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## **Opportunities and Constraints for Improving Quality Control of Fresh Mango (Sein Talone variety) for Exporting Growers in Myanmar**



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September, 2018

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**Opportunities and Constraints for Improving Quality Control of  
Fresh Mango (Sein Talone variety) for Exporting Growers in  
Myanmar**

**BY**

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Research Project submitted in partial fulfilment of the requirements for the  
award of the **Degree of Master in Agricultural Production Chain Management**,  
specialization in Horticultural Chain

**Van Hall Larenstein University of Applied Sciences  
The Netherlands**

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## DEDICATION

This work is dedicated to my beloved father, **U Tin Win** and beloved mother, **Daw Nyein Nyein Soe** who always supported and encouraged me throughout my study-life.

It is also dedicated to my husband **Thiha Naung** who motivated me to study a higher degree, our two daughters **Su Myatnoe Naung** and **Thoon Myatnoe Naung** for their support, resilience and patience a year without motherly love.

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## List of Abbreviations

ASEAN	Association of Southeast Asian Nations
AQSIQ	General Administration of Quality Supervision, Inspection and Quarantine
BRC	British Retail Consortium
DEAR Myanmar Myanmar	Development for Environmentally-friendly Agriculture and Rural Life of Myanmar
DOA	Department of Agriculture
EU	European Union
FAO	Food and Agriculture Organization
FFS	Farmer Field School
GAP	Good Agricultural Practices
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GMO	Genetically Modified Organism
GMP	Good Manufacturing Practices
G to G	Government to Government
HACCP	Hazard Analysis and Critical Control Points
IFS	International Featured Standards
IPM	Integrated Pest Management
ISO	International Organization for Standardization
Lao PDR	Lao People's Democratic Republic
MADB	Myanmar Agricultural Development Bank
MAS	Ministry of Agriculture Service
MEB	Myanmar Economic Bank
MFVP	Myanmar Fruit Flower and Vegetable Producer and Exporter Association
MI	Myanmar Insurance
MOLAI	Ministry of Agriculture, Livestock and Irrigation
MRL	Maximum Residue Limit
NGO	Non-Governmental Organization
PGs	Farmer Producer Groups
PHI	Pre Harvest Interval
PTTC	Post-harvest Technology Training Center
SME	Small and Medium Enterprise
UAE	United Arab Emirates
UK	United Kingdom
USA	United States of America
USDA	United States Department of Agriculture
VFRDC	Vegetable and Fruit Research and Development Center
WHO	World Health Organization
YAU	Yezin Agricultural University

## ABSTRACT

Mango (*Mangifera indica* Linn.) is an important fruit in Asia and the demand for high-quality mango is increasing all over the world. The mango sector is an important component of the Agriculture sector in Myanmar. It provides the country's economy with export earning. Diamond Solitaire called Sein Talone mango is the most famous variety in Myanmar for local consumption as well as for exporting. The sector has however not seen much growth over the decade. The slow pace of development of mango farmers to be able to export premium markets can be attributed to fluctuation in export quantity with decreasing trend and imperfect competitiveness in the international market leading to a low profit of mango farmers. Focusing on improving mango quality and developing new market opportunities are important aspects for assurance of better price and competitiveness in the export market in the future.

The research study intended to find out factors affecting on improving quality of Sein Talone mango variety faced by exporting growers. The study has been carried out in two different major mango cultivation areas in Myanmar; Mandalay and Southern Shan State. The overall research objective is to analyze the opportunities and constraints for fresh mango quality control and formulate the possible recommendations which will contribute to an improvement of Sein Talone mango quality for export. The research involved a review of the literature on relevant theories and concepts, overview of mango export and production of other countries and an overview of the export condition of Myanmar's mango.

The qualitative data were collected using in-depth interviews with key stakeholders in the chain between 2<sup>nd</sup> July and 6<sup>th</sup> August 2018. Twenty-four interviewees including 4 non-certified growers, 2 certified growers from each study area (Mandalay and Shan), 1 GLOBAL GAP certified farmer from Southern Shan State, 1 main exporter, 1 large broker from China border trade, 4 participants from government departments, 2 interviewees from NGOs, 2 interviewees from financial institutions and 1 expert from Yezin Agricultural University were participated in research interviews. The study assessed the factors affecting fresh mango quality control for export and the main supporting activities that contribute to sustainable fresh mango export in the future. The analysis has been done using PESTEC, SWOT, stakeholders' analysis and chain mapping.

The findings of this study show that most mango growers have strong intention for export. Most growers improved their cultivation practices and control of pests and diseases problem although they have difficulties for quality control process because of lack of post-harvest facilities, inadequate infrastructure for quality control and insufficient quality standards resulting limited market access for export. Moreover, creating special market opportunities for GAP certified products is required to promote GAP practices and improve farmers' motivation to apply GAP system in crop production.

For improving quality control of mango, government support for relevant technologies, post-harvest facilities, effective implementation of GAP practices, research and development activities and quality standards are still needed. Myanmar mango export can be improved by improving collaboration between stakeholders, providing long-term loan scheme for growers, providing product handling facilities, sharing information about market requirements and standards, capacity building activities, promoting GAP practices and creating new market linkages. Raising consumers' awareness on food safety and GAP products can improve the market opportunities and develop healthy-life by consuming safe food and healthy products.

