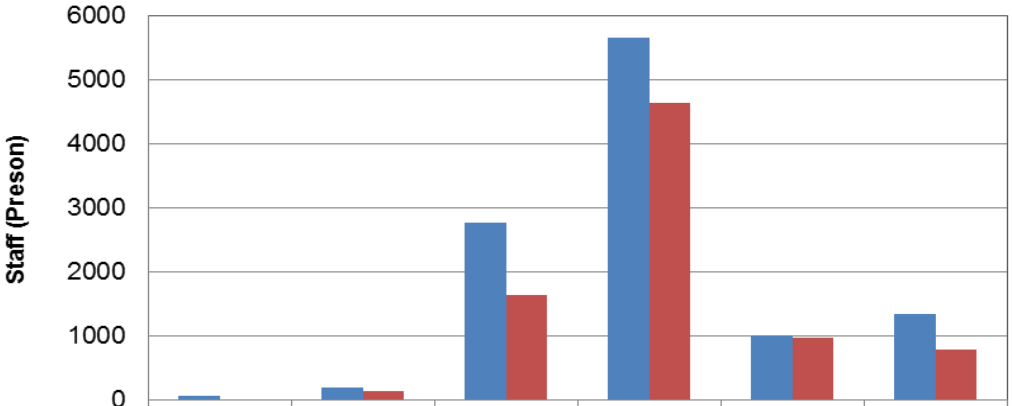
The DOA employs a wide range of extension approaches including i) integrated high technology demonstration villages; ii) block-wise demonstration programs; iii) organizing seed growers association; and iv) other conventional extension systems based on the extension camps. In addition, ICT tools are being employed by the DOA, such as "call centers", "facebook," and "mobile applications".

In ordinary extension services, the Assistant Staff Officer (ASO) and/or Deputy ASO take charge of extension activities in 2-4 village tracts, which are called "extension camps." In principle, an extension plan is made at the beginning of each cropping season, but the plan is formulated in a top-down style rather than a bottom-up approach, assessing the farmers' technical needs. Thus, the contents of the plan targeted areas of paddy cultivation and the budget. The major addressed commodities are paddy, beans and pulses, but vegetable cultivation is not much thoroughly addressed due to limited human resources in the horticultural crop sector. Although this is not common, as some extension staffs in Taktone Township (Nay Pyi Taw) know about horticulture, the farmers can therefore gain new horticulture information from them.

In terms of the utilization of agricultural inputs, extension staff are rarely able to fully respond to farmers' technical needs. For example, a fertilization recommendation is made regardless of the actual fertility of the farmers' farm plots, based on the DAR's common guidelines. Furthermore, the recommendation for the use of pesticide is not specifically made according to the seasonal occurrence of specific pest and diseases. In fact, sometimes extension staff recommend not using chemicals that wrongly reflect the concept of the GAP.

Other than that, the DOA is aware of its limitations and challenges in technology transfer and extension services,

which include i) limited technical skills and knowledge of extension staff; ii) limited budget and weak logistical support; iii) insufficient extension materials and access to ICT tools; and iv) weak linkage with stakeholders along the FVC. Regarding point i), as showed in the next figure, most extension workers graduate high schools and Universities related to agriculture, and hold a basic knowledge of agriculture. However, they seem to need to improve their skills and knowledge along with the demand from farmers.



	Ph.D	M.Sc.	B.Ag	Dip.Ag	Agri- high school	Other
DoA	67	205	2761	5652	1014	1346
Extension	9	139	1638	4631	983	795

Figure 4.4.18 Education Level of DOA and Extension Staff

Source: DOA, 2018

On the other hand, generally speaking, farmers have a strong will to work hard and learn new techniques and seem to have characteristics considered conducting to farming. However, the technical level of farmers varies by area and from farmer to farmer. Some farmers know a certain technique, but they do not know why a technique or method is required and why it is effective in growing their crops. For instance, although some farmers conduct straw mulching over their fields, they do not understand why the mulch is required. Thereby, when the straw is not available, they cannot take alternative effective measures to prevent or protect from damages derived from heavy rain, disease and so on. They learn cultivation techniques mostly from other farmers, but such extension sometimes does not give enough information about theories or principles of each kind of work. Without necessary theories or principles, they cannot achieve a high yield or take effective measures, even if they have expensive seed and chemicals.

4.4.4 Training

Regarding the participation in agricultural training, around 30% of farmers have joined at least one training session held in the last five years up to 2018. Especially, in Kyaukse, around 50% of farmer have joined training sessions. On the other hand, in Pathein, only 20% of farmer have joined a training session (Figure 4.4.19).

Figure 4.4.20 shows the number of farmers who have joined some training session for each cropping pattern. The experience ratio for the trainings of upland and horticultural farmers tend to be lower than other cropping patterns.

Figure 4.4.21 shows the total number of times of training sessions have been held for each townships. Farmers can learn general information about all cultivation steps (seeding, crop management, harvesting etc) from “General” trainings. This kind of general training is the most popular in every township. The GAP training is

also popular in Kyaukse and in Meiktila, but it is not popular in Kalaw or in Pathein. Various training is provided by the DOA and several donors/agencies (i.e. JICA, KOICA, GIZ etc).

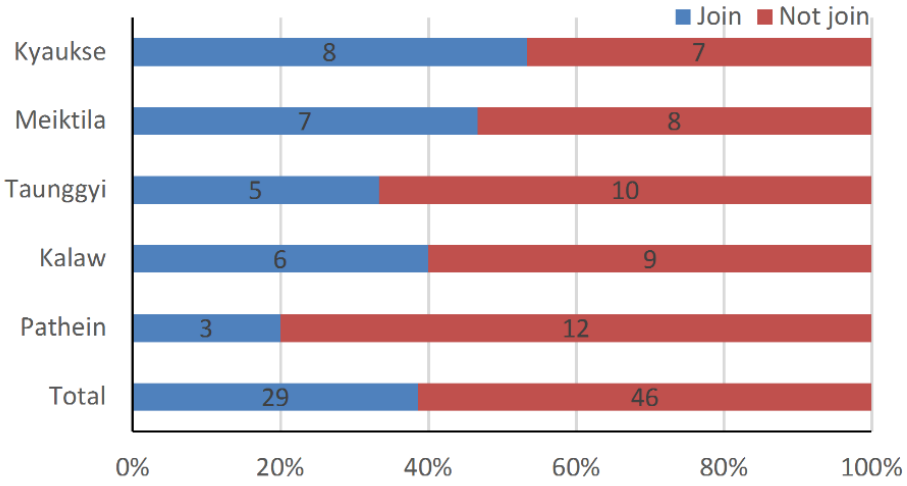


Figure 4.4.19 The Experience Ratio of Trainings for each Townships

Source: JICA Survey Team

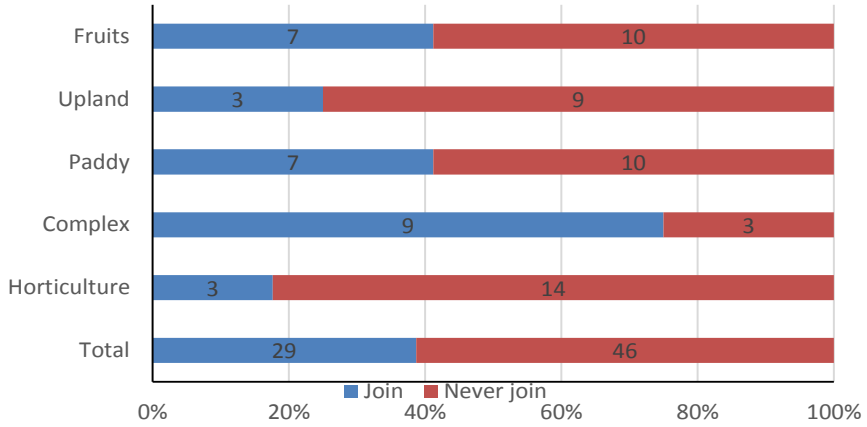


Figure 4.4.20 The Experience Ratio of Trainings for each Cropping Patterns

Source: JICA Survey Team

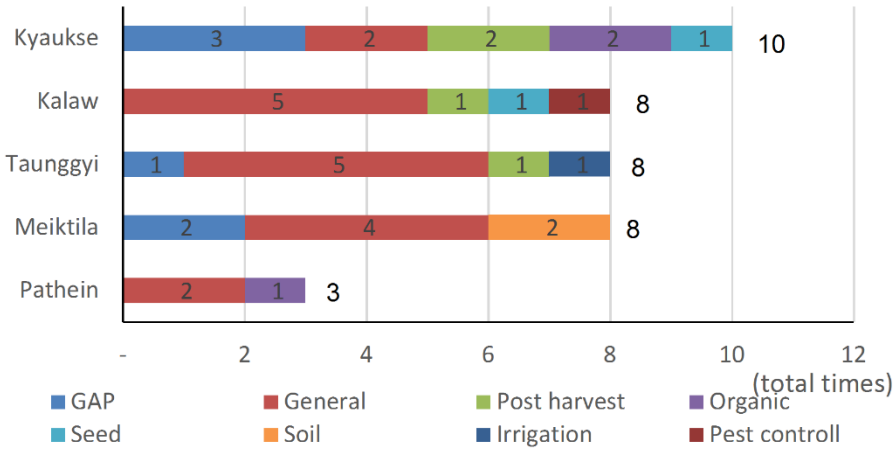


Figure 4.4.21 The Total Number of Times of Trainings for each Townships

Source: JICA Survey Team

4.4.5 Financial Service

As for financial service, an average of around 60% of farmers receive any financial service (Table 4.4.19). However, the ratio is different among the townships. In Meiktila, all respondents gained financial service, while only around 30% of respondents received the financial assistance in Kalaw. When the result is examined by cropping pattern, the fruit farmers were less likely to receive any financial service. On the other hand, almost all paddy farmers apply for any financial service.

The average monthly interest rates are also vary among the townships. The interest rates of Kyause, Meiktila and Taunggyi, which are located close to main road, are more likely to be lower, while the interest rates of Kalaw and Pathein, which are located a little far from the main road, are more likely to be higher. When the interest rates are examined by cropping pattern, the horticulture farmers tend to receive financial assistance with higher interest rates than the other cropping patterns. Among all responses, the lowest interest rate was 0.6%, and the highest one was 2.5% per a month.

Table 4.4.19 Financial Assistance and Interest Rate

Township	Financial Assistance Recipients (%)	Monthly Interest Rate (%)
Kyaukse	60	0.84
Meiktila	100	0.77
Taunggyi	40	0.69
Kalaw	33	1.21
Pathein	53	1.24
Average	57	0.95

Cropping Pattern	Financial Assistance Recipients (%)	Monthly Interest Rate (%)
Fruits	29	1.00
Upland	58	0.77
Paddy	94	0.88
Complex	67	0.67
Horticulture	41	1.33

Source: JICA Survey Team

Major financial organizations and their interest rates per month are as follows:

i) The MADB with less than 1 %.
ii) The Department of Cooperatives with 2 %
iii) Awba Company, also called as “Mahar”, with 2.5 %
iv) Shwe Sel Myay Company, which is an agro-chemical seller and seem to be available only in Kyaukse TS, with 1.5 %
v) Others such as Pact Myanmar with 1.5 %, Alliance and local brokers, etc.

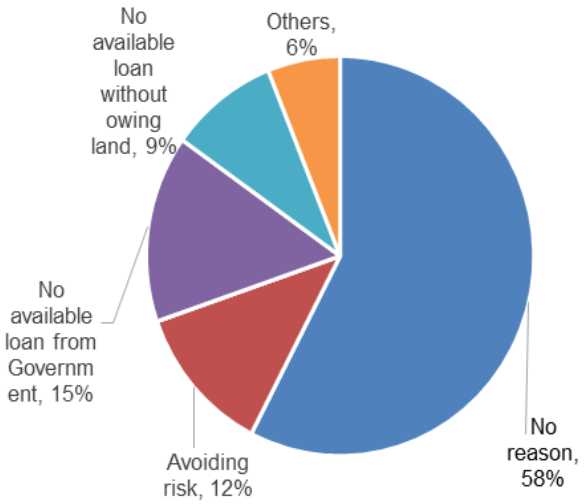


Figure 4.4.22 Reason Not Receiving Financial Assistance

n=33
Source: JICA Survey Team

The MADB provides lower interest rate than any other private company, and most of the farmers choose to receive financial assistance from the MADB in Myanmar. According to JICA former survey team, almost all paddy farmers borrowed a seasonal loan (150,000 kyats/acre) from the MADB. In areas with no MADB branches, farmers cannot borrow a MADB loan. Some farmers choose to receive financial assistance from other organizations and brokers. However, as the interest rates provided by the brokers are higher, few farmers take this financial assistance from brokers.

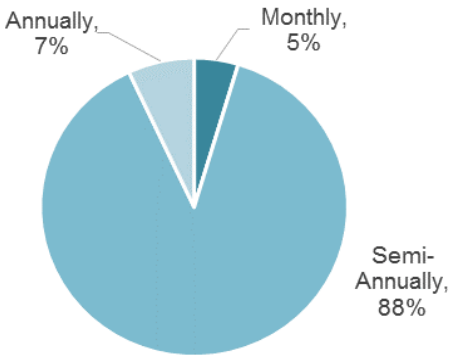


Figure 4.4.23 Refund Period of Financial Assistance

n =43
Source: JICA Survey Team

With respect to the reasons why the farmers do not receive any financial assistance, over half of them answered "no reason". It is hard to guess their real reasons, but they might do not need financial assistance. Also, "a lack of available financial assistance" is mentioned as a reason why the farmers do not receive financial assistance (Figure 4.4.22). In particular, the farmers of Pathein answered there is not available loan from the government, while the farmers of Kalaw answered there is no available loan without owning their own land.

Almost 90% of farmers who receive any financial assistance need to repay it within six months/semi-annually (Figure 4.4.23).

Regarding collateral, almost 90% of farmers answered "Copy of Form 07" (Figure 4.4.24). It is the certificate of right to use the farmland, which is related to "The Farmland Law (2012)". In the event that farmers cannot repay the financial assistance within the refund period, they will get financial assistance in the next year[27]. Several farmers become trapped in a vicious cycle of borrowing money, harvesting with limited profits only to be forced to borrow money again. It is very difficult for them to get out of such cycle.

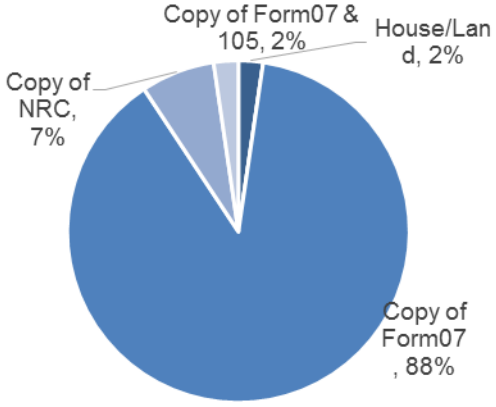


Figure 4.4.24 Collateral of Financial Assistance

n=43
Source: JICA Survey Team
*Form07&105; Certification of right to use farmland
*NRC; National Register of Citizens

4.5 Processing Situation in the Horticulture Sector

Most of the food processing industry in Myanmar is categorized as small and medium scale industry (SMI). According to DISI's statistics, out of 28,795 registered food companies, the SMI accounts for around 88%. Also, according to Myanmar Food Processors and Exporters Association (MFPEA), most domestic food companies are targeting domestic markets.

Among the food processing companies in Myanmar, rice related companies, including rice milling, rice

[27] Practically, the farmers will not lose the right to use their farmland.

cleaning/grading, processing of rice noodles/vermicelli and steamed rice (e.g. Biryani), is the largest, followed by edible oil companies such as groundnuts oil, sesame oil and sunflower oil. Other food processing companies include dry products (fruits, vegetable, meat and fish), noodle (rice flour, Mohinga), pickled/fermented products (tea leaf, beans, vegetables), snacks (agar, nuts, chips, candy), beverages (tea, coffee, fruits juice), bakeries (bread, cookie and cake), spices/sauce (chili, turmeric, soya bean), and food ingredient/additives.

In the horticulture sector, traditional processing methods are dry (chili), powdered (chili, turmeric and garlic) and sauce (chili) , whereas recent popular methods can be identified in fruit processing such as dry fruits, jam, paste (mango) and wine (grape, strawberry, pineapple, mulberry, etc,). Recently, high value-added technologies, such as dehydrated and frozen vegetables for example, have been introduced through foreign and domestic investments. The fllowing table shows the number and scale of the horticulture related enterprises in 2018.

Table 4.5.1 Breakdown of the Horticulture Related Enterprises

Items	Large	Medium	Small	Total	(%)
Coffee and Tea	50	41	61	152	8%
Jam and Paste	8	24	9	41	2%
Sauce and Vinegar	20	10	16	46	3%
Grinding products (powder)	72	265	1,078	1,415	78%
Fried Products	16	39	37	92	5%
Vegetable products	23	28	19	70	4%
Total	189	407	1,220	1,816	100%

Source: Created by JICA Survey Team based on DICA's statistical data on May 31, 2018

Processed products of vegetables, fruits, and livestock are still weak in Myanmar, and peculiarly, most exported vegetables/fruits are primary (raw) products without any value adding. According to the MFPEA, a number of conventional food processing companies, including edible oil and traditional snacks, have been declining due to tightening competition with products imported from other ASEAN countries including Thailand, Vietnam and Malaysia.

4.6 Distribution Situation in the Horticulture Sector

4.6.1 Overview of Distribution Situation in the Horticulture Sector

Several types of horticulture VC are shown in Figure 4.6.1. Firstly, individual farmers sell to local brokers/collectors at their farmyards at production sites. Farmers, by their own efforts, negotiate a price with local brokers/collectors, based on the information collected from markets at major cities. However, farmers do not have enough bargaining power due to lack of storage and transportation methods. In addition, farmers have to sell their produce immediately because they need to clear borrowed money often obtained from input suppliers to buy seeds, fertilizers and pesticides. As a result, they have to agree to sell their produce even under unfair conditions.

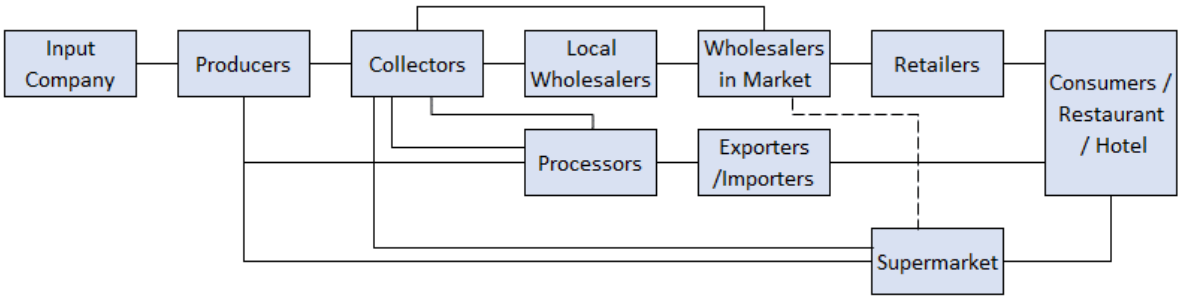


Figure 4.6.1 Typical Distribution Pattern in Horticulture Crops

Generally speaking, farmers in Myanmar do not share information with each other, such as sowing time, and type of crop to be produced. Such decisions are made by themselves based on market information, and this is a kind of non-physical capital for them. It is rational for individuals, however, with a macroeconomic viewpoint, to believe that the demand-supply balance cannot be adjusted properly, causing large price fluctuations of horticulture crops.

The brokers/collectors in production areas sell to local wholesalers/processors and then local wholesalers proceed to trade in markets in big cities such as Yangon and Mandalay. They often buy produce, transport it by traditional means such as in straw baskets, bamboo baskets and nylon-net bags, on a quantity basis (Figure 4.6.2). As the transportation cost is determined by the number of baskets or bags, transporters or collectors put produce into one basket or one bag as much as possible. As a result, one basket or one bag becomes more than 50 kg in weight, and sometimes it can even reach 100kg a basket/a bag. At the moment, those products are mixed in terms of colors, sizes, maturities, and sometimes different varieties are accidently mixed as well. Therefore, the brokers sort the products for pricing differently (Figure 4.6.3).

Figure 4.6.2 Traditional Transportation Means

Generally, rural roads from farmyards to warehouses located at the local markets are poorly maintained. They are narrow and unpaved. During transportation, products are piled up without any protection. For instance, round-shaped products such as cabbages, pineapples, and broccoli, are loaded onto a shelf of 3 meters size in separate pieces in trucks without trimming any outer leaves of the produce. All transportation happens under normal temperature. As a result, a huge weight loss occurs amongst the entire transportation.

Figure 4.6.3 Sorting

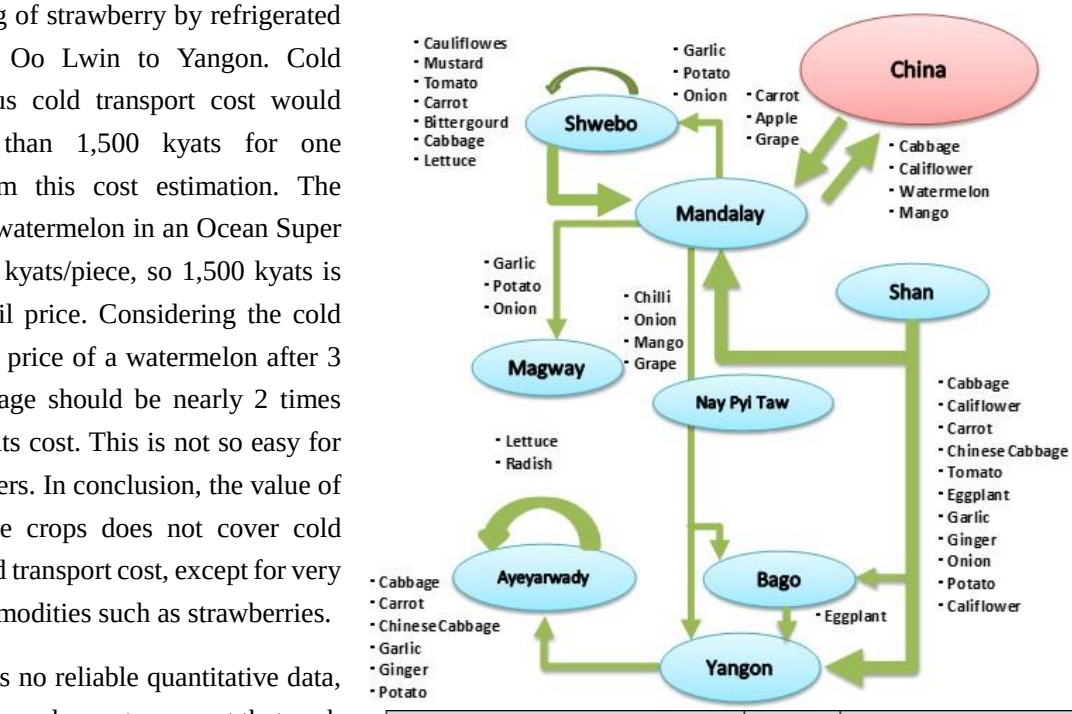
Since normal temperature transportation is prevalent in Myanmar, the entire fresh vegetables VC, from harvesting to consumers' hands, must be completed within half a day. In the case of the wholesale market in Yangon, for example, many vegetables are transported from Southern Shan in the evening, and arriving around/after midnight i.e. 1:00 AM to 4:00 AM, then sold at wholesale markets from 1:00 AM to 6:00 AM.

Retail markets are most crowded on from 6:00 AM to 8:00 AM.

In terms of the cold chain, there are several cold storages and refrigerated vans for cold chain services, especially in high consumption areas such as Yangon. However in the case of horticulture crops, the cold storage cost is higher than crops' value. The average cold storage cost for horticulture crops is 0.8-1.2 USD / pallet / day or 0.54-0.8 USD /m^3 /day by using the mesh cases (Figure 4.6.4). For example, if one pallet could accommodate 20 watermelons and stores them in 3 weeks, the storage cost becomes 16.8-25.2 USD for 20 watermelons. One watermelon storage cost is 1,130-1,700 kyats. Besides costs for storage, they need to be transported by refrigerated van to keep products in cold condition along the consistent cold chain. One company can transport 2,200 kyats/10kg of strawberry by refrigerated van from Pyin Oo Lwin to Yangon. Cold storage cost plus cold transport cost would become more than 1,500 kyats for one watermelon from this cost estimation. The retail price of a watermelon in an Ocean Super Market is 1,800 kyats/piece, so 1,500 kyats is 83% of the retail price. Considering the cold storage cost, the price of a watermelon after 3 weeks cold storage should be nearly 2 times higher to offset its cost. This is not so easy for watermelon traders. In conclusion, the value of most horticulture crops does not cover cold chain storage and transport cost, except for very high priced commodities such as strawberries.

Figure 4.6.4 Mesh Cases

Although there is no reliable quantitative data, several literatures and reports suggest that such traditional wet markets account for not less than 85% of horticulture distribution in Myanmar. In fact, supermarkets procured fresh vegetables and fruits from wholesale market such as Thiri Minglar market in Yangon in the past. However, as consumers' mindsets of health and food safety grow, especially within wealthier class of people, they mainly procure from local collectors/farmers at production sites directly, to ensure food traceability according to an interview to marketing-in-charge of a major supermarket.



Location between	Miles[1)]	est. travel times
Mandalay - Shwebo	68.5	2 hours 10 min
Mandalay - Magway	138	4 hours
Mandalay - Muse	282	8 hours 40 min
Mandalay - Nay Pyi Taw	168	3 hours 20 min
Shan (Aungban) - Mandalay	395	7 hours 30 min
Shan (Aungban) - Bago (Pegu)	327	7 hours 30 min
Shan (Aungban) - Yangon	367	8 hours 30 min
Yangon - Ayeyarwaddy (Pathein)	122	4 hours 30 min
Yangon - Naypyitaw	228	4 hours 40 min

Figure 4.6.5 Horticulture Distribution in the Whole Country

Source: "Preparatory Survey for Intensive Agriculture Promotion Program in the Republic of the Union of Myanmar, Final Report" (SCI, 2016)
https://distancecalculator.globefeed.com/Myanmar

4.6.2 Vegetable Distribution in the Whole of Myanmar

This chapter describes an overview of flows of horticulture crops in Myanmar. There are several major horticulture production sites in Myanmar. According to statistics, the production sites are Sagaing, Shan State, Ayeyarwady and Bago. The typical distribution flows of crops are summarized below.

Sagaing is one of the major production areas for vegetables including cauliflower, mustard, tomato, carrot, bitter gourd, cabbage and lettuce according to the statistics of SLRD (previous name of DALMS) in 2013/14. Sagaing and nearby Regions from the CDZ are also the largest production area of onion, chili, tomato, and watermelon. As for wholesalers in Mandalay markets, the major destinations of vegetables produced in Sagaing are within the Region and surrounding upper Myanmar. Some produce such as tomato and onion is marketed in Nay Pyi Taw and Yangon.

Shan is a major production area of garlic and potatoes in Myanmar. Shan is also famous for its major production of highland vegetables including cabbage, cauliflower, broccoli, Chinese cabbage, asparagus and other leafy vegetables, which are marketed in major consumption areas such as Yangon, Mandalay, Nay Pyi Taw, Myingyan, Magway and Pathein. Inlay Lake is famous for hydroponic tomato production on floating gardens and it attracts many tourists. However, almost 70% of tomatoes in 2013/14 were produced in the CDZ. At the beginning of harvest season, tomatoes from Shan are dominant in major markets including Yangon and Mandalay. However, when the tomatoes from CDZ flow into the major markets, the price of tomatoes from Inlay Lake decreases sharply due to their poor quality and taste.

Aungban wholesale market was developed as a way station of vegetable trading from Southern Shan to other Regions. Even though Taunggyi city is the third largest population in Myanmar, the wholesale market in Taunggyi is not well developed due to constraints on geographical condition and the limitation of area. Vegetables from Shan, mostly from Southern Shan, are once collected at the Aungban wholesale market and are redistributed to broader markets such as Thiri Marlar Market in Mandalay and Thiri Minglar Market in Yangon.

Ayeyarwady and Bago are major production areas of lowland vegetables, and production volume of lettuce, radish and bitter gourd in 2013/14 are higher than the other Regions and States in Myanmar. Especially lowland vegetables from Bago and Ayearwaddy are actively transacted in the same Region or Yangon because of its short distances, which indicates that Ayeyarwaddy and Bago are the important supply bases of vegetables to the commercial capital of Yangon.

4.6.3 The Wholesale/Retail Market Situation in Myanmar

In Myanmar, there is no clear distinction between wholesale market and retail market. Even in a “so-called” wholesale market, retailers can sell their product to the end consumers. In other words, a wholesale market also has a function as a retail market. For example, a retailer sells to wholesalers during the morning, and the same retailer sells to consumers during the day. Most of the wholesalers/retailers are small-scale, and more or less 2,000 wholesalers/retailers are usually running business in a large-scale wholesale market. Such disorganized and crowded markets seem complicated and confusing at a glance, but in fact, the markets function well because both sellers and buyers are mostly small-scale and no one can set unreasonably high/low price like in a monopoly/oligopoly market.

In some districts there are clusters of wholesaler’s formed with weak affiliates and without any membership, such as Bayintnang Market in Yangon and the Thirimalar market in Mandalay. The trade volume of wholesalers

in those markets is usually large -scale compared to that of other markets.

Prices in wholesale markets are determined by mutual negotiation between individual buyers and sellers. There is no auctioning system in markets in Myanmar. Each buyer and seller has their own source of information, and sharing the market information from major cities. The information is also shared to local collectors/brokers as well as farmers.

Wholesale price information is collected from 8 major wholesale markets such as Yangon, Mandalay and Aungban, but the grade information of most commodities that directly reflects their price is not shown. Each commodity's price information is collected from three fixed wholesalers in the markets. An average price is calculated from the collected prices.

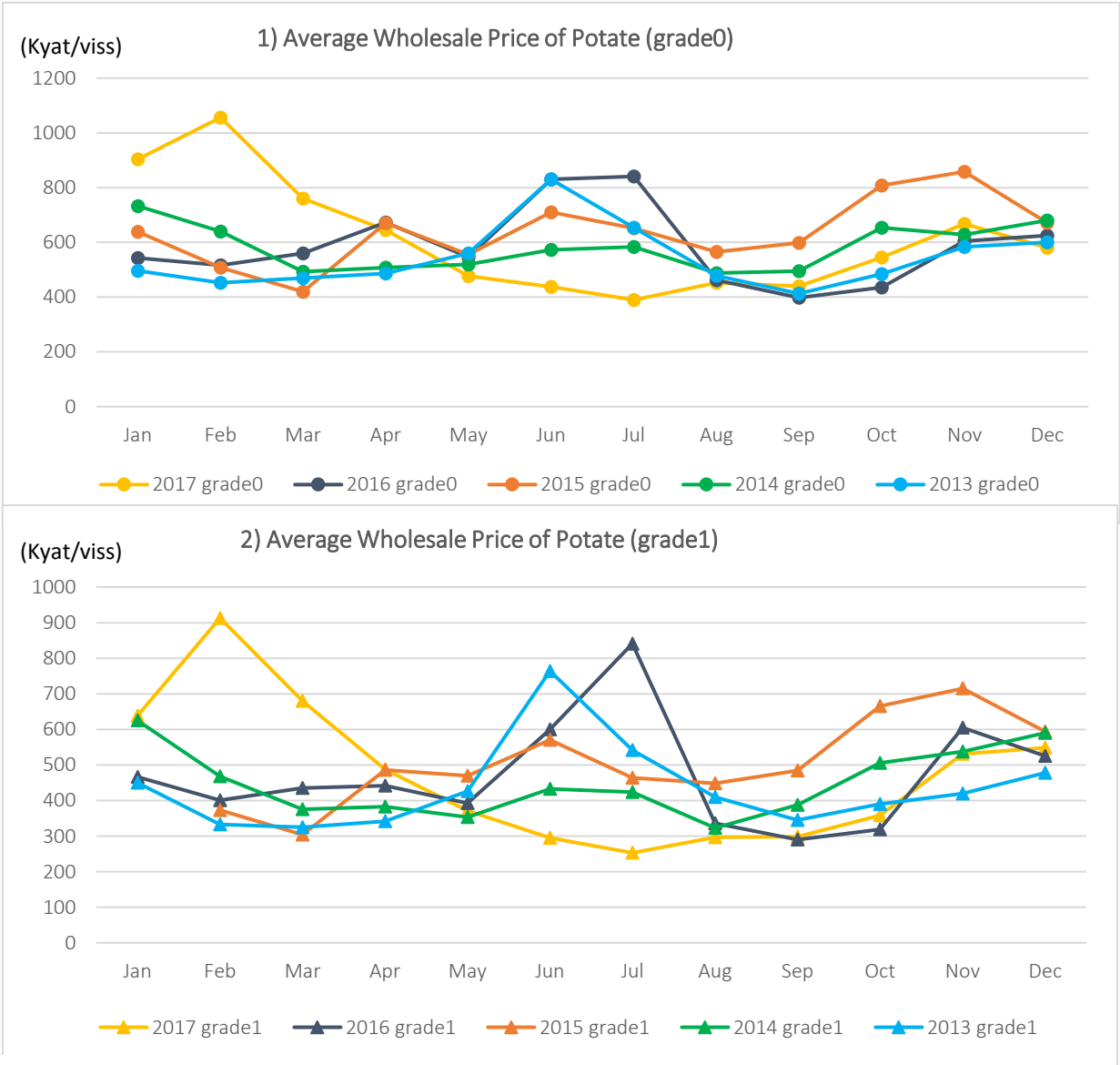


Figure 4.6.6 Average Wholesale Prices of Potato (Yangon, Bayintnaung Market)

Source: MIS Price Bulletin, MOALI

For instance, the average wholesale price of potatoes at Bayintnaung Market, which is located in Yangon, is demonstrated by month and by grade from 2013 to 2017 in Figure 4.6.6. The average price of Grade0 potato is higher than Grade1 potato, and the gap is from 0 kyat/viss to around 250 kyats/viss. The highest price was 1,056

kyats/viss with Grade0 potato in February 2017, and the lowest price is 253 kyats/viss with grade1 potato in July 2017. Therefore, it can be said that there was a great fluctuation, as the lowest price was only a quarter of the highest price, depending on the seasons. Based on the interview survey, the average prices of potatoes are significantly affected by imported potatoes from China.

Moreover, there is a tendency that the fluctuation range of horticulture crop prices in Myanmar is bigger than that in China. Although it is a comparison between wholesale price and producer price, the price of onions/carrots from 2013 to 2016/2017 in Myanmar changed more drastically than that in China, as shown in Figure 4.6.8 and Figure 4.6.7.

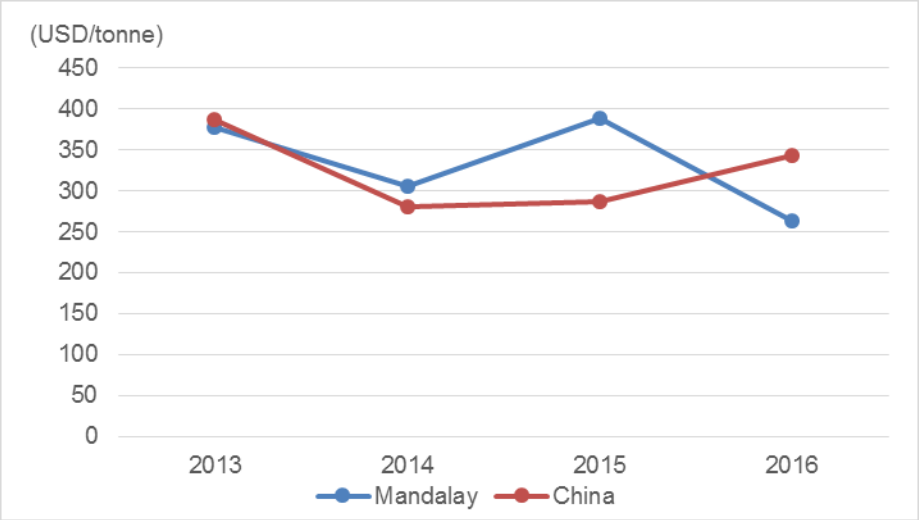


Figure 4.6.7 Comparison of Average Wholesale/Producer Price of Carrot between Myanmar and China

Source: MIS Price Bulletin, MOALI, FAOSTAT

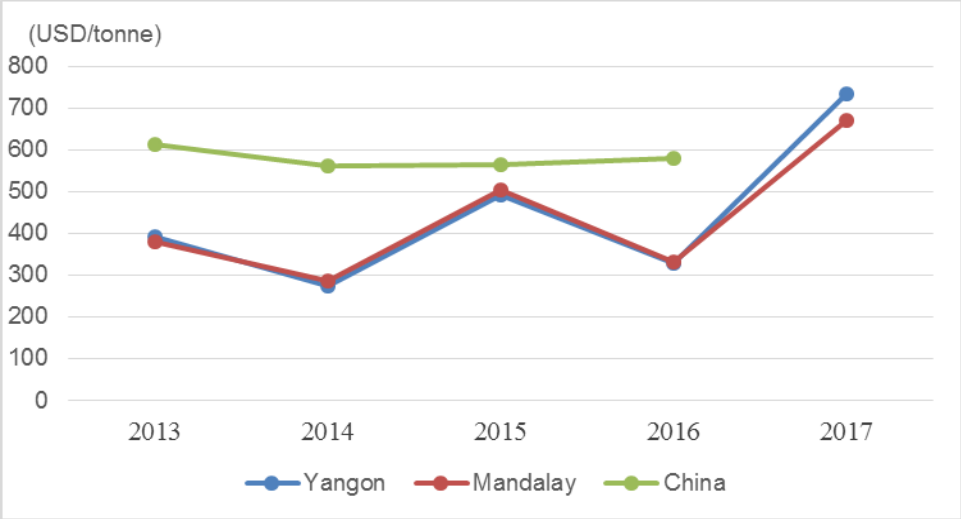


Figure 4.6.8 Comparison of Average Wholesale/Producer Price of Onion between Myanmar and China

Source: MIS Price Bulletin, MOALI, FAOSTAT

Marketing information needs to include not only price information, but also quantitative information. Each wholesale market does not collect quantitative information about produce amount brought by brokers and farmers. Production information from each place is also important market information because traders cannot estimate supply accurately without it.

In Yangon, there are about 180 wholesale and retail markets under the YCDC. For horticulture crops, Thiri Mingalar market, Da Nyin Gone Market, and Yadanar Thiri Market are the major wholesale markets in Yangon and its suburban areas. Thiri Mingalar Market is the largest market, in transaction volume, and is located in the western part of Yangon city beside Yangon River. Since the market is located in the inner part of the city, traffic jam in the surrounding roads cause the most common trouble regarding the transport of fresh products. In addition, the inside of the market shed is congested and small vans come into the shed using narrow entranceway, which affects cleanliness.

To overcome the above situation, Dagon International Limited proposed a plan of the rejuvenation of Da Nyin Gone market which is located northwest of Yangon International Airport.

Da Nyin Gone is a new wholesale market under construction from 2016 by build-operation-transfer (BOT)[28] concession between Dagon International Limited and the YCDC. The original area of old Da Nyin Gone market is 10 acre, but it will expand to 83 acre after expansion. When the survey team visited in May 2018, the first phase of construction had been completed and some parts of the market section (farmers' market, dry crop market, and a special section for vegetables produced in Southern Shan) had already opened. In the forthcoming second phase of the construction period, the market is to be equipped with cold storage, office spaces, motels, a hypermarket, a gasoline station, and a biogas station. Compared to traditional wholesale markets, the new wholesale market is innovative in terms of both its operation and facilities. For example, market sections are paved; there are passageways for driving vehicles, and two demonstration cooler containers were already installed that can be utilized free of charge for all the shoppers.

In Mandalay, there are about 50 wholesale and retail markets under the MCDC. Thiri Malar Market and 41 vegetable night markets are the major wholesale and retail markets for horticultural crops. There is also a plan for new horticulture wholesale market in Mandalay between Mandalay City and Mandalay airport. However, the construction is currently suspended because of financial problems.

The information of original States/Regions of several crops was collected through the interview survey at several major markets in Yangon and in Mandalay. Based on those information, two figures of horticulture distributions were created be seasons; rainy season and dry season, and are demonstrated in Figure 4.6.9 and Figure 4.6.10.

[28] BOT; Private companies invest, construct and manage the buildings/facilities until the end of the contract. After that, the property right is transferred from the private companies to the government.

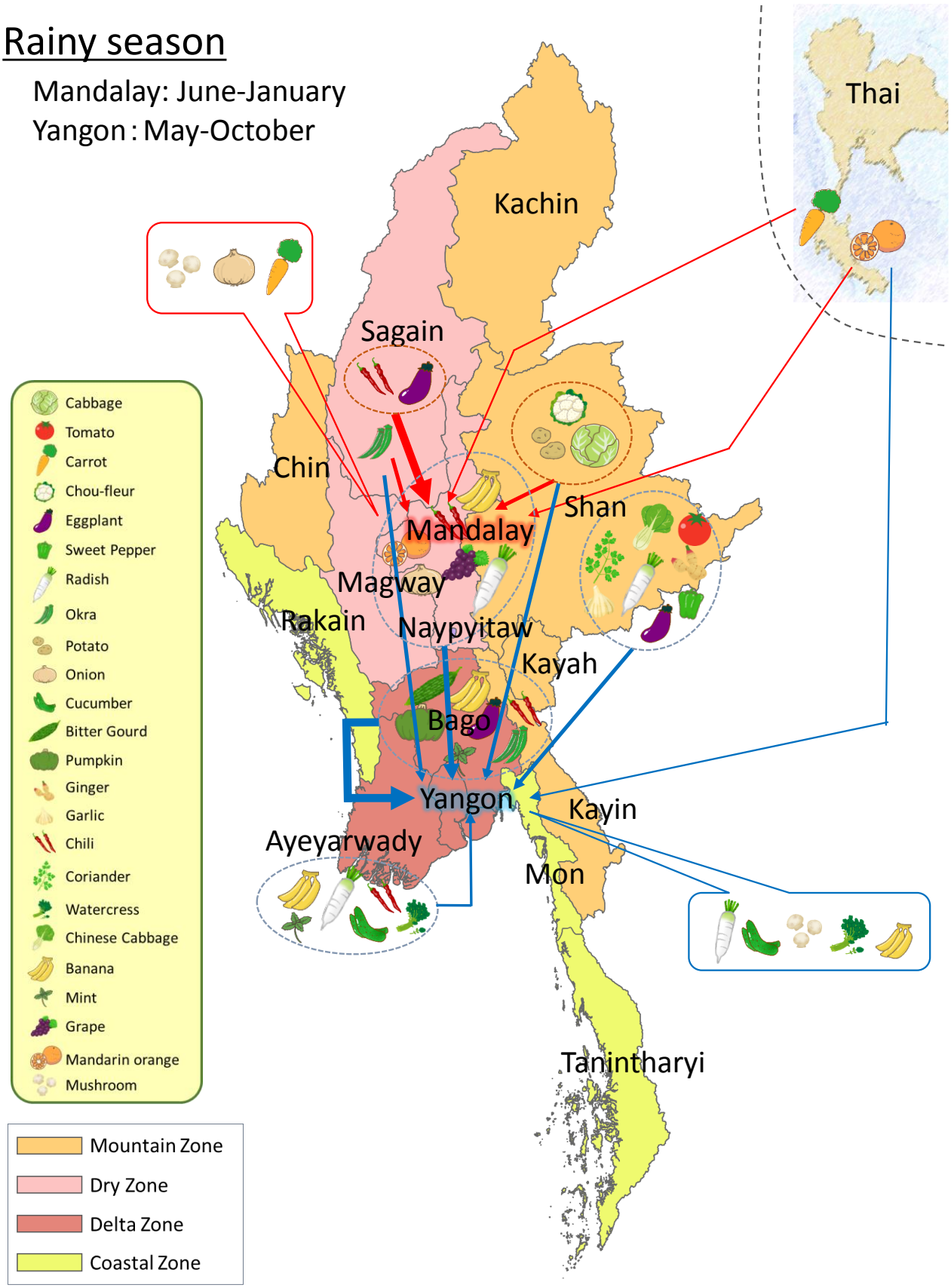


Figure 4.6.9 Distribution of Major Crops to the Traditional Markets in Yangon and in Mandalay in Rainy Season

Source: JICA Survey Team

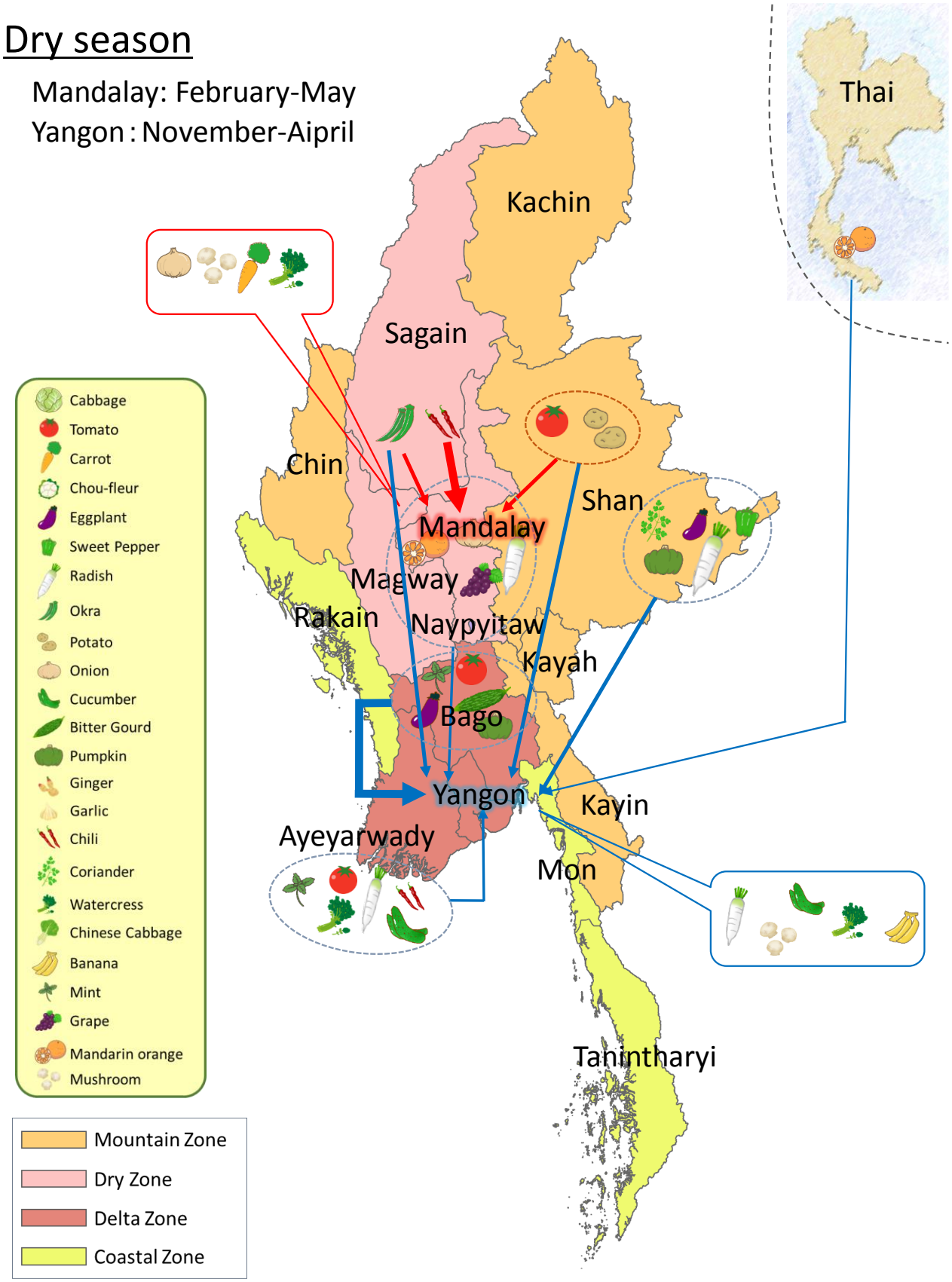


Figure 4.6.10 Distribution of Major Crops to the Traditional Markets in Yangon and in Mandalay in Dry Season

Source; JICA Survey Team

4.6.4 Possibility of Wholesale Market Renovation

A wholesale market is expected to perform three principal functions;

i) Collective Function: Every variety, quality, and size of vegetables is gathered in a wholesale market.
ii) Distribution Function: A buyer can purchase commodities that meet their own standards, as much as they require in a short space of time.
iii) Price Formulation Function: A wholesaler sells produce at a public auctioning place that creates the standard prices for commodities, without mutual negotiation.

If one would like to establish such a wholesale market system in Myanmar, the Japanese style of wholesale market may be one of the benchmarks to emulate. However, such a market system is not suitable for the current situation in Myanmar, because of the following reasons;

i) Farmers; a typical farmer is small-scaled, and has no means of transportation. A collective marketing system established through farmers' groups and cooperatives has not yet been organized. Accordingly, it is difficult to sell at a certain volume at one time. For buyers, load arranging is difficult under such situations.
ii) Collectors/local wholesalers; it is not realistic to expect that collectors/local wholesalers will make a sales' contract with wholesalers in market, because if they buy the commodities, the selling price will not always become larger than the buying price. Introducing an auctioning system creates a risk of selling below the buying price.
iii) Exporters; similarly, they prefer directly selling to importers so as not to sell at a lower price than the buying price.
iv) Wholesalers in the market; they have established their own procurement networks so that there is no incentive to change marketing systems.
v) Retailers; most of the retailers are marginal family businessmen and it is difficult for them to participate in all of the auctions because they will be conducted in many different places at the same time. In this respect, the retailers should participate in the auctions for only limited commodities.

Another option is to build local wholesale markets at production sites, which enable farmers sell directly there. In that case, financial problem for market operation would occur because the scale would be small, and costs must not be payable for farmers if the source of funds depend on a shopper's service charges only.

In these respects, a plan for the drastic innovation of the market system seems not to be the best option, considering the current situation in Myanmar. As mentioned above, the traditional markets still hold quite a large share. Under such conditions, the rejuvenation and improvement of traditional markets should be prioritized to create an efficient VC, and to improve food safety and hygiene conditions in the short term.

In the long run, the share of supermarkets should increase gradually as it did in other Asian countries, including Japan. At the moment, a modern traditional market that realizes a publicly fair trading system is required because quality standards will be expected, and this will reflect on prices. So far, supermarkets directly procure from production sites. In this respect, supporting contract farming and organizing farmers' groups/cooperatives are some of the possible solutions to this challenge, and to encourage private business activities, to make market prices more stable and to ensure food traceability.

CHAPTER 5 THE FVC IN LIVESTOCK SECTOR

5.1 Outline of Production/Consumption and Import/Export in the Sector

5.1.1 Production

Between 2005/6 and 2015/16, the production of meat such as sheep/goats, pigs, chickens and ducks has dramatically increased. Table 5.1.1 shows that sheep and chicken production more than tripled (by 3.17 and 3.30 times respectively), and pig and duck production more than doubled (by 2.65 and 2.37 times respectively) in the last ten years. The same table shows that number of buffalo and cattle have been increased slightly. It might be due to an absence of domestic market in Myanmar. Traditionally, it is said that there is no beef category market in Myanmar. An ordinal buddhist person in the country does not eat beef for religious reasons, and only old draft cattle are slaughtered to eat.

On the other hand, in order to respond to the market demand in China, the GOM has been allowing live cattle exports since the 9th of October 2017. As of February 2018, around 200 cattle were traded daily at the Muse border (Myanmar - China). It could be welcomed information by livestock producers and traders who are interested in live cattle exporting. However, regarding a national, political and economic viewpoint, expanding without any government control might not benefit for the country. It could also cause an increase of disease transmission across borders. In addition, the export of living animals might negatively affect business opportunities for domestic processing companies.

Table 5.1.1 Production of Major Livestock by Year from 2005/06 to 2016/17 (Million Heads)

Particular	2005/06 (A)	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16 (B)	(B)/(A)
Buffalo	12.1	13.6	14.0	14.5	15.0	15.5	16.0	1.32
Cattle	2.7	3.0	3.1	3.2	3.3	3.4	3.5	1.30
Sheep/goat	2.4	3.4	4.6	5.2	6.0	6.8	7.6	3.17
Pig	5.7	9.3	10.3	11.4	12.6	13.8	15.1	2.65
Chicken	81.7	153.0	172.6	194.2	217.1	241.9	269.3	3.30
Duck	9.2	13.9	15.3	16.8	18.3	20.0	21.8	2.37
Goose/Turkey	1.4	1.2	1.2	1.3	1.3	1.4	1.5	1.07

Source: Myanmar Agriculture at a Glance 2016

Major production areas are; cattle and sheep/goats are distributed in CDZ such as Mandalay, Sagaing, and Magway. Buffaloes are distributed in Sagaing and Lakhine states. Pigs are mainly distributed in Magway, Shan State, and Ayeyarwaddy. Chickens are distributed in Yangon, Bago and Magway. These areas are highlighted in red in Table 5.1.2. Most livestock farming occurs in a backyard system (small scale), but some of the commercial animal breeds such as pigs, and layer and broiler chickens, are kept in intensive systems by people in urban environments.

Table 5.1.2 Production of Major Livestock in 2016/17 (100,000 Heads or Birds)

		Cattle	Buffalo	Pig	Goat	Sheep	Chicken	Duck	Turkey
1	Nay Pyi Taw	2.48	0.70	3.18	0.17	0.00	40.05	1.06	0.05
2	Kachin	3.78	2.77	10.30	0.69	0.00	85.99	2.95	0.61
3	Kayah	0.98	0.37	1.46	0.04	0.00	27.14	0.24	0.08
4	Kayin	3.85	1.02	4.76	1.06	0.00	60.51	4.08	0.58
5	Chin	1.86	0.54	4.43	1.15	0.00	63.14	0.42	0.11
6	Sagaing	26.09	5.10	13.94	4.33	2.65	218.83	3.52	0.75
7	Tanintharyi	1.70	1.68	2.491	0.40	0.00	52.40	6.20	0.30
8	**Bago**	**15.89**	**3.37**	**11.90**	**0.79**	**0.00**	**408.39**	**99.49**	**1.51**

		Cattle	Buffalo	Pig	Goat	Sheep	Chicken	Duck	Turkey
	Bago (East)	7.89	2.78	7.34	0.37	0.00	196.70	88.79	0.87
	Bago (West)	8.00	0.59	4.56	0.42	0.00	211.69	10.70	0.64
9	Magway	29.86	1.80	38.11	37.98	8.96	475.47	4.04	0.19
10	Mandalay	24.00	0.73	9.20	15.25	3.35	262.00	6.45	0.65
11	Mon	5.37	0.99	4.94	1.34	0.00	120.68	19.10	0.90
12	Lakhine	13.23	4.43	4.00	4.15	0.00	105.34	4.28	1.70
13	Yangon	6.81	1.66	13.11	1.20	0.00	473.76	38.36	2.74
14	**Shan**	**16.42**	**8.78**	**23.87**	**1.17**	**0.00**	**324.82**	**4.89**	**0.90**
	Shan (South)	8.79	3.60	6.25	0.30	0.00	127.56	1.59	0.50
	Shan (East)	1.57	1.72	3.74	0.27	0.00	23.93	2.20	0.15
	Shan (North)	6.06	3.46	13.88	0.60	0.00	173.33	1.10	0.25
15	Ayeyarwaddy	12.75	2.44	17.73	1.20	0.00	217.51	40.64	4.11
	Total	**165.07**	**36.38**	**163.42**	**70.91**	**14.96**	**2,936.03**	**235.72**	**15.18**

Source: Myanmar Livestock Statistics, 2017

5.1.2 Consumption

Meat consumption is mainly fish and poultry in Myanmar. In fact, fowl meats accounted for approximately 51% of total meat production as of 2016/17, followed by pork (29%) and beef (12.4%) (Myanmar Livestock Statistics 2017).According to the LBVD, the per capital meat consumption in 2016 was about 59.0kg/year, and the per capital consumption of milk was 47.4 kg/year (Table 5.1.3). If the statistics are not overestimated, it could be said the meat per capital consumption in Myanmar has already exceeded the world average of 34.4 kg/year (Figure 5.1.1). While milk consumption per capital is far less than the world average, it is relatively high amongst other Southeast Asian countries (Figure 5.1.2).

Table 5.1.3 Per Capita Consumption of Major Livestock Products (2009/10 to 2015/16)

(kg/year/capita, egg/year/capita)

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Egg	122	129	136	147	159	172	230	241
Milk	24.80	26.59	27.36	29.6	31.62	34.54	46.88	47.44
Meat	30.40	32.46	34.07	37.01	40.16	43.91	58.38	59.04

Source: Myanmar Livestock Statistics, 2017

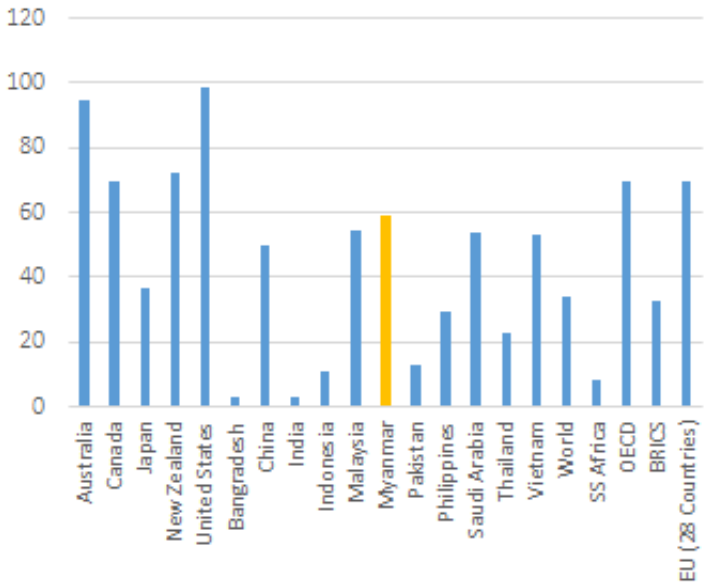


Figure 5.1.1 Per Capital Consumption of Meat for Selected Countries (2017) and Myanmar (2016/17)

Source: Myanmar: Myanmar Livestock Statistics 2017,
Other countries: OECD (https://data.oecd.org/agroutput/meat-consumption.htm)

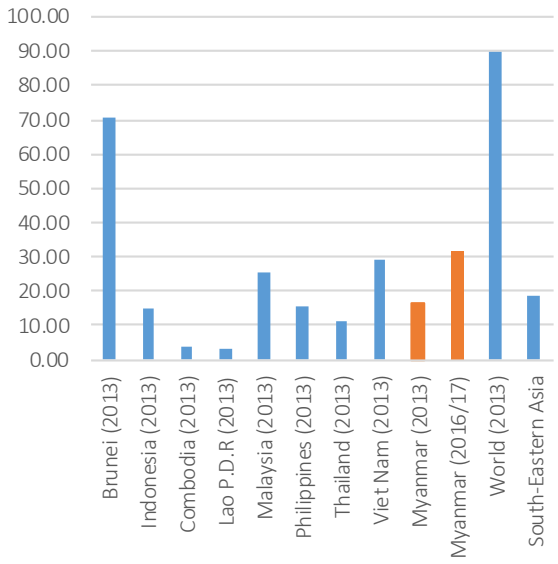


Figure 5.1.2 Per Capital Consumption of Milk for Selected Countries (2013) and Myanmar (2016/17)

Source: Myanmar: Myanmar Livestock Statistics 2017,
Other countries: OECD (https://data.oecd.org/agroutput/meat-consumption.htm)

5.1.3 Exports /Imports

(1) Exports

Table 5.1.4 shows the export volume of livestock products in 2013 to 2017. It indicates that animal hides, fish powder, and live goats are major livestock commodities.

Table 5.1.4 Export Volume of Livestock Products in 2013 to 2017 (Official Statistics)

		2013/14		2014/15		2015/16		2016/17	
		Qty (nos)	'000 USD	Qty (nos)	'000 USD	Qty (nos)	'000 USD	Qty (nos)	'000 USD
Buffalo/Cow Hide	MT	6,260	4,069	6,631	4,310	5,732	3,726	9,478	6,161
Sheep/Goat Hide	MT	306	122	697	279	598	239	574	230
Frozen Mutton	MT	24	177	15	107	12	87	3	23
Live Goat	Heads	990	59	-	-	2000	60	51,000	1,845
Raw Dried Bone Grist	MT	990	144	894	94	640	67	1,060	111
Pellet (Animal)	MT	-	-	-	-	-	-	-	-
Fish Powder	MT	1,500	825	11,351	6,243	9,045	4,975	13,513	11,084
Duck Down	MT	-	-	15.456	69.215	18.42	183.823	21.51	204.268
Prawn Shell	MT	14	8,400	36	119	180	369	72	74
Mat Pea	MT	-	-	-	-	1,000	150	-	-
Frozen Cricket	MT	-	-	-	-	-	-	5	4.000
Total	MT	9,472	5,405	19,639	11,220	19,225	9,856	24,727	19,736
	Heads	990	-	-	-	2,000		51,000	

Source: Myanmar Livestock Statistics, 2017
Note: The data includes fishery.

Based on the above table, live livestock exports appear to be almost nonexistent except for goats. However, there may be some undocumented exports through unofficial border checkpoints. The FAO estimated the numbers of exported living livestock from Myanmar to other countries based on data from counterparts. However, the data is only available until 2013 (Table 5.1.5). There is also a gap between national statistics and the FAO estimation. It might be due to existence of the existence of unofficial transaction that had not been declared at custom offices.

Table 5.1.5 Live Livestock Export in 2009 to 2013, (Heads or Birds)

Livestock Name	2009	2010	2011	2012	2013	Major Importing Countries (2009-2013, FAOSTAT)
Buffaloes	-	-	-	28,225	25,000	Thailand
Cattle	20,653	41,003	71,930	74,419	203,418	Malaysia, Thailand
Goats	-	2,739	251	250	814	Malaysia, Thailand
Sheep	-	-	-	150	235	Malaysia, Thailand

Source: The Survey Team based on FAOSTAT, the data are estimation sourced from imported countries

(2) Imports

As previously mentioned, local beef/cattle consumption is small. Namely, domestic poultry and pork production are sufficient to meet domestic demands. In this respect, imported meat is mainly for the consumption purposes of foreigners, for example when serving meals at hotels/restaurants. The major countries of origin are located in East Asia and Southeast Asia Regions such as Hong Kong SAR, Japan, Thailand and Singapore.

Table 5.1.6 Meat Import and Origin Countries (2009-2013) (MT)

Sr. No.	Particular	2009	2010	2011	2012	2013	Origin Countries
1	Meat, beef and veal sausages	108	139	21	160	197	Thailand
2	Meat, beef preparations	2	304	1	0	6	Hong Kong SAR, India, Thailand
3	Meat, cattle	1	20	150	314	1	India, Singapore
4	Meat, cattle, boneless(beef & veal)	538	1,141	10	2,821	667	Thailand, Hong Kong SAR, Malaysia
5	Meat, chicken	915	3,279	585	97	530	Thailand, Japan, India
6	Meat, pork	1,599	196	6	9	21	Thailand, Singapore
7	Meat, sheep	4	7	8	21	15	Singapore, Australia
8	Meat, turkey	4	121	158	11	43	Thailand, Singapore

Source: The Survey Team based on FAOSTAT, the data is an estimation sourced from importing countries
Note: “Origin Countries” is defined as the top two or three country in terms of export volume over a period of 7 years (2007 - 2013)

Dairy products are major import goods in the livestock sector. In Myanmar, it is said that raw milk consumption itself is small and mostly occurs in the form of condensed milk, for example when it is mixed with tea and coffee.

Table 5.1.6 Dairy Product Imports in 2015/16 to 2017/18 (Million USD)

	Milk, Condensed	Milk and evaporated	Milk powder	Others Milk, food including malted milk
2015-2016	53.70	12.00	33.80	17.00
2016-2017	21.60	21.80	37.20	27.10
2017-2018	2.60	5.00	26.30	20.70

Source: Central Statistical Organization

Aside from dairy products, day old chicks (DOC), day old ducks (DOD), hatching eggs (HEs) of layer and broiler breeds of chicken, animal feed, veterinary drugs, and farm equipment are imported, though the volume is very small. Frozen pork is also allowed to be imported if one can obtain an import license. While live adult livestock, that have matured enough to be sent directly to the slaughterhouse, are not permitted to be imported.

Table 5.1.7 Imports of Day Old Chicks and Hatching Eggs of Layer and Broiler

Year	Grand Parent Stock (GPS)			Parent Stock (PS)				Commercial Stock (CS)			
	Layer		Broiler	Layer		Broiler		Duck		Layer	Broiler
	DOC	HE	DOC	DOC	HE	DOC	HE	DOD	HE	DOC	DOC
2006/07	392	-	-	22,190	119,420	8,404	371,528	-	-	-	-
2007/08	-	-	-	-	-	-	-	-	-	-	-
2008/09	1,296	-	9,161	9,300	299,040	139,850	441,240	-	-	-	-
2009/10	5,241	246,200	-	-	-	87,611	101,475	-	-	-	-
2010/11	-	-	-	30,356	236,120	191,223	309,105	-	-	-	-
2011/12	-	-	21,672	11,760	510,060	171,600	394,140	-	-	-	-
2012/13	-	-	29,200	31,160	266,760	789,942	560,408	-	-	-	-
2013/14	-	-	-	403,640	440,200	3,433,674	799,940	54,837	10,200	-	-
2014/15	-	-	-	681,839	238,300	4,098,754	7,621,164	193,380	-	14,280	179,100
2015/16	-	-	37,003	33,360	3,260,680	363,205	5,712,705	372,105	-	78,820	293,285
2016/17	-	-	45,085	49,680	1,740,040	467,027	11,946,642	622,335	-	-	622,335

Source: Myanmar Livestock Statistics 2017

Table 5.1.8 Import on Animal Feed, Veterinary Drugs and Farm Equipment (Dose in Thousand)

Sr. No.	Particular	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
1	Poultry Vaccine	555,610.0	6,071.1	7,585.8	758,574.0	816,400.0	869,334.0	1,102,621.6	977,547.8
2	Rabies Vaccine	5.0	0.2	2.7	13.1	267.7	218.5	133.9	301.7
3	Swine Vaccine	8.9	0.1	1.6	15.8	-	435.1	356.5	3,084.3
4	Feline Vaccine	-	-	-	-	-	4.6	0.6	17.1
5	FMD (Cattle)	-	-	-	-	-	0.1	40.0	-

Source: Myanmar Livestock Statistics 2017

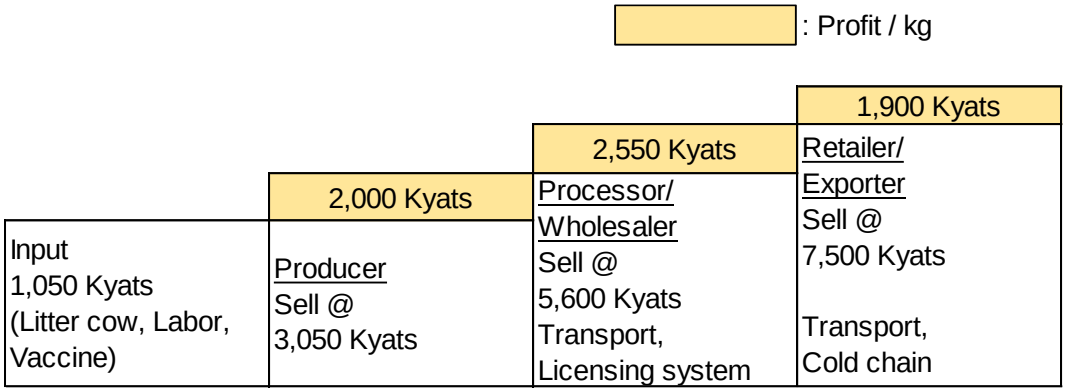
5.2 FVC Analysis in the Livestock Sector

The Survey team conducted FVC analysis workshops in May 2018. The covered livestock are; beef, milk, dairy production (yoghurt), pork, eggs, chicken and maize for feeding livestock[29]. The process to hold the workshops and to create each VC map is described in chapter 4.2.The VC maps are shown in the Appendix. In this section, the figures of their estimated profits in each stakeholders are shown.

[29]In the livestock production, in general, feed cost reaches 70% in the maximum case. Feed has the largest impact among several production inputs to whole value chain. Maize, as a energy source, is the biggest item in feed materials in general.

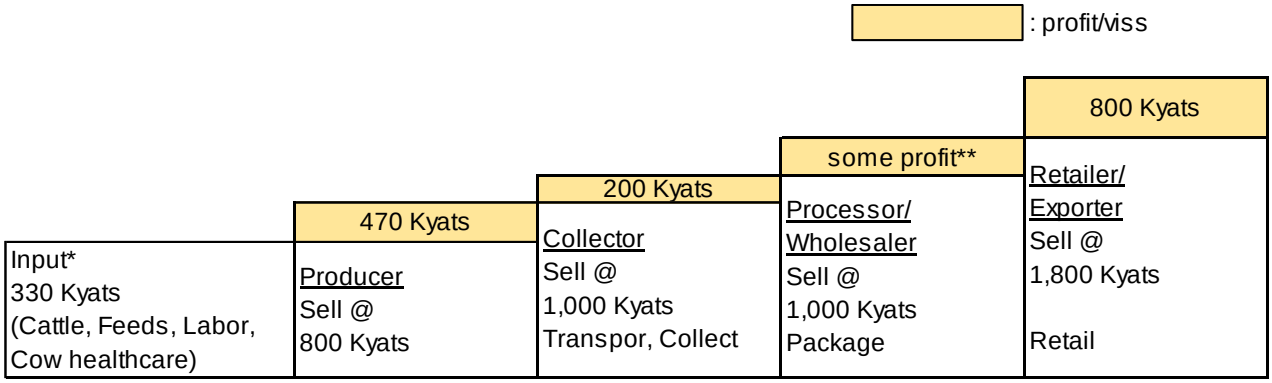
i) Estimated profit from beef sales by each stakeholder

In the beef VC, all stakeholders seem to make similar amount of profits.



ii) Estimated profit from milk sales by each stakeholder

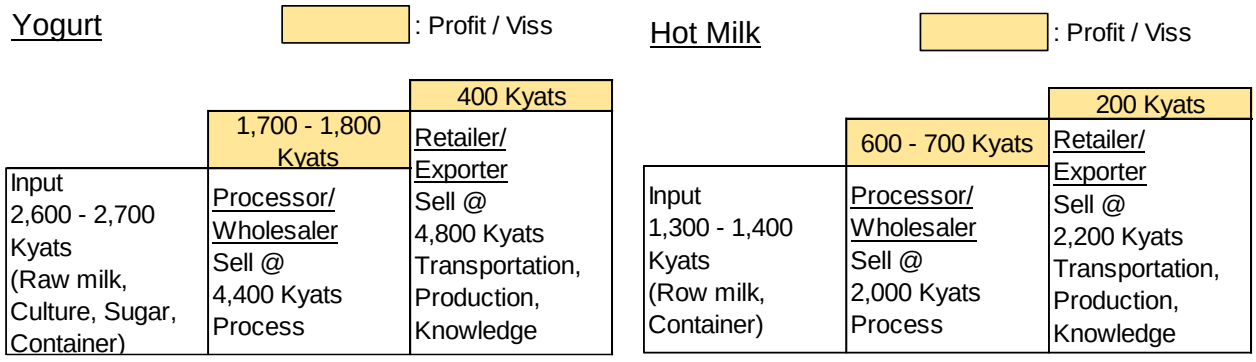
In the milk VC, the profits of retailers and exporters are large. Since the selling prices of collectors and processors/wholesalers are almost the same, the collectors may sell their produce directly to retailers/exporters.



*Input is calculated using WS data, interview survey etc; milking 8.5 viss/day, 5.5 years/cattle, 290 days/year
**There is a possibility that products are delivered from collector to retailer/exporter directly

iii) Estimated profit from dairy products sales by each stakeholder

In the dairy products VC (in both yogurt and hot milk), the profits of processors/wholesalers are large.



iv) Estimated profit of pork in each stakeholder

Regarding local pig, the profit of collectors is smaller amongst the stakeholders, while that of pocessors/wholesalers is larger amoongst the stakeholders. In terms of breeder pig, the profits of processors/wholesalers and retailers/exporters are large.

Local pig : Profit / Pig

Input*	28,570 Kyats	10,000 Kyats	60,000 Kyats	48,200 Kyats
121,430 Kyats (Local piglet, Feed)	Producer Sell @ 150,000 Kyats	Collector Sell @ 160,000 Kyats Feed, Transport	Processor/ Wholesaler Sell @ 220,000 Kyats Slauter, Clean	Retailer/ Exporter Sell @ 268,200 Kyats Retail, Transport

*Except for the cost of the farm construction.
Some data from interview survey ; growing period and breeding density are used to calculate input

Breeder pig : Profit / Pig

Input*	38,570 Kyats	20,0000 Kyats	60,000 Kyats	61,460 Kyats
161,430 Kyats (CP Breed, Feed)	Producer Sell @ 200,000 Kyats	Collector Sell @ 220,000 Kyats Feed, Transport	Processor/ Wholesaler Sell @ 280,000 Kyats Slauter, Clean	Retailer/ Exporter Sell @ 341,460 Kyats Retail, Transport

*Except for the cost of the farm construction
Some data from interview survey ; growing period and breeding density are used to calculate input

v) Estimated profit of eggs in each stakeholder

The selling prices of producers are fluctuated, and so their profits seem to be unstable.

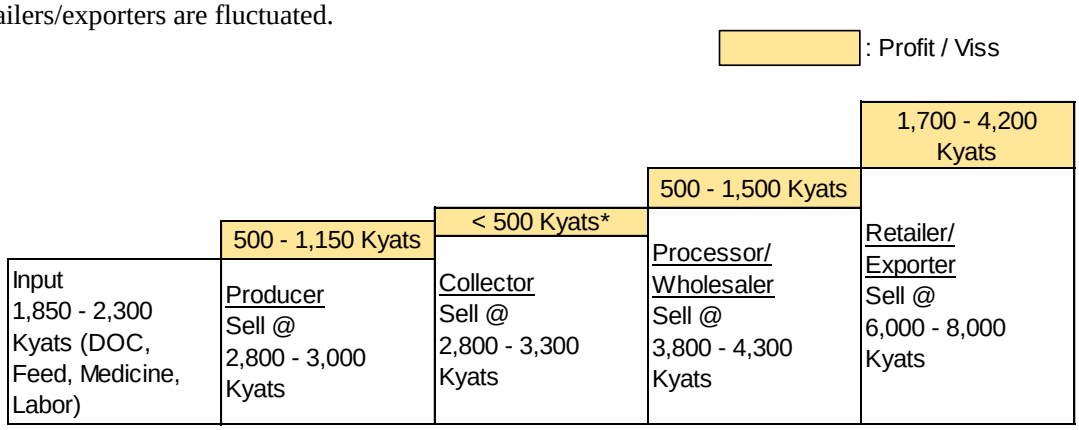
: Profit / Egg

Input*	20 - 80 Kyats	20 - 80 Kyats	30 Kyats
10 Kyats (DOC, Raising 16 week cost)	Producer Sell @ 30 - 90 Kyats	Collector Sell @ 110 Kyats Collect, Sort	Retailer/ Exporter Sell @ 140 Kyats Retail

*This “Input cost” is one which is assumed that a hen lays 1,500 eggs in shole life

vi) Estimated profit of chicken in each stakeholder

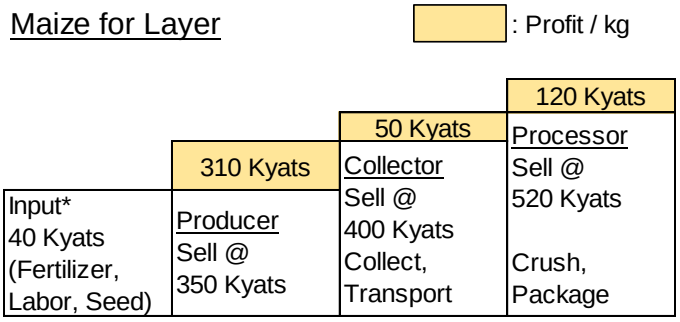
In the chicken VC, the profit of collectors is small and it occasionally makes a loss. The ranges of profits are large in all stages from production to retail, compared with the other products' VCs. In particular, the profits of retailers/exporters are fluctuated.



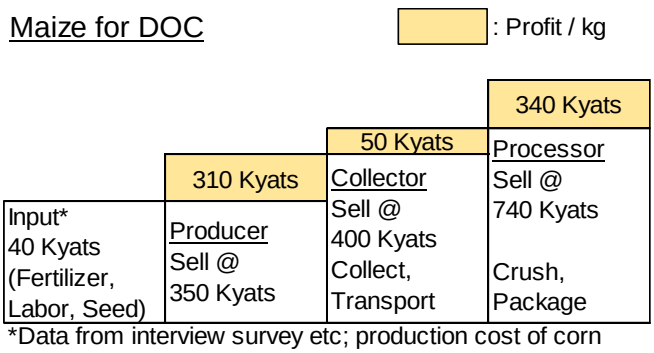
*Sometime profit becomes minus

vii) Estimated profit of maize for livestock in each stakeholder

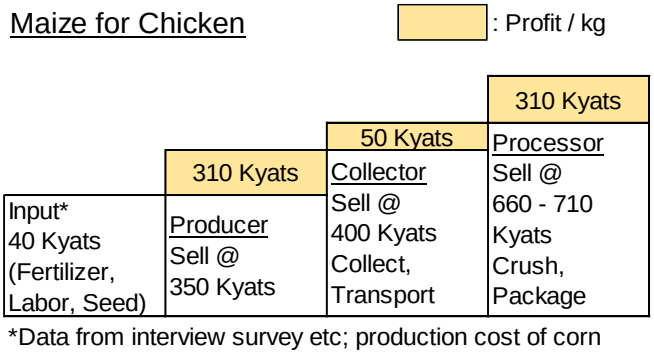
For processors, the profit is larger when they process maize for DOC and chicken (broiler) than for layer.



*Data from interview survey etc; production cost of corn and yield are used to culculate input because of lack of data



*Data from interview survey etc; production cost of corn and yield are used to culculate input because of lack of data



*Data from interview survey etc; production cost of corn and yield are used to culculate input because of lack of data

5.3 Trend Analysis in Livestock Business

5.3.1 General Trend

The livestock sector, including livestock production, breeding and production of fishery products, and its related services, is one of the priority investment fields in Myanmar, and is the third highest promoted sector in the investment policy[30]. However, investment in this sector is still low. According to Directorate of Investment and Company Administration (DICA), as of April 2018, the number of enterprises permitted to invest in the livestock sector is only 80 firms out of 1,384 firms (6%) and the investment cost accounts for only 0.86% in the total.[31] For foreign investment, the livestock sector accounts for only 0.5% of the total foreign investment in the 2017/18 fiscal year.[32]

Milk and milk products enterprises are mostly located in Mandalay (69%), whereas producers of livestock breeding products are located mainly in Yangon (43%) and Mandalay (32%). Amongst 467 livestock-related enterprises registered to the DISI in 2018, around 40% are related to the feed industry, and the share of milk and milk products is 13%, as shown in the table below. According to the statistics, there is a subtle difference in the scale of enterprises amongst feed producers, whereas milk and milk products are mostly produced by large and medium-scale enterprises.

Table 5.3.1 Breakdown of the Livestock Related Enterprises

Sr.	Items	Large	Medium	Small	Total	(%)
1	Milk and Milk products	31	29	3	63	13%
2	Grinding of animal feed	51	61	69	181	39%
3	Grinding of fish powder and shrimp's head	13	2	7	22	5%
4	Honey and Honey products	1	1	0	2	0%
5	Meat and Meat products	8	11	0	19	4%
6	Artificial meat ball	6	4	1	11	2%
7	Egg and chicks	3	0	0	3	1%
8	Sausage	2	5	6	13	3%
9	Meat cold storaging	6	0	0	6	1%
10	Fish powder /Fish slice/Steamed fish snack	12	3	2	17	4%
11	Fish paste/Fish Sauce/Dried fish	19	20	80	119	25%
12	Soft crab	1	2	0	3	1%
13	Drying of fish, prawn and cuttlefish	7	0	1	8	2%
	Total	160	138	169	467	100%

Source: Generated by JICA Survey Team based on DISI's statistical data on May 31, 2018.
Note: The data includes fishery.

5.3.2 Animal Feed

The livestock sector is one of the promising sectors from the point of view of the increase in demand of both domestic and foreign markets. Accordingly, the demand for animal feed continues to increase, even now. An estimate indicates that feed demand increased by 14% annually from 2012, and will keep rising by 10% untill 2025.[33]

30 MIC Notification No.13/2017, Classification of Promoted Sector.
31 https://www.dica.gov.mm/sites/dica.gov.mMILes/document-files/mcil_by_sector_0.pdf
32 https://www.dica.gov.mm/sites/dica.gov.mMILes/document-files/yearly_approved_amount_by_sector_0.pdf
33 "Myanmar's feed and livestock boom, murkey numbers and limitless prospects", Eric J. Brooks, September 9, 2016. (http://www.efeedlink.com/contents/09-09-2016/37483f80-264f-4cc9-95d4-888bde01d133-a181.html)

For the animal feed sector, 70% of the feed is produced by foreign firms, including 40% of Myanmar Charoen Pokphand Group (CP) Livestock and 20% by JAPFA Comfeed. Amongst domestic firms, Crystal Diamond accounts for over 10%, followed by Tet Chaung (Shan) and MRC with share of less than 10%.

Since Myanmar is a cattle-friendly country due to religious and traditional values, meat consumption has been mainly led by chicken and aquaculture products. According to MLF, chicken meat accounts for around two-thirds of meat demand, and 75% of chicken meat is provided by foreign firms. In addition to the long-established firms such as Myanmar CP Livestock and JAPFA Comfeed, several foreign firms recently joined the market, including New Hope Group, CJ, and Sun Jin, for example, which resulted in the low profitability of the poultry business.

5.3.3 Processing

Livestock processing, particularly for meat products, has not yet developed enough in Myanmar, and traditionally only dry meat (jerky, sausage, etc) is available in retail shops and traditional markets. For dairy products, one of the common processing methods in Myanmar is for making condensed milk. Recently, however, dairy products have diversified, and fresh milk, processed milk, butter, cheese, ice cream and milk candy can be found in supermarkets. For milk, demand is increasing due to health trends, particularly in hotels, coffee shops and restaurants.

5.3.4 Hotels and Restaurants

Hotels and restaurants want to supply high quality dairy products, but in fact it is difficult to source them from domestic markets. Therefore, in most case, they buy imported high quality products through specialized distributors such as Premium Distribution, MAR Myanmar Service etc. However, ‘Sharkey’s’, a health focused restaurant with a retail shop, started to supply Myanmar made cheese at their restaurant. These distributors have established marketing channels to foreign suppliers and supply imported products including high quality beef, fish (salmon), seafood (scallop adductor, salmon caviar), cheese, milk, yoghurt, cream and other food foodstuff.

In recent year, however, there is a case for producing high quality meat and dairy products and distributing them through their own marketing channel. ‘Sharkey’s’ was established in 1996, and supplies domestically produced meat and dairy products, including cheese, through their own restaurant and retail shop. Most customers are foreigners, but the quality of their products has achieved a high reputation amongst chefs of international hotels and restaurants.

A Yakiniku restaurant, Hana in Mandalay, also procures high quality meat, including Kobe beef (from Japan) and Australian Wagu, but buys ordinary meat from local markets. In this case, however, they need to go to a slaughterhouse to advise them on how to cut and prepare meat for their business needs.

5.4 Production and Distribution Situation in Livestock Sector

Poultry meat is the most consumed meat, followed by pork (Figure 5.3.1). The beef market is limited in Myanmar because beef is consumed primarily by a minority of people, i.e. non-Buddhist, although beef consumption seems to be expanding gradually especially amongst younger generations in urban areas. Furthermore, there is a certain demand for mutton. Thus, poultry meat production, namely the most consumed meat, is firstly discussed.

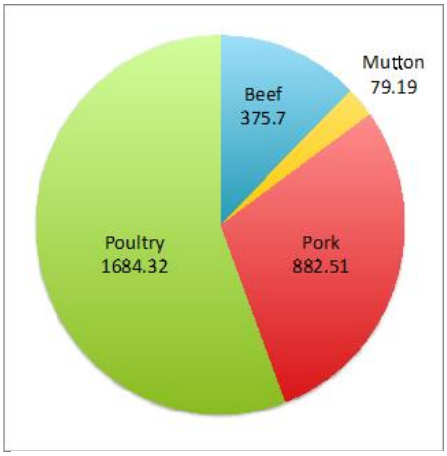


Figure 5.3.1 Share in the Meat Market in Myanmar in 2016/17 (Thousand Ton)

Source: Myanmar Livestock Statistics in 2017 (LBVD, 2018), processed by JICA Survey Team

5.4.1 Poultry and Egg Production

Chicken production in Myanmar has increased rapidly. The number of chickens nationwide in 2016/17 was 293,603 thousand birds, which increased by 91.8% from 2010/11. Magwe is the top producer and Yangon, Bago, Shan, Mandalay, Sagaing and Ayeyarwady are the next largest producers.

Table 5.4.1 Chicken Population from 2010/11 to 2016/17 (Thousand Birds)

	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	Rank
1 Naypyitaw	-	2,408	2,681	2,970	3,276	3,620	4,005	14
2 Kachin	5,295	5,952	6,679	7,243	7,669	8,121	8,599	10
3 Kayah	1,684	1,852	2,021	2,192	2,364	2,539	2,714	15
4 Kayin	3,582	3,960	4,361	4,767	5,185	5,612	6,051	12
5 Chin	3,178	3,584	4,035	4,526	5,067	5,661	6,314	11
6 Sagaing	12,286	13,447	14,761	16,218	17,829	19,723	21,883	6
7 Tanintharyi	3,693	3,919	4,156	4,405	4,668	4,946	5,240	13
8 Bago	19,655	22,419	25,459	28,807	32,539	36,710	**40,839**	**3**
9 Magwe	21,427	25,028	28,919	33,004	37,411	42,272	**47,547**	**1**
10 Mandalay	14,805	14,199	16,056	18,148	20,510	23,181	**26,200**	**5**
11 Mon	5,971	6,761	7,629	8,586	9,638	10,795	12,068	8
12 Rakhine	5,741	6,355	7,059	7,836	8,687	9,624	10,534	9
13 Yangon	25,449	28,934	32,768	36,985	41,621	46,723	**47,376**	**2**
14 Shan	15,848	18,090	20,587	23,252	26,143	29,283	**32,482**	**4**
15 Ayeyarwady	14,432	15,705	17,052	18,176	19,254	20,476	21,751	7
Total	153,046	172,613	194,223	217,115	241,861	269,286	293,603	
Increase rate	-	12.8	12.5	11.8	11.4	11.3	9.0	

Source: “Myanmar Livestock Statistics 2017” (LBVD, 2018)

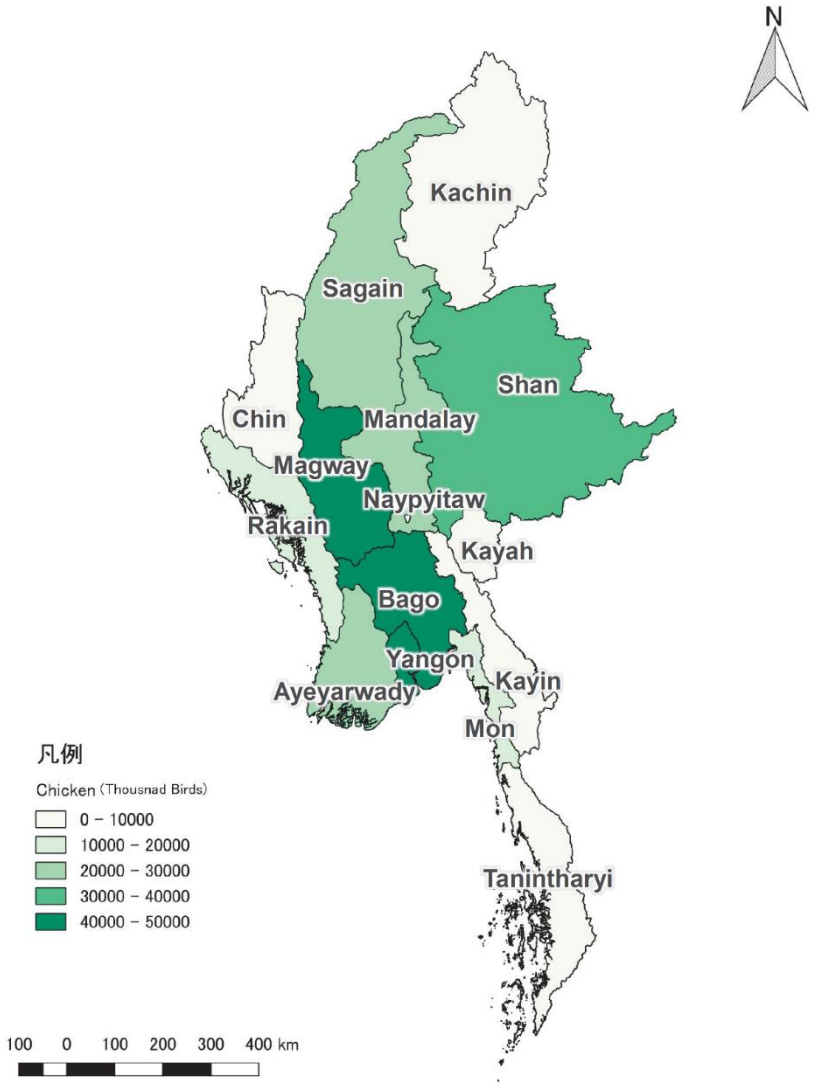


Figure 5.4.2 Chicken Population

Source: Myanmar Livestock Statistics 2017 (LBVD, 2018)

(1) Native Chicken Production

Table 5.4.2 indicates the number of 3 different types of chicken in 2016/17 by Region/State. The number of native chickens accounts for 87.9% of the total number of chickens. In most rural areas, farmers keep several native chickens in their backyard for selling locally and for self-consumption. Magwe is the top Region/State with the greatest number of native chicken, followed by Bago, Yangon and Shan.

Native chickens are grown under a complete free-range system or semi-confined system. The free-range system allows chickens to scavenge around the house and provides supplemental feed such as broken rice.

The semi-confined system also allows chickens to scavenge during the daytime. A farmer calls them back by feeding them in the evening, and confines the birds in a shed until the next morning. Although there is no statistical data, the complete free-range system seems to be the prevailing method according to observation and interviews of key informants including Township veterinary officers in the Survey.

Table 5.4.2 Chicken Population in Myanmar by 3 Types in 2016/17 (Thousand Birds)

	Layer	Broiler	Native	Total	Rank
1 Naypyitaw	4	295	3,707	4,005	14
2 Kachin	103	385	8,112	8,599	10
3 Kayah	77	11	2,626	2,714	15
4 Kayin	179	196	5,677	6,051	12
5 Chin	4	4	6,306	6,314	11
6 Sagaing	4,870	2,329	14,683	21,882	6
7 Tanintharyi	353	231	4,655	5,239	13
8 Bago	909	1,270	38,661	**40,839**	**3**
9 Magwe	118	498	46,930	**47,547**	**1**
10 Mandalay	1,834	786	23,580	**26,200**	**5**
11 Mon	383	733	10,952	12,068	8
12 Rakhine	338	47	10,149	10,533	9
13 Yangon	5,545	8,520	33,311	**47,376**	**2**
14 Shan	2,985	1,168	28,329	**32,482**	**4**
15 Ayeyarwady	512	716	20,523	21,751	7
Total	18,214	17,189	258,200	293,603	

Source: “Myanmar Livestock Statistics 2017” (LBVD, 2018)

There are more commercialized native chicken farms. For example a farmer keeps 100 chickens, for the purpose of selling; and regularly feeds them cereals such as broken rice. Basically the chickens are able to scavenge, and some farmers have a chicken shed and confine birds at night whereas some others do not (See Box 5.1).

Box 5.1 Small-scale commercial village chicken production

Mr. Win Min Thant in Ta Mok Soe village, Amaya Pura TS, Mandalay Region, is rearing 40-50 native chickens including 8 hens, as of the beginning of May 2018. A bird becomes 0.8-1 viss (1.3-1.6 kg) in 6-8 months and is sold at about 7,000 kyats. Mr. Win Min Thant remembers that it was 4,500 kyats three years ago. The chickens are scavenging freely and are fed broken rice once per day in the late afternoon. The amount of broken rice per month is 1.5 baskets, and costs him 20,000 kyats. He does not have a chicken shed. "I would like to expand the operation but now it is too hot and I am afraid of diseases. When the planted Dha Pyae trees have developed and make shade for chickens, I will be able to increase the number." Dr. Aye Kyi, Deputy Director, the LBVD Mandalay Regional Office, advised Mr. Win Min Thant to construct a simple chicken shed to reduce diseases. Dr. Aye Kyi also said that the vaccine for Newcastle Disease, which is a common disease amongst native chickens, is available at the LBVD office free of charge. The vaccine is delivered as an eye drop, and can be handled by farmers.

(2) Broiler Production

In Myanmar broiler chickens re already popular in urban centers. An outstanding broiler producing area is the Yangon Region - with nearly half of the national total - followed by Sagaing, Bago and Shan. Broiler production is highly commercialized. A DOC consumes formula feed and grows to nearly 2.0kg in 5 weeks and 2.2kg in 6 weeks. This growth rate is less than one-fifth that of ordinary native chickens. Originally, overall broiler chicken production technology was brought to Myanmar by foreign companies such as CP in Thailand, but currently many Myanmar companies already have that technology.

As Myanmar is a tropical country, heat stress greatly affects production performance. Although most broiler production in Myanmar occurs with an open system, some large-scale farms started to introduce evaporative

cooling systems with cool cell pads at one end of the house and large tunnel exhaust fans at the other end. For example, according to CP Myanmar, mortality in summer is more than 3.5% in open systems, whereas less than 2.5% in evaporative cooling systems.

Table 5.4.3 Poultry Meat Production in Myanmar (Thousand MT)

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	Rank
1 Naypyitaw	-	-	13.31	14.58	15.74	17.26	19.03	20.09	13
2 Kachin	29.46	32.05	34.64	34.34	40.59	41.33	44.04	46.26	11
3 Kayah	11.04	11.63	12.6	13.72	15.06	16.67	18.22	18.94	14
4 Kayin	22.2	24.47	25.78	27.39	29.56	32.07	34.98	37.84	15
5 Chin	16.85	18.3	19.75	21.36	23.37	25.45	27.87	29.12	12
6 Sagaing	140.45	154.41	155.76	174.64	195.34	228.29	255.51	274.53	**2**
7 Tanintharyi	28.98	32.24	35.73	39.62	44.1	49.59	55.55	60.63	10
8 Bago	149.36	172.8	182.42	206.55	232.24	240.59	260.66	**271.4**	**1**
9 Magwe	119.54	128.74	142.32	152.44	164.16	177.96	191.34	194.18	4
10 Mandalay	78.77	84.14	77.51	83.94	91.57	100.8	110.5	114.57	6
11 Mon	34.92	38.81	39.86	44.02	47.87	55.52	65.32	72.58	8
12 Rakhine	39.93	42.11	45.6	49.52	53.96	59.32	65.11	68.11	9
13 Yangon	129.41	137.15	137.05	160.12	173.02	190.76	209.45	**217.37**	**3**
14 Shan	90.08	99.38	108.1	118.84	129.66	141.32	145.92	158.55	5
15 Ayeyarwady	114.49	117.96	121.79	129.55	130.54	141.29	135.84	90.23	7
Total	1005.48	1094.19	1152.22	1270.63	1386.78	1518.22	1639.34	1674.4	
Increase rate	-	8.8	5.3	10.3	9.1	9.5	8.0	2.1	

Source: Myanmar Livestock Statistics 2017 (LBVD, 2018)

(3) Native Chicken vs Broiler

Table 5.4.4 indicates the economic comparison of broiler chickens and native chickens. Firstly, broiler chickens are high risk, whereas native chickens are low risk. In broiler production, the selling price fluctuates greatly and the price could become lower than the production cost in the worst case scenario. Some interviewees pointed out that one of the major causes of large-scale price fluctuation is reputation damage. Once Avian Influenza happens, or even human influenza becomes an epidemic, consumers stop buying broilers chickens, and the price goes down sharply. Reputation damage has less impact on native chickens according to the interviewees because consumers know that native chickens are grown under safer management methods.

Table 5.4.4 Economic Comparison of Broiler and Native Chicken

			Broiler chicken	Native chicken	Unit
Production	Production cost/viss	high	2,800	4,000	kyat
		low	-	3,000	kyat
	Farmgate price/viss	high	3,700	7,000	kyat
		low	2,500	5,000	kyat
	Gross profit/viss	high	900	4,000	kyat
		low	-300	1,000	kyat
	Viss/bird		1.1	0.63	viss
	Bird number/budge*		100	100	birds
	Number of budge/year		6.0	2.7	times
	Annual selling birds		600	270	birds
	Annual gross profit	high	594,000	680,400	kyat
		low	-198,000	170,100	kyat
Wholesale	Wholesale price/viss	high	3,500	7,500	kyat
		low	3,300	6,500	kyat
Retail	Retail price/viss	high	6,000	10.000	kyat
		low	5,000	8,000	kyat

Source: Multiple interviews in the Survey to chicken growers, collectors, wholesalers and retailers in Yangon and Mandalay Regions.

* This number is an assumption

Secondly, the growth rate of native chicken is far slower than broiler chickens. As a result, annual shipments from the same 100 birds farms, for example, are 600 broiler chickens and 270 native chickens. Also native chickens are scavengers and require a certain area of land to grow, whereas broilers are totally confined to chicken sheds and fed 100% on formula feed that costs growers. In other words, land productivity is high for broiler chicken production and low in native chicken production, but cash cost productivity is higher for native chickens than broilers.

Figure 5.4.3 Native Chicken in Myanmar, from Left to Right, In Bin Wa, Sitta Gaung, Lae Pyaung (Native Chicken Conservation Farm, LBVD, Nyaung Oo, Mandalay Region)

(4) Egg Production

As indicated in Table 5.4.5, the major egg production areas are Yangon, Bago and Sagaing, followed by Magwe and Shan. Yangon and Sagaing have the largest number of layers, accounting for 30.4% and 26.7%, respectively, followed by Shan and Mandalay.

Figure 5.4.4 Layer Chicken Housing (Shan Highland Livestock Zone 1)

Egg production by layers is highly commercialized with DOC and formula feed. Pullets come to the point of laying at about 19 weeks, and hens continue to lay until around 74-78 weeks after birth. The peak egg laying rate[34] is approximately 80%, according to several layer farmers interviewed in the Survey. Layer housing is elevated to allow feces to drop down, but some feces remain on the bamboo mesh. So, it could be noted that hygiene management still has room for improvement. A Japanese egg production company is planning to start a layer farm in Myanmar to produce antibiotics-free and Salmonella-free eggs, through better management techniques including hygiene improvement.

[34] Egg-lay rate is calculated as all produced eggs in a farm in a certain period of time such as 6 months divided by existed bird/days. If a farm started 100 layers but 5 chickens died after 3 months, total bird/days is 100 x 180 days minus 5 x 90 days. Because those data were not available in the Survey, "80%" here is the laying rate in the peak time.

Table 5.4.5 Egg Production in Myanmar (Million Eggs)

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	Rank
1 Naypyitaw	-	-	75.56	82.16	88.95	97.35	107.36	113.17	14
2 Kachin	179.21	192.40	207.79	152.41	168.04	178.12	188.81	199.35	12
3 Kayah	59.59	64.68	69.51	75.06	81.95	89.54	98.21	101.12	15
4 Kayin	123.47	131.55	144.09	157.83	168.23	187.72	206.34	222.96	10
5 Chin	103.21	111.71	120.57	130.42	141.90	155.37	170.13	180.02	13
6 Sagaing	910.88	994.03	1,040.22	1,161.89	1,292.63	1,508.79	1,722.42	**1,815.68**	**3**
7 Tanintharyi	231.43	236.05	246.04	260.25	277.93	298.39	321.72	343.67	11
8 Bago	954.74	1,131.89	1,187.48	1,347.07	1,515.86	1,602.92	1,710.34	**1,829.36**	**2**
9 Magwe	1,197.04	1,246.46	1,331.15	1,397.12	1,461.42	1,535.99	1,630.93	1,635.17	4
10 Mandalay	653.85	706.50	685.73	743.29	808.58	885.41	969.52	1,029.2	6
11 Mon	280.00	312.82	345.3	377.99	427.50	460.01	468.54	508.93	8
12 Rakhine	286.47	293.55	323.23	349.82	380.51	416.66	448.51	476.77	9
13 Yangon	910.82	945.25	946.21	1,103.56	1,194.15	1,314.73	1,439.05	**1,846.56**	**1**
14 Shan	658.75	727.18	791.27	868.57	957.07	1,074.07	1,180.30	1,259.19	5
15 Ayeyarwady	615.82	669.99	752.05	789.53	835.67	890.27	901.17	672.70	7
Total	7,165.28	7,764.06	8,266.20	8,996.97	9,800.39	10,695.34	11,563.35	12,233.85	
Increase rate		8.4	6.5	8.8	8.9	9.1	8.1	5.8	

Source: Myanmar Livestock Statistics 2017 (LBVD, 2018)

(5) Production Input

In Myanmar, large-scale private companies are producing DOC, both broiler and layer breeds. For instance a company in Yangon produces 60,000 broiler DOCs every week. The breeds are Hubbard, Indian River and Ross 308. According to this company, the average number of chickens in a customer farm is about 1000. A farm manager of another company, who operates on a larger scale than the first one, said that there is no substantial problem in the production technologies except the cost of the use of a generator due to frequent power outages. However, according to the Japanese egg production company, proper management of the nutrition, hygiene and environment of parent chickens makes a large difference in the quality of DOC. The Japanese egg production company is also planning to start layer DOC production in Myanmar based on their growth management methods of parent chickens.

Figure 5.4.5 A Medium-scale Feed Mill in Yangon

The price of DOC fluctuates frequently, from 300 to 800 kyats daily. According to the managing director of a feed company, this large difference in the price is too risky for farmers. Depending on the price on any given day, they may make a profit or a loss. The director requested the government to establish a mechanism that stabilizes the fluctuating DOC prices.

Feed is produced by private companies including foreign direct investment (FDI). According to the governmental statistics, 145 factories were operating nationwide in 2016/17. Major feed manufacturing Regions/States are Yangon with 72 mills, Sagaing with 21 mills, Mandalay with 14 mills, Bago with 13 mills and Shan with 9 mills. These are manufacturing feed not only for poultry but also for pigs.

According to feed manufacturers, the feed industry seems to be overly competitive because new companies created by FDI have entered in the past couple of years, and will soon enter into the feed production sector. A

managing director of a medium-scale feed company in Yangon mentioned that prices of feed materials, especially corn, are now going up but it is difficult to raise selling prices of feed products due to the extensive competition. Another managing director of a feed mill in Mandalay introduced a forecast of a bank staff member on the possible over supply of animal feed in Myanmar in the near future.

One of the characteristics of input suppliers is that there are many cases in which a company produces both DOC and formula feed. Moreover, some companies have their own market channels. A small number of large-scale companies play multiple roles in the chicken VC, which is typical Vertical Integration.

(6) Environmental Problem

Finally, environmental problems are already a big issue in livestock production. There are conflicts between chicken producers and residents nearby. For example, in Taunggyi in Shan State, several small-scale layer farms were forced to stop their operations because of claims by neighboring communities complaining of the odor, according to the LBVD Taunggyi district office. Most layer farms are selling chicken manure dropped under the chicken housing, but because the manure remaining under the chicken housing is not treated at all, it emits a strong odor.

Figure 5.4.6 Dropped Raw Chicken Manure under Chicken House Emitting Odor

(Taunggyi, Shan State)

Composting is one of the most efficient techniques to remove this odor and for producing effective soil conditioning material that can be utilized for healthy crop growth in fields. The process of turning manure into compost is almost unknown in Myanmar, according to the LBVD Shan State office. In Yangon Region, there are also many instances of conflict between livestock farms and neighboring communities. Dr. Nyan Lin, Director, LBVD Yangon Regional office, emphasized the necessity of addressing the issue.

5.4.2 Pig Production

According to Table 5.4.6, the trends of pig production in the past seven years, the total number of pigs nationwide increased by 76.6%. Major production area is Magwe with 3,811 thousand pigs and Shan with 2,387 thousand pigs. Ayeyarwady, Sagaing, Yangon, Bago and Kachin are the next largest pig producers (Figure 5.4.7)

Table 5.4.6 Pig Population in Myanmar from 2010/11 to 2016/17 (Thousand Heads)

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	Rank
1 Naypyitaw	-	-	10.06	10.88	11.84	12.97	14.27	14.75	13
2 Kachin	36.93	39.67	42.92	38.31	49.08	52.02	55.43	58.22	6
3 Kayah	6.97	7.39	7.98	8.64	9.42	10.32	11.35	11.81	15
4 Kayin	15.01	15.88	17.92	20.26	22.89	25.97	29.16	31.49	10
5 Chin	14.22	15.02	16.21	17.54	19.08	20.9	22.89	23.92	12
6 Sagaing	80.48	88.08	88.78	99.38	109.59	129.79	147.24	**155.34**	**1**
7 Tanintharyi	10.65	10.74	11.29	11.87	12.48	13.18	13.91	14.72	14
8 Bago	64.62	79.92	77.86	88.23	99.61	103.6	111.5	**118.65**	**3**
9 Magwe	48.23	55.48	63.6	70.95	79.35	89.1	99.62	101.11	4
10 Mandalay	40.7	43.31	36.61	39.66	43.15	47.27	51.75	53.63	8
11 Mon	17.35	17.35	17.96	20.67	22.86	23.68	24.49	26.27	11
12 Rakhine	17.4	20.1	21.65	23.51	25.55	27.98	30.43	32.01	9
13 Yangon	34.25	35.88	35.88	41.89	45.54	49.9	55.13	56.52	7
14 Shan	73.86	80.74	84.1	92.14	100.44	109.35	116.15	**121.59**	**2**
15 Ayeyarwady	69.99	71.59	82.13	84.18	86.68	114.22	88.99	62.48	5
Total	530.66	581.15	614.95	668.11	737.56	830.25	872.31	882.51	
Increase rate	-	9.5	5.8	8.6	10.4	12.6	5.1	1.2	

Source: Myanmar Livestock Statistics 2017 (LBVD, 2018)

Table 5.4.7 Pork Production in Myanmar (Thousand MT)

	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	Rank
1 Naypyitaw	-	185	208	233	259	287	318	13
2 Kachin	698	768	841	890	936	982	1,030	7
3 Kayah	104	110	118	124	131	138	146	15
4 Kayin	287	312	340	370	402	437	476	10
5 Chin	282	306	332	358	385	414	443	11
6 Sagaing	918	981	1,045	1,115	1,195	1,289	1,394	4
7 Tanintharyi	168	180	192	205	219	234	249	14
8 Bago	752	822	894	968	1,044	1,123	1,190	6
9 Magwe	1,548	1,867	2,207	2,564	2,948	3,363	**3,811**	**1**
10 Mandalay	672	547	606	674	748	830	920	8
11 Mon	295	324	356	388	421	457	494	9
12 Rakhine	234	258	284	313	342	372	400	12
13 Yangon	777	865	956	1,051	1,150	1,253	1,311	5
14 Shan	1,310	1,473	1,643	1,816	2,002	2,203	**2,387**	**2**
15 Ayeyarwady	1,209	1,307	1,410	1,498	1,579	1,674	**1,773**	**3**
Total	9,254	10,305	11,432	12,567	13,761	15,056	16,342	
Increase rate	-	11.4	10.9	9.9	9.5	9.4	8.5	

Source: Myanmar Livestock Statistics 2017 (LBVD, 2018)

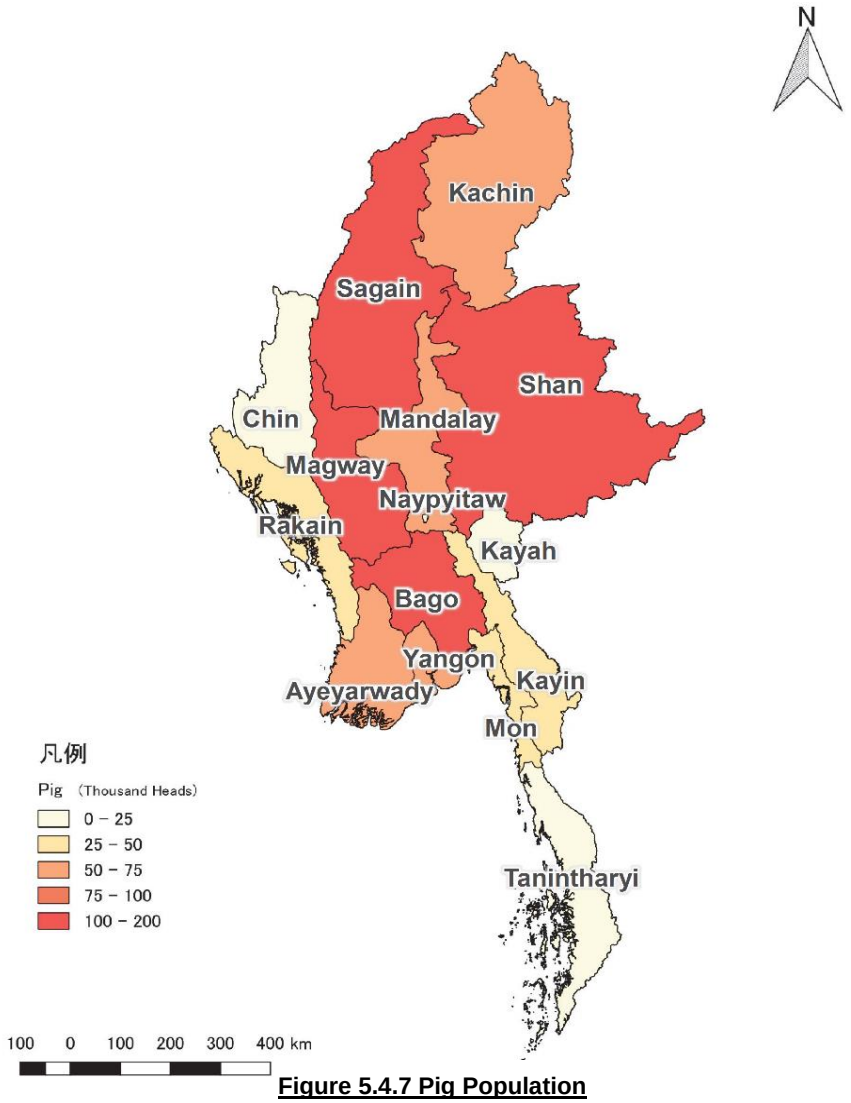


Figure 5.4.7 Pig Population

Source: Myanmar Livestock Statistics 2017 (LBVD, 2018)

(1) Small and Medium Scale Pig Production

Pig production has both traditional village system of scavenging with supplemental feed (TVS) (primarily in rural areas), and commercialized confined system with formula feed (CFF). There is another system of the commercialized confined system like CFF, but it does not involve formula feed, rather food waste (CFW). The operational scale of CFW is smaller than CFF in general, and CFW can be implemented only in suburban areas with food processing waste.

Figure 5.4.8 A Small-scale CFF in Yangon with Low Profit

Issues of feed production are explained in the previous section on chickens. Piglets are largely produced by large-scale companies such as CP and small-scale farrowing farms, but the required number of piglets is not being supplied from the domestic markets, and are instead imported from Thailand, according to the LBVD.

In Myanmar, piglets were produced collectively by large-scale state-own

farms in the past, but they have already closed. Therefore, a stable piglet supply is an issue in pig production in Myanmar.

Another issue in the pig production in Myanmar is low profitability in CFF. For example, the owner of a CFF growing-finishing farm with 100 hogs in Yangon said that the sale of a hog in the market size 70 viss (114kg), is 310,000 kyats, whereas the production cost is 300,000 kyats, including 190,000 kyats of piglets. The gross profit in this case is just 10,000 kyats although labor is used to only giving formula feed and cleaning pens.

In contrast, in a small-scale CFW farrowing-growing-finishing small farm in Yangon, pigs are fed with food waste and small amount of purchased mixed vitamins. Sale of a hog at 55 viss (89kg) is 225,000kyats while the production cost is 20,000 kyats per head. As a result the gross profit is 205,000 kyats, which is far larger than the CFF case. However, CFW requires much more labor involvement than CFF as food waste must be collected, which is watery, bulky, heavy and bad-smelling.

The low profitability in CFF is an issue in small and medium-scale pig production because CFF seems to be a major production method in Myanmar, and CFW is feasible in the few areas where certain amounts of food waste are constantly available, according to the observation of the Survey.

Figure 5.4.9 A Small-scale CFW in Yangon with High Profit

(2) Large Scale Pig Production

Lastly the large-scale, highly commercialized production system is discussed. Production technologies are mostly established and diseases are controlled well through good hygiene management. For example, a large-scale pig farm near Yangon had 5, 6 disinfection points on the premise for spraying disinfectant on cars. Not only cars from outside the farm, but also cars used inside the premise are also required to be disinfected every time they pass these points. When people, including staff, enter pig housing, they are required to shower. Profitability is better than a small-scale pig farm because large-scale farm can purchase feed in lower prices or they can buy feed materials and mix by themselves to save costs. Piglets can be produced on their own.

One issue of medium and large-scale pig farms is the odor and wastewater emitted. In the suburban areas of urban centers, residents near a pig farm are complaining about the odor and wastewater of the farms. Some farms introduced a biogas system and the odor is reduced, but digested effluent is not treated and released into rivers and canals, and this effluence is high in nitrogen and phosphorus.

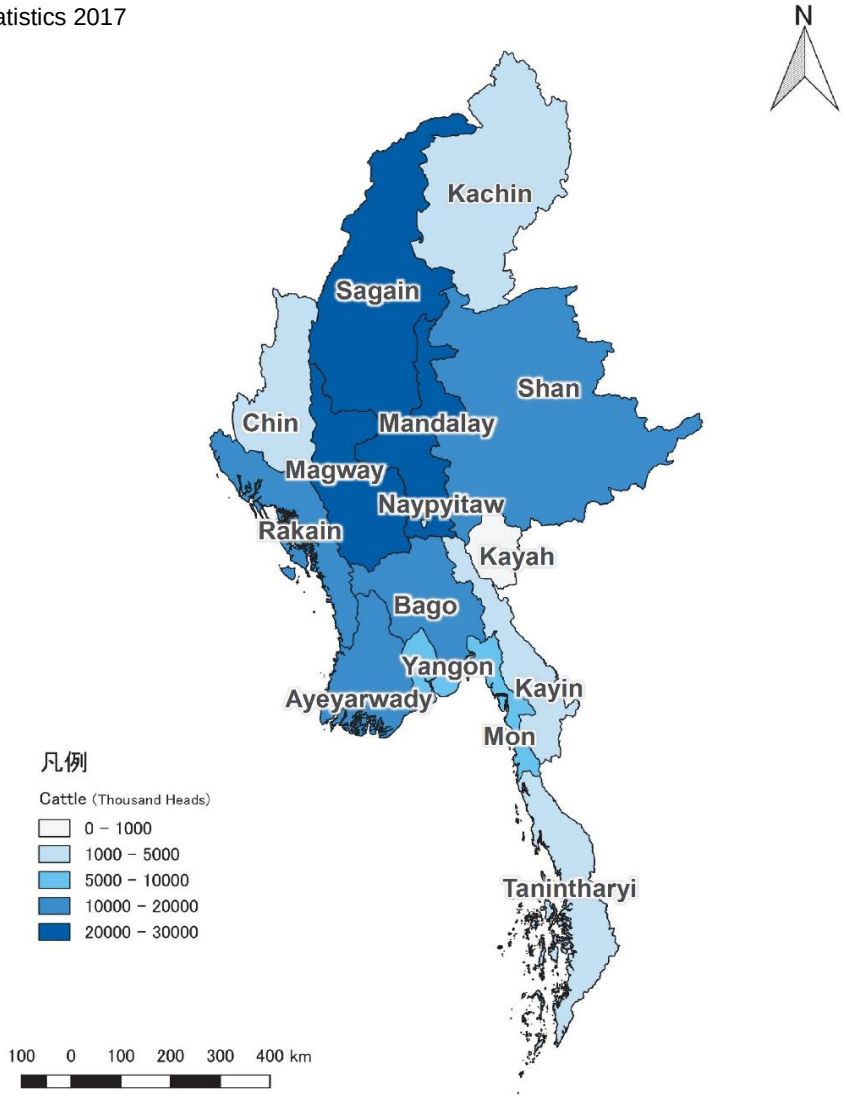
5.4.3 Cattle Production

The cattle production trend is different from those of pigs and chickens. The number of cattle in 2016/17 was 165,070,000 nationwide, which increases by 21.7% from 2010/11 number (Table 5.4.8), whereas chickens and pigs increased by 91.8% and 76.6%, respectively.

Table 5.4.8 Cattle Population in Myanmar from 2010/11 to 2016/17 (Thousand Heads)

	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	Rank
1 Naypyitaw	-	2,190	2,230	2,290	2,340	2,410	2,480	12
2 Kachin	3,140	3,310	3,480	3,580	3,640	3,710	3,780	11
3 Kayah	830	850	870	890	920	950	980	15
4 Kayin	3,270	3,370	3,460	3,560	3,660	3,750	3,850	10
5 Chin	1,520	1,570	1,620	1,680	1,740	1,800	1,860	13
6 Sagaing	22,490	22,980	23,470	23,990	24,570	25,270	**26,090**	**2**
7 Tanintharyi	1,470	1,500	1,540	1,580	1,620	1,660	1,700	14
8 Bago	13,950	14,270	14,580	14,900	15,230	15,560	15,890	5
9 Magwe	22,660	23,720	24,880	26,070	27,290	28,560	**29,860**	**1**
10 Mandalay	22,070	20,520	21,170	21,860	22,550	23,260	**24,000**	**3**
11 Mon	4,460	4,600	4,750	4,900	5,060	5,210	5,370	9
12 Rakhine	8,800	9,500	10,250	11,020	11,790	12,570	13,230	6
13 Yangon	5,850	6,010	6,170	6,340	6,510	6,680	6,810	8
14 Shan	13,440	13,900	14,450	14,930	15,430	15,930	16,420	4
15 Ayeyarwady	11,710	11,940	12,180	12,330	12,460	12,600	12,750	7
Total	135,660	140,230	145,100	149,930	154,810	159,920	165,070	
Increase rate	-	3.4	3.5	3.3	3.3	3.3	3.2	

Source: Myanmar Livestock Statistics 2017
(LBVD, 2018)



Source: Myanmar Livestock Statistics 2017
(LBVD, 2018)

Figure 5.4.10 Cattle Population

(1) Animal Breeding

In Myanmar cattle have been produced primarily for draft power, and not for beef. Eating beef is not a clear religious taboo within Buddhism, but most Buddhists do not traditionally eat beef. As a result, the number of cattle used for draft power has been slowly increasing, though the number of chickens and pigs reared for their meat increased as a result of rapid economic growth.

Because meat has not been the target of the cattle production, cattle breeds for better meat quality have not been developed. According to the LBVD, recent cattle high demand primarily for export made the LBVD realize the strong necessity of strain development for improving the cattle meat quality and of the disseminating improved strains. This is the primary issue in cattle production.

Natural mating is the common practice for cattle propagation. According to the LBVD, more than 95% of cows are allowed to mate naturally. The LBVD is promoting AI for diffusing higher quality semen, although the achievements of this method are still limited. The number of cows inseminated through AI was 40,867 in 2016/17 according to the statistics by the LBVD. The LBVD has AI laboratories in Yangon and Mandalay. They keep several bulls that are produced from better strains of traditional breeds such as white *Pya Sein* and brown *Shee Ni*. Some of the cattle kept in the AI laboratory were awarded the first prize in competitive exhibitions, but they are bred from selected lines over many generations to achieve this stable level of high quality product. The LBVD is also trying to spread Brahman imported from Thailand through AI.

The AI laboratory in Mandalay, for instance, has a machine for filling plastic straws with semen. The laboratory collects semen twice a week, and produces 2,000 semen straws per week. A semen straw costs 2,000 kyats but is delivered to farmers free of charge. The production of liquid nitrogen for freezing and keeping semen is limited, and is currently only in Yangon and transported to Mandalay, according to the AI laboratory in Mandalay.

The only liquid nitrogen plant in Yangon operates 24 hours a day, 6 days per a week to produce 1500 liters weekly. The amount manages to meet the national demand for frozen semen transportation but the LBVD is planning to make AI five times larger than the current practice. If this plan is realized, liquid nitrogen supplies will be short, even if the value of semen itself might be limited, unless preferable strains in the bloodlines are developed.

Figure 5.4.11 *Pya Sein* at the AI Laboratory, LBVD Mandalay

Figure 5.4.12 *Shee Ni* at the AI Laboratory, LBVD Mandalay

(2) Animal Nutrition

Another issue in cattle production is forage. Growing grasses for feeding cattle through cut-and-carry system is not practiced widely except dairy cattle rearing but simple grazing with supplemental forage such as rice straw is common in Myanmar. In the CDZ, which is a major cattle production area in Myanmar, price of the rice straw is going up, according to the interviews of multiple cattle growers. A possible cause of the price increase seems to be the introduction of a combine harvester in rice farming. Because the combine harvester chops straw into small pieces and returns to the paddy fields, straw supply for feeding decreased. According to an expert of agricultural machinery, however, it is possible to change the chopping mode to leave straw longer and to roll straw up with hay baler after harvesting. This system does not seem to be practiced so far. Introducing cut-and-carry system to some extent and reducing rice straw price for stable nutrition provision should be considered.

Box 5.2 Human resources in livestock sector

Yezin University of Veterinary Science is the only higher education institution for animal science. Since 1957 it has trained 5030 veterinarians. After graduation approximately half of them work in private farms, companies and NGOs, 30% are veterinary officers in the LBVD and 20% are private veterinarians. They have an alumni network. According to the University of Veterinary Science, however, there is a large difference between the income of government veterinarian and veterinarians in private companies. For instance, a newly hired government veterinarian gets 180,000 kyats per month, while in a private company it is 600,000 kyats per month. As a result, some government veterinarians have their own businesss, such as an animal clinic and/or a retail shop of animal medicine to earn their livelihoods.

There are 330 townships nationwide, and a veterinary officer and some deputy veterinary officers are sent to township veterinary offices. Because it is very difficult to cover an entire township with only several veterinary officers, there are Community Animal Health Workers (CAHWs). They attended a training program about animal production and veterinary science. They work as an assistant for veterinary officers performing such tasks as vaccination and animal health monitoring. Because they are volunteers, the activity costs are not covered by the public budget. But several CAHWs interviewed said that they are asking the LBVD to cover activity cost items such as transportation.

(3) Animal Health

According to LBVD and private veterinarians, FMD is still spreading and its outbreaks sometimes occur in the country. For instance, LBVD reported a cluster of FMD outbreaks in Rakhine State[35]. The World Organization for Animal Health (OIE) received the immediate notification on 24 May 2018.

According to the report by LBVD, five outbreaks affecting cattle took place in total (out of 97 cases), and the number of 1,500 animals were infected. No deaths were reported and none of the infected animals were killed or disposed of. While the source of the outbreaks is not exactly clear, contact with infected animal(s) at grazing/watering appears to be the most likely cause. Implementation of proactive vaccination and strengthening monitoring/diagnostic mechanism in Township level are issues to be addressed.

35 http://www.thecattlesite.com/news/53003/oie-reports-fmd-outbreaks-in-myanmar/

5.4.4 Dairy Production

Apart from the intensive commercial dairy production by the Horstein and Fresian crossbred milking cows, local cattle breeds primarily used for draft power, but they also provide milk nationwide during their lactation period. Actually this milk production method seems still to be the largest share of total milk production in Myanmar, because the estimated milk production based on the numbers of the Horstein and Fresian crossbred milking cow is far lower than the total milk production in the LBVD statistics.

Figure 5.4.13 Hand Milking at a Small-scale Dairy Farm Urban Area, Mandalay

Table 5.4.9 indicates the milk production from 2009/10 to 2016/17. These figures include traditional dairy production by local breeds. Sagaing is the top milk producer, followed by Magwe, Bago, Mandalay and Shan.

Table 5.4.9 Milk Production in Myanmar (Thousand Ton)

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	Rank
1 Naypyitaw	-	-	16.76	18.10	19.71	21.56	23.69	24.06	13
2 Kachin	32.93	35.36	38.19	33.69	36.66	38.66	40.98	43.26	12
3 Kayah	8.62	9.11	9.62	10.18	10.81	11.50	12.26	12.32	15
4 Kayin	29.75	31.91	34.19	36.04	38.20	40.27	42.34	45.73	10
5 Chin	11.44	12.14	13.10	14.17	15.42	16.88	18.49	19.32	14
6 Sagaing	305.02	342.16	344.45	386.42	415.62	488.20	557.32	**574.40**	**1**
7 Tanintharyi	30.22	33.63	35.49	37.54	39.73	42.11	44.64	48.30	9
8 Bago	167.27	196.19	198.31	223.02	252.52	265.15	281.09	**302.40**	**3**
9 Magwe	213.98	243.10	257.05	285.06	310.62	358.57	422.57	**438.13**	**2**
10 Mandalay	188.01	201.95	201.15	218.43	236.84	259.04	283.65	289.58	4
11 Mon	43.29	43.29	43.44	43.54	43.57	43.60	44.47	44.47	11
12 Rakhine	99.55	102.02	109.96	118.99	129.45	141.75	152.32	162.20	6
13 Yangon	63.57	65.22	65.22	76.14	82.80	90.71	99.45	102.31	7
14 Shan	166.26	180.03	188.50	201.06	213.40	227.50	238.93	247.44	5
15 Ayeyarwady	104.72	106.39	109.81	116.6	117.22	119.33	113.77	74.39	8
Total	1,464.63	1,602.5	1,665.24	1,818.98	1,962.57	2,164.83	2,375.97	2,428.31	
Increase rate	-	9.4	3.9	9.2	7.9	10.3	9.8	2.2	

Source: Myanmar Livestock Statistics 2017 (LBVD, 2018)

(1) Milk Production System

Under tropical environment, intensive commercial dairy production has not been traditional activity for a long time in Myanmar. During 1960 to 1980, through donor projects such as of World Bank and AusAid, intensive dairy production capacity in Myanmar was enhanced. Jan van der Lee et al. estimated the number of dairy cattle such as Holstein and Fresian crossbred as 180,000 heads nationwide. Mandalay is the top Region of the intensive dairy production.[36]

[36] Jan van der Lee et. al. 2014. The Myanmar dairy sector

Major dairy cattle breed used in intensive commercial farming is crossbred of Holstein Fresian and the local breeds as mentioned above. Milk production capacity of the local breeds such as *Pyar Sein* is much lower than Holstein Fresian but heat tolerance is higher. Operation scale of the intensive dairy farm varies depending on the scale of farms. Large-scale farms keep 80-200 dairy cattle with 30-150 milking cows while small-scale farms have several cows[37]. A typical large-scale farm has free-housing system and pastureland to grow forage crops. Milking is done on their own by machinery. In contrast a small-scale farm does not have the pastureland, tying an animal to a pole in a shed and feed chopped grasses and agro-industrial by-products. A milk collector often conducts milking by hands with a bucket.

Figure 5.4.14 Free-housing in a Large-scale Dairy Farm in Rural Area, Mandalay

(2) Milk Production Performance

The production performance depends on breed, nutrition and environmental settings. For example, a large-scale dairy farm owner in Mandalay answered that milk production per day was 160-180 viss from 30-40 milking cows in the past. It was improved by a project funded by New Zealand government in terms of new pasture variety introduction, calf management improvement and hygienic milk handling. Present milk production performance is 350-400 viss from 60 milking cows according to the owner. This is from 4.9 viss per cow increased 6.3 viss (from 8 to 10.3 kg).

In contrast, according to Nobels Company Limited, a Japanese dairy and beef production company planning to start a dairy business in Myanmar, their milking performance in Japan is 35 kg per cow per day. Although the variety of cow and the level of heat stress vary, the difference in milk production efficiency between Myanmar and Japan is greater than 3 times. There seems to be room for improving dairy production methods in Myanmar.

5.5 Distribution and Processing Situation in Livestock Sector

5.5.1 Poultry Meat Distribution and Processing

(1) Meat Chicken Distribution System

Under ambient tropical temperature, meat goes rotten quickly. Thus, as often as possible, live poultry is transported to areas where they will be sold. As a result, chickens are slaughtered by retailers at traditional markets, or somewhere nearby the markets. For example, at Pazundaung Zay Market, one of the typical traditional retail markets in Yangon, several poultry retailers have slaughtering spaces.

Figure 5.4.1 Fresh Meat Slaughtered at the Backspace of the Shop (Yangon)

[37] ibid

According to a shop owner, they purchase live birds at a wholesale market at 3:00 AM and keep them in the shop. They slaughter chickens freshly to minimize time between slaughter and purchase. The shop closes at 10:00 and reopens 17:00-21:00.

Figure 5.5.2 Eighty Thousand Live Chickens are Traded a Day in Mingalar Tong Nyunt Wholesale Market, Yangon

According to the interviews with multiple meat retailers, traditionally a consumer makes a judgment on meat freshness by checking the blood color, degradation and the warmness of the meat.

In Yangon, there are 3 public poultry wholesale markets. Only live birds are traded in all the markets. In the Mingalar Tong Nyunt Chicken Wholesale Market in Yangon, for example, 80,000 birds are traded per day. According to the market officer, the market is reaching the limits of its capacity and needs to be expanded.

Figure 5.5.3 A Native Chicken Collector is Delivering Live Birds to a Retailer at the Local Market in Yangon

According to a couple of wholesalers in Mingalar Tong Nyunt Market, broiler chickens sourced from the Ayeyarwaddy Region, which is approximately 150 km from Yangon, have come the furthest to market. The furthest-sourced native chickens are from the Pyay in Bago Region, which is 280km from Yangon. Multiple traders sell and buy chickens from chicken farms, and they are transported to the 3 wholesale markets in Yangon. Retailers purchase live birds in the 3 wholesale markets and they slaughter these chickens freshly to order to. There are individual trading channels that do not pass through public wholesale markets. In those cases, chicken collectors purchase live birds at farms and deliver them directly to retailers in the traditional markets.

(2) Issues in the Present Chicken Distribution System

There is a logical element to the system to keep the meat as fresh as possible for consumers through minimizing time after slaughtering under the ambient tropical temperature. But there is a problem because the live birds could contain pathogens such as bacteria and viruses, and there is a high risk of cross infection under this system. Once an outbreak of infectious diseases such as Avian Influenza occurs, it will be very difficult to address. Thus slaughtering near chicken farms to minimize the possibility of infection is necessary from a disease control point of view.

Because introducing an entire cold chain system at once is not realistic, the issue is how to improve the situation under the ambient temperature. One of the possible solutions has already been attempted by private companies. A medium scale chicken farm started collective slaughtering near the farm and packed meat with ice to deliver to retail shops in traditional markets. See Box 5.3.

Hygiene is another issue in retail shops in the traditional market. Availability of washing water is limited and shops do not use disinfectant on tools such as cutting boards and knifes. According to research conducted in Yangon, the prevalence of salmonella in chicken meat samples from the 141 retail markets in Yangon was 97.9%[38].

Box 5.3 Chicken slaughtering near farm and delivery with ice

Dr. Aung Moe, the managing director of a broiler farm, started his own abattoir in 2015 because he, as a veterinarian, understood the risk of the current chicken distribution system regarding disease control, and also wanted to avoid low hygiene condition at a slaughtering spaces of the shop in the traditional market. Now his abattoir processes 600 birds a day and meat is delivered with ice as a cooling method to 12 chicken retail shops in the traditional markets in Taik Kyi and Hmawbi TS. Dr. Aung Moe started to advise retail shop owners about how to arrange the shop in more hygienic ways, for instance, not selling on the ground but using a table and keeping that clean. "Because consumers, in general, do not prefer to cold meat, it is a challenge to change their way of thinking." Dr. Aung Moe is reiterating the advantage of meat treated hygienic ways from slaughtering to retailing.

(3) Chicken Consumption and Market Trend

Figure 5.5.5 is a comparison of livestock product consumption per capita among several countries including Myanmar. Poultry consumption per capita in Myanmar in 2013 was already a greater amount than the other countries in ASEAN and Japan. When comparing total meat consumption, Myanmar people are consuming more meat than the Philippines, Thailand and Indonesia. Egg consumption is lower than in Thailand but higher than in Indonesia, the Philippines and Vietnam. Milk is the top product consumed in the ASEAN countries. Each country has its own characteristics and Myanmar can be described as a chicken-eating country when comparing it to the other types of meat consumed. It may be difficult to say that the chicken meat market in Myanmar has already been saturated, but meat consumption including poultry seems to be reaching its peak, and its growth might slow down from now.

[38] Aung Zaw Moe et. al. 2017. Prevalence and Antimicrobial Resistance of Salmonella Isolates from Chicken Carcasses in Retail Markets in Yangon, Myanmar

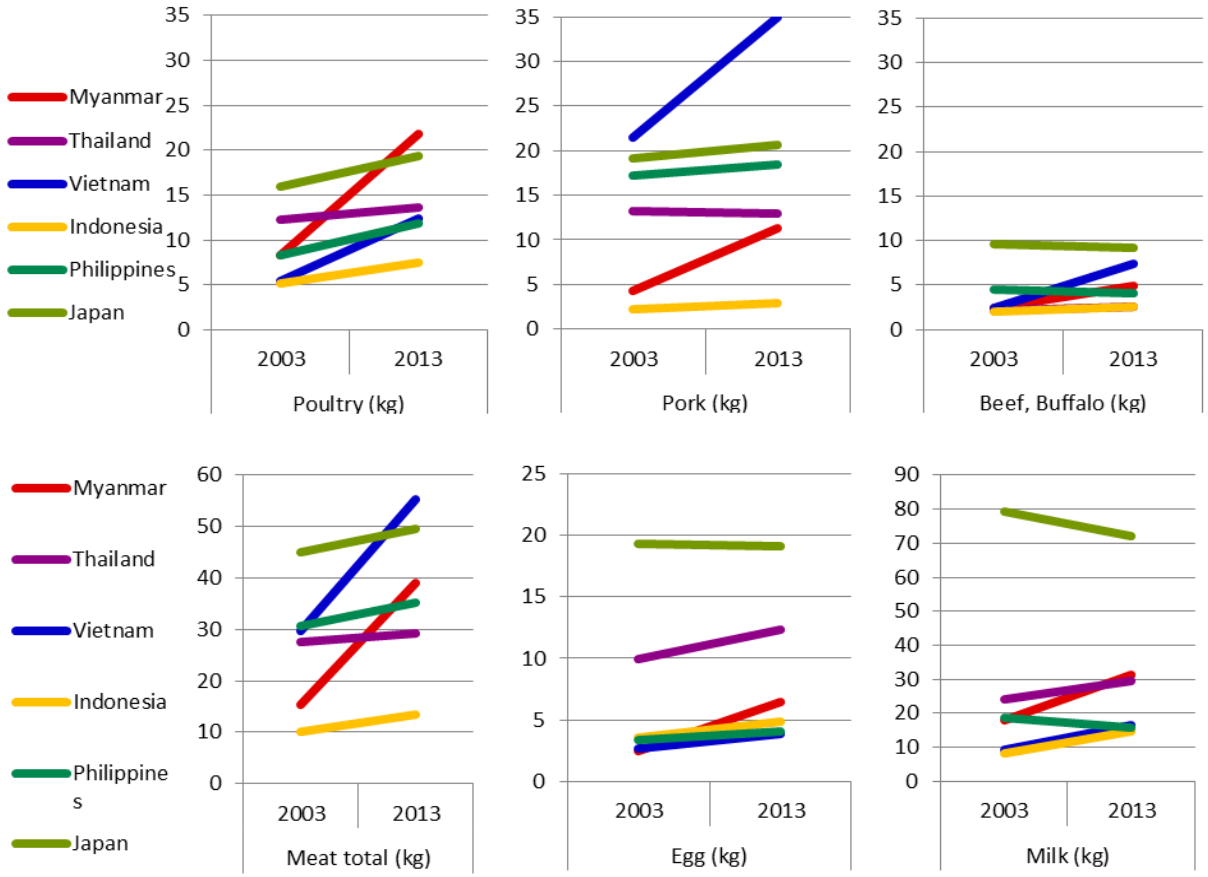


Figure 5.5.5 Comparison of Livestock Product Consumption per Capita

Source: FAOSTAT, processed by author,
Note: Meat total includes other meat than poultry, pork and beef/buffalo

Lastly the market trend should be discussed because many stakeholders in the chicken meat VC pointed out the possibility of market saturation. See Figure 5.5.4. Chicken meat production has been increased persistently from 2010/11 till 2016/17, but its speed seems to have slowed after 2013/14. It is difficult to forecast because the market expansion seems to be losing momentum but it is still growing in 2% annually.

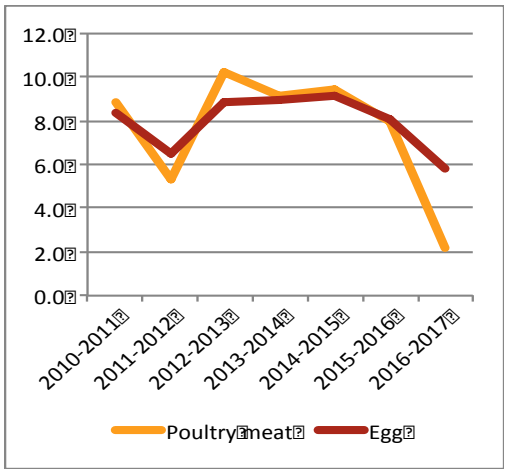


Figure 5.5.4 Trend of Growth Rate in Poultry Meat and Egg Production (% Change from the Previous Year)

Source: Myanmar Livestock Statistics 2017 (LBVD, 2018), processed by author

5.5.2 Egg Distribution

Eggs are collected by distributors from layer farms and delivered to egg retail shops in the traditional market. For instance, a large-scale egg wholesaler in Yangon has 30 trucks and collects 3 to 5 million eggs per day. The company measures the weight and makes 300 eggs packages and delivers to egg retailers in 117 traditional markets in Yangon. It also packs eggs separately for a large-scale supermarket chain store in Yangon. The share of the supermarket is less than 5% of the total sale according to the wholesaler.

An issue for egg wholesalers is the breakage of eggs during transportation. Average breakage rate is 1.5% at present according to the large-scale wholesaler. Primary cause of breakage is road condition.

According to the managing director of a large-scale egg wholesaler, another issue in egg distribution is that they do not have advanced technologies such as checking the inside of eggs for abnormalities, washing eggs by machinery and sterilization by ultraviolet radiation. Most of these methods are practiced in developed countries including Japan. As a result, it is difficult to export eggs to meet the requirements by foreign countries.

Figure 5.5.6 Egg Repacked into 300 Eggs at a Distribution Center of a Wholesaler in Yangon

The egg market expansion seems to have slowed down. It still remains at more or less 6% of annual growth, and has not shown such a sharp decrease as poultry meat production, but the trend started going down in 2014/15. However, the average amount of egg consumption per person per year in Myanmar is 6.45 kg, which is approximately 117 eggs. In contrast, a Japanese person consumes 19.15kg, which is approximately 348 eggs. In short a Japanese person consumes an egg every day, while a Myanmar person eats an egg every 3 days.

5.5.3 Pork and Beef Distribution and Processing

(1) Cattle Distribution System

Cattle are grown in various areas and collected by animal traders and transported to consumption areas by trucks. In Yangon region, there is the largest cattle market in southern Myanmar. The market is opened every Saturday in Okekan township. More or less 1,000 cattle from Yangon, Bago and Ayeyarwaddy are traded in the market.

Figure 5.5.7 Okekan Cattle Wholesale Market in Yangon Region

Sellers are animal traders and farmers. Buyers are 38 license holders for slaughtering or traders for exportation to China. One of the largest-scale slaughtering license holders said that he purchases about 100 heads every time. An exporter to China said that after legalization of cattle exportation in 2017 it came to take 2 to 3 months to complete exportation procedures but his business is still profitable. He buys an animal at 1.5 million Kyats, for example, and sell it to Chinese importers at 2.5 million kyats. Selling price has been rising up and Chinese importers ask him more supply. This trend seems to be backed up by the remarks of multiple cattle growers in CDZ, saying that cattle price was 0.7-0.8 million per head of medium size a couple of years ago and is 1.2-1.5 million now.

Table 5.5.1 Number of Slaughtering Licensee in Yangon and Mandalay (psn)

	Slaughterhouse	Cattle	Goat/Sheep	Pig
Yangon	Ywar Thar Gyi	39	7	13
	Hlaing Thar Yar	3	2	-
	Insein	-	-	25
	Shwe Pyi Thar	-	1	-

	Slaughterhouse	Cattle	Goat/Sheep	Pig
	Dala	1	-	-
	Sate Kyi Kha Naung Toe	1	-	-
	Yangon Total	44	10	38
Mandalay	Mandalay Total	49	57	90

Source: Interview to YCDC and MCDC

Currently live cattle exportation from Myanmar to China seems to be growing. Myanmar government had prohibited live cattle exportation a long time ago but the illegal border trade has been conducted widely. The Myanmar government lifted the ban and legalized the exportation in 2017.

(2) Issues in the Present Cattle Distribution

Firstly, according to the LBVD, strain development for meat quality enhancement was not conducted in Myanmar because the majority of Buddhists do not eat beef, and rear animals only for draught power. As the exported cattle are not used for draught power but for their meet, quality improvement would be necessary for enhancing the value of Myanmar's cattle.

Secondly, however, live cattle exportation from Myanmar runs contrary to international efforts to control FMD because Myanmar is an FMD "endemic" country according to the FAO/OIE. With this insufficient approach to control in Myanmar regarding FMD, live animal exportation runs a risk of spreading FMD to other countries.

Thirdly, there are some companies that process cattle down to carcasses and small cuts and freeze them for exportation. The processing procedure within Myanmar is in a position where it could have more value added, but current processing practices have problems with hygiene management. For instance, in a company in the Mandalay Region, workers were cutting meat on wooden tables outside the building. According to the managing director, it takes five hours to cut the meat. The surface of cut meat would surely be contaminated during the long processing time outside in the elements using unsterilized tools. If they would like to export their products to industrialized countries, it is necessary to improve their practices..

(3) Pig Distribution System

Pigs are collected from pig farms by animal traders. Some of them have a license for slaughtering issued by the relevant municipalities. Pigs are traded only for domestic consumption.

Pigs and cattle are slaughtered in public slaughterhouses in urban centers such as Yangon and Mandalay. Slaughtering is performed using traditional methods except in Mandalay (see next paragraph). Licensed traders have slaughtering staff, and they work at the slaughterhouse. According to the site observation of a pig section in Mandalay in May 2018, the slaughtering process was i) driving a knife into the animal's heart and leaving the body on the ground for a while; ii) putting the body into a basin with boiled water and removing hair; and iii) cutting the body into several pieces. Blood is not taken out. Carcasses are made smaller for easy handling. Cut meat is transported to retail shops in traditional markets.

(4) License by Municipality

In Mandalay, the municipality introduced a modern slaughterhouse for cattle and pigs in 2018. As of May, the cattle section started operations, and the pig section will move to the new facility in June 2018, according to the Market and Slaughterhouse Department, MCDC. The total cost of the new slaughterhouse was 200 billion kyats including the land acquisition cost. The new slaughtering system incorporates a hygienic hanging system in

ambient temperatures. Slaughtering is conducted from 2:00 AM to 6:00 AM - the coolest period in a day.

The Yangon municipality is also trying to modernize the current slaughtering system, but budget shortages have hindered its progress, according to the explanation by the YCDC.

The license system differs among municipalities. For example, in Yangon a slaughtering license and retail license are separate, while in Mandalay they are treated as one license. In Nay Pyi Taw a retail license is issued to only one person per retail market, and this person can work with other retailers under the regulations of this licensee.

The license fee is 500,000 kyats in Yangon, but some stakeholders in the meat value chain pointed out that the actual cost is much higher than that because there are many steps required to obtain the license, and applicants need to facilitate the process by spending more money. As a result, all of these extra costs are added to meat prices (i.e. meat costs more according), and consumers are forced to cover the extra cost.

Figure 5.5.8 Meat is Put Directly on the Concrete Floor in Some Retail Shops (Mandalay)

(5) Hygiene in Retail Shop and Market Trend

As already explained in the poultry meat section, pork and beef retail shops in the traditional markets have similar conditions as poultry shops, except the point that pork and beef shops do not have slaughtering spaces within the shop (Figure 5.5.8).

Available washing water is limited and retailers do not use disinfectants in facilities or on tools in general. A couple of shops in the Diamond Plaza market in Mandalay, for example, covered wooden selling tables with stainless steel. However, this seems to be an exception to usual practices. Enhancing and expanding hygiene awareness, as well as appropriate facility improvements (such as increasing the number of water taps, and using tables made of stainless steel for easy washing for cleaning) are issues that need to be addressed.

Figure 5.5.9 Khlong Toei Wet Market in Bangkok, Thailand. Meat is Kept on the Top of Ice and Stainless Steel Table is Washed Every Day.

For instance, Figure 5.5.9 shows meat kept on ice on the stainless steel table, and the table is washed by running water every day in a traditional market in Bangkok, Thailand. This is an example of improving methods to enhance hygiene levels in meat VC even without cold chain system.

Lastly, as indicated in Figure 5.5.10 pork market is still expanding but its rate of expansion suddenly slowed after 2014/15. The beef growth trend appears to be similar to pork, declining recently. However, it is difficult to say this graph indicates the true nature of pork and beef consumption. Observation over the next several years will be required to identify the reasons for this decline.

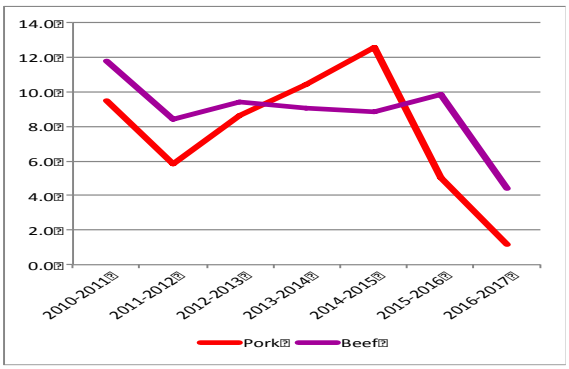


Figure 5.5.10 Trend of Growth Rate in Pork and Beef Production (% Change from the Previous Year)

Source: Myanmar Livestock Statistics in 2017 (LBVD, 2018), processed by author

5.5.4 Milk Distribution and Processing

Milk from draft cattle is widely consumed in rural areas without complicated distribution channels because the shelf life of milk is short in tropical climate. In contrast, in terms of intensively produced milk (obtained from crossbreeding exotic breeds such as Holstein Fresian and local breeds) the largest share of milk consumption is through tea drinking according to the results of a couple of studies of the dairy sector in Myanmar[39].

Raw milk collected by milk collectors is delivered to teashops as well as condensed milk factories. Most condensed milk is also used for tea. There are many large to small-scale condensed milk factories near Mandalay and Yangon.

Some milk collectors transport milk to processing factories for pasteurization and homogenization, or for making yoghurt and ice cream. This pasteurized milk is put into plastic bottles or plastic bags and sold at small retail shops and supermarkets.

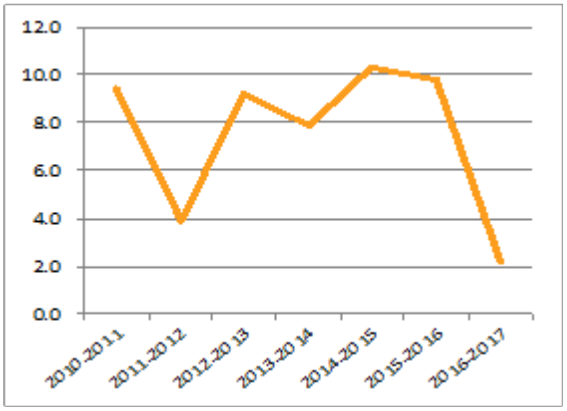


Figure 5.5.11 Trend of Growth Rate in Milk Production (% Change from the Previous Year)

Source: Myanmar Livestock Statistics in 2017 (LBVD, 2018), processed by author

(1) Milk Market Trend

Large-scale dairy farms often integrate third parties in the milk VC. A large-scale dairy farm in Mandalay has a processing factory for pasteurizing and making yogurt, three retail shops and a cafe. Two managing directors of the large-scale dairy farms in Mandalay said that there is the possibility of market saturation. Figure 5.5.11 shows a sharp drop in the growth rate after 2015/16. One director mentioned the possibility of developing the Yangon market. Another director explained their

[39] [1] Jan Van Der Lee et al. 2014. The Myanmar Dairy Sector, http://edepot.wur.nl/330602,
[2] Jan Heinrichs. 2014. Dairy Value Chain Assessment in Yangon and Mandalay Region, Myanmar, http://www.value-chains.org/dyn/bds/docs/900/ADN_WP1_Dairy%20supply%20chain%20assessment%20for%20Yangon.pdf,
[3] Y. Aonuma et al. 2017. Performance and issues of milk and milk products in Myanmar (in Japanese), https://lin.alic.go.jp/alic/month/domefore/2017/jun/wrepo02.htm, and
[4] Khine Kyaw. 2017. Increasing productivity to drive competitive dairy industry in Myanmar, http://www.nationmultimedia.com/news/business/EconomyAndTourism/30315877,

attempts at processing new products other than yoghurt.

These are basic national statistics, and there seems to be a different trend in urban centers. For instance, a buyer in charge of dairy products in a large-scale supermarket chain store in Myanmar said that fresh milk and yoghurt sales are increasing 20-25% annually over the last 2, 3 years. The supermarket chain store checked all the processes from milking, handling, processing and packing of 12 milk suppliers and instructed them on how to improve any undesirable practices. As a result the quality of the products increased. The buyer said the efforts were evaluated by customers.

The Myanmar government is supporting small and medium-scale milk processors with their processing machinery in exchange for supplying milk to school. See Box 5.4.

Box 5.4 A Small Milk Processor collaborated with School Milk Program

The Mother Milk company in Mandalay was founded in 2016 by 3 young men who studied together in Mandalay Technological University. At first they warmed raw milk for pasteurization using a simple pan and fire, but they joined the School Milk Program in July 2017. In this scheme, Mother Milk has to provide 250 litres of pasteurized milk to schools every month free of charge. In exchange they got machinery used for pasteurization and homogenization. After receiving this machinery, the quality and quantity of their products increased. Small-scale milk processors generally have technical issues primarily with hygiene management, and milk handled improperly goes off easily. Machinery for pasteurization and homogenization could help the company to enhance their level of hygiene management. Now the company is processing 320 litres per day from their own dairy farm as well as what they collect from small-scale dairy farms. The burden of 250 litres per month for the School Milk Program is not great for the company - just 3.1% of the total raw milk they produce. The company sells their products - pasteurized milk and yoghurt - primarily to supermarkets. Recently they started to produce strawberry yoghurt, without the use of artificial flavors, choosing to use fresh strawberries from Pyin Oo Lwin instead. A low profitability is the issue, however. For instance, a 135 ml quantity of yoghurt is sold at supermarkets for 334 kyats, but the production cost is 306 kyats. The gross profit is 28 kyats. “We need to enhance profits without compromising quality” because price competitiveness is not strong due to a limited business scale.

CHAPTER 6 FOOD SAFETY AND FOOD HYGIENE

6.1 Utilization of Agricultural Inputs in Horticulture Production

The Survey was conducted to clarify the situation of the utilization of agricultural inputs in Myanmar. This survey was conducted with 75 respondents in five townships. Famers were categorized into four groups by their cropping patterns. The number of the respondents who cultivate a rice paddy (Monsoon), rice paddy (Summer), garlic, okra, potato, sesame, mango and pineapple is high. In this section, these eight major crops are analyzed and described.[40]

Table 6.1.1 shows the number of farmers who use listed pesticides or fungicides or herbicides (agro-chemicals). The listed agro-chemicals are the main ones used for the listed crops in Myanmar. The basic information of those major agro-chemicals is described in Table 6.1.2.

Table 6.1.1 The Total Number of Farmers Using Main Pesticides/Fungicides/Herbicides

Crop	Agro-Chemical(1)	No. (psn)	Agro-Chemical(2)	No. (psn)	Agro-Chemical(3)	No. (psn)
Paddy (Monsoon)	Acephate (Pesticide)	8	Chlorpyrifos + Cypermethrin (Pesticide)	7	Cypermethrin (Pesticide)	4
Paddy (Summer)	Abamectin (Pesticide)	4	Bispyribac-sodium (Herbicide)	4	Chlorpyrifos + Cypermethrin (Pesticide)	4
Garlic	Metalaxyl (Fungicide)	2	Emamectin Benzoate (Pesticide)	1	Emamectin Benzoate + Lambda Cyhalothrin (Pesticide)	1
Okra	Cypermethrin (Pesticide)	4	Imidacloprid (Pesticide)	3	Cartap Hydrochloride (Pesticide)	2
Potato	Mancozeb (Fungicide)	4	Carbofuran (Pesticide)	3	Abamectin (Pesticide)	2
Sesame	Acephate (Pesticide)	4	Imidacloprid (Pesticide)	2	Abamectin (Pesticide)	1
Mango	Lambda-cyhalothrin (Pesticide)	4	Acephate (Pesticide)	3	Cypermethrin (Pesticide)	3
Pineapple	Cypermethrin (Pesticide)	1	-	0	-	0

Source: JICA Survey Team

Table 6.1.2 The basic Information of Major Pesticides/Fungicides/Herbicides

Crop	Agro-Chemical	Amount (Sack/Acre)	Unit	Unit Cost (Kyats/Sack or Bottle)	Total Cost (Kyats)
Paddy (Monsoon)	Acephate (Pesticide)	1.3	sack	8,029	10,438
	Chlorpyrifos + Cypermethrin (Pesticide)	1.4	bottle	7,000	9,800
	Cypermethrin (Pesticide)	1.0	bottle	4,200	4,200

[40] Detailed information of the respondents is available in the beginning part of section 4.4.2.

Crop	Agro-Chemical	Amount (Sack/Acre)	Unit	Unit Cost (Kyats/Sack or Bottle)	Total Cost (Kyats)
Paddy (Summer)	Abamectin (Pesticide)	1.5	bottle	2,325	3,488
	Bispyribac-sodium (Herbicide)	7.0	sack	3,888	27,216
	Chlorpyrifos + Cypermethrin (Pesticide)	1.6	bottle	4,950	7,920
Garlic	Metalaxyl (Fungicide)	1.5	sack	5,500	8,250
	Emamectin Benzoate (Pesticide)	1.5	bottle	25,000	37,500
	Emamectin Benzoate + Lambda Cyhalothrin (Pesticide)	1.0	bottle	12,000	12,000
Okra	Cypermethrin (Pesticide)	1.3	bottle	11,500	14,950
	Imidacloprid (Pesticide)	4.3	bottle	7,333	31,532
	Cartap Hydrochloride (Pesticide)	3.0	sack	15,750	47,250
Potato	Mancozeb (Fungicide)	3.3	sack	9,250	30,525
	Carbofuran (Pesticide)	6.3	sack	2,500	15,750
	Abamectin (Pesticide)	1.5	bottle	21,500	32,250
Sesame	Acephate (Pesticide)	1.0	sack	27,250	27,250
	Imidacloprid (Pesticide)	2.3	sack	5,150	11,845
	Abamectin (Pesticide)	3.0	bottle	4,000	12,000
Mango	Lambda-cyhalothrin (Pesticide)	1.3	bottle	14,000	18,200
	Acephate (Pesticide)	1.3	sack	16,500	21,450
	Cypermethrin (Pesticide)	1.0	bottle	7,500	7,500
Pineapple	Cypermethrin (Pesticide)	2.0	bottle	5,000	10,000

Source: JICA Survey Team

The Survey asked respondents about the language used on the labels of the agro-chemicals tht they are using. As shown in Table 6.1.3, almost all of the label instructions are written in the Myanmar language.

Table 6.1.3 The Ratio of Myanmar Language Instruction of Listed Pesticides/Fungicides/Herbicides

Crop	Agro-Chemical (1)	Ratio (%)	Agro-Chemical (2)	Ratio (%)	Agro-Chemical (3)	Ratio (%)
Paddy (Monsoon)	Acephate (Pesticide)	100.0	Chlorpyrifos + Cypermethrin (Pesticide)	100.0	Cypermethrin (Pesticide)	100.0
Paddy (Summer)	Abamectin (Pesticide)	100.0	Bispyribac-sodium (Herbicide)	75.0	Chlorpyrifos + Cypermethrin (Pesticide)	75.0
Garlic	Metalaxyl (Fungicide)	100.0	Emamectin Benzoate (Pesticide)	100.0	Emamectin Benzoate + Lambda Cyhalothrin (Pesticide)	100.0
Okra	Cypermethrin (Pesticide)	75.0	Imidacloprid (Pesticide)	100.0	Cartap Hydrochloride (Pesticide)	100.0
Potato	Mancozeb (Fungicide)	100.0	Carbofuran (Pesticide)	100.0	Abamectin (Pesticide)	50.0
Sesame	Acephate (Pesticide)	100.0	Imidacloprid (Pesticide)	100.0	Abamectin (Pesticide)	100.0
Mango	Lambda-cyhalothrin (Pesticide)	100.0	Acephate (Pesticide)	100.0	Cypermethrin (Pesticide)	100.0
Pineapple	Cypermethrin (Pesticide)	100.0	-	-	-	-

Source: JICA Survey Team

Table 6.1.4 shows the average times of agro-chemical application for each crop. Regarding paddy and upland crops (garlic, potato and sesame), farmers use the pesticides or fungicides properly. However, regarding okra and pineapple, some farmers use them more than the recommended application times.

Table 6.1.4 Application Times of Major Pesticides/Fungicides for Each Crop

Crop	Agro-Chemical (1)	Times	Agro-Chemical (2)	Times	Agro-Chemical (3)	Times
Paddy (Monsoon)	Acephate (Pesticide)	1.8 (4.8)	Chlorpyrifos + Cypermethrin (Pesticide)	1.7 (4.0)	Cypermethrin (Pesticide)	2.0 (2.0)
Paddy (Summer)	Abamectin (Pesticide)	3.3 (4.1)	Bispyribac-sodium (Herbicide)	1.9 (1.8)	Chlorpyrifos + Cypermethrin (Pesticide)	2.8 (4.0)
Garlic	Metalaxyl (Fungicide)	3.5 (3.0)	Emamectin Benzoate (Pesticide)	3.0 (3.0)	Emamectin Benzoate + Lambda Cyhalothrin (Pesticide)	2.0 (3.5)
Okra	Cypermethrin (Pesticide)	5.5 (1.5)	Imidacloprid (Pesticide)	6.3 (3.2)	Cartap Hydrochloride (Pesticide)	6.5 (4.0)
Potato	Mancozeb (Fungicide)	3.0 (4.5)	Carbofuran (Pesticide)	1.0 (1.0)	Abamectin (Pesticide)	2.0 (3.0)
Sesame	Acephate (Pesticide)	2.5 (5.0)	Imidacloprid (Pesticide)	2.5 (4.0)	Abamectin (Pesticide)	1.0 (6.0)
Mango	Lambda-cyhalothrin (Pesticide)	2.3 (3.1)	Acephate (Pesticide)	4.0 (4.0)	Cypermethrin (Pesticide)	1.7 (2.3)
Pineapple	Cypermethrin (Pesticide)	10.0 (2.0)	-	-	-	-

Note:Recommended Application Times are written in parentheses.

Source: JICA Survey Team

The Survey asked respondents about their compliance with the PHI. Regarding almost all agro-chemicals, farmers comply with the PHI described on the product labels as shown in Table 6.1.5. However, especially regarding okra in particular, farmers do not comply with the PHI.

Table 6.1.5 Complying Ratio of Pre Harvest Interval (PHI)

Crop	Agro-Chemical (1)	Complying Ratio (%)	Agro-Chemical (2)	Complying Ratio (%)	Agro-Chemical (3)	Complying Ratio (%)
Paddy (Monsoon)	Acephate (Pesticide)	100	Chlorpyrifos + Cypermethrin (Pesticide)	100	Cypermethrin (Pesticide)	100
Paddy (Summer)	Abamectin (Pesticide)	100	Bispyribac-sodium (Herbicide)	75	Chlorpyrifos + Cypermethrin (Pesticide)	100
Garlic	Metalaxyl (Fungicide)	100	Emamectin Benzoate (Pesticide)	100	Emamectin Benzoate + Lambda Cyhalothrin (Pesticide)	100
Okra	Cypermethrin (Pesticide)	25	Imidacloprid (Pesticide)	33	Cartap Hydrochloride (Pesticide)	50
Potato	Mancozeb (Fungicide)	100	Carbofuran (Pesticide)	67	Abamectin (Pesticide)	50
Sesame	Acephate (Pesticide)	100	Imidacloprid (Pesticide)	100	Abamectin (Pesticide)	100
Mango	Lambda-cyhalothrin (Pesticide)	100	Acephate (Pesticide)	100	Cypermethrin (Pesticide)	100
Pineapple	Cypermethrin (Pesticide)	100	-	-	-	-

Source: JICA Survey Team

Table 6.1.6 shows the average PHI of agro-chemicals for each crop. Regarding okra, some farmers use agro-chemicals after the proper PHI. Regarding other crops, the PHI is generally adhered to.

Table 6.1.6 Pre Harvest Interval (PHI) for each Crop

Crop	Agro-Chemical (1)	PHI (Days)	Agro-Chemical (2)	PHI (Days)	Agro-Chemical (3)	PHI (Days)
Paddy (Monsoon)	Acephate (Pesticide)	45.6 (15.1)	Chlorpyrifos + Cypermethrin (Pesticide)	48.6 (14.6)	Cypermethrin (Pesticide)	37.5 (19.8)
Paddy (Summer)	Abamectin (Pesticide)	37.5 (14.5)	Bispyribac-sodium (Herbicide)	60.3 (29.8)	Chlorpyrifos + Cypermethrin (Pesticide)	37.5 (12.3)
Garlic	Metalaxyl (Fungicide)	30.0 (17.0)	Emamectin Benzoate (Pesticide)	25.0 (14.0)	Emamectin Benzoate + Lambda Cyhalothrin (Pesticide)	30.0 (4.0)
Okra	Cypermethrin (Pesticide)	5.5 (10.5)	Imidacloprid (Pesticide)	8.0 (9.3)	Cartap Hydrochloride (Pesticide)	8.5 (10.5)
Potato	Mancozeb (Fungicide)	20.5 (12.5)	Carbofuran (Pesticide)	60.0 (15.0)	Abamectin (Pesticide)	22.0 (7.0)

Crop	Agro-Chemical (1)	PHI (Days)	Agro-Chemical (2)	PHI (Days)	Agro-Chemical (3)	PHI (Days)
Sesame	Acephate (Pesticide)	41.8 (15.3)	Imidacloprid (Pesticide)	40.0 (14.5)	Abamectin (Pesticide)	30.0 (21.0)
Mango	Lambda-cyhalothrin (Pesticide)	76.3 (23.3)	Acephate (Pesticide)	51.3 (18.7)	Cypermethrin (Pesticide)	90.0 (23.7)
Pineapple	Cypermethrin (Pesticide)	20.0 (14.0)	-	- (-)	-	- (-)

Note: Recommended PHI are written in parentheses.
Source: JICA Survey Team

The Survey asked respondents about the suppliers of agro-chemicals which farmers use. As shown Figure 6.1.1, almost all of the respondents buy agro-chemicals from regional retailers. On the other hand, especially in Kyaukse, 11 farmers buy agro-chemicals from the branch shop of Awba co. ltd (local private company).

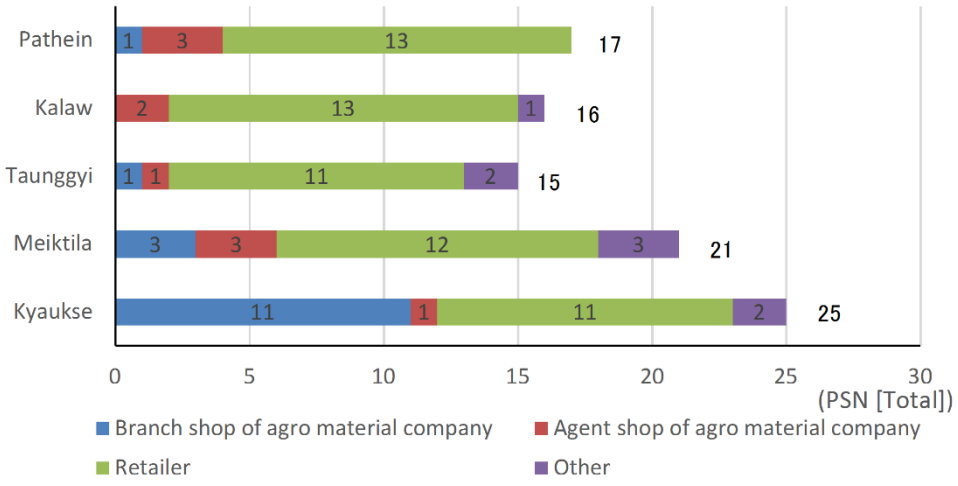


Figure 6.1.1 The Total Number of Farmers by Type of Agro-Chemical Supplier by each Township

Source: JICA Survey Team

Figure 6.1.2 shows the total number of farmers by type of agro-chemicals supplier by each cropping pattern. More than half of the farmers buy agro-chemicals from regional retailers in any cropping pattern.

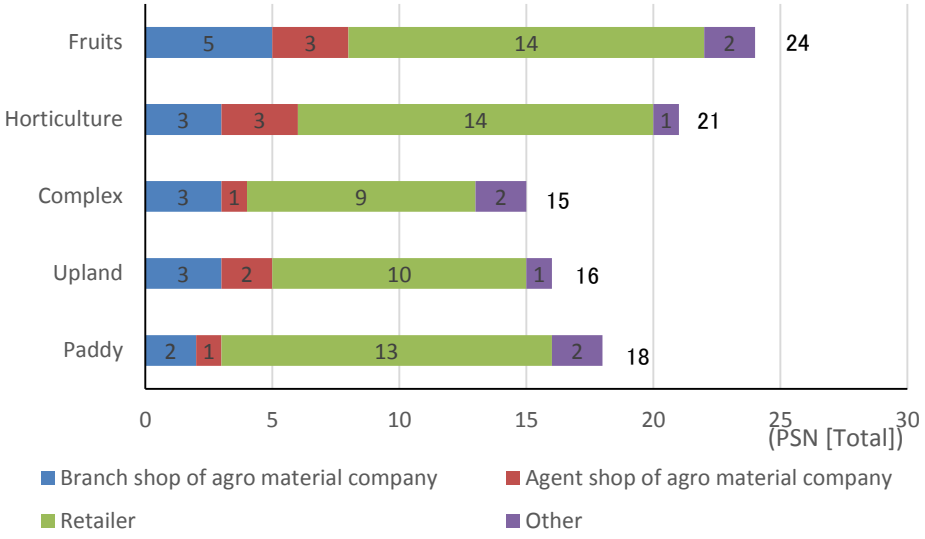


Figure 6.1.2 The Total Number of Farmers by Type of Agro-Chemical Supplier by each cropping pattern

Source: JICA Survey Team

Figure 6.1.3 shows the total times of consultation when farmers have trouble with agro-chemical use by the type of counselor by each township. Famers consult their friends and neighbors in any township surveyed. Retail shops and agencies are also used for consultation by farmers. At four townships, some farmer consult agriculture extension workers, but in Pathein Township, no farmers use them for consulting.

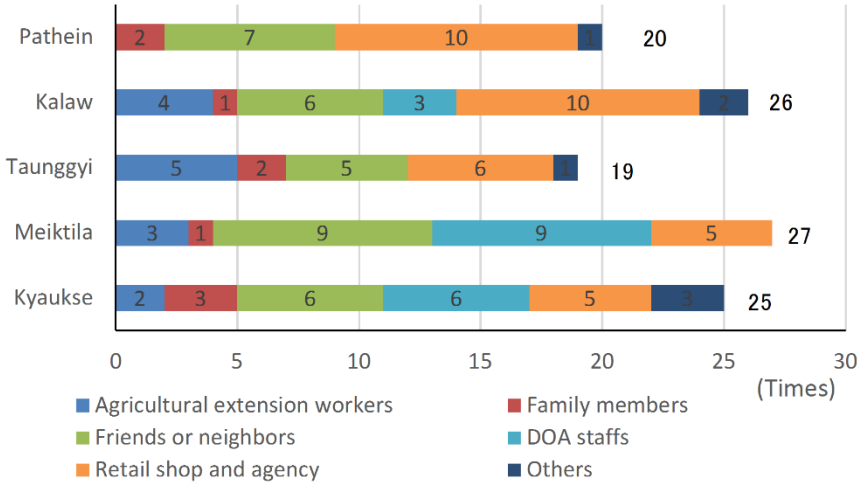


Figure 6.1.3 The Total Times of Consultation When Farmers Have Troubles in Agro-Chemical Use by Type of Counselor by each Township

Source: JICA Survey Team

Figure 6.1.4 shows the total number of times of consultation when farmers have trouble using agro-chemical by the type of counselor by each cropping pattern. Horticulture and paddy farmers consult anyone around 30 times. However upland farmers consult around 15 times. The major advisors are friends, neighbors, retailers and agencies for all cropping patterns.

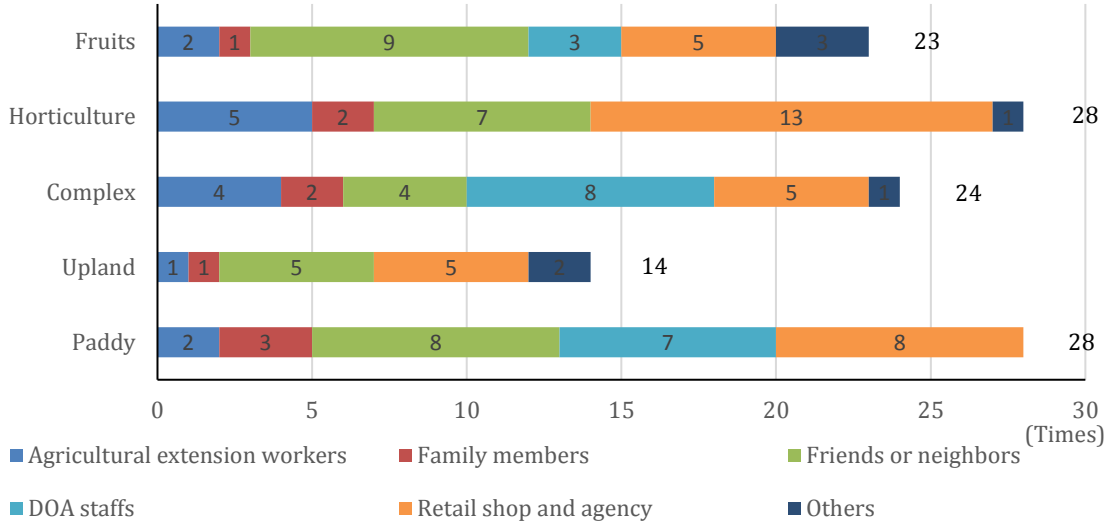


Figure 6.1.4 The Total Times of Consultation When Farmers Have Troubles in Agro-Chemical Use by Type of Counselor by each Cropping Pattern

Source: JICA Survey Team

The Survey asked farmers about the type of instructions provided by sellers (Figure 6.1.5). The major methods of instructions are “Face to face communication at the shop” and “Irregularly visiting farmers’ plots”

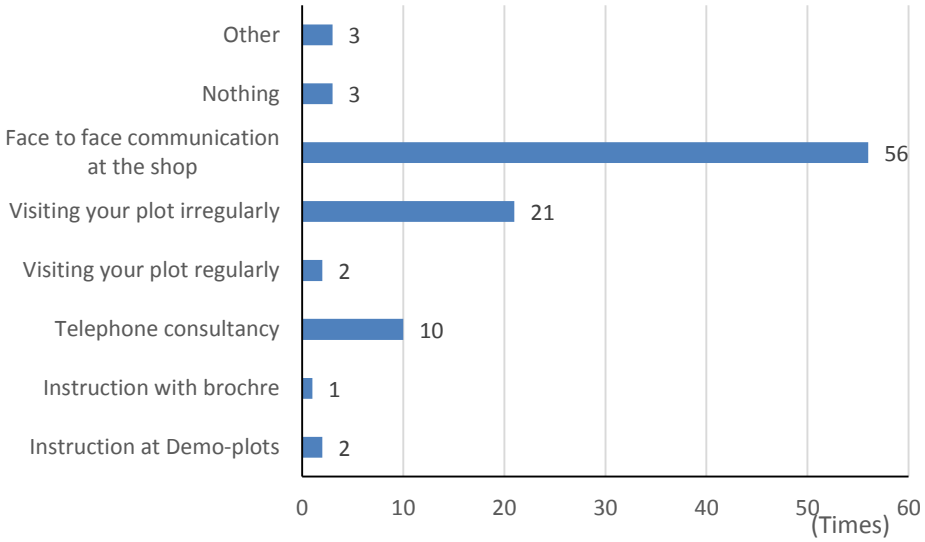


Figure 6.1.5 The Total Times of Instruction Which Sellers Provide for each Type of Instruction

Source: JICA Survey Team

Figure 6.1.7 shows the degree of satisfaction of information about agro-chemical use. 27 and 12 farmers feel information is informed. On the other hand, 10 and 21 farmers feel that information is not sufficiently informed.

The Survey asked farmers about agro-chemical use after harvesting. Figure 6.1.6shows the number of farmers who use agro-chemical after harvesting. Only two farmers use agro-chemical after harvesting. The detailed information of agro-chemical they use is described in Table 6.1.7.

The reasons that farmers do not use agro-chemicals after harvesting are described in Figure 6.1.8. Almost all farmers do not have any reason.

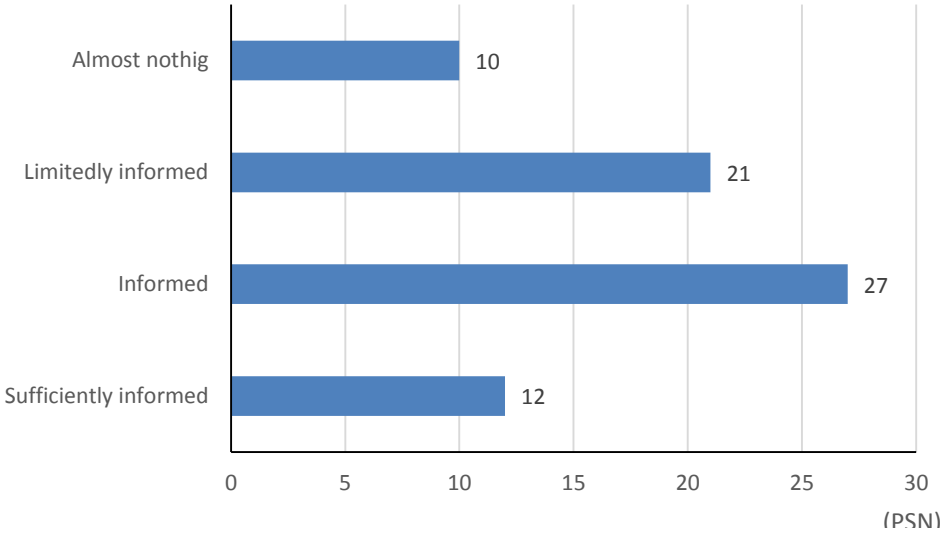


Figure 6.1.7 The Degree of Satisfaction of Information about Agro-Chemical Use

Source: JICA Survey Team

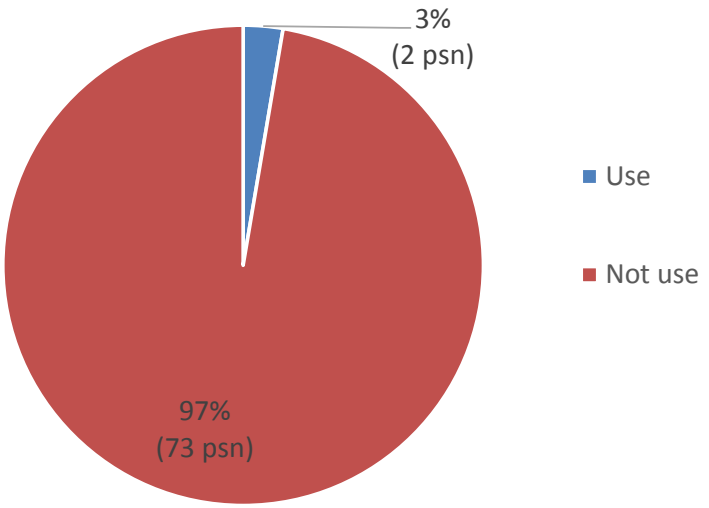


Figure 6.1.6 The Number of Farmers Who Use Agro-Chemicals after Harvesting

Source: JICA Survey Team

Table 6.1.7 The Detail Information of Agro-Chemicals Applicated after Harvesting

TS	Crop	Agro-Chemical	Amount (per Acre)	Cost (per unit)	Producer
Meiktila	Pigeon pea	Aluminium Phosphide (Pesticide)	1 pcs	100	Marlarmyaing Co.ltd,.
Kalaw	Potato	Trichlorfor + Chlorpyrifos (Pesticide)	1 sack	1,500	Chinese company

Source: JICA Survey Team

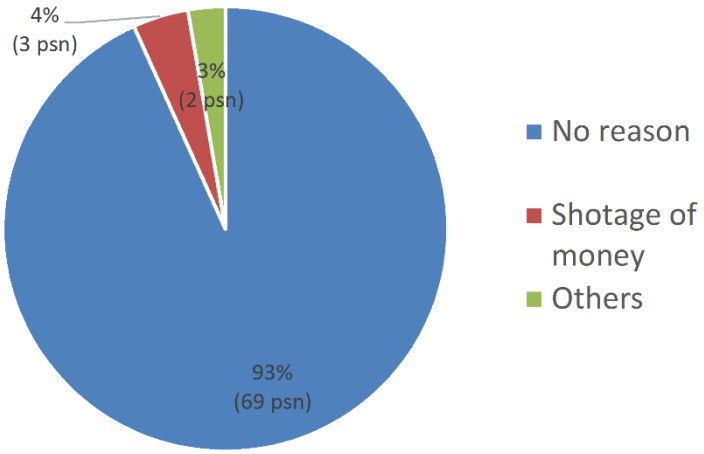


Figure 6.1.8 The Reason that Farmers Do Not Use Agro-chemicals after Harvesting

Source: JICA Survey Team

6.2 Administration for Pesticide Management

PPD is one of 15 divisions of the DOA of the MOALI. The PPD has 17 sections and is responsible for assisting the nation to safely export and import agriculture products, ensuring pesticide management, helping farmers to minimize the impact of pest damage by applying IPM and educating stakeholders on all aspect of plant protection. In particular, Food Safety Testing Laboratory for Agricultural Products (FSTLAP) and Pesticide Analytical Laboratory (PAL) are mainly responsible for chemical analysis. The FSTLAP is in charge of analyzing pesticide residue and it has around 20 official staff members, while the PAL is in charge of analyzing formulations and it has around 21 official staff members.

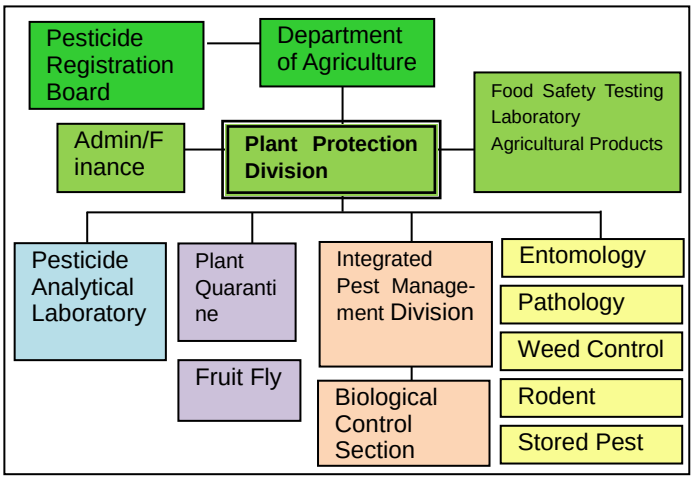


Figure 6.2.1 Organization of Plant Protection Division

Source: PPD, 2018

However, their resources are not enough to investigate all commodities on the markets. In some cases of pesticide residue analysis, some companies send samples of their products to competent private companies' laboratories in Bangkok or other cities in foreign countries before export. This activity is quite costly and a big burden for such companies.

The PAL is equipped with specialized equipment such as Gas Chromatographers (GS) with an Electron Capture Detector, a Flame Lionization Detector (FLD) and a Flame Photometer Detector (FPD), as well as HPLC with Ultra Violet (UV) and Atomic Absorption Spectrometry (AAS). On the other hand, the FSTLAP is equipped with specialized equipment such as GS with an Electron Capture Detector, FLD and a Mass Spectrometer (MS), HPLC used for aflatoxin analysis, and AAS.

Although several other donors support the PPD, this appears to be inadequate for the capacity development of PPD (Table 6.2.1).

Table 6.2.1 Supports Provided by the Other Donors to the PPD

Donor	Support	Contents
GIZ	FSTLAP	The program consists of 4 components. One component is related to “Food safety and SPS”. In this program, technical training related to residual pesticide analysis using GC is conducted.
FAO	PPD	The program supports legislation concerning the registration of pesticides. FAO collaborated with Netherland government and provided training with pesticide registration toolkit in the project.
Netherland Government	PPD	Two-year short program related to pesticide was conducted. The themes of this program were ”Agriculture and Food Quality Field” in 2015, and “Pesticide Registration and Risk Reduction of Pesticides” in 2016.
World Bank	PAL	20 equipment are installed with a loan in 2018.

Source: JICA Survey Team, and Kitamura, 2018 (Report on Management Guidance Survey for Strengthening Pesticide Administration System in the Republic of the Union of Myanmar).

6.3 Administration for Food Safety and Hygiene

The sanitary conditions of almost all the wholesale markets and retailers is inappropriate to achieve the international standard for food safety and hygiene in Myanmar. Although the analysis results of microorganisms such as coliform bacteria on horticultural produce and livestock products should be referred to in the next section, improvement of sanitary conditions is urgently required.

Regarding food safety, the analysis are carried out by the DA of the MOHS, laboratories of the LBVD, DOF and DOA, Commodity Testing an Quality Management Center (CTQM) and Myanmar Inspection and Testing Service Ltd (MITS) of the MOC, Food Industry Development Supporting Laboratory (FIDSL) of the UMFCCI, and private companies such as Overseas Merchandise Inspection Co., Ltd (OMIC) Myanmar and SGS Myanmar and AMTT. The laboratories of the DOA (the PPD), have already been mentioned in section 6.2. The capacity of each laboratory is referred to in the table below.

Table 6.3.1 Capacity of Laboratories for Food Safety

Organization	Target commodities /Purpose	Analysis Menu	Locations
The FDA of the MOHS	Processed foods including frozen meat and fish (In the future, fresh produce can be included.） Mainly, imported products. Livestock and feed for export	Microorganisms such as Salmonella and Coliform, Aflatoxin, Heavy metals, Edible oil content, Food coloring, and Formalin Antibiotics for exporting product in livestock, Additive in feed for export	12 State/regional offices, 24 district offices, Offices in border areas/trade zones such as Muse and Myawaddyi
The laboratories of the LBVD	Live livestock for export Feed especially for import Meat and Milk for import and	Visual health check, and checking with document such as record of vaccinations for live livestock	Visual health checks are performed by the District/TS office, and

Organization	Target commodities /Purpose	Analysis Menu	Locations
	export (At Yangon laboratory, 90% of samples are brought from Yangon and Mandalay airports)	exports Aflatoxin for feed such as maize and rice Microorganisms such as Plate Count, Salmonella, E.Coli, Staphylococcus Aureus, and Coliform	document checks are performed by NPT head office. Laboratories in Yangon & Mandalay Mini laboratories in 8 border areas
The laboratory of the DOF	Fishery produce	Microorganisms such as Coliform,E.Coli, Salmonella, and Staphylococcus Aureus, and Heavy metals	Yangon
The PPD of the DOA	Fresh horticultural produce mainly for export	Pesticide Residue, Heavy metals,	(Refer to 6.2)
The CTQM of the MOC	Vegetables (fresh & dry), Rice, Beans, Maize, and Sesame for import, export and domestic consumption (Analysis for export occupies huge ratio)	Pesticide Residue (limited items; BHC、DDT、Dieldrin、Aldrin、Endrin、Parathion Methyl、Malathion), Aflatoxin, Edible oil content, Grain chemical composition, Grain characteristics,	Laboratory at Hlegu (45km away from Yangon), Office at Yangon
The MITS of the MOC	Mainly edible oil	Edible oil content, Moisture contents of oil (grains)	Next to CTQM Yangon office Private company, but CEO is from MOC
The FIDSL of the UMFCCI (MFPEA)	Mainly for export Non-members can also take the analysis service with analysis fee	Microorganisms such as Plate Count, Coliform, E.coli, Staphylococcus Aureus and Salmonella, Edible oil content, Nutrition content, Aflatoxin	Yangon
The OMIC Myanmar	Mainly Rice, Sesame, and Beans for export	Nutrition Content such as Moisture, Fiber, Protein, HCN, Edible oil, and Salt, and Aflatoxin	Yangon
The SGS Myanmar	Mainly Rice and Beans for export	Aflatoxin	Yangon
The AMTT	Analysis service especially for University students such as for their theses Analysis for foods and water (AMTT cannot provide official certification.)	Heavy metals such as Ca, Cd, Cu, Fe, Pb, Mg, K, Ag, Zn Edible oil content, Ethanol content and Alcoholic beverages Water analysis	Offices in Yangon, NPT and Mandalay (Main services include selling analysis machineries, its aftercare, and providing instructions on how to use them)

Source: JICA Survey Team

6.4 Laboratory Test Analysis for Food Safety and Food Hygiene

6.4.1 Locations, Number of Samples and Analytical Menu

Thirty agricultural produce were taken as samples at different markets, wholesale markets and supermarkets in Yangon and Mandalay, and the wholesale market in Taunggyi. In addition, one mango sample was taken at a farm, which holds a Myanmar GAP certification in Mandalay. The number of these produce and locations is shown in Table 6.4.1.

Table 6.4.1 Locations and Number of Samples

Locations / Produce	Yangon		Mandalay			Taunggyi	No. of samples
	Supermarket (Y-S)	Wholesale (Y-W)	Supermarket (M-S)	Wholesale (M-F)	Farm (M-F)	Wholesale (T-W)	
Sesame	○	○ Sagaing, Monywa TS	○	○ Kyaukse			4
Green/Black Gram	○	○ Ayeyarwady, Various TS		○ Kyaukse			3
Tomato	○	○ Inle	○			○ Southern Shan, Nauns Ta Ya Village	4
Mustard	○	○ Yangon, Pyi Thar TS	○			○ Taunggyi	4
Mango			○	○ Kyaukse	○ Thazin Nwe	○ Mandalay Meiktila	4
Rice	○	○ Pathein	○	○ Shwebo			4
Pork/ Chicken		○×2 ○×2					2 2
Milk	○	○×2					3
Animal Feed						○×2 (T-Farm)	2

*The locations, where each wholesaler purchases the agricultural produce, are written below the circle in each cell.
Source: JICA Survey Team

An analytical menu is shown in Table 6.4.2. Active Ingredients (AIs) of pesticide residue to analyze were selected based on the data of imported pesticides, popular pesticides used in Myanmar, and cultivation manuals of each produce provided by the PPD.

Those horticulture samples were analyzed at the OMIC Bangkok. However, the livestock samples such as chicken, pork and milk were analyzed at LBVD Laboratory in Myanmar because livestock samples were difficult to pass quarantine. The analysis of aflatoxins on feed and maize for chicken was carried out at the OMIC Myanmar.

Table 6.4.2 Analytical Menu

Category	Analysis Item	Sesame	Black/ Green Gram	Tomato	Mustard	Rice	Mango	Chicken/ Pork	Milk
Pesticide Residue	Screening 194 items (major AIs classified into organic phosphorus, organic chloride, carbamate, & pyrethroid)	✓	✓	✓	✓	✓	✓		
	2,4-D (herbicide)	✓							
	Abamectin (insecticide)				✓		✓		
	Acetamiprid(insecticide)		✓						
	Carbendazim (fungicide)			✓		✓			
	Cartap hydrochloride (insecticide)					✓			
	Imidacloprid(insecticide)	✓	✓	✓	✓		✓		
Micro organism	Total Plate count	✓	✓	✓	✓	✓	✓	✓	✓
	Coliform bacteria	✓	✓	✓	✓	✓	✓	✓	✓

Category	Analysis Item	Sesame	Black/ Green Gram	Tomato	Mustard	Rice	Mango	Chicken/ Pork	Milk
	Salmonella							✓	✓
	Escherichia coli							✓	✓
	Staphylococcus aureus							✓	✓
	Bacillus cereus	✓	✓			✓			
	Clostridium perfringens	✓	✓			✓			
Mycotoxin	Aflatoxin (B1,B2,G1,G2)	✓	✓	✓	✓	✓	✓	✓ (Animal feed)	
Heavy* Metal	Arsenic				✓				
	Cadmium				✓				
	Lead				✓				

*Analyses of heavy metals were carried out only for two samples of Mustard.
Source: JICA Survey Team

6.4.2 Results of Analysis for Food Safety and Food Hygiene

(1) The Result of Pesticide Residue

There are no detected pesticide residues on all the samples of sesame and mango. On the other hand, several pesticide residues were detected on two samples of green gram, three samples of tomato, one sample of mustard and one sample of rice. The result is shown in Table 6.4.3. On the table, the MRLs are referred to as the MRLs List of Agricultural Chemicals in Foods, provided by the Japan Food Chemical Research Foundation. When the amount of detected pesticide residue is compared with the Japanese MRLs, only cyanophos on tomato is over the MRLs by 0.01mg/kg. Cyanophos is one of the popular insecticide used in Myanmar, and one of the AIs classified into organophosphorus compounds.

Table 6.4.3 Result of Pesticide Residue

(Unit ; mg/kg)

	Green Gram		Tomato			Mustard	Rice	
Description*	Y-S Natural	M-W	Y-S Chemical Free	Y-W	M-S	T-W	M-S	MRLs* in Japan
Acephate	0.052	-	-	-	-	-	-	1
Chlorpyrifos	0.040	-	-	-	0.086	-	<0.03	Bean 0.05 Tomato 0.5 Rice 0.1
Cyanophos	-	-	-	-	<0.06	-	-	0.05
Dimethoate	-	-	-	-	-	<0.03	-	1
Methamidophos	0.060	-	-	-	<0.009	-	-	Bean 0.3 Tomato 2
Profenofos	-	-	-	-	0.066	-	-	3
Acetamiprid	<0.015	<0.015	-	-	-	-	-	2
Carbendazim	-	-	0.032	-	0.024	-	-	3
Imidacloprid	<0.015	<0.015	0.038	<0.015	<0.015	-	-	Bean 3 Tomato 2

*Maximum Residue Limits (MRLs) is referred to the MRLs List of Agricultural Chemicals in Foods, provided by The Japan Food Chemical Research Foundation, where provides the data based on the publications of Ministry of Health, Labour, and Welfare, Japan.
*Description Y; Yangon. M;Mandalay, T; Taunggyi, S;Supermarket, W;Wholesale
Source: JICA Survey Team, The analysis was conducted by OMIC Bangkok

Although not a huge amount of pesticide residue being over the MRLs, is detected in this analysis, the fact that pesticide residues were found from the samples labeled as “Chemical Free” and “100% natural” seems to be a problem. In fact, the residue of “imidacloprid” which is one of AIs and used as insecticide in Myanmar, was found in black sesame impoted from Myanmar to Japan. The resuidue level was over the Japanese MRL (0.01 ppm before July 2017), and it was a serious problem for the importers. They have to send the sesames back to Myanmar or the other countries, where the MRL of imidacloprid is not as high as Japanese MRL. Although the Japanese MRL of imidacloprid for sesame becomes 0.05 ppm instead of 0.01 ppm and it becomes easier to import sesame, it is essential to manage the use of pesticides, and even knowledge and management for organic produce and less chemically used produce are necessary.

(2) The Result of Microorganism

Regarding the result of microorganisms, the numbers of coliform bacteria were high on almost all the samples of tomato, mustard and mango. (Table 6.4.4) When over 10 CFU (Colony Forming Unit)/g of coliform bacteria are found in produce, the produce is recognized as coliform bacteria positive, and it is not accepted as importable produce according to Japanese standards. As demonstrated in the next table, the results of almost all the samples of tomato, mustard and mango were positive. On the other hand, as the amounts of Bacillus cereus and Clostridium perfringens were less than 10 CFU/g, they satisfy the standard. However, the numbers of total plate count were also high in tomato, mustard and mango. In this survey, it was not further investigated as to the specific stages/reasons of the formulation of high numbers of bacteria. However, as the number of bacteria is lower on the mango sample collected at the farm gate than from the wholesales and supermarkets, it is estimated that there are poor food hygiene practices during distribution. Therefore, improvement of the food handling environment of wholesale markets, supermarkets, and distribution is urgently required for food safety and food sanitation.

Table 6.4.4 Result of Microorganism

(Unit ; CFU/g)

Produce	Place	Total Plate count	Coliform bacteria	Bacillus cereus	Clostridium perfringens
Sesame	Y-S	1.5×10^{5}	-	<10	<10
	Y-W	1.3×10^{3}	-	<10	<10
	M-S	1.2×10^{5}	-	<10	<10
	M-W	3.5×10^{3}	-	<10	<10
BlackGram	Y-W	2.6×10^{6}	-	<10	<10
	Y-S	3.6×10^{4}	-	<10	<10
GreenGram	M-W	3.6×10^{5}	-	<10	<10
Tomato	Y-S	7.6×10^{4}	Positive (80)	n.d.	n.d.
	Y-W	3.2×10^{6}	Positive (7.0×10^{4})	n.d.	n.d.
	M-S	5.8×10^{7}	Positive (6.4×10^{3})	n.d.	n.d.
	T-W	1.1×10^{7}	Positive (8.4×10^{4})	n.d.	n.d.
Mustard	Y-S	5.5×10^{6}	Positive (5.8×10^{4})	n.d.	n.d.
	Y-W	1.6×10^{8}	Positive (7.0×10^{5})	n.d.	n.d.
	M-S	4.7×10^{7}	Positive (3.8×10^{5})	n.d.	n.d.
	T-W	2.4×10^{8}	Positive (8.0×10^{4})	n.d.	n.d.
Mango	M-S	6.4×10^{6}	Positive (15)	n.d.	n.d.

(Unit ; CFU/g)

Produce	Place	Total Plate count	Coliform bacteria	Bacillus cereus	Clostridium perfringens
	M-W	6.6×10^{7}	Positive (5.6×10^{4})	n.d.	n.d.
	M-F	3.0×10^{3}	-	n.d.	n.d.
	T-W	1.5×10^{5}	Positive (70)	n.d.	n.d.
Rice	Y-S	5.8×10^{3}	-	<10	<10
	Y-W	7.2×10^{2}	-	<10	<10
	M-S	3.9×10^{3}	-	<10	<10
	M-W	2.6×10^{3}	-	<10	<10

* "-" ;less than ten of Coliform bacteria are found.
*"n.d."; the analysis was not carried out and so no data.
*Description Y; Yangon. M;Mandalay, T; Taunggyi, S;Supermarket, W;Wholesale, F; Farm
Source: JICA Survey Team, The analysis was conducted by OMIC Bangkok

Food hygiene is a serious problem not only in the horticulture sector, but also in the livestock sector. No matter when and where the samples were taken in Yangon Region, high numbers of microorganisms were found in chicken, pork and milk (Table 6.4.5). The samples hardly satisfy the acceptable level of Japanese Food Sanitation Act for frozen food and meat. The highest number of microorganisms was found in the sample of pork collected at Tamwe Market. The pork sample seemed to have been on the wooden cutting board for a while. Therefore, the introduction of stainless steel tables and the use of water should help the improvement of food hygiene in traditional market.

Table 6.4.5 Result of Microorganism in the Livestock Sector

(Unit ; CFU/g)

Produce	Place	Aerobic Plate count	Salmonella	E.Coliform	Coliform	Staphylococcus aureus
Chicken	Insein Market	5,927,928	230,000	10,000	50,000	560,000
	Bogalay Market	7,000,000	240,000	172,727	281,818	504,000
Pork	Tamwe Market	370,000,000	16,000,000	2,018,181	10,800,000	2,900,000
	Bogalay Market	9,216,216	1,900,000	590,909	1,945,455	935,000
Milk	Yangon Supermarket	4,000,000	0	272	2,272	272,000
	Bogalay Market	38,600,000	0	5,909	41,636	2,880,000
	Tamwe Market	527,027	0	77,000	288,181	360,000
Reference (Acceptable)*		≦1,000,000	≦0	≦100	≦10,000	≦100
Japanese Food Sanitation Act for frozen food/meat		≦3,000,000	Negative	≦100 /Negative	Negative	≦1,000

*Reference; Practical Food Microbiology 3rd Edition, PHLS
Source: JICA Survey Team, The analysis was conducted by the LBVD Laboratory

(3) The Result of Aflatoxin

Aflatoxin B1 was found on one each sample of sesame and rice, although the amount was less than the Codex standard (international standard). In Japan, no aflatoxin should be detected in any foods under the Food Sanitation Act. The amount of aflatoxin B1 should be less than 10 μ g/kg (0.01 ppm) as the indicator to regulate it. However, 11μg/kg of aflatoxin was founrd in black sesame imported from Myanmar in May 2018, and the importer gets to have to inspect all the produce every time the importer submits the importation document to the

relevant Japanese office based on the article 26 (3) of the Food Sanitaion Act (Box 6.1). Thereby, aflatoxin is also a serious problem when agricultural produce is imported from Myanmar.

Table 6.4.6 Result of Aflatoxin

(Unit ; μg/kg)

		B1	B2	G1	G2	Codex Standard
Sesame	Y-S	-	-	-	-	
	Y-W	<0.4	-	-	-	＜10 (nuts*)
	M-S	-	-	-	-	
	M-W	-	-	-	-	
BlackGram	Y-W	-	-	-	-	
	Y-S	-	-		-	
GreenGram	M-W	-	-	-	-	
Tomato	Y-S	-	-	-	-	
	Y-W	-	-	-	-	
	M-S	-	-	-	-	
	T-W	-	-	-	-	
Mustard	Y-S	-	-	-	-	
	Y-W	-	-	-	-	
	M-S	-	-	-	-	
	T-W	-	-	-	-	
Mango	M-S	-	-	-	-	
	M-W	-	-	-	-	
	M-F	-	-	-	-	
	T-W	-	-	-	-	
Rice	Y-S	-	-	-	-	
	Y-W	-	-	-	-	
	M-S	-	-	-	-	
	M-W	<0.4	-	-	-	＜10 (nuts*)
Yellow Maize as feed	T-F	-	-	-	-	
Mixed feed for chicken	T-F	-	-	-	-	

nuts*; The survey team refers to the Codex standard of nuts. According to Codex standard, which is an international standard, less than ten μg/kg of total amount of aflatoxin B1,B2,G1, and G2 means food safety satisfied.

*Description Y; Yangon. M;Mandalay, T; Taunggyi, S;Supermarket, W;Wholesale, F; Farm

Source: JICA Survey Team, The analysis was conducted by OMIC Bangkok and OMIC Myanmar

Box 6.1 Article 26 (3) of the Food Sanitation Law

When the Minister of Health, Labour and Welfare finds it necessary to prevent food sanitation hazards, he/she may order a person who imports food, additives, apparatus or containers and packaging which are found likely to fall under those listed in each item of Article 26 (1) or food prescribed in Article 10, judging from circumstances at production sites and other circumstances, to receive inspections by the Minister of Health, Labour and Welfare or a registered conformity assessment body regarding said food, additives, apparatus or containers and packaging.

(4) The Result of Heavy Metals

Although heavy metals were detected in two samples of mustard, the amount was less than the Codex standard. Thereby, they can satisfy the requirements of the international standard for heavy metal presence; arsenic, cadmium and lead.

Table 6.4.7 Result of Heavy Metals

(Unit ; mg/kg)

Category	Analysis Item	Mustard Y-S	Mustard T-W	Codex Standard
Heavy Metal	Arsenic	<0.02	-	0.1(edible oil), 0.2(rice)
	Cadmium	0.0046	0.0075	0.2(leaf vegetables)
	Lead	0.0418	0.0391	0.1

Source: JICA Survey Team, The analysis was conducted by OMIC Bangkok

As a conclusion of Chapter 6, two main issues; pesticide residue and lack of food hygiene, are identified as high priority issues to address for food safety.

First of all, it is essential to improve the capacity of laboratories in Myanmar, as the current limited capacity is summarized in section 6.2 and section 6.3. In Myanmar, only the CTQM of the MOC and the PPD of the DOA conduct pesticide residue analysis, and the number of items that are analyzed are also limited. According to the DOCA, there were several reports that the farmers use excessive amount of pesticide especially for horticultural crops. Therefore, it is a necessary for organizations to be able to analyze more AIs of pesticide residue. In fact, pesticide residue over the MRLs is found in one out of 23 samples of horticultural crops (Table 6.4.3). Furthermore, as pesticide residues were found in the samples described as “natural production” and “chemical free”, a basic understating of pesticide use and food safety shall be required by the farmers. Although pesticide residue may be caused by the previous crop cultivation, the farmers may change their attitudes to use pesticides properly through workshop about appropriate pesticide use.

Secondly, it is important to improve the environment of the supermarket, the wholesale markets and distribution for the purpose of food hygiene. Based on the result of food safety and food hygiene analysis, lots of coliform bacteria are found on almost all samples of tomato, mustard, mango, chicken, pork and milk (Table 6.4.4, and Table 6.4.5). The samples are classified as coliform bacteria positive by Japanese standard, and it will be difficult to export these products to other countries, as a result. Additionally, the numbers of total plate count were high in tomato, mustard, mango, chicken, pork and milk. Compared with the pesticide residue analysis, several organizations including private companies already have the skills/capacity to analyze microorganisms, such as coliform bacteria. Therefore, it is necessary that the environment of supermarket, wholesale and distributions are improved to obtain proper food hygiene standards by taking advantage of analysis skills of these laboratories. In fact, there were several food poisoning reports to DOCA. As the level of food hygiene standards can be inadequate anywhere from the production stage to the consumption stage, all stakeholders involved in the FVC need to understand how important food hygiene is.

CHAPTER 7 PROPOSED POTENTIAL PROJECTS

7.1 Selection of Potential Projects

Based on the Survey, Issues Maps were created in the horticulture sector and in the livestock sector (Figure 7.1.1 to Figure 7.1.4). Regarding the livestock sector, Issues Maps of poultry, pork and cattle were created. In both the horticulture and livestock sectors, the "Low Income of Farmers" is taken as the core issue. Several problems connecting to the core issue are considered throughout the VC - from the production stage to the marketing stage. The contents of Issues Maps and potential projects are determined through the discussion with the FVC taskforce team. The members of the FVC taskforce team is listed at the end of this chapter.

7.1.1 Horticulture

Three main bottlenecks were recognized through the Survey and discussions with the FVC taskforce team, as well as based on the ADS and the Road Map. Firstly, out of the eight issues directly connected to the "Low Income of Farmers", three issues are focused on; "Low Productivity", "Limited Access to High-end Markets", and "Limited Food Safety and Hygiene".

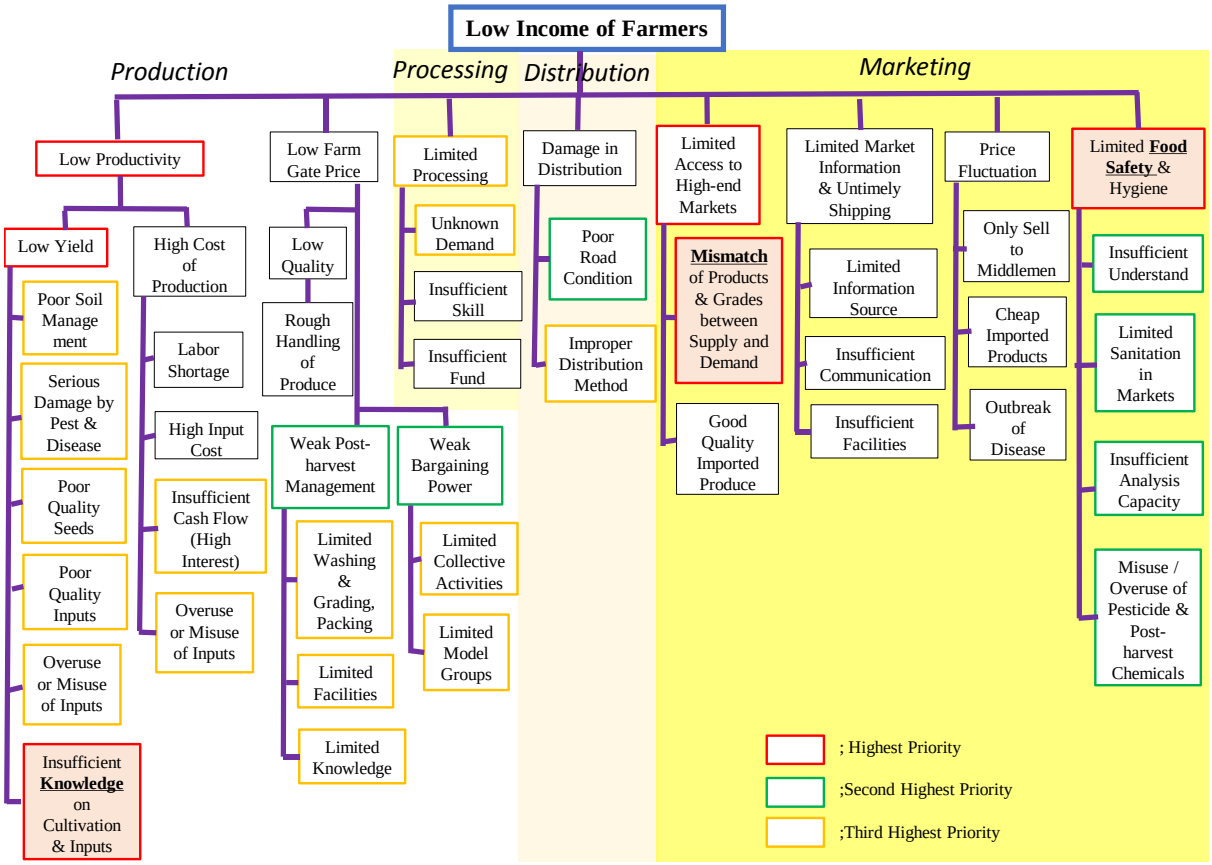


Figure 7.1.1 Issues Map of Horticulture

Secondly, under those three issues, each essential component is considered. In terms of "Low Productivity", "Low yield" is paid more attention than the "High cost of production". Then, under "Low Yield", in particular, farmers' inadequate knowledge of cultivation and inputs is considered as priority matter to address. This is because knowledge acquisition can improve the other issues such as poor soil management, serious damage by pest and diseases, and inappropriate use of inputs. Regarding "Limited Access to High-end Markets", the

"Mismatch of products and grades between Supply and Demand[41]" is taken as the second major bottleneck in the horticulture. Lastly, with respect to "Limited food safety and hygiene", all components are considered to be equally importanat. Thus, "Limited food safety and hygiene" is taken as the third bottleneck in the horticulture (Figure 7.1.1).

(1) Production Stage

Two main issues; "Low productivity", and "Low farm gate price" are identified at the production stage. The capacity development of farmers and extension workers is required to solve most of the issues related to low yields through the proposed potential projects.

For instance, as good quality vegetable and fruit seeds are currently inadequate, it can be a valuable suggestion to promote the extension use of improved seeds and production of improved seeds by the DOA and private companies. However, since there seems to be a difficulty in registration of new seeds in Myanmar, the advanced preparation for the introduction of new seed varieties is required.

As for poor soil management, it shall be improved through cooperative activities between livestock farmers and horticultural farmers such as compost production in one of proposed potential projects. Livestock farmers provide the animal manure and product compost, and then horticulture farmers can use the compos at their fields.

If the farmers work cooperatively and sell their produce together, they may increase their income. This is because the selling price will be increased through the larger amount of trade with stronger bargaining power, compared with a smaller amount of trade with weak bargaining power. Furthermore, to meet the demands of agri-food companies or processors, cooperative work among producers will be required to produce and sell a large and sustainable amount of produce in certain periods. A stable supply chain for consumers is also beneficial for the agri-food companies or processors to obtain customers' trust. Although it is frequently stated that grouping and cooperative activities are difficult in Myanmar, there are already several successful farmers' groups in some projects in Myanmar. It is essential to clearly understand the reasons why such farmers' groups have been successful. Then cooperative activities could be started by identifying or possibly organizing model groups at several pilot project sites.

In terms of a shortage of fund services, the promotion of another JICA project: a Two-step Loan will be one of the options to solve this challenge. However, another finance service aimed primarily at small-scale farmers can be considered.

(2) Processing Stage

Agricultural produce is value added through processing. However, the demand for processing raw materials is not yet clear to farmers. On the other hand, several processors mentioned that it is difficult to gain proper and stable procurement sources of raw materials. Therefore, matching between farmers and processors will be one of the solutions. Matching seminars and business forums in horticultural promotion projects in Indonesia and Vietnam have been working successfully. Moreover, contract framing has also been a success in those two example projects. Such activities in those referenced successful projects shall be included in the proposed project in Myanmar.

[41] "Mismatch of products and grades between Supply and Demand" will be explained well in 7.1.1 (4) Marketing.

(3) Distribution Stage

At the distribution stage, the improvement of rural roads will be integral to reducing the damage on agricultural produce during transportation and the logistics process. It can enable the efficient distribution of agricultural products, and improve product freshness up to the point it arrives at the markets. The improvement of roads is beneficial throughout the entire VC because it is related to all the stages from agricultural inputs to processed products. Additionally, post-harvest loss may be reduced by improving knowledge and skills of post-harvest management and through the introduction of shipping facilities and these considerations can be incorporated into one of the potential projects..

The Myanmar GAP, which has just started its activities in cultivation stage, has the potential for expanding the distribution volume through the application of the guidelines and the widespread adoption of the certification because food safety is one of the fundamental needs of consumers. If the benefits and security of food safety provided by the Myanmar Gap are recognized by wholesalers, then farmers' groups that apply the Myanmar GAP to their produce can conduct large-scale trades with them, including in exports since those wholesalers understand the value added by a sense of food security.

(4) Marketing Stage

Through the Survey, two main limitations/gaps between supply and demand were discovered. The first limitation is that the farmers do not recognize the demand of potential crops that have never been cultivated but can be cultivated considering the climate zones of Myanmar. The second limitation is that the farmers do not understand what kind of size, grade and quality of crops are required in the markets. For example, farmers grow small potatoes, meanwhile the hotels and restaurants prefer to buy big potatoes. These two limitations are expressed as "Mismatch of products and grades between Supply and Demand" in.Figure 7.1.1. Matching between farmers and buyers will be a solution to the limited market information of farmers and buyers, poor communication between them, and non-matching problem of demand and supply.

Based on the Survey, at the marketing stage, the improvement of food safety and hygiene is urgently required. Education about food safety and sanitation is integral not only for farmers but also for collectors, processors, distributers, wholesalers, retailers and consumers throughout the FVC. For instance, the Myanmar GAP will not be as effective if the related stakeholders including traders, wholesalers, retailers and consumers do not understand the true worth of food safety and sanitation. Regarding such education, the support of the MOC and Ministry of Education may be required. However, as the first step in the process, it is necessary to discuss with the DOA about their plans to extend the value of the Myanmar GAP.

Empowerment of laboratories that perform analysis also be an important part in improving food safety and sanitation. The FAO and USAID are working on such issue from the aspect of policy, SPS measures mainly with the FDA laboratory. Therefore, from the perspective of pesticide, the capacity development of the PPD is absolutely necessary to eliminate illegal pesticide and poor quality pesticides. In addition, the food sanitation in local markets must be improved through the introduction of stainless steel tables, water taps, simple drainage units and so on.

7.1.2 Poultry Meat and Eggs in Livestock

Regarding the poultry and egg sector, the issues differ slightly amongst native chickens, broiler chickens and layer chickens. However, two major bottlenecks are considered through the survey; "Limited Food Safety and Hygiene" and "Not Meet Potential Demand." The latter issue is related particularly to native chickens.

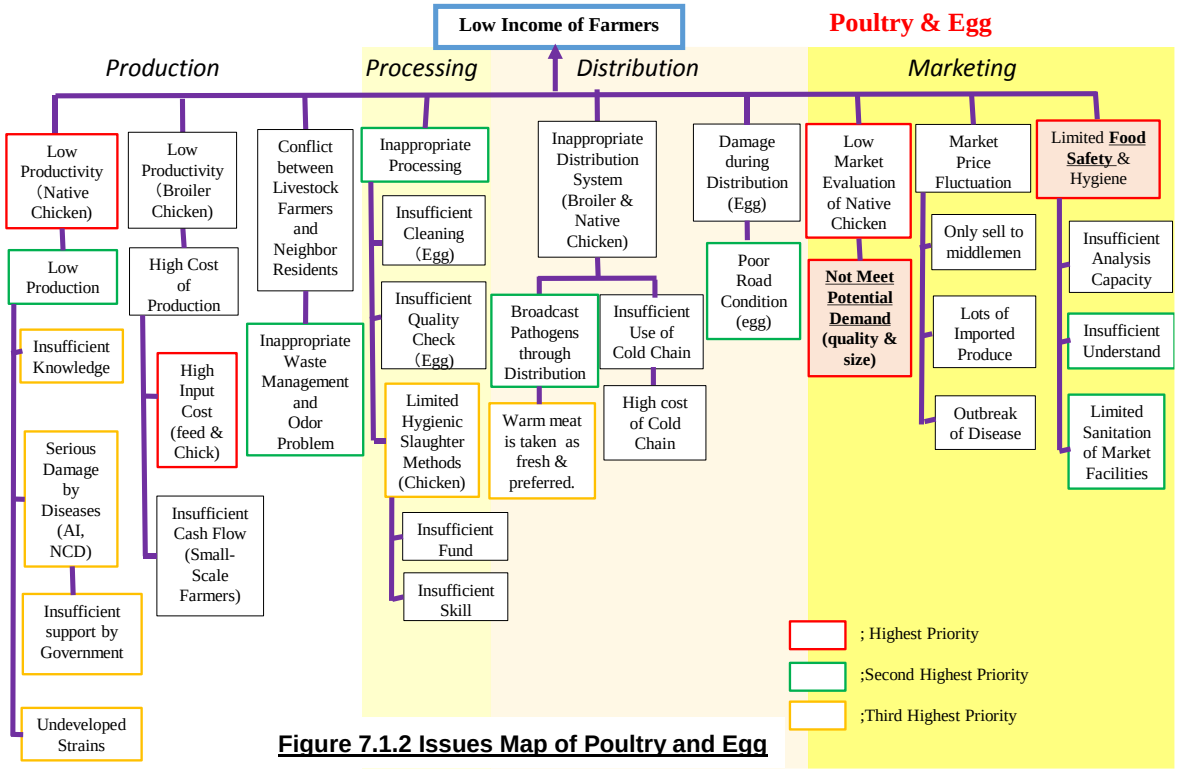


Figure 7.1.2 Issues Map of Poultry and Egg

(1) Production Stage

In particular, small-scale broiler/egg producing businesses are not profitable due to high input cost. In terms of feed, the price of maize and soybeans is going up, and the profitability of the feed businesses is being undermined. Considering this, support for cropping area expansion is suggested. This might be conducted through financial support of the government and by the promotion of contract farming with the cooperation of private companies.

The native chicken production system is inefficient and not necessarily meeting the potential of urban demand. This issue can be addressed through one of the proposed projects.

Regarding disease, Avian influenza and Newcastle Disease (NCD) are common diseases in Myanmar, but occurrences are not necessarily brought to the attention of the TS veterinary office. Therefore, the full extent of the current situation is not well known. This issue can be improved through TS veterinaey service support.

In addition, the odor has become a serious environmental problem in suburban areas. This issue can be addressed though the introduction of compost pits and compost centers. This activity will be included in one of the potential projects.

(2) Processing Stage

It is important to add value through processing around the production sites. For instance, value can be added to chicken through slaughtering, separating the meat components (cuts) and other parts, and cooking them near their production sites. Eggs are sorted by size but not cleaned well and there is no inspection of abnormal eggs. This issue can be resolved through teaching assistance provided by private companies.

(3) Distribution Stage

Most chickens are traded as live birds to retail shops. This method is possibly responsible for spreading pathogens. Although some companies started operating hygienic abattoir and distributing chicken meat using ice to better regulate the temperature of the product, the overall number of such companies making these positive reform is very limited. It is essential to slaughter chickens at production sites and transport them within a temperature-controlled supply system to sites where the meat will be sold/consumed. This distribution method can improve transportation efficiency as well.

Egg breakage during transportation is a serious problem. To address this issue, the improvement of protective packaging and infrastructure, especially road improvement, is suggested. The improvement of roads will improve not only egg VC, but also other produce VC.

(4) Marketing Stage

In marketing stage, food safety and hygiene are problems requiring urgent attention, as the numbers of microorganisms causing food poisoning detected in the samples of the Survey show. Most retailers are slaughtering birds in their shops in the less hygienic conditions of traditional markets. Furthermore, general consumers prefer “warm” meat with fresh blood, seeing this as indicators of freshness. For these challenges, trainings about food sanitation under normal temperature and the support for upgrading traditional markets shall be suggested, and shall be conducted in the potential projects.

7.1.3 Pork in Livestock

In terms of pork sector, one major issue is given attention. Similarly to the poultry and cattle sectors, it is the “Limited Food Safety and Hygiene” (Figure 7.1.3).

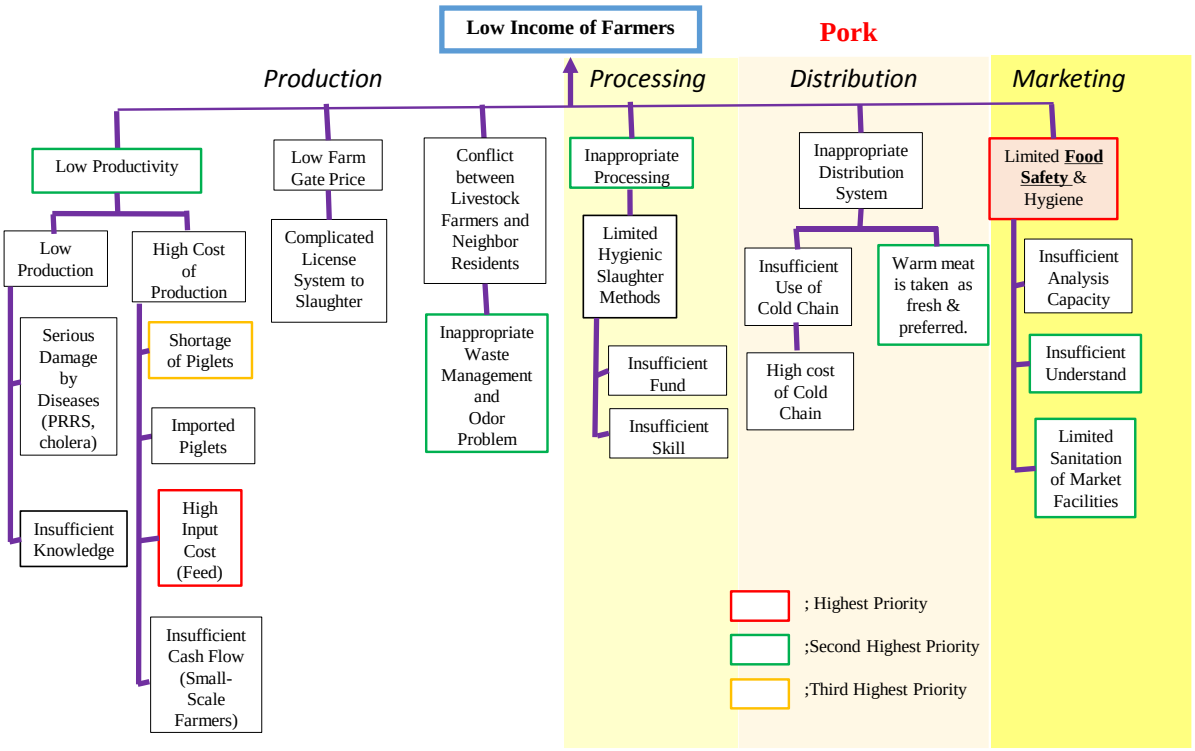


Figure 7.1.3 Issues Map of Pork

(1) Production Stage

In the production stage, the shortage of piglets is a serious issue when examining the domestic demand growth of pork. Currently, piglets are provided by large-scale companies, but their output is not enough to meet demand which is currently met by imports from Thailand. Support of farrowing production investment and training for pig farmers will be suggested as countermeasures.

Similarly to the poultry industry, the high price of inputs including feed, pig diseases such as Porcine Reproductive and Respiratory Syndrome (PRRS) and swine cholera, and limited waste management are serious issues. Similar countermeasures to the poultry industry will be suggested. In particular, small-scale pig farmers are more likely to face difficulty in continuing their businesses due to increased feed costs. As for waste management, it is a more complicated system than poultry requires, such as solid-liquid separation and composting, and/or biogass system.

(2) Processing Stage

Regarding slaughtering, the system is really complicated in Myanmar. In particular, slaughtering license systems under municipalities are complicated, and increase the cost. However, this is a difficult issue to work with, and strong political leadership will be required to change the system. Furthermore, slaughtering methods are not hygienic except for in Mandalay, where there are established modern slaughtering houses. The financial support to introduce modern slaughtering systems will be required across the country.

(3) Distribution and Marketing Stages

Similarly to the poultry situation, food safety and sanitation of pigs are serious problems. Thus, trainings of food safety and food hygiene practices for normal temperature conditions, and support to upgrade traditional markets

will be conducted through proposed projects. In the future, as the next step, it will be important to transport processed pork with a temperature-control supply system to consumption sites. To cover the additional cost of such transportation systems, it will be required to develop value-added products, which can be successfully sold at big consumption sites like Yangon.

7.1.4 Cattle for Beef and Dairy in Livestock

In the cattle sector, out of eight problems directly relating to the main issue "Low Income of Farmers", three problems are focused on. They are "Low Productivity", "Low Farm Gate Price" and "Limited Food Safety and Hygiene". Under "Low Productivity", "Undeveloped Strains" and "Limited AI Services" are considered as serious issues. Under "Low Farm Gate Price", "Low Quality" is considered the biggest issue. Then, one common constraint "Undeveloped Strains" is seen as a major bottleneck in the cattle sector. Similarly to the other previous sectors, "Limited Food Safety and Hygiene" is seen as another bottleneck in the cattle sector.

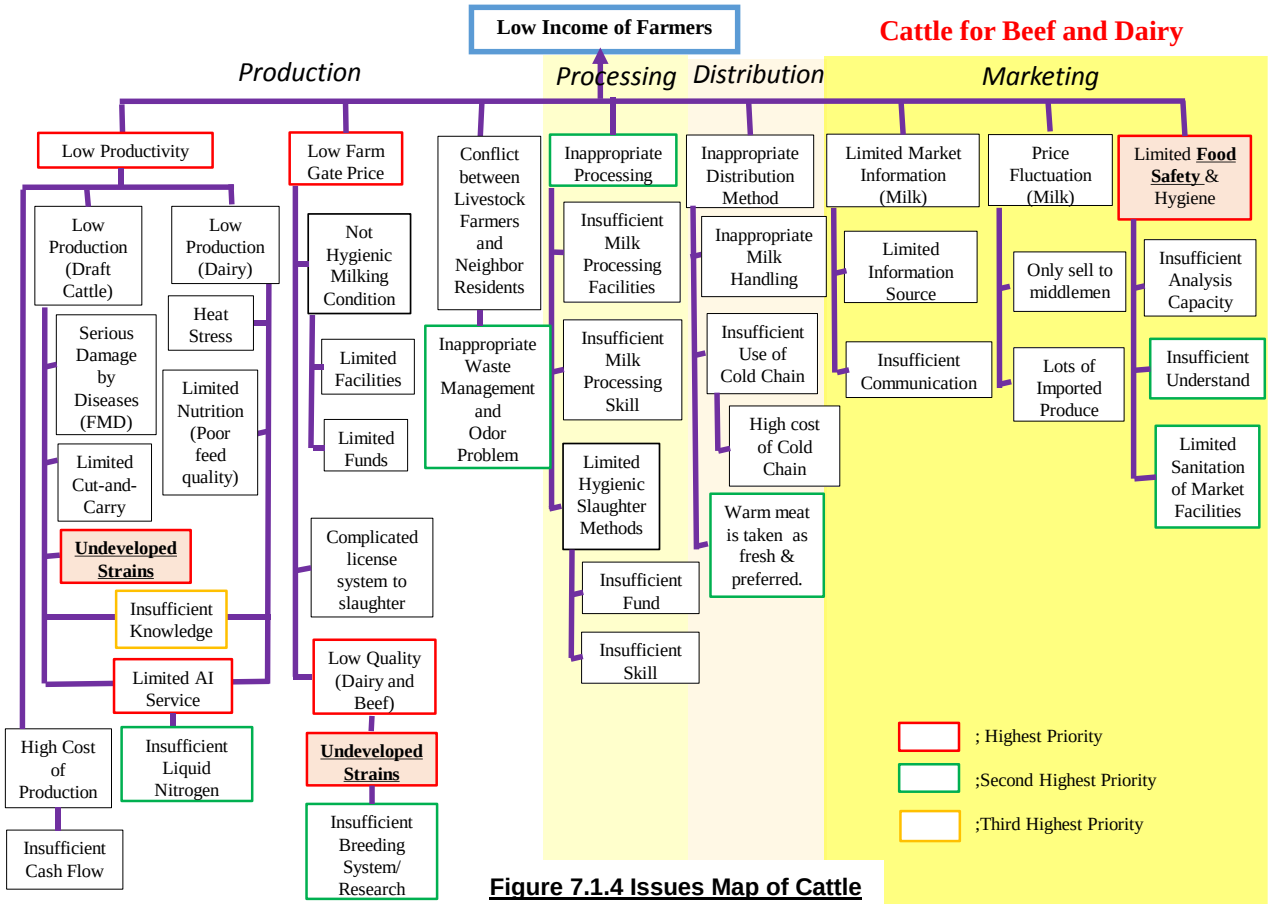


Figure 7.1.4 Issues Map of Cattle

(1) Production Stage

At the cattle production stage, a significant matter "Undeveloped Strains" is focused on. High quality beef cattle strains have not been developed systematically, because cattle have been traditionally grown not for meat but for draft power in Myanmar. Moreover, AI services are limited due to insufficient production of semen of high quality strains and limited available liquid nitrogen. To address these matters, support for cattle breeding technique and introductions of cattle breeding research centers and liquid nitrogen plants are necessary, and can

be conducted through proposed projects.

Regarding dairy production, there are several issues such as limited strains, insufficient feed, inappropriate calf management and poor sanitation of milking. It will be required to improve these issues through relevant training. In particular, as the milking conditions used by small-scale dairy farmers are not hygienic, trainings for them of food sanitation practices will be beneficial to improve the first stages of the dairy VC. On the other hand, in terms of limited feed for beef cattle, the support of a cut-and-carry system can be suggested. Grazing is the major fattening method to grow the cattle for beef in Myanmar, and the cut-and-carry currently is rarely used.

Similarly to poultry and pork production, countermeasures of cattle diseases including Foot and Mouth Disease (FMD), and waste management are required. According to FAO/OIE, Myanmar is a FMD "endemic" country. Therefore, strengthening the veterinary service system, which provides integral instructions including how to grow cattle, what and how to feed, nutrition and how to prevent diseases is essential. Regarding waste management, a similar system to pork waste management mentioned above, will be required.

(2) Processing Stage

With respect to the slaughtering system, the cattle situation is similar to that of pork, and food hygiene must be similarly improved. Regarding the dairy VC, milk processing technology and equipment are limited, and so, training and financial support will be helpful for milk processors.

Various dairy products can be produced through processing such as processed milk, skim milk, beverages including milk, ice cream, yoghurt, condensed milk, cheese and butter. Although presently condensed milk is commonly produced in Myanmar, the demand of other dairy products will increase. As mentioned in Chapter 4, the consumers' meal preferences have changed in Myanmar. It is important for the producers and other stakeholders of VC to understand the current market demand and to improve the whole VC to meet market needs.

(3) Distribution and Marketing Stages

Similarly to chicken VC and pork VC, the hygiene of traditional markets is insufficient, and the stakeholders need to be mindful of it. Therefore, as a short-term solution, training about food hygiene will be provided, and traditional markets will be upgraded through the proposed project.

In recent years, the live cattle trade has been legalized in Myanmar, and because of this there is a high risk of pathogen transmission. However, the operational procedures of border check-points for export are not sufficient to control diseases. Thus, such a checking system and the inspectors' abilities are required to significantly improve.

7.1.5 Other Donors' Activities

The information of current and future projects of other international donors was collected through the survey. In the next table, several projects are mentioned. The other projects and their detailed information are available in the Appendix. In terms of food safety policy, the USAID and the FAO currently support the GOM. In near future, the GIZ, the World Bank and the UK will also conduct new projects to improve food quality and food safety in Myanmar. Regarding the improvent of horticulture production including the promotion of the Myanmar GAP, several international donors conduct their projects across the country, and will conduct new projects. In particular,

the KOICA established and will establish a few training centers and research institutions, and assists their operations. In livestock sector, the USAID, the FAO, the Netherland and the Newzeland have conducted several projects to improve livestock productivities in Myanmar.

Table 7.1.1 Other Donors Activities

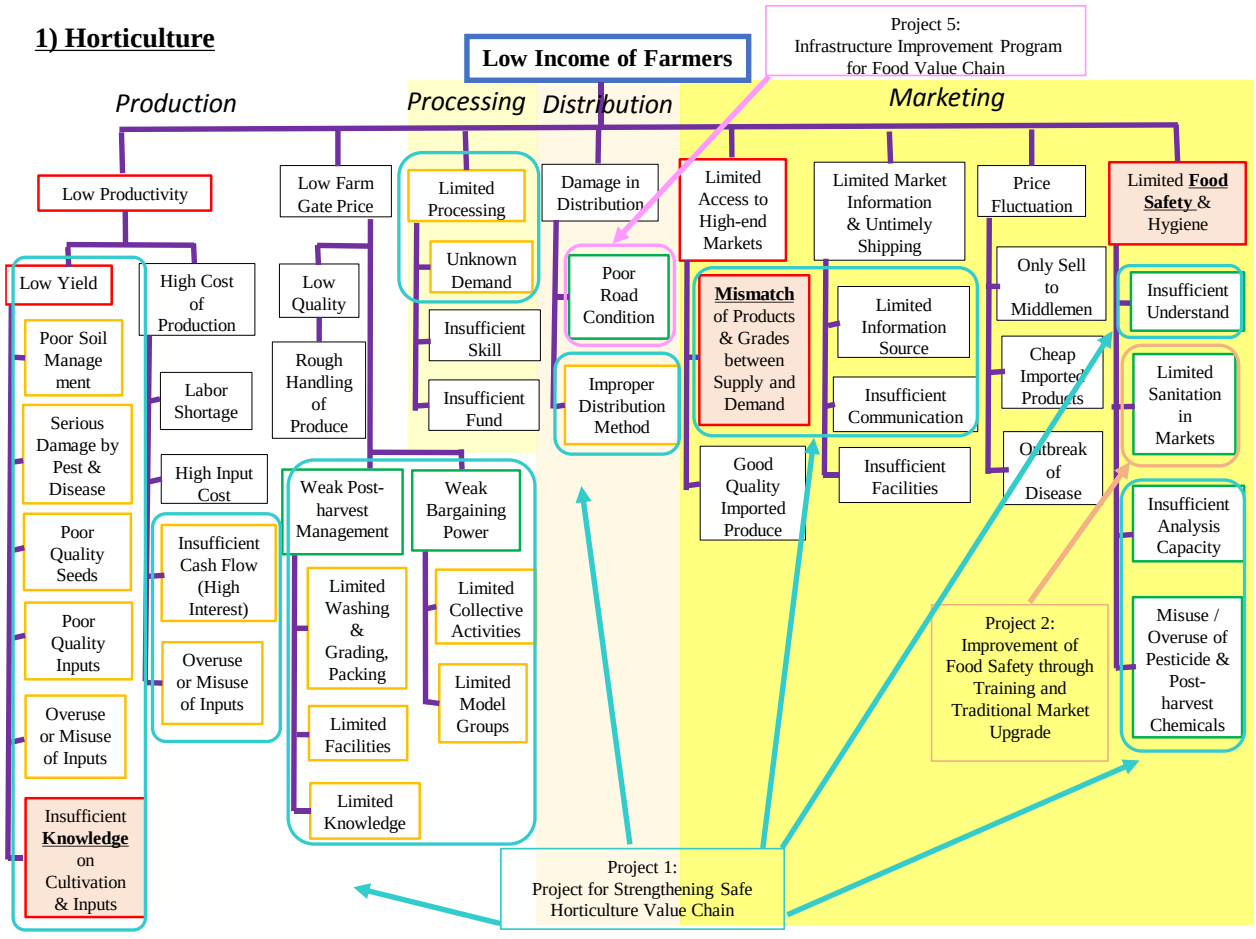
Section	Donor	Project name/Activities	Locations
Food Safety	GIZ	"Sustainable Agricultural Development and Food Qualty Initiative(SAFI)" The activities involve policy, strategy, education, consumer awareness and VC interventions. e.g.SPS Certifications, Food safety course in University Myanmar Trade Development Programme(e.g. SPS)	Shan State and two other areas
	World Bank and UK	New Project related to Food Safety (Detailed information is not yet available)	-
	USAID	Support for policy/governance, especially food law. Survey with International Food Policy Research Institute（IFPRI）	-
	FAO	Support for food safety policy	-
GAP	GIZ, FAO, USAID, and Natherland	In each project, extension/development/utilisation of GAP is mentioned.	Each project sites
Horticultu re	USAID and Winrock	Sesame, Melon, Ginger, Soybean, Coffee's FVC e.g.cooperation between farmers	Shan State
	KOICA	Myanmar Rural Area Development, Postharvest Technology Training Center, Postharvest Research Institute, Agriculture Machienary Traning Center (plan), Agricultural Marketing Center (plan) Coolection Center (Plan)	Nationwide Mandalay Nay Pyi Taw Nay Pyi Taw Nay Pyi Taw Aungban
	GIZ	Strengthening capacities in the private sector(tea, mango, pomelo, coffee)	-
	World Bank	Agricultural Development Support Project (Project for multiplication of good quality seed)	-
	FAO and ADB	Climate Friendly Agribusiness VC Sector Project	Central Dry Zone
Livestock	USAID and Winrock	Farmer to Farmer Project	Nationwide
	FAO	Development of livestock census Income generation via livestock Animal disease control	Central Zone Central Zone -
	Newzeland	Myanmar Dairy Excellence Project (MDEP)	Nationwide
	Netherland	Sustainable and Affordable Poultry for All （SAPA）	Nationwide
Finance and Others	International Finance Corporation (IFC)	Finance project	-
	(United Nations Office for Project Services) UNOPS	Livelihoods and Food Security Trust Fund (LIFT) Financial assistance	-
	KOICA	Support Myanmar Development Institute(think-tank)	-

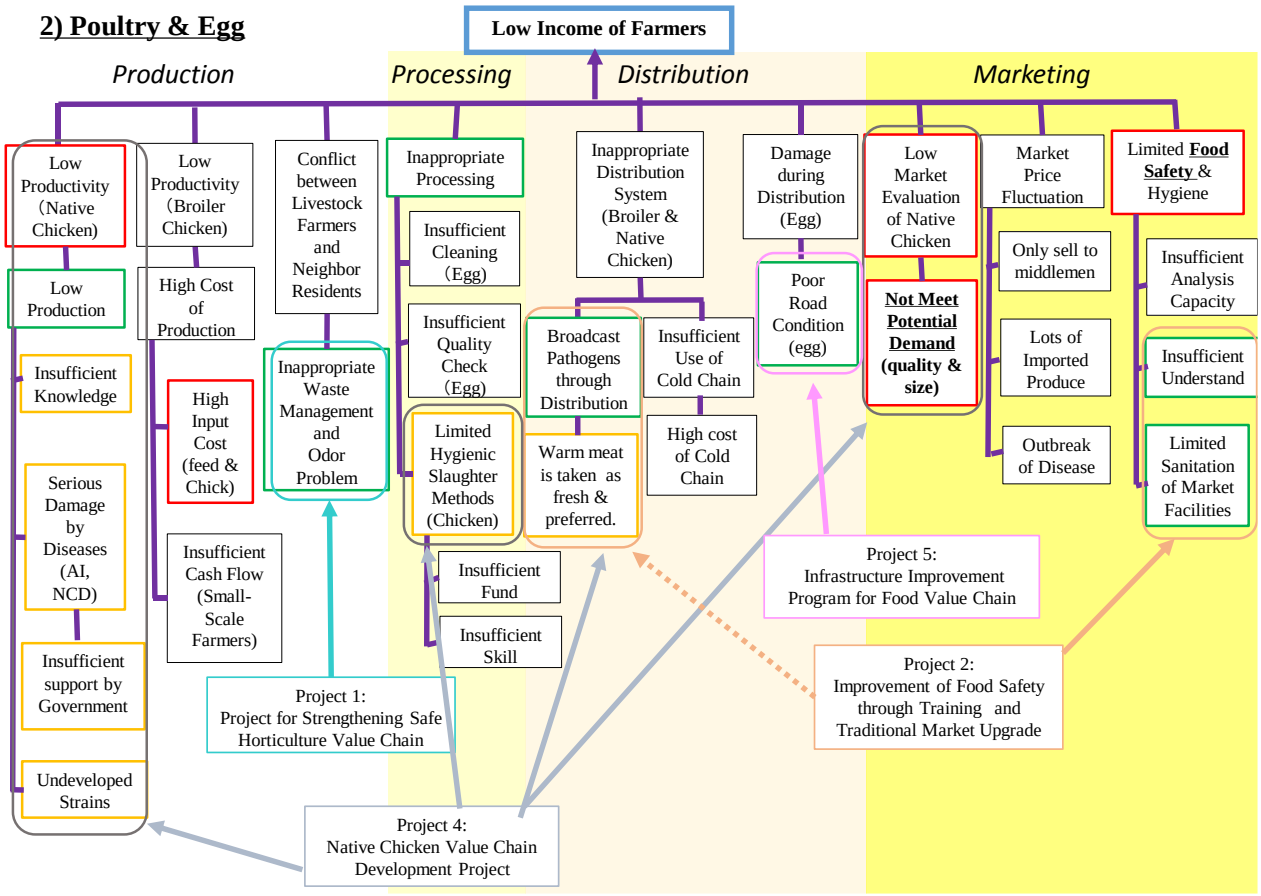
*Regarding the project related to pesticide and PPD capacity development, section 6.2. is reffered.

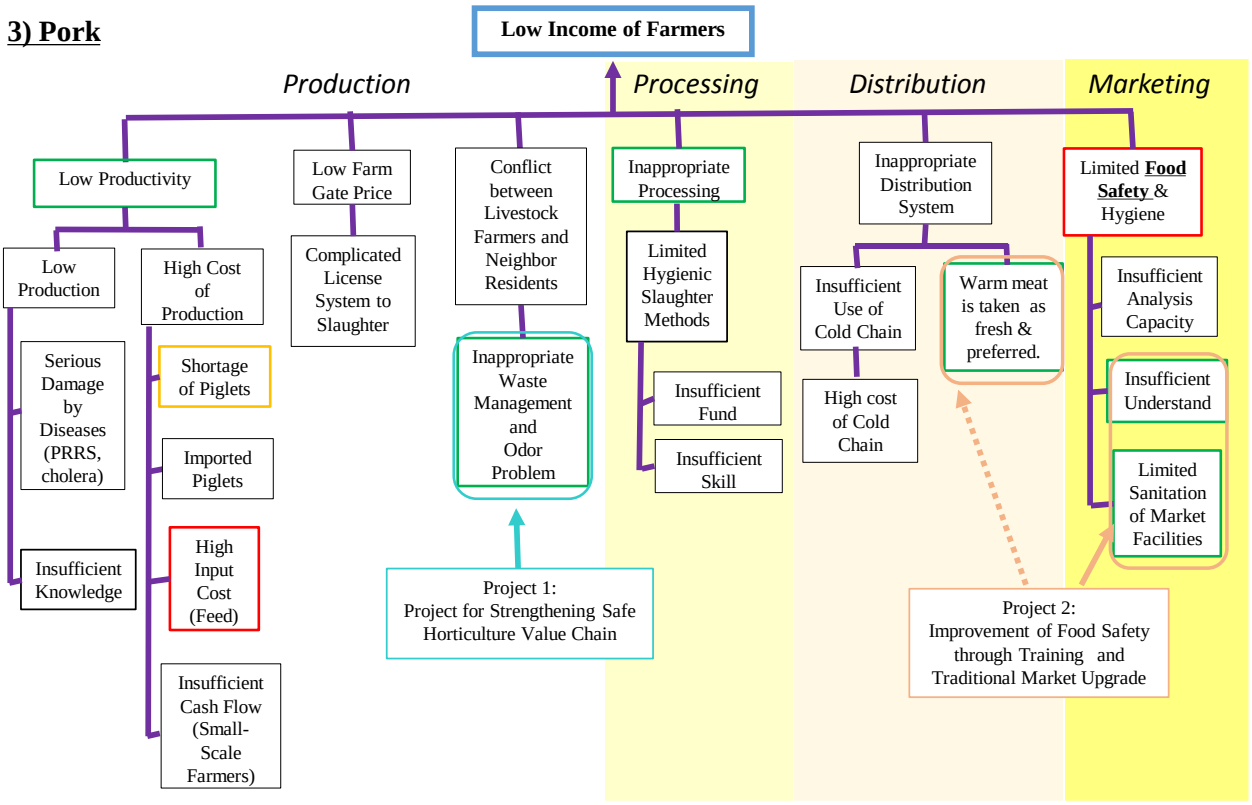
7.1.6 Proposed Potential Projects

To work out those issues, five potential projects are considered and will be suggested. Potential projects 1, 2 and 5 are related to the horticulture sector. All five projects are related to livestock sector, although Project 1 is only partially related to livestock such as compost production. The next figure demonstrates what issues each Project plans to work out.

Project 1. Project for Strengthening a Safe Horticulture Value Chain
(Including improvement of the pesticide management system)
Project 2. Improvement of Food Safety through Training and Upgrading Traditional Markets in Yangon and in Mandalay
Project 3. Introduction of a Livestock Breeding and Research Center in Mandalay
Project 4. Native Chicken Value Chain Development Project
Project 5. Infrastructure Improvement Program for the Food Value Chain




2) Poultry & Egg
Low Income of Farmers
Production
Processing
Distribution
Marketing
Low Productivity (Native Chicken)
Low Productivity (Broiler Chicken)
Conflict between Livestock Farmers and Neighbor Residents
Inappropriate Processing
Inappropriate Distribution System (Broiler & Native Chicken)
Damage during Distribution (Egg)
Low Market Evaluation of Native Chicken
Market Price Fluctuation
Limited Food Safety & Hygiene
Low Production
High Cost of Production
Insufficient Cleaning (Egg)
Only sell to middlemen
Insufficient Analysis Capacity
Insufficient Knowledge
Insufficient Quality Check (Egg)
Broadcast Pathogens through Distribution
Insufficient Use of Cold Chain
Poor Road Condition (egg)
Not Meet Potential Demand (quality & size)
Lots of Imported Produce
Insufficient Understand
High Input Cost (feed & Chick)
Inappropriate Waste Management and Odor Problem
Limited Hygienic Slaughter Methods (Chicken)
Warm meat is taken as fresh & preferred.
High cost of Cold Chain
Outbreak of Disease
Limited Sanitation of Market Facilities
Serious Damage by Diseases (AI, NCD)
Insufficient Cash Flow (Small-Scale Farmers)
Insufficient Fund
Project 5: Infrastructure Improvement Program for Food Value Chain
Insufficient Skill
Insufficient support by Government
Project 1: Project for Strengthening Safe Horticulture Value Chain
Project 2: Improvement of Food Safety through Training and Traditional Market Upgrade
Undeveloped Strains
Project 4: Native Chicken Value Chain Development Project


3) Pork
Low Income of Farmers
Production
Processing
Distribution
Marketing
Low Productivity
Low Farm Gate Price
Conflict between Livestock Farmers and Neighbor Residents
Inappropriate Processing
Inappropriate Distribution System
Limited Food Safety & Hygiene
Low Production
High Cost of Production
Complicated License System to Slaughter
Limited Hygienic Slaughter Methods
Insufficient Use of Cold Chain
Warm meat is taken as fresh & preferred.
Insufficient Analysis Capacity
Serious Damage by Diseases (PRRS, cholera)
Shortage of Piglets
Inappropriate Waste Management and Odor Problem
Insufficient Fund
High cost of Cold Chain
Insufficient Understand
Imported Piglets
Insufficient Skill
Limited Sanitation of Market Facilities
Insufficient Knowledge
High Input Cost (Feed)
Project 1: Project for Strengthening Safe Horticulture Value Chain
Project 2: Improvement of Food Safety through Training and Traditional Market Upgrade
Insufficient Cash Flow (Small-Scale Farmers)

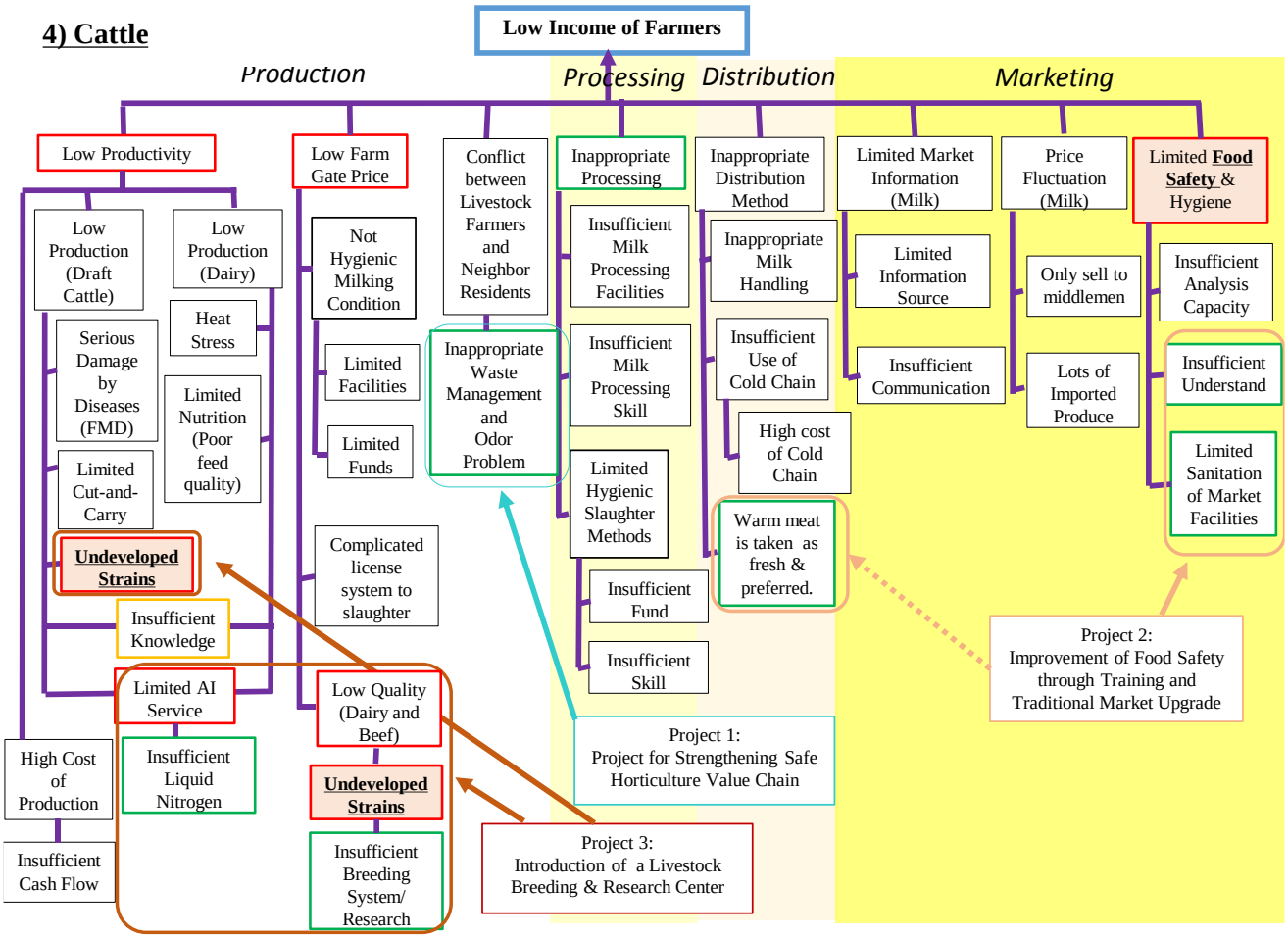


Figure 7.1.5 Target Issues of Proposed Projects

Source: JICA Survey Team

7.2 Project for Strengthening a Safe Horticulture Value Chain

(Including Improvement of the Pesticide Management System)

7.2.1 Project Concept

To solve the issues in the horticulture sector, four outputs are expected through some activities. The activities to achieve those four outputs are summarized in the next simplified project design matrix. However, depending on the situation of each pilot site, the method is required to be easily modified. One model method developed may not be able to be widely applied without modification, due to diversified conditions in terms of different natural and socioeconomic situations and various people's characteristics in Myanmar. As for the project scheme, a technical cooperation project is considered.

(1) Simplified Project Design Matrix

Tentative Project Title	Project for Strengthening a Safe Horticulture Value Chain
Project Concept	Promotion of Safe and Secure Vegetables and Fruit
Model Areas/Beneficiaries	Directly; Horticulture farmers in pilot sites, PPD regional staff and PPD analysts in Yangon

	Indirectly; Consumers
Implementing Agency	DOP, DOA
Collaborators/Stakeholders	LBVD, Department of Cooperatives, MADB, MFVP
Overall Goal: To Extend the Vegetables and Fruit Value Chain to Improve Smallholders' Income in Myanmar	
Project Purpose: To Formulate the Vegetables and Fruits Value Chain to Improves Smallholders' Income in Pilot Sites	
Rationale (Issues related to the FVC of horticulture): In order to improve the income of small-scale farmers (who are the majority of Myanmar farmers) improved horticulture practices need to be introduced to their farms, since horticultural cultivation could provide higher profits for farmers despite their small farm holdings. At the same time, horticultural productivity needs to be improved in terms of unit yield, as cultivable land of small farmers is limited. A necessary measure is to directly train and instruct farmers and extension staff in terms of basic cultivation knowledge and technology, as well as farm management. This technical assistance could have a great effect because farmers have a strong desire to grow horticulture crops in many places. In suitable production areas, some experienced farmers have already achieved a high unit yield close to tat in Japan. In this regard, we could expect that non-experienced farmers also could achieve high yields if they receive enough basic knowledge and technology support from the training. In terms of quality improvement, the classification of grades by size/appearance needs to be introduced and the training needs to aim for a high ratio of high-grade produce. High-grade produce could be traded with higher price at the farm gates and the markets. Furthermore, the demand for safe food is increasing in accordance with the growth of consumers' health-consciousness. However, there are several concerns about pesticide residue in agricultural produce in terms of "food safety" in the FVC. It is because some farmers apply some pesticides excessively. Illegal pesticides and poor-quality pesticides are on the market, and this vicious cycle is constant. There are many opportunities for farmers to use such pesticides. Also, it is important to reduce overuse/misuse of pesticides and post-harvest chemicals, which will reduce pesticide costs and increase the income of horticulture farmers. Therefore, the improvement of farmers' pesticide use and farmers' knowledge of pesticides is an urgent issue to ensure safe agriculture produce.	
Expected Outputs	
1. Establishment of partnership among the FVC stakeholders 2. Quantity and quality improvement in vegetable and fruit production 3. Improvement in vegetable and fruit distribution, processing techniques and marketing systems 4. Improvement of pesticide management systems throughout the country	
Project Activities: 1-1. Identification of target stakeholders and potential agricultural produce 1-2. Establishment of a platform to promote dialogue amongst the stakeholders 1-3. Preparation for collective activities among farmers' groups, including input procurement and marketing 1-4. Preparation for providing Value Chain Finance 1-5. Promotion of appropriate "contract farming" with farming recorded for transparency	

1-6. Creating awareness of the Myanmar GAP and food safety for related stakeholders 2-1. Promotion of high-quality seeds through the DOA farm/private sectors 2-2. Expanding IPM for farming using less chemicals 2-3. Improvement of soil fertility by using compost, and animal/green manure 2-4. Promotion of the GAP guideline for use of fertilizers and pesticides for commercial production of selected vegetables and fruits 2-5. Promotion of upland farming through irrigation practices such as small-scale pump irrigation, sprinkler irrigation, and drip irrigation 2-6. Demonstration of harvesting/transporting materials for farmers 3-1. Quick pesticide residue check before packing 3-2. Introduction of primary processing such as cleaning, grading and packing 3-3. Promotion of an appropriate collection and delivery system 3-4. Holding a series of matching seminars with identified stakeholders 4-1. Installation of analytical equipment in PPD Yangon 4-2. Development of manuals related to basic analytical skills 4-3. Monitoring target pesticides used in pilot sites and sold in agrochemical shops 4-4. Technical training of formulation analysis for PAL staff (Feedback to Activity 2-2) 4-5. Technical training of pesticide residue analysis for FSTLAP staff (Feedback to Activity 2-2)	
Tentative Implementing Schedule	October 2019 to September 2023 (four years)
Inputs	
Experts and their activities: 1) Long-term expert; three persons (Chief/Horticulture Cultivation, FVC, Capacity Building/Coordination/Public relation) 2) Short-term expert; three persons (Pesticide Formulation, Pesticide Residue, Pesticide Administration) For processing and distribution improvement: 1) Cooperative collection points and packing houses if necessary 2) Compost pits at every farm 3) Plastic containers as distribution materials For analytical laboratories: 1) Basic analytical equipment; two sets (PAL, FSTLAP) 2) Basic detectors if necessary 3) Reagents; two sets (PAL, FSTLAP) 4) Waste disposal warehouse; one place for new PAL laboratory	

From the production, processing, distribution to market levels, several activities will be conducted to achieve the expected four outputs mentioned above.

(2) Project Activities to achieve Output 1; Establishment of partnership among the FVC stakeholders

1-1. Identification of target stakeholders and potential agricultural produce

The potential agricultural produce can be identified through market surveys, such as identifying the market demand. Both vegetables and fruit have a large potential to grow within Myanmar. According to the interview survey, there are two reasons for this potential. Firstly, although it is easy to cultivate vegetables near cities, fruit is currently cultivated in limited areas of Myanmar, such as Mandalay. Due to the recent well-managed transportation system from Mandalay to Yangon, fruit is now more easily transported. Secondly, although some vegetables need to be cooked, fruit can be consumed without cooking. They are easy for the consumers to eat. In particular, Sein Ta Lone is a popular mango variety in Myanmar. Furthermore, the demand for durians is increasing, and recently the amount of durian exports to China has also been increasing.

Spice crops are also considered for crop diversification, because there is a stable demand not only in Myanmar, but also in neighboring countries, and there is an especially strong demand in China recently. Spice crops are relatively easy to produce due to their strong resistance to diseases, and better capability to be kept in storage longer if harvested products are dried thoroughly.

Similarly, there is a good potential within medicinal plant production, not only in the domestic market but also the global market. The examples of cultivated of medicinal plants in Thailand are demonstrated in Table 7.2.1. Although it is necessary to identify specific markets firstly, the plants mentioned in the list might be plants that can be considered for cultivation in Myanmar, considering the similar climates of Myanmar and Thailand. The National Herbal Park was opened in Nay Pyi Taw in 2007, and has about 500 different species producing herbal medicine[42]. These products are effective for the treatment of major diseases such as diabetes, hypertension, tuberculosis, malaria, diarrhoea and dysentery.

Table 7.2.1 Examples of Potential Medicinal Plants

Plants	Treatment for
Turmeric	Peptic ulcer
Ginger, Clove, Garlic	Flatulence and dyspepsia
Hairy basil, Senna	Constipation
Ginger, Noni, Mahaat, Rangoon creeper	Nausea and vomiting
Spilanthes acmella, Murraya paniculata, Streblus asper	Toothache
Mahaat, Rangoon creeper	Intestinal parasites

Source: WHO SEARO, 2009

1-2. Establishment of a platform to promote dialogue amongst the stakeholders

Some participants of the FVC analysis workshops stated that the opportunities to discuss their situations and challenges with all stakeholders throughout the VC were rare and would like to continue to hold such workshops. Therefore, it will be important to provide such opportunities to the stakeholders. To establish the platform, the cooperation of the DOA, DOP and UMFCCI will be asked for.

[42] WHO SEARO, 2009, The Use of herbal Medicines in Primary Health care

1-3. Preparation for collective activities among farmers' groups, including input procurement and marketing

In Myanmar, many farmers seem to prefer individual selling to collective marketing. One of the reasons is that the technical levels are very different amongst the farmers, and they hesitate to sell together because the selling price becomes low due to the variable quality of produce. However, through the proposed project and farmers' capacity development, such concerns may be resolved. Additionally, there are some good examples of farmers' groups, which conduct collective marketing and collective production in Myanmar. Assistance of the Department of Cooperatives may be requested to identify such potential cooperative groups, and to support such cooperative activities.

In accordance with economic growth, modern trade portion will become larger than traditional trade in the near future. With modern trade buyers, supermarket demand will increase and they will select only big suppliers who can respond to their large demand and consistent supply requirement. Small-scale individual farmers will be excluded from those markets dominated by modern trade. Such movements have taken place in many countries. In order to respond to this movement, collective activities are essential in developing countries with many small-scale farmers.

Considering the current situation of farmers, the appropriate entry point for collective activities is not from marketing but from production. Many farmers are interested in production technique, and some of them have already exchanged a lot of knowledge and technology with each other in nearby areas. If farmers are invited to join a project for farmers' groups on the FVC of horticulture, we could expect many farmers would join such a project.

Such groups could become collective production groups. Through several training sessions of the proposed project, the difference between member farmers' technical skill levels could be minimized. Then, we could expect they would extend collective production activities to include collective input purchasing or collective marketing based on unified quality production of the member farmers. However, this process will take time. Long-term training projects are required to be prepared in accordance with the growth of collective groups.

If collective marketing groups for specific produce are formed in an area, one permanent committee for each type of produce needs to be organized to discuss the details of collective marketing including details of grading the produce and the target buyers in markets.

In a collective marketing group, representatives need to negotiate with several brokers/wholesalers, but this kind of negotiation requires some skill utilizing bargaining power. JICA former survey team identified several competent brokers in farmers' communities or competent farmers with a side broker business. Such men/women are more suitable as good negotiators for this kind of work. The collective marketing groups need to provide these competent representatives with remuneration that comes from the groups' income.

Several different types of cooperative activities can be carried out in different pilot sites. Through the activities in pilot sites, suitable cooperative activities for each area will be identified.

JICA former survey team found good examples in Thailand horticulture VC. The team members visited Thailand to study the horticulture sector situation in Thailand through visiting TOPS supermarket, Talaad Thai Wholesale Market and Kicthkood Cooperative in Chanthaburi Province. The Kitchkood Cooperative plays an important role in collecting and marketing fruit produced in the cooperative service areas. In the cooperative, each kind of

fruit producer group has been organized, such as a durian producers group, mangosteen producers group etc. The producers bring their products to the collection center constructed by the cooperative, supported by the Cooperative Promotion Department (CPD) of the Ministery of Agriculture and Cooperatives (MOAC) and private companies (China and Thailand). This is a good example of PPP. In the collection center, the collected products are cleaned, graded, and packed in designated containers by buyers such as the Makro wholesale club. Their products are traceable to the individual producers in each group. After these processes, the cooperative buys the products from producers and sells them to end users such as dealers and supermarket integrators. In the past, each farmer sold their products individually, but they realized collective marketing was more profitable in terms of marketing cost reduction, a higher selling price supported by strong bargaining power, and through ensuring high quality on all producers' products, in comparison with several years ago. Their marketing channel is illustrated as follows:

Successful examples in Thailand are useful for Myanmar FVC stakeholders, because the Thai marketing system is similar to Myanmar's. For example, there is no auctioning in markets, and no delivery of products to other persons. In this regard, it is easier to consider new FVC development strategies referring to the good examples in Thailand rather than the Japanese example, because the Japanese horticulture FVC is based on an auction wholesale market and consignment marketing conducted by the Japan Agricultural Cooperatives (JA).

In the future, group alliances need to be established to trade with big buyers. One group by itself cannot respond to the needs of these big buyers in the case of trading, in terms of product volume and consistent supply. Such alliances could support individual groups such as labor, sharing facilities and information.

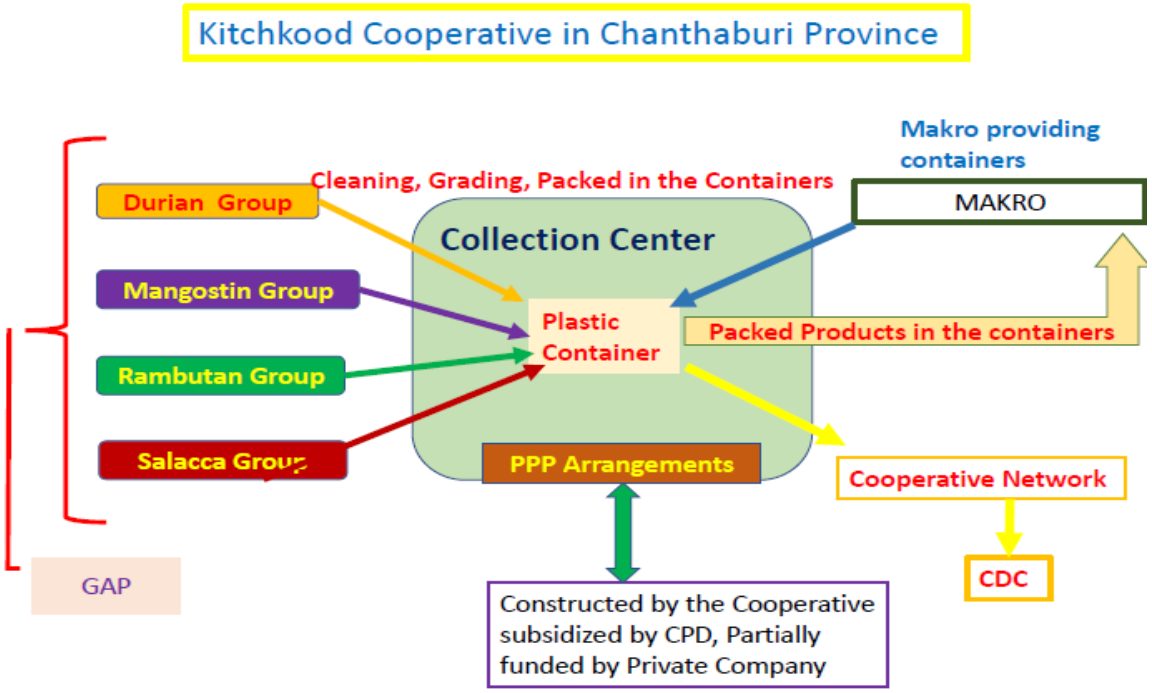


Figure 7.2.1 Kitchkood Cooperative in Chanthaburi Province

Source: JICA former survey team, 2018

1-4. Preparation for providing Value Chain Finance

In Myanmar, there are already several means of financial assistance. They are provided by the MADB, Department of Cooperatives, private companies including Awba Company and Shwe Sel Myay Company, and Two-Step Loan (a financial support project funded by Japanese government). However, there is still demand

from small-scale farmers for financial assistance. Therefore, the needs and appropriate approach will be discussed with the coordination unit[43] and it will be prepared to offer any suitable plan to the farmers. The capacity of bank staff including the MADB needs to be developed in terms of loan examination.

1-5. Promotion of appropriate "contract farming" with farming recorded for transparency

The high-end market including food processing companies, restaurants, hotels, and supermarkets requires a stable supply of good quality agricultural produce. In Myanmar, contract farming is not always working efficiently. Even if a farmer grows a specific crop under a contract, he/she sells the crop to the other buyers when the buyers propose a higher buying price. Thus, it will be required to promote the appropriate contract farming, which sets up the rules and penalties of selling conditions and breaking the contract. Additionally, the high-end market pays attention to the quality of products, and what and when agricultural inputs are used. Therefore, it is integral for farmers to record their farming practices and submit it to the contract person for transparency purposes.

1-6. Creating awareness of the Myanmar GAP and food safety for related stakeholders

If related stakeholders including traders, wholesalers, retailers and consumers disregard the Myanmar GAP, then agricultural produce made under the Myanmar GAP will be treated similarly to the other agricultural produce. It means the producers' effort and work related to the Myanmar GAP does not create additional value. Thereby, awareness of food safety and the Myanmar GAP's value needs to be raised with related stakeholders. The coordination unit formed for the proposed project needs to determine how to conduct public education. For instance, the coordination unit can request the support of the Ministry of Education and promote education of food safety and food hygiene to school children. The coordination unit can provide leaflets of the Myanmar GAP and food safety at traditional markets, supermarkets, restaurants and so on. Moreover, it can raise the awareness through media such as radio, TV, mobile phones and SNS.

(3) Project Activities to achieve Output 2; Quantity and quality improvement in vegetable and fruit production

2-1. Promotion of high-quality seeds through the DOA farm/private sectors

Some seeds are produced by farmers themselves, such as onions, potatoes etc. Their quality is not so good, due to disease infection or other damage. In the future, seeds and seedlings of priority horticulture crops such as potatoes need to be produced by the government for ensuring they are virus/disease-free. Healthy and disease-resistant plants could reduce pest/disease damage and pesticide use. Thereby, the expansion of such high-quality seeds registered in Myanmar will be required. In Myanmar, the introduction of new seeds takes approximately two years. This is because the government examines the seeds and conducts testing to register the seeds in Myanmar. Therefore, in the case of the introduction of new seeds, it is important to prepare for such processes beforehand.

As the next step of introducing high-quality seeds, capacity building of nursery management must be considered. Good nursery preparation is important for productivity and quality improvement by using the following outlined

[43] Coordination unit; each representative or several representatives from several related departments are the members and work together especially for the project.

measures. It is promoted to produce nursery bed soil with fermented compost and charcoal. It is also important to form a ridge for suitable soil conditions, and appropriate width of transplanting lines. Furthermore, application of grass/rice straw mulch is effective for protecting the soil and the nursery, as well as for supplying organic matter to the soil.

2-2. Expanding PM for farming using less chemicals

The IPM has been already introduced in Myanmar, and so expanding the IPM is required. The IPM consists of four main factors; biological controls, cultural controls, mechanical/ physical controls, and chemical controls. Regarding biological controls, research to identify appropriate natural enemies in Myanmar may be required as the first step. Cultural controls include tillage, irrigation and crop rotation. Cropping rotation is effective not only for pest management, but also for soil fertility. For example, it can be recommended that vegetables are used as a cash crop, legumes as a nitrogen provider, grasses/ cereals as ground cover, and deep rooted crops as nutrient transporters, as all are involved in crop rotation. Mechanical/physical controls include traps/barriers for insects, rodents and birds, and mulches for weed control. Currently, chemical control, in short, pesticides, are widely used in Myanmar. However, it is essential to use only selected pesticides properly in combination with other approaches. A pesticide can be used as a spot-spray to reduce the amount of pesticide use. It is necessary to train the farmers to take preventive measures for pest/disease by growing healthy plants through pruning and reduction of branches. Thereby, good environmental conditions can be created for plants.

2-3. Improvement of soil fertility by using compost, and animal/green manure

Crop farmers in Myanmar are facing soil degradation primarily because of insufficient supply of organic matter to the soil. Some farmers claim that soil has become harder year-by-year. Soil fertility is enhanced by chemical fertilizers and soil physical properties may be worse because of the insufficient addition of organic matter.

On the other hand, livestock production in Myanmar has been intensified and the amount of animal excreta per area has increased. As a result, odor and waste water became an environmental problem claimed by neighboring communities. Residential areas were far from livestock production areas in the past, but urbanization continued and residential areas expanded to grow closer to livestock farms.

According to the LBVD, conflicts between livestock farms and neighboring communities have already become serious in suburban areas in urban centers such as Yangon, Mandalay and Taunggyi. For example, in Taunggyi, layer farms were forced to stop their operations because of strong claims from neighboring communities about odour. Because odour and wastewater from livestock farms is a relatively new issue in Myanmar, the LBVD has not established methods to handle animal manure to solve the problem.

In the first phase of the project (4years), compost pits will be introduced to each farm. However, in the second phase of the project (6years), the introduction of a compost center will be considered. Before the introduction of compost a center, a feasibility study will be definitely be required. The compost center accepts raw animal manure from livestock farms to make high quality compost and solve the conflict between livestock farms and neighboring communities. The compost produced in the center is delivered to crop farmers to improve their soil through the addition of sufficient amounts of organic matter. As the first full-scale composting facility, the center demonstrates that composting is an effective technology to process animal manure to a high quality soil conditioning material.

Regarding the compost center, the LBVD will be an implementing agency. For example, Shan Hill Livestock

Zone 1 in Taunggyi has 64 layer farms and 850,000 layers, in total collecting 64 tons of excreta per day. To process this amount of faeces requires 2,500 m2 facilities in two places. The center produces 11,680 tons of compost in total per year from two sites in the zone. If a crop farmer inputs 30 ton of compost to 1 ha of crop field per year, the center accommodates 389 ha of cropland.

One of the most important discussion points is who manages this composting business. In the case of Shan Hill Livestock Zone 1, there are two committees. One is the Administration Committee, headed by the Director of the LBVD Shan State. Another one is the Development Committee, which consists of ten representatives of 64 farms and headed by the largest farm owner. The composting business body would be this Development Committee.

Table 7.2.2 Two Committees of Shan Hill Livestock Zone 1

Shan Hill Livestock Zone 1: Administration Committee		
Dr. Khin Aung	Director - Shan State - LBVD	President
Dr. San Tun Wai	Deputy Director LVBD Taunggyi District	Secretary
Dr. Aung Min Tun	(Temporary) Nyaung Shwe T/S Vet Officer	Member
4 farm owners are members		
Shan Hill Livestock Zone 1: Development Committee		
Dr. Sai Lon	Farm Business Owner	President
Mr. Zaw Naing	Farm Business Owner	Vice President
Mr. Than Tun Oo	Farm Business Owner	Vice President
Mr. Than Tun	Farm Business Owner	Financial Controller
Mr. Mya Thein Oo	Farm Business Owner	Secretary
Mr. Aung Shwe	Farm Business Owner	Assistant Secretary
2 farm owners are auditors and 2 farm owners are members		

Source: Shan Hill Livestock Zone 1

The steps and activities to introduce the compost center are as follows:

i) Preparation

1) The DOA determines the target areas of compost use considering the demand of crop farmers
2) The DOA starts promoting the advantages of "soil building by compost" through seminars.

ii) Construction

1) The LBVD takes legal procedures to make the land available for the center.
2) The LBVD orders the construction of the facilities and procures equipment of the center.

iii) Operation and dissemination

1) The center makes a contract with a livestock farmer on the condition of raw manure supply.
2) The center collects raw manure and subsidiary materials to the center and produces compost.
3) The DOA conducts training to farmers who expressed interest in compost and extension officers on how to "build-up soil" using compost.
4) The center delivers produced compost based on the order by crop farmers.
5) The DOA promotes the effect of "soil-building" through demonstration farms and on-farm trials.

Promotion of high quality compost by the DOA to crop farmers is a key activity for the success of the Compost Center. Horticultural farmers should be targeted first because horticultural crops are more susceptible to diseases and horticulture farmers are conscious of soil quality in general.

The next table indicates profit and loss in the case of a Compost Center in Shan Hill Livestock Zone 1. Initial facility investment is granted for the Project, and the business management body will perform maintenance control every year; and agreed to replace the facility after 25 years and vehicles and machinery after 7 years.

Table 7.2.3 Profit and Loss Statement (P/L) of the Compost Center for Shan Hill Livestock Zone 1

(Unit; Kyat)

COST			Unit price	Quantity	Amount	Depreciation	
						Period	Annual
	Initial cost					(Year)	
		Facility (2500m^2)	877,062,500	2	1,754,125,000	25	70,165,000
		Truck	82,500,000	4	330,000,000	7	47,142,857
		Wheel loader	110,000,000	2	220,000,000	7	31,428,571
		Back hoe	96,250,000	2	192,500,000	7	27,500,000
		Chopper	1,000,000	4	4,000,000	7	571,429
		Sub total	−	-	2,500,625,000	−	176,807,857
	Running cost						
		Manager	6,000,000	1	6,000,000		
		Staff	2,100,000	6	12,600,000		
		Fuel	656,250	6	3,937,500		
		Subsidiary material*	32,444,444	1	32,444,444		
		Maintenance	3,508,250	1	3,508,250		
		Contingency	1,161,268	1	1,161,268		
		Sub total	−	−	59,651,463		
	Total		−	−	236,459,320		
SALE							
	Compost		30,000	11,680	350,400,000		
PROFIT			−	−	113,940,680		

Source: JICA Survey Team

Note: Subsidiary material* indicates the materials except for raw manure

2-4. Promotion of the GAP guideline for use of fertilizers and pesticides for commercial production of selected vegetables and fruits

In order to ensure the appropriate application of pesticides, it is urgently required to train farmers to apply the right pesticides correctly based on identification of pest/disease, and detailed information on how to use them. Recently, Myanmar GAP is focused on, and so it is effective to take advantage of GAP guideline for appropriate use of fertilizers and pesticides.

Not only farmers, but also extension staff will be trained how to select appropriate pesticides and how to properly use them based on identified pests and disease. For extension staff, a manual for the expansion of the safe and appropriate usage of pesticides may be developed. Furthermore, technical training related to safety and appropriate use of pesticides may be provided for them.

In terms of chemical fertilizer application, the soil of each field needs to be analyzed, at least for the N-P-K component, EC and pH. Each township office needs to be equipped with soil test kits for this analysis. Based on the results of the analysis, the necessary amounts of chemical fertilizer for each type of soil needs to be calculated and applied in each field at the appropriate time. Basal fertilizer application on its own is not effective sometimes for the limited fertilizer holding capacity of soil (low CEC-value soil). This measure could reduce the application amount of chemical fertilizer and its cost.

2-5. Promotion of upland farming through irrigation practices such as small-scale pump irrigation, sprinkler irrigation, and drip irrigation

JICA former survey team identified many underutilized underground water sources in the shallow layers of alluvial soil locations near rivers. In terms of their costs and information from a lot of suppliers in Myanmar, sprinkler, sprayer and drip irrigation equipment can be introduced because it is readily available. The MADB term loan (TSL) could be provided for the introduction of such equipment if the branch staff has enough capacity to examine that process.

2-6. Demonstration of harvesting/transporting materials for farmers

Japanese experts will discuss what harvesting/transporting materials are suitable to demonstrate, and how to demonstrate them with the coordination unit. The coordination unit and Japanese experts may cooperate to provide training to extension workers and farmers. Awareness of the Myanmar GAP and food safety (how to treat the produce carefully and safely) will be also included in the demonstration.

(4) Project Activities to achieve the Output 3; Improvement in vegetable and fruit distribution, processing techniques and marketing systems

3-1. Quick pesticide residue check before packing

To guarantee food safety, pesticide residue analysis is essential. Although it is obvious that detailed analysis at PPD laboratories provides certain results, it may take time to send the samples and to analyze them. Furthermore, these days the export samples are likely to be brought to PPD laboratories by the traders and the sellers. When there are several middlemen in the value chain, it is not easy to track the samples back to the production place (origin). If the farmers can understand the pesticide residue at their premises before any product shipped, it is more of an inducement to adopt this method. Therefore, through the project, quick pesticide residue checks can be carried out using quick and mobile pesticide residue analysis kits.

3-2. Introduction of primary processing such as cleaning, grading and packing

Through the project and cooperative work, the members of farmers' groups may be able to pay attention to grading their products, and to clean and to pack their produce. Unified national quality grades for each kind of commodity needs to be set by the MOC/MOALI. In terms of horticulture crops, there is no unified national quality grade in Myanmar. For the time being, collective marketing groups need to set their own grading standards for each kind of product to more efficiently sell their products and receive greater income. Otherwise the commodities, which are mixture of high and low-quality products, are set at a lower price than the average price.

The grade is set by size and quality (appearance, smell, shelf life, etc.) For example, in the case of tomato, there are four colors of grading from red to green, and four sizes grading of large, medium, small and below the standard. As the grades need to reflect buyers' expectations, they must refer to to the grades adopted by retailers in retail markets. The final grades need to be set through discussion amongst retailers, wholesalers and marketing groups. Buyers also need to set priorities on products graded in places of production by elaborating their business strategies. If unified grades are set by stakeholders in wider areas, the market could expand through the introduction of telephone orders from buyers in remote areas without checking products directly. These kind of grading could play a role in making a brand.

Presently, selection from products piled in mounds is carried out by workers (seated) based on visual checks, as instructed by their employers (wholesalers); and this method is not so accurate. Selection work should be carried out by workers (standing) to check products moving past them on conveyer belts, which would allow for larger quantities of collected products to be inspected. This could ensure the more accurate selection of products, and improve work efficiency.

Selection work needs to be carried out by individual producers separately, and the groups need to keep the records for individual producers' products. Thereby, the producers of good quality products could achieve a higher income from this careful selection, which would in turn ensure the fair payment of individual farmers and motivate them to produce high quality products. This data includes the quality and size of products supplied by individual farmers, and could be utilized for cultivation training of individual farmers. If the group continuously makes accounting practice errors through mixing high and low-quality products without calculating individual producers' incomes based on separate records, most high-level producers will leave the group.

Figure 7.2.2 TOPS Supermarket

TOPS Supermarket i one of the prominent modernized fresh food retailers in Thailand, and has established reliable horticulture VC crops through 160 communities' groups with 3000 farmers. TOPS provided technical assistance and packing house facilities with quick test kits for food safety. In the packing houses, the products were washed, cleaned, graded and packed in designated boxes, and then sent to Food Distribution Centers (FDCs) of the company.

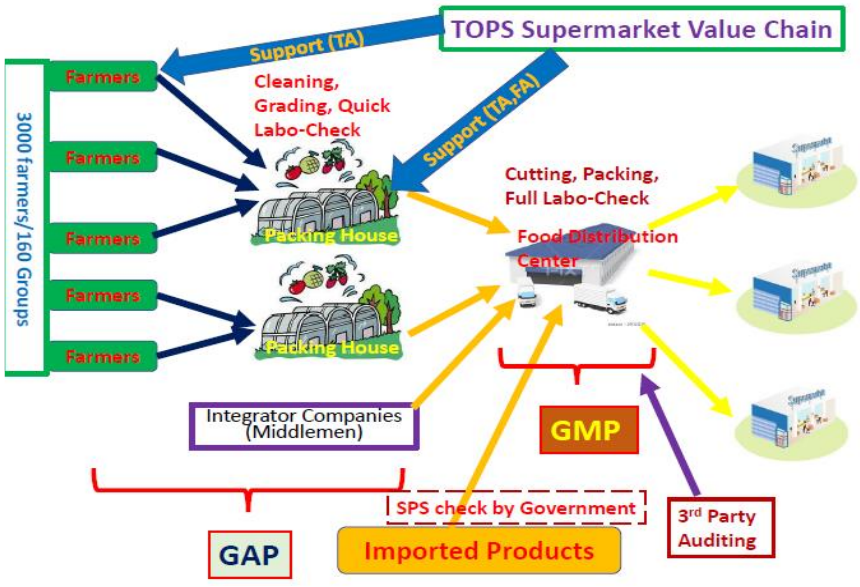


Figure 7.2.3 TOPS Supermarket Value Chain

Source: JICA former survey team, 2018

In FDCs, the products are graded again, cut and repacked. Then, they are sent to each supermarket and other stores. This process is implemented under the application of the Good Manufacturing Practice (GMP). Each FDC has a laboratory to check the food safety of products, and this check is audited by a third-party test organization to verify the self-check results on food safety.

Under such conditions, the GAP has been applied to all groups' vegetable production. They received a GAP certificate issued by the DOA of the MOAC, and put GAP labels on their products that are displayed on supermarket shelves. This VC is illustrated as follows.

3-3. Promotion of an appropriate collection and delivery system

A significant portion of post-harvest loss could be reduced by introducing shape-fixed plastic containers within collective marketing. The introduction of plastic containers only by one farmer is difficult and not acceptable for buyers. This introduction of collective marketing could provide all stakeholders with the following merits or benefits. For all stakeholders the transparency of price formulation is improved through packaging, which indicates the precise volume and weight of the products.

For wholesalers selection work at markets could be reduced by receiving products that have already been classified at the places of production. A wide space for selection is not necessary in markets. One operator using a folk-lift to loading palettes of products onto trucks could be used to replace several workers at truck yards, and so minimize labor costs while improving work efficiency. Truck loading efficiency could be also improved by using shape-fixed containers, and thereby reducing transportation costs in the process.

For retailers, a method of fast and simple quality checks can be realized since workers would be able to see inside the plastic containers. Product losses caused by damaged produce can sometimes be more than 30% in the cases of eggplants, potatoes and so on. Weighing bags or baskets is not so accurate, which means that retailers face inaccurate pricing. If the products are already graded without any damage, the retailers can display the products directly from the containers on their store shelves. This process could reduce retail costs and offer increase benefits to both retailers and consumers.

In order to introduce plastic containers at a collective marketing level, the recycling system of containers needs to be established amongst the stakeholders. Most used containers could be used again, and the recycling system reduces the necessary costs of production.

3-4. Holding a series of matching seminars with identified stakeholders

A specific target market for farmers is needed to sell their agricultural produce and satisfy quality demands. Therefore, matching seminars between buyers/agri-food companies and the farmers will be held. It is assumed that cooperation with the MFVP for participants from local companies, the Japan External Trade Organization (JETRO) for participants from Japanese companies, as well as other potential organizations will be required.

For example, Myanmar has a section of land that holds a high potential to cultivate herbal plants for medicine and where no chemical agricultural inputs have ever been used. Several international companies have already paid close attention to Myanmar for such reasons, and have already initiated their projects to cultivate medicinal plants such as hibiscus, spearmint, lemongrass, dandelion, ginger and so on within Myanmar. So, matching seminars are hoped to connect the stages of VC from production to the markets. As to the domestic market, some of the plants grown in nine public gardens are provided to one of the public pharmaceutical factories in Myanmar[44] (Table. 7.2.4). The factories produce at least 21 types of traditional medicine powder, and 12 types of tablets. According to the interview survey, the supply of medicinal plants does not satisfy the demand, and some of them have to be imported to meet the shortfall.

[44] The Department of Traditional Medicine of MOHS owns two pharmaceutical factories and follows national formulary and GMP standards (Ministry of Health, 2014, “Health in Myanmar”)

Table 7.2.4 Medicinal Plants Supplied to the Public Pharmaceutical Factory

No.	Myanmar Name	Botanical Name
1	Ka Ra Way	*Cinnamaonum tamala* (Buch-Ham.) T.Nees & Nees
2	Kant Choke Ni	*Plumbago indica* L.
3	Kyaung Shar Kauk	*Orohylum indicum* Vent.
4	Khum Sar Ga Mone	*Kaempferia galanga* L.
5	Kha Paung Gyi	*Strychnos nux-vomica* L.
6	Kha Tack Khauk	-
7	Kway Tauk	*Wattakaka Volubilis* (L.f.) Stapf.
8	Gin Kyauk	*Zingiber officinale* Roscoe
9	San Pal	*Jasminum* officinale
10	Hsay Ma Khan	*Jatropha multifida* L.
11	Hsin Tone Ma Nwel	*Tinospora* sp.
12	Hsin Nar Hmaung	*Heliotropium indica* L.
13	Ta Yote Sa Gar	*Plumeria Alba* L.
14	Na Nwin Tack	*Coseinium fenestratum* (Gaertn) Colebr
15	Nant Thar Phyu	*Santalum album* L.
16	Nwar Myat Yinn	*Cyperus scariosus* R.Br.
17	Pa Dae Kaw	*Alpinia conchigera* Griff.
18	Pauk Pwint	-
19	Phwar Phat Gyi	*Cassia renigera* Wall.
20	Ma Nit Aw Ga	*Carallia brachiata* (Lour.) Merr.
21	Tha Kyar Ma Gite	*Orthosiphon aristatus* (Blume) Miq
22	That Yinn Gyi	*Croton oblongifolius* Roxb.
23	Thit Ja Poe	*Cinnamomum zeylanicum* Blume
24	A Loe Kya	*Arundo donax* L.

Source:The Department of Traditional Medicine, The MOHS

(5) Project Activities to achieve Output 4; Improvement of pesticide management system throughout the country

The purpose of these activities is to enhance functions of the PPD in Yangon and in the pilot sites for strengthening pesticide management. The PAL and the FSTLAP in Yangon need to be upgraded. As the next step, fields for efficacy and residue tests are also required to be upgraded in the long term. The Entomology Section, Pathology Section, Weed Control Section and the FSTLAP may be responsible for field tests and investigations. The number of private companies that possibly conduct field efficacy tests in Myanmar are very limited. Additionally, various techniques of field test are necessary so that some sections in the PPD need to cooperate with each other. In that case, not only the improvement of the PAL and the FSTLAP, but also the cooperation of the other sections under the PPD is important.

4-1. Installation of analytical equipment in PPD Yangon

The PPD of the DOA is in charge of pesticide registration, analysis of pesticide residue, analysis of pesticide formulation, and field testing (efficacy and residue). However, the analytical instruments of the laboratory and the technical skills of the analysts are insufficient. To achieve good pesticide management, improvement of i) pesticide formulation analysis, and ii) pesticide residue analysis knowledge are necessary. For the improvement

of laboratories such as the PAL and the FSTLAP, basic analytical equipment would be provided first, and then higher performance equipment such as High Performance Liquid Chromatography (HPLC) would be installed and introduced as the next step, according to the developing skills of the analysts. A summary of the proposed equipment to be installed is shown in the next Table.

Table 7.2.5 Equipment for Analytical Laboratory

Target laboratory	Target	Proposed installation analytical equipment	Remarks
PAL	Basic equipment	・Laboratory glassware	For basic analysis
	Physiological equipment	・RO-TAP Sieve shaker ・Drying machine ・Incubator	For measurement of the particle size of the granules For measurement of water contents of granules and powders For measurement of stability of the formulation
	GC/HPLC-Detector	・Ex. GC-FID (Flame Lionization Detector)	For measurement of organic compound
	Ventilation	・Draft chamber	For exhausting hazardous gases and volatile harmful substances
	Waste disposal	・Storage room	For collecting waste
	Electricity supply	・Backup generator	For supplying electricity
FSTLAP	Basic equipment	・Laboratory glassware	For basic analysis
	GC- Detector	・GC/FPD (Flame Photometer Detector) ・GC/NPD (Nitrogen phosphorus Detector) or FTD	For measurement of organic phosphorus/sulfur For measurement of organic nitrogen compounds

Source: JICA Survey Team

4-2. Development of manuals related to basic analytical skills

To encourage the PPD analysts to improve their skill and knowledge by themselves in the future, basic manuals for pesticide analysis will be developed.

4-3. Monitoring target pesticides used in pilot sites and sold in agrochemical shops

In Myanmar, the labels on imported pesticides are occasionally replaced, and the expiration dates are expanded, and then the pesticides are sold cheaply. For the sake of enhancement of food safety, illegal pesticide and poor-quality pesticides should be eliminated from the market.

Based on the monitoring results of the target pesticides, the guidelines on implementation of appropriate stewardship activity conducted by pesticide companies will be prepared. In addition, workshops/seminars on stewardship activity for technical staff of pesticide companies might be conducted if required. Therefore, proper information will be extended to not only to technical staff of pesticide companies but also to pesticide shops, farmers and extension officers on the pilot sites..

4-4. Technical training of formulation analysis for PAL staff (Feedback to Activity 2-2)

The PAL, whose new building has just been completed recently, is in charge of formulation analysis for the monitoring of pesticides. However, facilities and basic equipment needed for the laboratory are still insufficient. Concerning the capacity of technical staff in the PAL, it is mentioned that the fundamental principles of pesticide analysis such as pesticide preparation analysis and formulation analysis, must not be carried out using the same

instruments, the same devices, and, of course, in the same room (Kitamura, 2006). Moreover, the PAL staff do not have enough knowledge about experimental methods of active ingredients and physicochemical properties in formulation analysis.

Therefore, technical training such as fundamental principles of pesticide usage is necessary for the PPD/PAL staff, needs to be provided over time from techniques/manuals of basic analysis measurements, to advanced analysis measurements by means of new equipment.

4-5. Technical training of pesticide residue analysis for FSTLAP staff (Feedback to Activity 2-2)

The FSTLAP is in charge of pesticide residue analysis for food safety. Concerning the capacity of technical staff in the FSTLAP, they do not have the knowledge and techniques for conducting experimental methods of pesticide residue analysis although there is appropriate equipment. In addition, their knowledge is limited about priority selected pesticides/agri-products for testing analysis[45].

Therefore, technical training is necessary for the FSTLAP staff, gradually introduced from techniques/manuals of basic analysis measurements to advanced analysis measurements, for extending analysis of other agri-commodities by means of new equipment.

Consumers feel that there is a risk of pesticide residue on some imported crops from China. If domestic products could get the credibility of consumers regarding food safety, domestic products could become more sought after and valued than imported products in markets, and the work of the FSTLAP will be essential in changing the way that domestic products are viewed by Myanmar consumers.

7.2.2 Potential Project Sites and Potential Horticulture Produce

(1) Potential Project Sites

Potential project sites are West Bago, Magway, South Sagaing, Mandalay, and South Shan. They were selected based on their horticulture production output (mentioned in Chapter 4) and the results of the Survey. The agriculture produce of West Bago is frequently sold in Yangon. Yangon is the biggest city in Myanmar, and is a great consumer of products. In addition, one of the JICA projects - Project for Profitable Irrigated Agriculture in Western Bago Region (PROFIA) - is now conducted in West Bago, and collaboration with the project would contribute to successful results.

Magway town is located within a three-hour drive of the Bagan archaeological zone, which has been tentatively placed on the World Heritage list of the United Nations Educational, Scientific and Cultural Organization (UNESCO). Bagan is one of the most famous sightseeing places in Myanmar, and the number of tourists visiting Bagan increased by 15% in 2016; from around 240,000 visitors in 2015 to around 290,000 visitors in 2016. So it can be said that there is a large potential market if the provision channel is established from Magway to Bagan. Furthermore, in Magway, one of the JICA projects - Project for Development of Water Saving Agriculture Technology (WSAT) - is conducted and an irrigation system is introduced. The proposed project can take

[45] Report on Management Guidance Survey for Strengthening Pesticide Administration System in the Republic of the Union of Myanmar (Kitamura, 2018)

advantage of such properties and obtain the relevant information/knowledge necessary to make it successful.

Sagaing occupies 15% of the total land used for agriculture in Myanmar, and it is the second largest Region next to Ayeyarwaddy (18%)[46]. According to Table 4.1.1, l larger amounts of cauliflowers, tomatoes, radishes, watermelons, and jujubes are produced in Sagaing than in other Regions. In Chang-U, which is located in South Sagaing, cooperative activities with muskmelons are working successfully through a Winrock project funded by USAID. Many farmers cooperate to purchase agricultural inputs, to make a cultivation plan, and to sell their produce to China via Muse. The members can get discounts by cooperatively purchasing inputs. They can gain a higher income because they check the selling price of their produce on SNS, grade the agricultural produce at the farm gate, and sell them for longer periods as a group, which then avoids the risk of price fluctuation.

Mandalay is located in central Myanmar, and it plays an important role in domestic agri-product distribution. However, Mandalay has a high potential for the improvement of marketing agricultural produce through the PPP, not only for the domestic market, but also for export produce, including exports that travel via the overland route from Mandalay through the Muse to China border area, and the route from Mandalay International Airport to other countries by plane. In addition, the Pyin Oo Lwin district in the Mandalay Region is famous for sightseeing such as the Pait Chin Myanug Cave, Pwe Kauk Waterfall and the National Kandawgyi Botanical Garden. Also, there is a successful cooperative marketing society.

The climate of Shan highland is suitable to produce various horticulture produce. According to Table 4.1.1, larger amounts of potatoes, garlic, cabbages, mustard, beet and oranges are produced in Shan than other Regions. In the livestock sector, a larger amount of buffalo and pigs is produced in Shan than the other Regions (Table 5.1.2). So, there seems to be a potential for soil improvement through cooperative activities between horticulture and livestock sectors.

(2) Potential Horticulture Produce

Target crops will be determined through the Project activities such as understanding market demand.
According to the results of the Survey, various crops are already cultivated in the potential project sites: bananas, watermelons, dragonfruits, grapes, mangoes, muskmelons, oranges, pomelos, strawberries, yardlong beans, cabbages, carrots, cauliflowers, chilis, eggplants, garlic, ginger, okra, potatoes, tomatoes, onions and so on.

[46] Su Myat Yadanar, n.d. Myanmar Fruit, Flower and Vegetable Producer and Exporter Association, cited from Information on Myanmar Agriculture

7.3 Improvement of Food Safety through Training and Upgrading Traditional Markets in Yangon and in Mandalay

7.3.1 Background

People in Myanmar purchase daily food products at traditional markets, but the hygiene condition of traditional markets is not good in general. Pathogens such as Salmonella on meat and tools, such as cutting boards, propagate rapidly in ambient temperatures in the tropics, and could result in food poisoning. For example, one research indicated that the prevalence of Salmonella in chicken meat samples from the 141 traditional retail markets in Yangon was 97.9%[47].

Figure 7.3.1 Meat is Sold on the Wood Board on the Table Covered by Tile, Yangon

In some samples taken and tested in the Survey, the number of microorganisms was over the acceptable level. For instance, Staphylococcus aureus produces an enterotoxin that cannot be destroyed by heat - even when subjected to 100 degrees centigrade - and causes food poisoning. In the worst case example, a pork sample that had been sold at a stall in the traditional markets in Yangon contained Staphylococcus aureus at 29,000 times of the acceptable level.

The reason of the contamination is insufficient hygiene management practices in the process of handling from in slaughtering to in retailing. Slaughtering improvement has only just started. In Mandalay, a modern slaughtering system was introduced in 2018 for cattle and pigs. In the traditional slaughtering method, the carcass is handled on the concrete floor without sufficient water use to clean the area and meat is easily contaminated, but in the modern system the carcass is hung from the ceiling and does not touch to the floor. In Yangon, the YCDC is planning to introduce modern the slaughtering system but is currently facing financial difficulty, according to the Slaughtering Department, YCDC.

Figure 7.3.2 Meat is Sold on Banana Leaves on the Wooden Table, Mandalay

Prime meat cut at the slaughtering locations is transported to traditional markets, but the hygiene management practices in the traditional markets is poor. Meat is put on the table, sometimes directly. The table is covered by tiles in many cases, and some stalls put wood boards on top. Some stalls use banana leaves as a sheet, but tables and tools such as a cutting boards contain pathogens and even the banana leaves could be contaminated if the pathogens have not been removed. Unfortunately available tap water is very limited in the traditional markets and each stall cannot wash the table and tools using clean running water. Some stalls simply wipe the tables using cloths, although it is difficult to remove the pathogens without washing.

[47] Aung Zaw Moe et. al. 2017. Prevalence and Antimicrobial Resistance of Salmonella Isolates from Chicken Carcasses in Retail Markets in Yangon, Myanmar

As for vegetables and fruit, pathogens cannot propagate as quickly as they can in meat because the nutritional value in vegetables and fruit is much lower than that in meat. Even vegetables and fruit, however, can be contaminated if it is handled on the ground because soil is the major source of pathogens, and it easily comes into contact with the products. For instance, in the samples taken of vegetables and fruit tested in the Survey, tomatoes, mustard and mangoes tested positive for Coliform bacteria. Not only in traditional markets but also in some assembly markets, which is a kind of a collection point of vegetables and fruit near rural areas, products are handled on the ground and easily contaminated from the soil according to the observations of the Survey

There is an opinion that a cold chain system should be introduced into food supply chains in Myanmar. Although it is true that a cold chain system could significantly enhance hygiene levels, no stakeholders in the traditional food supply chain in Myanmar can afford to invest and maintain the very expensive cold chain systems, unfortunately. It is also unrealistic to expect a cold chain system can be operated effectively and consistently because of the unstable power supply in Myanmar. Moreover, there are many things to do to improve hygiene levels, even within the current supply chains under normal temperatures.

7.3.2 Objective

The project aims to improve the hygiene levels of traditional markets and assembly markets under normal temperature conditions in Yangon and in Mandalay through introducing stainless steel tables and increasing the number of water taps for washing tables and tools in the meat section where there is a high possibility of food poisoning occurring. Training about hygiene management will be conducted for the YCDC/MCDC staff and stakeholders who are working in meat, vegetable and fruit sections in traditional markets and assembly markets.

7.3.3 Scheme, Duration and Implementing Agency

Scheme: Combination of i) Project Grant, ii) Short-term Technical Advisor and 3) Country Training on Site

Duration: 2 years

Implementing Agency: The YCDC and MCDC

7.3.4 Activities

For instance, in Yangon City, there are 3,391 meat/fish stalls in total, according to Market Department, YCDC (Table 7.3.1). Because it is difficult to improve all the stalls due to limited resources, the Project needs to select at least some of them, and consider demonstrating the visible effects to the citizens as well as the feasibility of the upgrade intervention. The facilities belong to the YCDC/MCDC, but the attitude of stall owners should be considered also when the Project selects target traditional markets.

After selection of the target traditional markets, the Project offers not only physical upgrades such as stainless steel covers and the introduction and water pipe construction, but also training for YCDC/MCDC staff and stall owners/workers regarding hygiene management. Basic theory and practical daily methods will also be instructed.

Table 7.3.1 Number of Meat /Fish Stalls, Yangon City

District	Township	No	No. of Building	No. of Meat/Fish Stall	District	Township	No	No. of Building	No. of Meat/Fish Stall
Eastern	North Okkalapa	1	2	102	Southern	Thaketa	31	2	123
		2	1	13			32	1	59
		3	1	40			33	2	58
		4	1	48			34	1	38
	South Okkalapa	5	2	52			35	1	43
		6	3	109			36	1	69
		7	1	8			37	3	30
	North Dagon	8	1	24			38	1	42
		9	1	19		Sub Total		30	1193
		10	1	32	Northern	Kamaryut	39	1	84
	Thingangyun	11	1	68			40	2	62
		12	1	20		Mingalardon	41	1	24
		13	1	20			42	1	15
		14	1	30			43	1	73
	Sub Total		18	585			44	1	52
Western	Kyimyidaing	15	8	142		Shwepyithar	45	1	30
		16	2	47			46	1	22
		17	3	100		Hlaing	47	1	54
	San Chaung	18	1	67			48	1	44
		19	1	3			49	1	38
	Bahan	20	1	61			50	1	32
	Ahlone	21	1	100		Hlaingthaya	51	2	32
		22	1	60			52	1	40
	Sub Total		18	580			53	2	59
Southern	Tamwe	23	4	100		Insein	54	1	84
		24	7	146			55	1	48
		25	1	76			56	1	19
	Pazundaung	26	2	164			57	1	54
	Botataung	27	1	71			58	1	21
	Yankin	28	1	144			59	1	25
		29	1	10			60	1	40
		30	1	20			61	2	40
							62	1	41
						Sub Total		28	1033
					TOTAL			94	3391

Source: The YCDC

Detailed activities are as follows;

(1) Target selection

i) YCDC and MCDC discuss with the JICA advisor to set selection criteria for targeting traditional markets.

ii) YCDC and MCDC select 60-80 target traditional markets in total based on the selection criteria.

(2) Facility upgrade

i) YCDC and MCDC make detailed facility upgrade plans including introducing stainless steel covers for selling tables and water washing system.

ii) YCDC and MCDC select manufacturers to make stainless steel selling tables and water-service engineers for the construction of water washing systems including a tank with a pump, and a pipe network with the necessary number of taps.

iii) YCDC and MCDC implement facility upgrades.

(3) Training and monitoring

i) The JICA advisor trains YCDC, MCDC, retailers and dealers on daily practices of hygiene management.

ii) YCDC and MCDC monitor daily practices of retailers/dealers and evaluate them.

Table 7.3.2 Budget for Facility Upgrade in the Traditional Market

		Unit price	Number	Unit	Amount-kyat	Amount-JPY
For a market budget						
	Stainless steel cover	200,000	70	stall*	14,000,000	1,022,000
	Water system	20,000,000	1	set**	20,000,000	1,460,000
	Sub-total	-	-	-	34,000,000	2,482,000
For entire budget						
	Total A	34,000,000	60	market	2,040,000,000	148,920,000
	Total B	34,000,000	80	market	2,720,000,000	198,560,000

Note

* Average number of stalls in a market is assumed to be 40 meat stalls and 30 vegetable/fruit stalls

** The unit price of water system is for 40 meat stalls in 300 ft x 150 ft space

Source: JICA Survey Team

7.4 Introduction of a Livestock Breeding and Research Center in Mandalay

7.4.1 Background

Because cattle have been traditionally reared for draught power in the fields in Myanmar, strains of high quality beef cattle have not been developed. Recently the beef market is expanding rapidly primarily for exportation, but the present cattle breeds in Myanmar are not ones that produce high quality beef in a reliable manner.

The LBVD has several native cattle conservation farms where some "good" individual animals are crossbred and propagated. Through AI centers in Yangon and Mandalay, the frozen semen is delivered to small-scale cattle farmers by township veterinary officers. But the LBVD has not conducted animal breeding in order to establish the bloodlines with improved strains through selection and testing over many generations. From individual "good" animals, the stability of the expression of desired strains is low and accordingly the probability to get the expected strains becomes low.

The LBVD would like to promote the exportation higher quality beef cattle, but the LBVD does not have semen of animals of bloodlines with desired strains so far.

On the other hand, liquid nitrogen used for keeping semen frozen, is supplied by a plant in Yangon. To establish a frozen semen delivery system, a plant should be constructed near the Mandalay area to cover the upper Myanmar Region.

Figure 7.4.1 LBVD Native Cattle Conservation Farm, Pathein Gyi, Mandalay

7.4.2 Objective

The Project aims to initiate a National Livestock Breeding and Research Center in the Native Cattle Conservation Farm in Pathein Gyi township, Mandalay, primarily for developing strains of high quality beef cattle. Before establishing of the Center, the Project will train counterparts members in the LBVD on the theory and practice of animal improvement activities, as well as establish a frozen semen delivery system using imported semen as a short-term measure.

7.4.3 Scheme, Duration and Implementing Agency

Scheme: Technical Cooperation Project

Duration: Three years

Implementing Agency: The LBVD

7.4.4 Activities

Establishing all of the functions of the Livestock Breeding and Research Center takes time because animal improvement itself takes time. The Center needs personnel knowledgable in breeding techniques on selection and testing. Mastering breeding techniques takes time, even for

Figure 7.4.2 Native Cattle for Exportation Waiting for the Completion of the Administrative Procedures, Mandalay

practicing trainees. The Project is the first phase of the Center. In this first phase, training the LBVD staff is the main focus using existing facilities in the Native Cattle Conservation Farm in Mandalay as much as possible. At the same time, as a short-term measure, the Project will establish a semen delivery system using imported semen by constructing a liquid nitrogen plant.

Overall picture is shown in Table 7.4.1.

Table 7.4.1 Overall Picture of Livestock Breeding and Research Center

	Phase 1	Phase 2
Duration	3 years	3 - 5 years
Objective	Training a certain number of LBVD staff on animal improvement techniques, and establishing semen delivery system using imported semen	Starting full-scale breeding activities
Facility and equipment	• Using existing animals and animal housing • Using an existing building as a laboratory and introducing simple equipment • Constructing a liquid nitrogen plant	• Renovating animal housing • Introducing animals

In the Project, following activities will be conducted.

i) The Project begins to establish a frozen semen delivery system using imported semen of high quality strains of cattle.
ii) The Project constructs a liquid nitrogen plant.
iii) The Project introduces the necessary equipment to a laboratory in the Native Cattle Conservation Farm in Mandalay.
iv) The Japanese experts train their counterparts on theories and methods of animal breeding including selection and testing.
v) The Japanese experts train their counterparts in conducting crossbreeding and the selection of animal practices in the Native Cattle Conservation Farm.
vi) The Japanese experts train their counterparts on the analysis and evaluation of the data regarding the crossbreeding and the selection
vii) The Japanese experts train their counterpart on the planning of animal improvement.

7.5 Native Chicken Value Chain Development Project

7.5.1 Background

According to statistics by LBVD, 258 million chickens out of 294 million chickens in Myanmar are native chicken, which amounts to 87.8%; and they contribute to the livelihood of small-scale farmers nationwide. From the consumption side, chicken meat has the largest share, 55.7%, followed by pork, 29.2%, amongst all types of meat. In short, chickens can said to be the national meat in Myanmar.

The major production method of native chickens, however, is simple, i.e. free-ranging in the backyard with small amount of feed without a shed. This method has room for improvement because the productivity is low in this method. For instance, predators sometimes attack chicks if they are not confined at night, and supplemental feed is not sufficient from the viewpoint of animal nutrition. Veterinarians believe that the mortality rate of native chickens can be reduced if farmers provide native chickens with greater nutrition, housing environments and better consider animal health, according to interviews of veterinarians in the Survey

Figure 7.5.1 Scavenging Native Chickens in Latt Pya Par village, Mandalay

In suburban areas in Yangon and Mandalay Regions, there are some commercial native chicken farms with over 100 birds. Their production techniques are better than the aforementioned simple farming techniques in terms of nutrition and housing, but their marketing and distribution systems are still conventional. In general, as mentioned in the previous paragraph, consumers prefer "warm" meat because they believe warmness is proof of freshness, leading to shorter periods of time after slaughtering. However, this belief requires transporting chickens as live birds to retailing points in the middle of urban centers. This conventional live bird distribution system to retailing points has problems from the perspectives of animal disease control and meat hygiene. For instance, 80,000 live birds are traded per day in the largest chicken wholesale market in the middle of Yangon City, and the birds have a high probability to transmit pathogens to each other. Also the slaughtering environment in small-scale stalls in traditional markets is not hygienic. As a result harmful microorganisms such as Salmonella are propagated rapidly in tropical temperatures.

Figure 7.5.3 Native Chickens (right) and Broiler in the Traditional Market, Yangon

A couple of companies have attempted an alternative distribution model such as collectively slaughtering near farms in a hygienic way, and keeping the chickens fresh using ice during delivery to traditional markets, but few companies have adopted such measures. In addition, native chickens could have more value added if they are properly marketed and branded, because consumers in urban centers know that the quality of native chickens is higher than broiler chickens. So far feedback of the market is not passed on to native chicken producers for improving production performance, such as in size and in texture. Although this kind of communication between markets and producers is one of the most important areas in VC

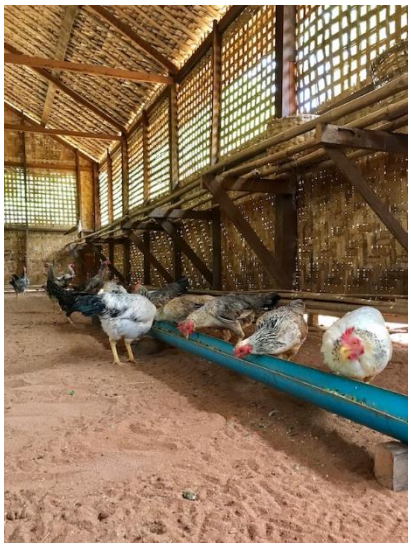


Figure 7.5.2 LBVD Native Chicken Conservation Farm in Nyaung Oo, Mandalay

development.

On the other hand the LBVD has Native Chicken Conservation Farms in Nyaung Oo in Mandalay and in Yangon. The activities are limited to developing some native breeds and delivering to farmers. Training for improving native chicken production has not been implemented, and the farms have not yet been functioning as the center for the promotion of native chickens in production and marketing.

7.5.2 Objective

The Project aims to achieve higher productivity of native chickens through cascading training and demonstrating how to increase the income of small-scale farmers. Supported by expanded supply through enhanced productivity, the Project will develop a value chain for native chicken breeding. Through establishing an alternative distribution model for minimizing the risk of pathogen transmission, safe meat will be provided with the use of hygienic slaughtering and transportation practices. The Project enhances branding of native chicken by improved characteristics.

7.5.3 Scheme, Duration and Implementing Agency

Scheme: Technical Cooperation Project

Duration: Three years

Implementing Agency:The LBVD

7.5.4 Activities

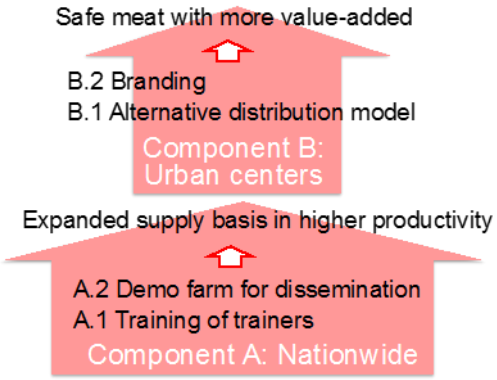


Figure 7.5.4 Two Components in the Project

There are two components to the Project. First, production improvement through a cascading training system from the LBVD staff to farmers is implemented in Component A. The Native Chicken Conservation Farms in Mandalay and Yangon are used as the training centers. The objective of the first component is to enhance the productivity of native chicken breeding, nationwide eventually, to allow small-scale farmers to increase their income.

Component B is native chicken value-chain development in urban centers. Existing commercialized native chicken farms in Yangon Region are targeted and the Project will connect the farms to abattoirs and retailers, establishing an alternative distribution model in which chickens are slaughtered, not at retailing points but at an abattoir near chicken farms for minimizing the risk of transmitting pathogens, which has been happening in current live bird trading. Collective slaughtering in an abattoir under hygienic conditions instead guarantees safe meat for consumers. In this component, the Project facilitates communication between market and farms on quality, including size and texture of the chickens. Moreover the Project promotes branding of the specially processed native chickens as a higher value-added product.

If Component A promotes the expansion of improved native chicken production techniques successfully, the result will be a strong supply basis for branded native chicken with a better distribution system, which is initiated by Component B.

Component A; Production

A.1. Training programs on improved native chicken production is planned and implemented at LBVD Native

Chicken Conservation Farms.

i) Three to four target States/Regions are selected considering the potential of production and marketing.
ii) The LBVD veterinarians and Community Animal Health Workers (CAHW) in the selected States/Regions are trained on improved native chicken production at the LBVD Native Chicken Farms.
iii) Trained veterinarian and CAHW train farmers in their areas.

A.2. Improved native chicken production techniques are demonstrated in the selected farms.

i) Demonstration farms are selected from the TSs of trained veterinarians and CAHW. Current production performance of the selected farm is surveyed.
ii) Materials of sheds and chicks are provided to start improved production. Performance is recorded.
iii) On-farm seminars inviting farmers in the area is conducted.

Component B; VC development

B.1. A pilot project to establish alternative distribution models of native chicken for better animal disease control and meat delivery in improved hygienic conditions is planned and implemented.

i) Approximately ten commercialized native chicken farmers with more than 200 birds in Yangon Region are selected.
ii) Market demand on the size, texture and quantity of high quality native chicken is surveyed in the supermarket and retail market.
iii) Linking chicken farms with a private abattoir that can slaughter and pack in hygienic manner, high quality native chicken with desired characteristics is produced, processed and delivered.

B.2. Branding activities for higher value-added of native chicken is planned and implemented.

i) The brand name of high quality native chicken is determined by the standard of the production system.
ii) The native chicken is promoted through labels and point-of-purchase displays as well as short video clips broadcasted in the media.
iii) Market surveys in neighboring countries such as Thailand are conducted and the feasibility of exportation of high quality Myanmar native chicken is studied.

Possible output and outcome indicators are shown in the table below.

Table 7.5.1 Expected Results of the Project

	Output			Outcome		
	Indicator	Project period (3 yrs)	Post project (2, 3 yrs)	Indicator	Project period (3 yrs)	Post project (2, 3 yrs)
Component A Production 1. Training of improved native chicken production 2. Demonstration of improved production system	Trained VO/CAHW	40 persons x 6 batches =240 persons	40 persons x 10 batches =400 persons	-	-	-
	Demo farm	40 trainees x 3 farms=120 farms	200 trainees x 3 farms=600 farms	-	-	-
	Audience of demo farm	10 farmers x 120 farms=1200 farmers	10 farmers x 600 farms=6000 farmers	Farmers adopted improved production	600 farmers	3,000 farmers
	-	-	-	Farm sales increased	(50-40) birds* x 6,000kyats	(50-40) birds* x 6,000kyats

	Output			Outcome		
	Indicator	Project period (3 yrs)	Post project (2, 3 yrs)	Indicator	Project period (3 yrs)	Post project (2, 3 yrs)
					x 600 farmers=36 million kyats	x 3,000 farmers=180 million kyats
Component B VC dev't 3. The pilot project on improved distribution system	Commercial farm	10 farms	50 farms	Farm sale increased	(4,500-4,000) kyats** x 500 birds x 10 farms=2.5 million kyats	(4,500-4,000) kyats** x 500 birds x 50 farms=12.5 million kyats
	Abattoir	1 abattoir	2 abattoirs	-	-	-
	Retailer	3 retailers	10 retailers	-	-	-
4. Promotion and branding of high quality native chicken	-	-	-	Consumer	500 birds x 10 farms =5,000 consumers	500 birds x 50 farms =25,000 consumers

*Productivity increase is assumed as the increase from 40 birds to 50 birds as annual shipment of native chickens per farm
**Value-added increase is assumed as the increase from 4000 kyats to 4500 kyats per bird as a unit farm gate price

7.6 Infrastructure Improvement Program for the Food Value Chain

7.6.1 Improvement of Rural Logistic Roads

The damage and loss of produce during the logistics of transportation is a bottleneck in the shipment process, in terms of preserving the integrity of agro-products such as freshness, flavor and taste. At traditional fresh markets, waste products are produced on a daily basis, and this is not unrelated to the problems of transportation.

The poor condition of rural roads has not only been restricting the speed at which vehicles can safely travel, but also has been causing damage and deterioration of the products during the process of transportation. Currently, farmers themselves deliver their produce to the market place, mostly using trolleys and motorbikes. Such inefficient logistical methods of transportation is one of the factors that increases transportation costs. Around 60% of rural roads under the control of the DRRD are earthen roads; sometimes it is difficult to travel on them during the rainy season, and thus, farmers have to use another route, taking extra time. In general, rural road conditions surrounding upland fields are worse than that of lowland fields, because they are mostly located in remote areas that are currently shaped by rice-centric policies.

Rural roads are one of the key components of infrastructure, and will be part of a fair, inclusive, and balanced road development plan to bring rural areas in line with urban areas. The DRRD recognizes this importance, and has set a goal that, “by 2030, 80 percent of villages in the Union or 90 percent of the rural population will be able to access regional roads all year around”. However, the allocated budget for the construction/improvement of rural roads is only 30 million USD/year, which is far less than planned total budget 7.5 billion USD.

Amongst the potential project sites of the Program, there is an ongoing agricultural development project in the Sagaing Region which covers rural road maintenance. Thus, the Region should be made a low priority. Southern Shan is a well-known horticultural production base. However, in spite of the large potential of the State to be developed, it might be difficult to formulate a Yen loan project for road improvement of the appropriate scale. This is because the rural roads are widespread. In conclusion, the first priority shall be given to West Bago Region, Magway Region, and Mandalay Region for this infrastructure improvement Program.

Scheme: Yen-Loan

Implementing Agency: The DRRD

Activities:

1) The Project selects priorities rural road selection based on importance of the development of horticulture/livestock distribution.
2) The Project improves the selected rural roads by lane widening and upgrading pavement.

Project Cost: 11.0 Million USD

7.6.2 Introduction of Collection Centers

The vegetable supply chain in Myanmar is characterized by its length. A lot of stakeholders are involved in the process of distribution from the production site to consumer's hand. It could be attributed to the unfair distribution of profit, especially to farmers.

Regarding organizing a farmer's group, establishing technical assistance and expanding its activities to collective marketing are some of the possible solutions to enhance farmers' bargaining power. A collection center could play an important role in ensuring the successfulness of the group activity, as shown in the example of the Kitchkood cooperative in Thailand. Since many private food companies in Myanmar are becoming interested in direct procurement of material from producers, construction of a collection center through PPP seems to be a good idea. While, construction through project grants is also worth considering if the producers are well-motivated but it is difficult to find and secure funding sources. A detailed plan has to be formulated in the stage of a feasibility study after selection of potential project sites and target crops.

The design of a collection center will be in line with the quality and safety standards required from markets. For example the vegetables produced in West Bago are transported mainly to Yangon, the largest city in Myanmar, and some produce will then be exported to neighboring counties like Singapore. In order to boost exports, the facilities generally equipped in a collection center (e.g. parking lots, loading and unloading spaces, temporary storage places, and building with equipment for washing, sorting, and packaging) might also require specific equipment, for example, a cold storage system to create a consistent cold supply chain. The Project cost could be various depending on its specification. .

Scheme: Project Grants (or PPP)

Implementing Agency: The DOA in target Region

Activities:

(1) The Project selects land in the potential site for the collection center
(2) The project constructs collection centers to be utilized by farmers' groups.
(3) The project formulates a operation and management plan of the collection centers.

7.7 Tentative Plan of Operation

In the next figure, a tentative plan of the projects' operation is demonstrated. Firstly, Project 1 "Project for Strengthening a Safe Horticulture Value Chain" will be conducted in one of potential project sites for four years. Then, the second phase of Project 1 will be started in another two potential project sites for six years. Any medicinal plants can be included as the target crops, and the project assistance will be improved based on the learnings fom the first phase of the project. Meanwhile, Project 2 to Project 5, which are related to livestock and infrastructure, will be also conducted and the whole objective "Safe Food Value Chain" can be acheived.

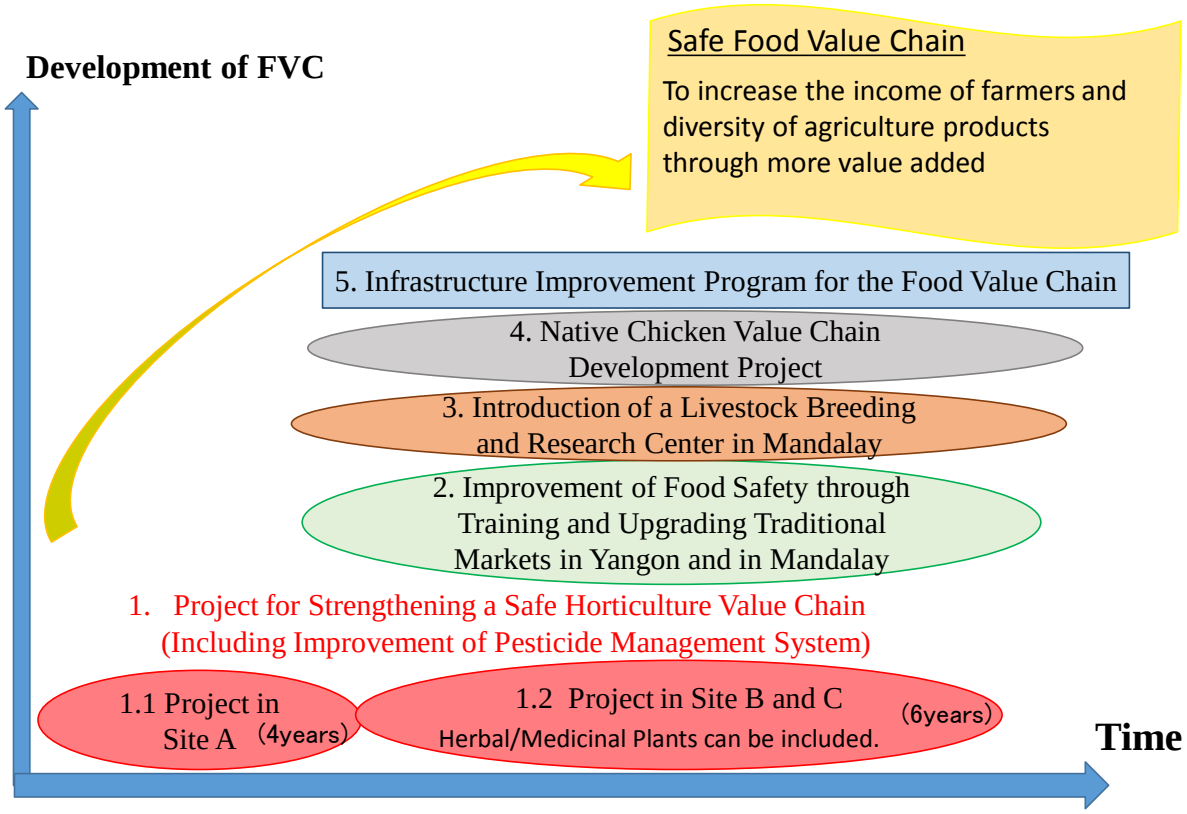


Figure 7.7.1 Tentative Plan of Operation

Source: JICA Survey Team

7.8 Other Potential Projects

Other than the potential projects proposed in the previous sections, several topics and potential projects were discussed with the FVC taskforce team during the Survey. As the topics/issues will be difficult to work out anytime soon, they can be listed as other potential projects in the long term.

Table 7.8.1 List of Other Potential Projects

No.	Other Potential Project
1	Improvement of Slaughterhouses and System
2	Improvement of Animal Feed
3	Improvement of Small Ruminants Value Chain
4	Crop-Livestock Integrated Agriculture Promotion
5	Promotion of PPP

*The order of listed projects does not refer their priority.

Firstly, the improvement of slaughterhouses and slaughtering system can be suggested. According to the Survey, the YCDC and MCDC already have their own plans to modernize the slaughterhouses in each city within their own budget. However, it will be necessary to redevelop these facilities in other cities within Myanmar as well. In addition, the improvement of buildings/slaughterhouses, but also the improvement of the slaughtering system including licensing might be necessary to address in the long term.

Secondly, it will be beneficial if any approaches to resolve the issues of feed in livestock are advanced. The expansion of potential agricultural land for animal feed can be suggested. Furthermore, the utilization of cakes made from oilseed crops including groundnuts, can be proposed. Although the impact of the promotion of oilseed-cake used for feed is limited, oilseed-cakes made by new-type oil presses is already used in Myanmar as feed. As it is identified through the survey that oilseed-cakes made by old-type oil presses are not suitable as feed, the introduction of such knowledge, skills and facilities might be considered.

Thirdly, it is stated by the LBVD that the support for improvement of VC/production of small ruminants, such as sheep and goats, is required. According to their statement, small ruminants also have high potential to grow. It is expected that both living small ruminants and processed ones, including frozen and dried meat, will be exported more in the future. Small ruminants are currently processed in Magway, Mandalay and Yangon, and these locations can be the areas targeted to improve production, processing and marketing.

Fourthly, it is an integrated project between horticulture and livestock sectors; "Crop-Livestock Integrated Agriculture Promotion". One of the activities, the introduction of a compost center, is already mentioned as one of the components of the proposed potential project. However, in the future, an upgraded integrated project might be considered. Through the proposed project, once the partnership between the DOA and LBVD as well as horticulture farmers and livestock farmers is established in an area, a wider range of activities may be conducted through their integrated work.

Lastly, it is also incredibly important to promote PPP. As mentioned in the previous sections, several issues may be resolved well through PPP. Therefore, it will be imperative to promote such opportunities to private companies.

7.9 The FVC Taskforce Team

Regarding the cooperation of the MOALI and MAFF to implement the processes of Road Map for the effective establishment of the FVC in Myanmar, the MOALI has organized the following FVC Taskforce Team.

Table 7.9.1 FVC Taskforce Team

No.	Name	Position	Responsibility
1	Kyaw Min Oo (Mr.)	Director General Department of Planning	Chairman
2	Khin Mar Oo (Ms.)	Director Department of Planning	Member
3	San San Yee (Dr.)	Deputy Director Department of Agriculture	Member
4	Aung Moe Myo Tint (Dr.)	Deputy Director Department of Agricultural Research	Member
5	Khin Mar Lay (Dr.)	Deputy Director Minister's Office	Member
6	Yu Yu Htun (Dr.)	Assistant Professor Yezin Agricultural University	Member
7	Zaw Loon Aung (Dr.)	Deputy Director Livestock, Breeding and Veterinary Department	Member

No.	Name	Position	Responsibility
8	Nyan Win Maung (Mr.)	Deputy Director Cooperative Department	Member
9	Tin Tin Aung (Dr.)	Assistant Director Department of Planning	Member
10	Khin Thandar Win(Ms.)	Assistant Director Department of Planning	Member
11	Soe Htun Aung (Mr.)	Assistant Director Irrigation and Water Utilization Management Department	Member
12	Khin San Nwe (Ms.)	Assistant Director Irrigation and Water Utilization Management Department	Member
13	Nyi Nyi Latt (Mr.)	Assistant Director Department of Agricultural Land Management and Statistics	Member
14	Tin Ohnmar Win (Dr.)	Senior Researcher Department of Agricultural Research	Member
15	Khin Thandar Oo (Dr.)	Staff Officer Department of Agriculture	Member
16	Khin Maung Latt (Dr.)	Lecturer University of Veterinary Science	Member
17	May Myat Mon (Ms.)	Staff Officer Agricultural Mechanization Department	Member
18	Khaine Htun (Mr.)	Deputy Programme officer Department of Planning	Member
19	Wah Wah Kyaw (Ms.)	Deputy Programme Officer Department of Planning	Member
20	Aung Phyo Htike (Mr.)	Deputy Assistant Programme Officer Department of Planning	Member
21	Kyaw Swe Lin (Mr.)	Deputy Director General Department of Planning	Secretary

CHAPTER 8 ENVIRONMENTAL AND SOCIAL CONSIDERATION

8.1 Legal and Institutional Framework for Environmental and Social Consideration in Myanmar

The Ministry of Natural Resources and Environmental Conservation (MONREC) is responsible for forestry, logging, the implementation of national environmental policies, strategies, framework, and action plans, amongst other things. Under the MONREC, the Environmental Conservation Department (ECD) is responsible for environmental conservation in Myanmar, and it employs 400 official personnel. Furthermore, there are four Divisions in this department; and one of them, the Environmental Impact Assessment Division, is in charge of Environmental Impact Assessment (EIA) in Myanmar, and it employs around 20 official personnel.

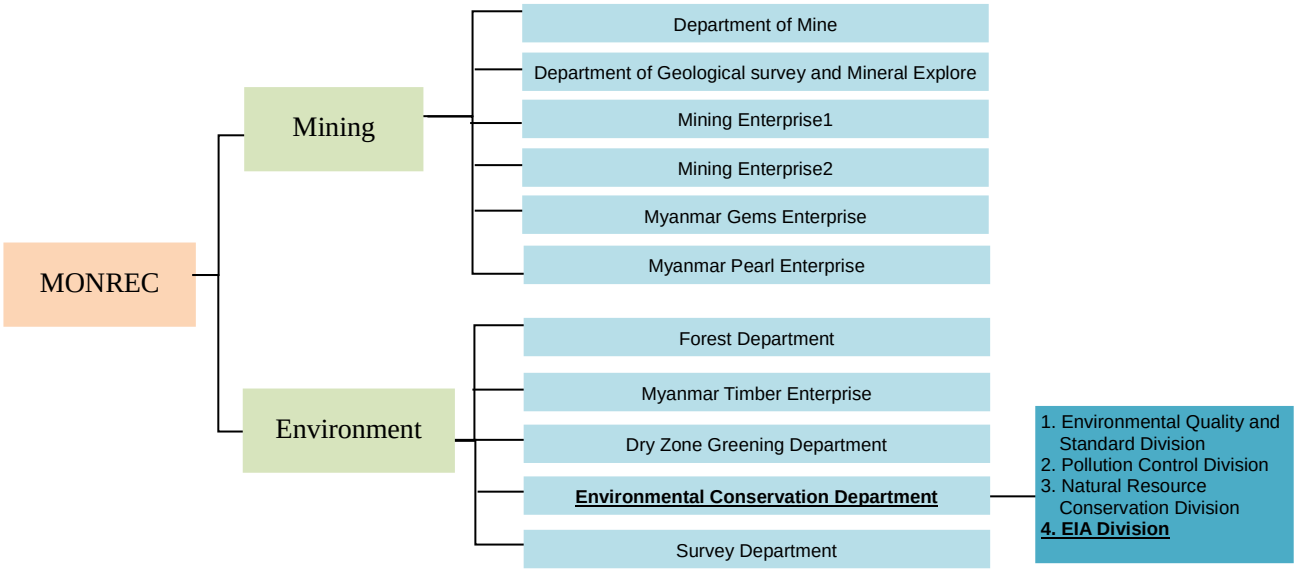


Figure 8.1.1 Organization Structure of MONREC

Source: Hearing from Environmental Conservation Department staff、2018

The "Environmental Impact Assessment Procedure" (hereinafter referred to as "EIA Procedure"), which states the processes and procedures of the EIA and the Initial Environmental Examination (IEE) and the responsibilities of stakeholders, amongst other things, was established in 2015. Any proposed projects are classified into three categories, namely: i) projects requiring EIA; ii) projects requiring IEE; and iii) projects which do not require EIA/IEE. The necessity of employing EIA/IEE depends on the project's components, scale and extent of the anticipated environmental impacts. Stipulated procedures of EIA and IEE are as follows:

8.1.1 EIA Procedures

In the case of projects requiring EIA, it is necessary to follow the procedures as outlined below:

i) The project proponents must appoint a registered third party/organization to prepare an EIA report, and then inform the ECD of this person/organization.
ii) The ECD confirms (in accordance with the MONREC's approval) whether such experts are in good standing with the ECD, within seven working days after receiving the information.
iii) The project proponents will be responsible for scoping, preparation of Terms of Reference (TOR) for the EIA report and reporting of the scoping results, then, the proponents will submit the completed

scoping report and TOR to the ECD.

iv) The ECD approves the scoping report and TOR, and if necessary, the ECD will instruct the project proponents to revise the scoping report and TOR within 15 working days after receipt of the scoping report and TOR.

v) The project proponents will conduct a thorough investigation of the EIA, address all adverse impacts and will ensure the investigation is undertaken in accordance with the TOR as approved by the ECD.

vi) The Project Proponents will disclose the EIA Report not later than 15 days after submission.

vii) Upon receipt of the EIA report from the project proponents, the ECD then submits the EIA report to the EIA Report Review Body for comments and recommendations. Then, the ECD discloses the EIA Report and requests comments from the related governments, project affected persons (PAPs), civil societies and other stakeholders.

viii) The MONREC will deliver its final decision within 90 working days of the receipt of the EIA report.

ix) Upon completion of its review of the EIA report, the MONREC will i) approve the EIA report and issue an Environmental Compliance Certificate (ECC); or ii) reject the EIA report and specify the reasons for such a decision.

8.1.2 IEE Procedures

In the case of projects which require IEE, the necessary procedures are as shown below:

i) The project proponents may carry out IEE and reporting by themselves, or may appoint a registered third party or organization. In the case of that the appointment of another person/organization is chosen, the proponents shall inform the ECD of the appointed person(s).

ii) The ECD confirms (in accordance with the MONREC approval) whether such experts are in good standing with the ECD, within 7 working days after the appointment of the expert.

iii) The project proponents will undertake a public consultation process in regard to the type of IEE project (disclosure of relevant information about the proposed project, and the arrangement of necessary follow-up consultation meetings).

iv) The project proponent will submit the IEE Report of the project to the ECD.

v) Not later than 15 days after submission of the IEE Report to the ECD, the project proponents will disclose the IEE Report.

vi) The ECD shall disclose the IEE Report to the public on the MONREC and/or department website and invite comments and suggestions on the IEE Report from all relevant parties.

vii) The project proponents collect and review all the comments and recommendations, then forward them to the MONREC to enable it to make a final decision on the approval of the IEE Report.

viii) The MONREC shall approve the IEE Report, subject to any conditions it may prescribe, and issue an ECC; or require that the Project carry out an EIA.

ix) The ECD shall deliver the final decision of the MONREC within 60 working days of the receipt of the IEE Report. If the MONREC requires the IEE Report to be amended, then the due date for delivery of the MONREC's decision shall be extended accordingly.

8.2 Legal Framework for Involuntary Resettlement and Land Acquisition

There are no laws and regulations concerning involuntary resettlement in Myanmar. However, there are about

70 laws concerning land use at this moment, including laws established before independence; and about half of them are still in effect. However, the actual operation status of laws/regulations is not clearly identified, and these laws/regulations are applied depending on present land use or the situation of each project.

The Farmland Law enacted in 2012 provides private use rights relating to farmland, which includes the right to sell, exchange, inherit and so on. The Law also states that if there is an inappropriate farmland transfer or farmland use for non-agricultural purposes are identified, such land transfer/land use becomes invalid and the owners are fined. Moreover, the Land Acquisition Act (1894) is still in effect and governs the legality of land acquisition. The Act permits the government to acquire land for public purposes, and states the necessity for appropriate compensation for the land acquired by the government. Details of the procedure are described in the Land Acquisition Directions, which is a part of the Land Acquisition Act. For example, Chapter 11 of the "Land Acquisition Directions" states the following:

> A notification under section 4 will be issued in every case in which land acquisition is proposed under the Act, whether the acquisition is for a public purpose or for a company. Application for the issue of notification should be made as soon as possible after it has been decided by a competent authority (vide Direction, 3) that land is needed or likely to be needed in a definite locality, though the actual land proposed for acquisition has not been determined. If the application is delayed, compensation is to be awarded under section 23, and depends on the market value at the date of publication of the notification under section 4, which is liable to be inflated by speculative transactions.

8.3 Project Components Requiring Environmental and Social Consideration

As described in Chapter 7, five programs/projects are proposed, and of them three programs/projects require environmental and social consideration given that they are structural measures. Within the three programs/projects, four components are proposed. They are the "Construction of compost centers", "Improvement of logistically-important roads", "Construction of collection centers", and "Construction of liquid nitrogen plants", as described in in Table 8.3.1. This involves the construction or improvement of existing infrastructure, and to some extent that process could have a negative effect on the surrounding environment, and this needs to be avoided through careful preparation and management at all stages of the development.

Table 8.3.1 Project Components Requiring Environmental and Social Consideration

No	Program/Project	Component
1	Project for Strengthening a Safe Horticulture Value Chain	Construction of a compost center
2	Infrastructure Improvement Program for Food Value Chain	Improvement of logistics roads
		Construction of collection center
3	Introduction of a Livestock Breeding and Research Center	Construction of a liquid nitrogen plant

Source: JICA Survey Team

It is planned to construct the compost center within a livestock complex area in Shane State, which is owned by the State. The compost center will produce compost by using livestock excrement and crop residues. A massive amount of livestock excrement and crop residue is provided from the livestock complex area. Originally, there were few houses around the complex area, however, the number of residents is increasing, which causes severe conflicts. In fact, there are many complaints about odor of chicken droppings and buzzing flies, thus, disposal of the excreta is an urgent matter. . If the excrement and crop residue can be recycled as manure, it would be useful for the livestock and agriculture sectors, as well as having the effect of reducing the smell of animal feces; and therefore it can be recommended that a compost center is

constructed. It is important to examine the proper compost making methods to minimize odor in the process of compost fermentation, e.g. by means of aeration and moisture control.

Concerning the "Improvement of logistically-important roads", the development of branch/rural roads is planned. The new highway between Mandalay and Yangon is well-maintained; and the old highway is also upgraded by private companies. However, it seems that there are insufficient development plans for branch/rural roads between production areas and markets. Therefore, their development has been proposed, however a detailed development plan including the route, extension and structure of the improvements is still under discussion, and is to be decided in the next stage. Moreover, if asphalt is used to surface the roads that are narrower than 20 feet, the road will be expanded by one foot on each side, according to the DRD[48] design standards. In such a case, land acquisition would be necessary.

In the case of "upgrading roads (upgrading surfaces or widening of shoulders) ", it is stated in the "EIA Procedure" that improvement projects targeting roads more than 50km long need to incorporate IEE, while all activities regarding road improvement require an EIA as far as the MONREC deems necessary. However, the necessity of IEE/EIA for the proposed road improvements cannot be determined at this moment..

The proposed collection center is planned to be introduced in the Bago area. At the collection center, a certain amount of vegetables will be gathered and sorted according to appropriate standards. As the products can be shipped according to the market needs, not only domestic markets but also international markets can be targeted. Currently, the vegetables produced in West Bago are transported to various markets, especially to big cities such as Yangon, but no collection center has been established so far. The proposed location, scale and so on of the center have yet to be fixed, and will be discussed in the next stage.

The liquid nitrogen plant is planned to be introduced in Mandalay. The new plant will provide two AI centers in Yangon and Mandalay with liquid nitrogen, which enables TS level veterinarians to conduct AI of cows in each TS. The proposed scale of the plant has yet to be fixed, and will be discussed in the next stage.

There is no mention in the EIA Procedure, whether EIA/IEE is necessary for the proposed components except the road improvement, namely, "Construction of a compost center", "Construction of a collection center" and "Construction of a liquid nitrogen plant". Therefore, it is needed to confirm the necessity of EIA/IEE with the Division of Policy, International Relations, which is under ECD after the examination of locations and scale of the proposed facilities.

8.4 Protected Area and Priority Areas of Proposed Projects

The Survey would cover the whole area of Myanmar, however, there are specified priority areas for the FVC development. They are Shan State, Mandalay Region, Yangon Region, Magway Region, Sagaing Region, Bago Region, and Ayeyarwady Region. According to the Protection of Wildlife and Conservation of Natural Area Law (1994), a total of 43 areas have been registered as the protected areas in Myanmar. Out of the 43 protected areas, the areas in the priority zones are shown in Figure 8.4.1 and Table 8.4.1. Principally, the proposed components of the projects will not be established in or around the protected areas,

[48] It is under the Ministry of Construction.

which therefore would result in little to no environmental impact in those areas

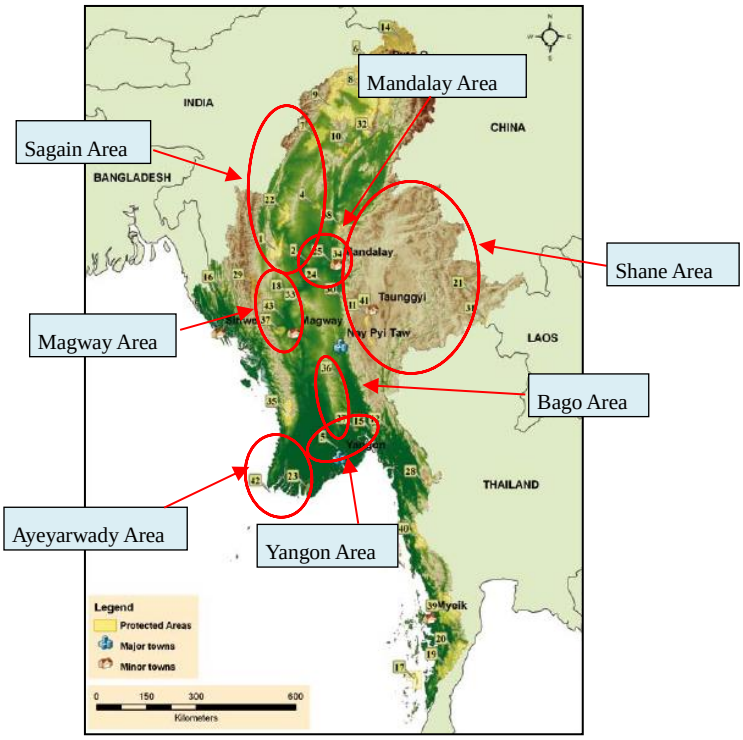


Figure 8.4.1 Protected Areas in Myanmar and Seven Priority Areas of Proposed Projects

Source:" Myanmar Protected Areas, Context, Current Status and Challenges"
(Istituto Olikos and Biodiversity and Nature Conservation Association, 2010)

Table 8.4.1 Protected Area in Each Priority Area

No	Priority Area	Protected Area
1	Shan State	Inlay Lake (No.21), Lomiwe Protected Area (No.21), Panlaung-Pyadalin Cave wildlife Sanctuary (No.30), Panlaung-Pyadalin Cave Wildlife Sanctuary (No.31), Taunggyi Bird Sanctuary (No.41)
2	Mandalay Region	Minsontaung Wildlife Sanctuary (No.24), Minwuntaung wildlife Sanctuary (No 25), Pyin-O-Lwin Bird Sanctuary (No.34)
3	Yangon Region	Hlawga Wildlife Park (No.5), Kyaikhtiyoe Wildlife Sanctuary (No.15)
4	Magway Region	Kelatha Wildlife Sanctuary (No.13), Popa Mountain Park (No.33), Shwesettaw Wildlife Sanctuary (No.37) , Wenthtikan Bird Sanctuary (No.43)
5	Sagaing Region	Alaungdaw Kathapa National Park (No 1), Bawditataung Nature Reserve (No 2), Chatthin Wildlife Sanctuary (No 4), Htamanthi Wildlife Sanctuary (No 7), Maharmyaing Wildlife Sanctuary (No 22)
6	Bago Region	Moyingyi Wetland Bird Sanctuary (No.27), Shinpinkyetthauk Wildlife Sanctuary (No.36)
7	Ayeyarwady Region	Mainmahla Kyun Wildlife Sanctuary (No.23), Thamihla Kyun Wildlife Sanctuary (No.42)

8.5 Environmental Categories of the Proposed Components

The necessity of EIA/IEE and category classification[49] based on the JICA Guidelines for Environmental and Social Consideration (hereinafter referred to as "the JICA Guidelines") for each proposed component is examined based on the collected information.

"Construction of compost center" would generate bad odors in compost production, thus, proper production methods such as moisture control need to be applied. However, compost centers are not recognized for their severe impact on the natural environment. In addition, land acquisition is not required because the centers will be constructed on government/State-owned land. Considering those factors, the component requires IEE, and it would probably be classified into Category B according to the JICA Guidelines.

Concerning the "Improvement of logistically-important roads", the necessity of IEE or EIA cannot be determined at this moment, since the roads to be targeted for extension are yet to be finalized. Moreover, there is a possibility of land acquisition when considering roads surfaced with asphalt that are narrower than 20 feet. As the scale of land acquisition will not be large, it will be classified into Category B.

Regarding the "Construction of collection centers", some negative impacts such as noise/vibration caused by the construction works are expected. In addition, noise/vibration will be generated in the operational stage also due to the increase of transportation during construction, however this depends on the scale and location of the collection centers. On the other hand, the proposed construction sites are located on public land, which results in no land acquisition. Considering such a situation, this component can be classified into Category B based on the JICA Guidelines and following "EIA Procedure", and it will probably be necessary to prepare an IEE.

As for the "Construction of liquid nitrogen plants", this would cause noise and vibration issues through the operation of compressors. These factors have to be determined carefully in planning stage since the extent of these impacts depends on the location and scale of the plant. Some advanced compressors are designed to reduce their noise output during operation, and the introduction of such equipment is recommended where necessary. However, in general, any significant negative impacts by this component of the project are not expected. Moreover, no land acquisition is necessary since it will be constructed on public land. Considering the situation, the component can be classified into Category B following the JICA Guidelines, while in Myanmar it will most likely require IEE preparation.

The expected environmental and social impacts caused by the proposed components are summarized as shown below:

[49] Any projects are classified into Category A, B and C according to the JICA Guideline in terms of magnitude of impacts. Category A projects could cause significant environmental impacts, while Category B projects would cause environmental impacts to some extent. Category C projects are stipulated as those will not cause environmental impacts or contribute to environmental conservation.

Table 8.5.1 Expected Environmental Category of Each Component

No	Proposed Components	Necessity of IEE/EIA	Category Classification	Expected Impacts in Construction Period	Expected Impacts in Operation Period
1	Construction of compost center	IEE	B	・Land acquisition: Since the center is to be constructed in government/State - owned land, land acquisition is not required. ・Noise and Vibration: Transport of material by heavy machinery and trucks takes place near the construction site. However, serious noise/vibration will not be generated from the works.	・Odor: At this moment, odor is a serious issue in the area of complex, so the odor will be managed with the construction of the compost center. However, the proper compost making procedure is to be applied for this to be successful.
2	Improvement of logistic roads	Either IEE or EIA	B	・Land Acquisition: In the instance of asphalting rural roads which are narrower than 20 feet, the roads have to be expanded, which results in the need for land acquisition. Compensation for the land loss shall be provided. ・Existing Social infrastructure and Service: Traffic jams can be caused by the increase of the passage of vehicles on the roads around the construction sites.	Once available for use, no impacts are expected since the target roads already exist.
3	Construction of collection centers	IEE	B	・ Land acquisition: Since it is planned to be constructed on government/State - owned land, land acquisition is not required*1. ・ Noise and Vibration: Transport of material by heavy machinery and trucks takes place near the construction site. However, serious noise/vibrations will not be generated from the works.	・Noise and Vibration: Transport of agricultural products by trucks takes place near the construction site. So consideration is required for the selection of suitable places for noise countermeasures.
4	Construction of liquid nitrogen plant	IEE	B	・Land acquisition : Since it is planned to be constructed on government/State - owned land, land acquisition is not required ・ Noise and Vibration: Transport of material by heavy machinery and trucks takes place towards the construction site. However serious noise/vibrations will not be generated from the works.	・Noise and Vibration: There is a possibility that the noise may be generated from the compressor used in the production of liquid nitrogen. Therefore, soundproofing equipment is needed.

Source: JICA Survey Team

Table 8.5.2 Expected Environmental and Social Impacts by Each Component

No	Components	Land Acquisition	Resettlement	Expected Impacts in Construction	Expected Impacts in Operation
1	Construction of Compost Center	Not expected	Not expected	Noise and vibration	Odor
2	Improvement of Logistics Roads	Probable	Probable	Noise and vibration	Not expected
3	Construction of Collection Center	Not expected	Not expected	Noise and vibration	Noise and vibration
4	Comstruction of Liquid nitrogen plant	Not expected	Not expected	Noise and vibration	Noise and vibration

Source: JICA Survey Team

CHAPTER 9 CONCLUSION AND RECOMMENDATIONS

As a result of the Survey, five high-priority projects could be selected, any of which would lead to the improvement of the FVC which would in turn would improve the income of smallholdings. It is desirable to conduct these projects while considering the direction and countermeasures of the FVC improvement examined by the Survey.

9.1 Proposed Potential Projects and Their Outlines

Project 1 **Project for Strengthening a Safe Horticulture Value Chain:** Cultivating highly desirable crops with consideration for safety and hygiene; and improving the added value of horticulture crops through proper marketing.

Project 2 **Improvement of Food Safety Through Training and Upgrading Traditional Markets in Yangon and in Mandalay:** Increasing the safety of food distribution through improving hygienic conditions of agricultural and livestock products which are sent to and sold at traditional markets.

Project 3 **Introduction of a Livestock Breeding and Research Center in Mandalay:** Adapting to the changing use of cattle bred for their beef rather than the tradition of draft-bred cattle; to this end research and development and the productive management of of high-quality breeding cattle will be conducted.

Project 4 **Native Chicken Value Chain Development Project:** Improving the productivity of native chickens which are more popular than broiler chickens; and increasing the added value of native chickens through marketing practices including brand development.

Project 5 **Infrastructure Improvement Program for the Food Value Chain:** Developing rural roads and introducing/maintaining collecting and loading platforms, and keeping the freshness of agricultural and livestock products leads to the improvement the FVC. This is because there would be a reduction of the damage during handling and transportation, and it would also shorten transportation time.

9.2 Direction of FVC Improvement

In order to improve the FVC, it is important to focus work on increasing the income of farmers, supplying safe and hygienic agricultural products; ensuring a competitive domestic market that can compete with imported produce, and to broaden and strengthen the economies of rural areas. Based on these points, it is necessary to improve and update the legal system to meet the requirements of a changing, modernizing market. Coordination of this multidimensional system needs to move beyond the organizational level through the relevant associations; and promote the projects in a structured and comprehensive way from production to consumption.

In the future, when the consumers become more economically active and their eating habits have broadened, they will demand a higher standard of food quality. These standards will include the guarantee of greater freshness, lower costs and greater produce diversity. Producers will deliver various agricultural products in an organized way, and fruit, vegetables and processed goods will be handled with freshness and quality being paramount so that they can be shipped and sold to cities in the best possible condition. Draft cattle used for tilling or carrying will replaced by tractors (mechanizing the process), and cattle will be processed in rural areas mainly for their beef which will be supplied to cities.

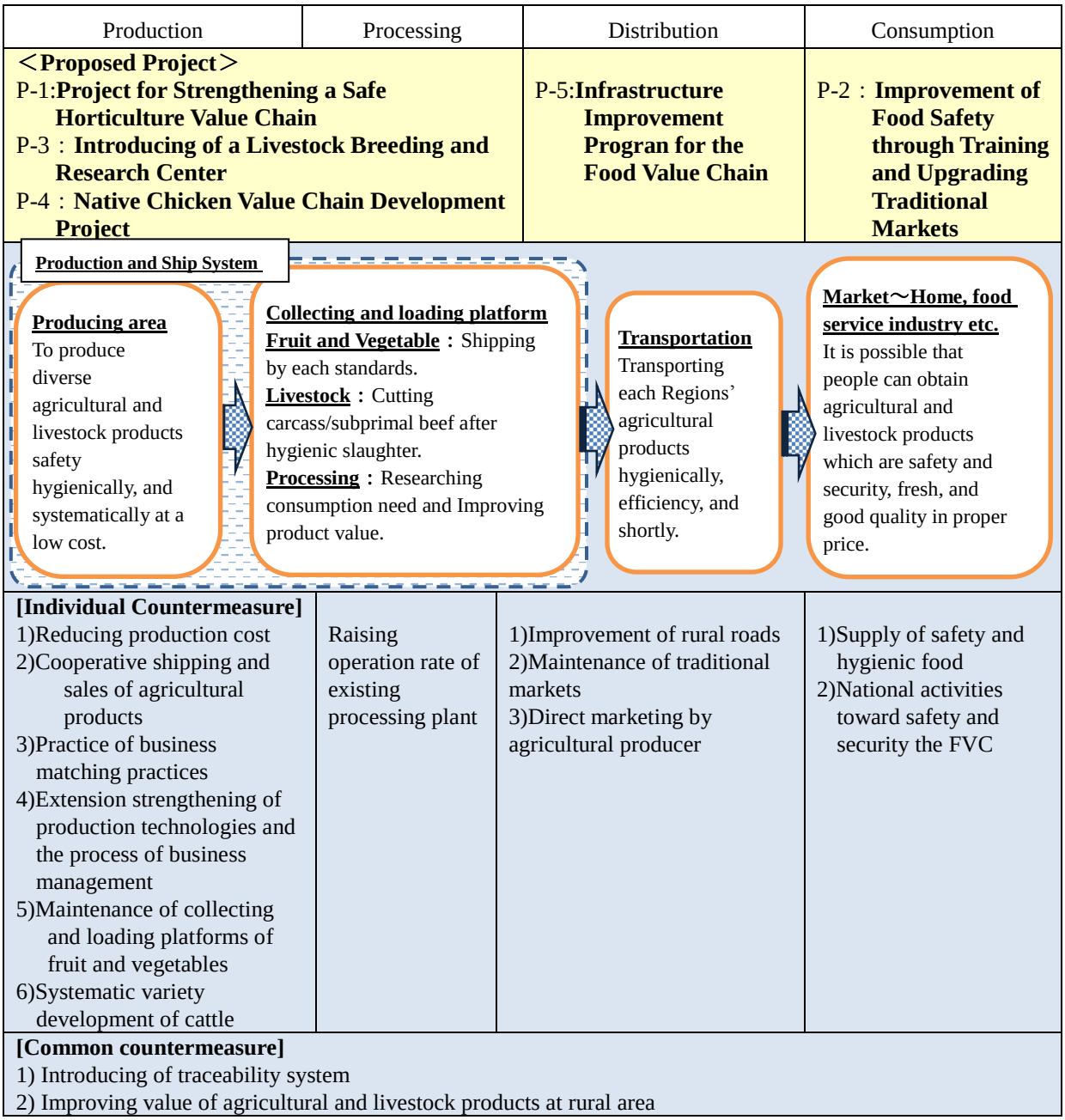


Figure 9.2.1 Improvement Direction and Countermeasures of the VC of Agricultural and Livestock Products

9.3 Countermeasure for the FVC improvement

9.3.1 Improvement of the production stage

(1) Reducing production costs

Reducing production material costs by cooperative buying - The fact is that small-scale farmers purchase fertilizer, forage, and agricultural chemical at the seller's asking price when they want to buy them individually, and this is often expensive and they have no means of negotiation or choice in this process. Since reducing production costs is essential to increase the smallholder's agricultural income, cooperative buying of agricultural materials by the farmers' groups means that they purchase at the proper price and can avoid excessive spending.

Multiple management of horticultural crops and livestock - It is necessary to reduce the production costs of livestock through the multi-aspect management of horticulture crops and livestock. In the case of livestock, since its management is often difficult because of the incorporated increased costs of the forage price, the countermeasure employed to keep forage costs down through farmers producing corn or forage themselves to feed their livestock is considered.

(2) Cooperative shipping and sales of agricultural products

Selling at the proper price - In most cases, smallholders are forced to sell their agricultural products at a cheap asking price as set by buyers, when they want to sell them individually. Therefore, if the selling quantity at any given time is increased by cooperative marketing through a farmers' group and they have price-bargaining power, it will be possible to sell their products at an appropriate price.

Systematic farming - To realize cooperative shipment through farmers' groups, it is essential that careful preparation of crop variety, harvest period, and quality within the groups is fixed and consistent. Regarding land use, farming management and postharvest treatment, it is necessary for the group members to have rigorous discussions and consensus on these practices.

Cooperative selection of agricultural products - Regarding shipment, it is necessary that the farmers' groups select agricultural products based on their quality and standard and according to market demand. The merits of cooperative shipments is that the groups can ship their agricultural products, which are of the same quality and standard, in regular quantities during a fixed period through the cooperative selection of their harvest. This results in a levelling of price fluctuation, and branding for production sites.

(3) Practice of business matching

For individual farmers, it is uncommon that they have a chance to bargain over what they can buy, what kind of improvements are needed, the selling price, or when they develop new processed products to be introduced in the future. For future extensive farming, it is essential to practice business-matching connecting brokers, food producers and consumers so that they can consult and improve the FVC and market. It is important that farmers' groups plan their proposals with government support, hold business-matching sessions regularly in each region to introduce new crops and livestock, and discuss and formulate product development plans for new processed products.

(4) Strengthening the expansion of production technologies and the process of business management

Technique for proper fertilizer application - In the Survey, it was clarified that more agricultural chemicals than necessary are used in the cultivation of horticulture crops, and also low quality and dangerous chemicals are used. Therefore, it is necessary to expand techniques for proper fertilizer application, and evaluate practices and outcomes through technical guidance in order to reduce the amount of agricultural chemicals applied by horticultural farmers by using the appropriate agricultural chemicals adapted to pest treatment and by strictly adhering to the proper dosage time-application. In order to promote this, it is imperative to establish an effective supply system of agricultural chemicals that includes a method of use and an indication of quality. The PPD is expected to be the main focus of the establishment of the system of agricultural chemical registration, and it is necessary to strengthen the analytical ability of the PPD in the immediate future. Project 1 (Project for

Strengthening a Safe Horticulture Value Chain) is the combination of the promotion of horticulture and the management of agricultural chemicals, so the more practical improvement of agricultural chemical management will be attempted through management of the horticultural VC improvements in the Project.

Promotion of horticulture through the extension of cultivation knowledge - The DOA selected 15 crops for the Myanmar GAP, which includes 9 horticulture crops. The DOA is putting a great deal of effort into the extension of the Myanmar GAP. It is currently a good time to conduct a project to promote horticulture, which could compile cultivation knowledge based on the GAP guidelines, and formulate models of the farming in accordance with the FVC. Moreover, the results of the Project could be extended with the Myanmar GAP.

Cultivating technology of flexible products and the processes of business management - The agricultural and livestock product market is expanding yearly, and at the same time food diversification is developing. Agricultural producers should select items they want to introduce into the market by investigating the diverse and attractive market trends, and carefully develop and implement the necessary production management plan. Therefore, under the leadership of the DOA/LBVD, it is necessary to extend cultivation technologies of versatile products, breeding techniques of highly valuable livestock and ways of business management.

(5) Introduction of collecting and loading platforms of fruit and vegetables

Introduction of collecting and loading platform - By the introduction of collecting and loading platforms in production areas, individual producers can know how the quality of their products compares with that of other producers, and at what price they are sold. Transactions at collecting and loading platforms can lead to competition between producers and can result in the improvement in the quality of products through market competition.

Implementation of simple food inspection - In collecting and loading platforms, it is required that there is a system of simple food inspection for the inspection of any residual pesticides or germs. In the future, it will be necessary to have a system that can cooperate with specialized agencies and follow laws and ordinances; and when problems are found, the causes are investigated and training is conducted for the relevant producers' group to avoid similar problems reoccurring in the future and to strengthen the trust in the production sites.

Standardization of agricultural and livestock products- Today, most agricultural and livestock products are separated by their size/weight before they are distributed and sold, but these standards are defined by each area, and there is no unified standard to this process. Therefore, it is necessary to define the unified standard referring the market situation of the surrounding nations toward the effect of the FVC.

(6) Systematic cattle breeding

Traditionally, in Myanmar, cattle have been bred as draft animals and not for beef, but recently because of the drastic increase in demand for beef in China, several good quality beef breeds are being exported. Today, cattle sellers and the LBVD are putting all their energy into the promotion of exports, but these cattle are not specially bred for beef.

Systematic cattle breeding is one of the urgent issues in the livestock sector because Myanmar is required to provide quality beef to the surrounding nations, and the domestic demand for quality beef is expected to gradually increase. All efforts for the improvement of the beef VC are now being conducted, based on the strains which are being developed. It is the equivalent of trying to increase the yield/quality of a crop without quality

seeds. Systematic development of cattle strains is the first step toward the improvement of the VC.

9.3.2 Improvement of the processing stage

Existing processing facilities are a valuable investment, further improving the value of agricultural products. To fully utilize the existing facilities, problems of the FVC which impede the full operation of processing facilities should be resolved as soon as possible. The shortage of processing materials or the mismatch of materials, and the grade/quality could be solved in cooperation with farmers/farmers' associations through the arrangement of shipment timing, cultivation varieties, post harvest treatment, etc, thus strengthening the whole FVC.

9.3.3 Improvement of the distribution stage

(1) Improvement of rural roads

Agricultural products are transported in bulk loads from the field or farmyard to the collecting and loading platforms, so if the roads are unpaved transportation occurs more slowly. Nevertheless, even if products are transported at slower speeds on unpaved roads, that likelihood that fruit and vegetables will be damaged during handling and transporting is increased, and leads to shipping losses. Also, roads suffer flooding and deterioration in the rainy season, and this causes the transportation distance to significantly increase because transportation must then rely on detour routes. As described above, the improvement of regional roads requires shortening the distance in the transportation chain and improving resurfacing.

(2) Maintenance of traditional markets

Maintenance of market facilities - Traditional markets have been working as an essential part of food distribution to Myanmar's citizens. More attention has been paid to food hygiene in these markets with the widespread advancement in hygiene knowledge in Myanmar. Therefore, the maintenance of hygienic market facilities that are well-equipped with clean water and sewerage infrastructure and waste treatment capabilities, is required. Also, since both sellers and buyers have come to use their cars more frequently, it is a requirement that there are sufficient and maintained roads and parking places in the markets.

Maintenance of food inspection structure - Fruit and vegetables sent to the markets from each production site are traded without any residual pesticide analysis, so that it is difficult to maintain or guarantee food safety. Therefore, it is necessary to conduct residual pesticide analysis in the marketplace, and dispose of the product if the result of the analysis is positive; and identify the production site and producer responsible for the contaminated goods to stop them from shipping until a countermeasure is arranged to safely and appropriately remedy this problem. For this purpose, it is urgent to strengthen the analysis capacity and function of the FSTLAP which is in charge of analyzing for residual pesticides.

(3) Direct marketing by agricultural producers

Direct marketing to consumers - Agricultural products prepared for cooperative shipping are basically standard products, whose shape and weight are similar, but there are some products produced in the fields which are overripe or misshapen. Especially when the temperature is high, the ripening of fruits and vegetables tends to be faster, so many things cannot be shipped to remote areas. Therefore, it is important for producers to directly sell fresh agricultural products that have just been harvested to consumers at the direct sales store, and therefore gain as much income as possible from all produce. At the direct sales store, it is also possible for producers to sell processed agricultural products.

Direct marketing to hotels/restaurants − Direct bargaining power and selling to regional hotels or restaurants is one way of marketing, instead of direct selling to general consumers. Through informing customers during negotiation of produce varieties and characteristics, and ways in which the local agricultural and livestock produce can be prepared and consumed, it is possible to increase the product's value. Such direct sale practices of agricultural and livestock goods may be beneficial for local tourism, as good produce used in the hospitality industry could increase tourist numbers and so broaden the market base for the farmers and increase the demand for their fresh produce. This will also let farmers better understand the market's demands and adapt their businesses accordingly to meet these changing trends. Related local industries in rural areas will be revitalized through this wider process. In addition to hotels and restaurants, schools, hospitals, and sports facilities can be considered as direct selling targets.

9.3.4 Improvement of the consumption stage

(1) Supplying safe and hygienic food

Safe and hygienic food is fundamental to the market. Almost all consumers know the risks of pesticide residue and unhygienic food, but they often forget the risk in their everyday life because residual pesticides and germs are invisible. The project 2 "Improvement of Food Safety through Training and Upgrading Traditional Markets" as countermeasures to these issues, outlines how the provision of safe and hygienic food can be achieved through the visualization, and management of those aforementioned risks.

(2) National Activities for safety and security

In order for citizens to be able to safely and reliably eat agricultural and livestock products, there is a limit to improvements that can be made to food safety when the only people involved in the development are those in the production stage through to the distribution stage. Therefore, parallel to these efforts, it is necessary to encourage citizens and society as a whole to actively raise awareness about food safety. Campaigns through the various forms of media intended to improve awareness at home, and dealing with the importance of food safety in school education, are required.

9.3.5 Common countermeasures from production to consumption

(1) Introduction of a traceability system

A traceability system is needed to promote exportation of domestic agricultural products including the expansion of safe food distribution networks nationwide. For introducing this system, it is necessary to record and disclose detailed production information, such as the condition of agricultural and livestock products, the production process and distribution stage. This is essential to ensure the transparency of the industry and the cooperation with agriculturally-related associations.

(2) Improving the value of agricultural and livestock products in rural areas

On the VC of agricultural and livestock products, presently the greatest value is added in cities through processing, but if the products are processed in villages near the production sites, the greatest value is kept these rural areas. Considering the future population concentration in cities/population decrease in rural areas, it is important to increase the value of agricultural and livestock products in rural areas as much as possible. This would bring employment opportunities which would in tern help to sustain the regional industry structure and economy. This survey focused on horticulture crops and agricultural and livestock products, but there are many

other local foods produced within Myanmar in its many different States and Regions. In terms of tourism promotion, efforts to improve the VC nationally are also important for these other products.