# 1. INTRODUCTION

## 1.1 Country Description

Myanmar is geographically located in the South Eastern part of Asia continent. It is bordered by five neighboring countries: China to north and north-east, India to the north-west, Thailand to the east and south-east, Lao PDR to the east and Bangladesh to the west (Figure 1). Myanmar has a total area of 676,600 square kilometers (UNFPA, 2014). The country's coastline lies to the southwest by the Bay of Bengal and southern by the Andaman Sea. In Myanmar, there are 15 States and Regions (7 States, 7 Divisions and 1 union territory); seven States (Kachin, Kayah, Kayin, Chin, Mon, Rakhine, and Shan) cover the hill regions and seven Divisions (Mandalay, Magway, Bago, Yangon, Tanintharyi, Sagaing and Ayeyarwady) and the union territory (Nay Pyi Taw) are mostly plains regions (FSWG, 2016).



Figure 1 Map of The Republic of the Union of Myanmar

Source: UN, 2012

The climate of Myanmar is tropical monsoon with two seasons; dry season (mid-Oct to mid-May) and wet season (the rest of the year). The average annual rainfall is about 2,300 mm with the highest rainfall in hot humid months of southwest monsoon (from May to October). Cool and entirely dry weather can be found in the northwest monsoon (from December to March). In coastal regions, annual rainfall covers from 4000 to 6000 mm. Intermediate level of rainfall (2000-3000 mm) can be

found in Ayeyarwady delta regions. In the central dry zone, annual rainfall ranges as low as 500-1000 mm (FAO, 2011). All parts of Myanmar generally have adequate rainfall for agriculture. In dry inter-monsoon season (February-May), irrigation is required in lowland areas (FAO, 2011). The population in Myanmar is increasing steadily at an average annual growth rate of 0.9% (from 1983 to 2014) and it was over 51 million in 2014. In Myanmar, approximately 75% of the population is living in rural areas and most of their livelihoods are based on agriculture (UNFPA, 2014).

Myanmar is an agriculture-based country. The agriculture sector is the backbone of the country's economy and its GDP has increased at an average growth rate of 3.2% from 2011 to 2016 (FSWG, 2016). Agriculture, livestock and fisheries account for almost 40% of National GDP provide over 60% of employment (U.S. Commercial Service Myanmar, 2017). The export of products from these sectors such as rice, pulses, rubber, shrimp, fruits and livestock earn foreign exchange of over USD 3.1 billion in 2015 (FSWG, 2016). A wide variety of crops can be grown in different areas of Myanmar including cash crops and horticultural crops, agricultural crops, forest and tropical crops. Myanmar has three distinctive agricultural zones; the Ayeyarwady Division and deltas, the dry lowlands, and hill and plateau regions (UNFPA, 2014).

Horticulture sector has the potential to become an important sector for the country's economic and income growth and rural development. The domestic market demand for its products; vegetables, flowers and fresh fruits, is relatively high and providing for about 15% of rural households' income (The Embassy of the Kingdom of the Netherlands, Myanmar, 2015). Among them, the top horticultural fresh fruits that provide foreign exchange earnings are mango, avocado, pomelo, guava and banana (Sein, 2016).

## **1.2 Mango Sector in Myanmar**

Mango (*Mangifera indica* Linn) is an important fruit in Asia and has developed its own importance all over the world. In 4000 years, mango has been cultivated in the Indo-Myanmar region where it has originated. Nowadays, mango is cultivated as a commercial production in tropical and subtropical regions around the world (Eain, 2015).

In 2016, top mango exporting countries are Mexico, Netherlands, India, Peru and Brazil. In Asia, India is the highest mango exporting country with the world market share of 8.7% (ITC, 2016). In 2016, ASEAN countries exported 285,544 metric tonnes of mango. Among ASEAN countries, Thailand export the highest quantity (183,290 tons), followed by the Philippines (20,618 tons), Malaysia (10,912 tons), Vietnam (2,351 tons), Indonesia (473 tons), Singapore (344 tons), Cambodia (332 tons) and Myanmar (91 tons) (FAOSTAT, 2016).

In Myanmar, mango is one of the most important fruit for local consumption as well as for export earning. Among over hundred varieties of mango in Myanmar, the exportable varieties are Sein Talone (Diamond Solitaire), Mya Kyauk, Shwe Hinthar and Yin Kwal because they have high sweetness level. Diamond Solitaire called Sein Talone mango is the most famous and popular variety in Myanmar because of its fibreless pulp, adorable aroma, yellowish color, sweetness and juiciness nature.

The main mango growing areas in Myanmar are the Central region (Mandalay Division, Sagaing Divisions and border of Bago and Mandalay Division), East Region (Southern Shan State) and Southern Region (Yangon, Ayeyarwaddy and Bago Divisions) over a cultivation size of about 80,000 hectares (average seasonal production about 500,000 tonnes) (Avery, 2015). The main exporting mango producing areas are Central and East regions (Figure 2). The remaining areas are producing mango especially for local consumption (Myat, 2012).

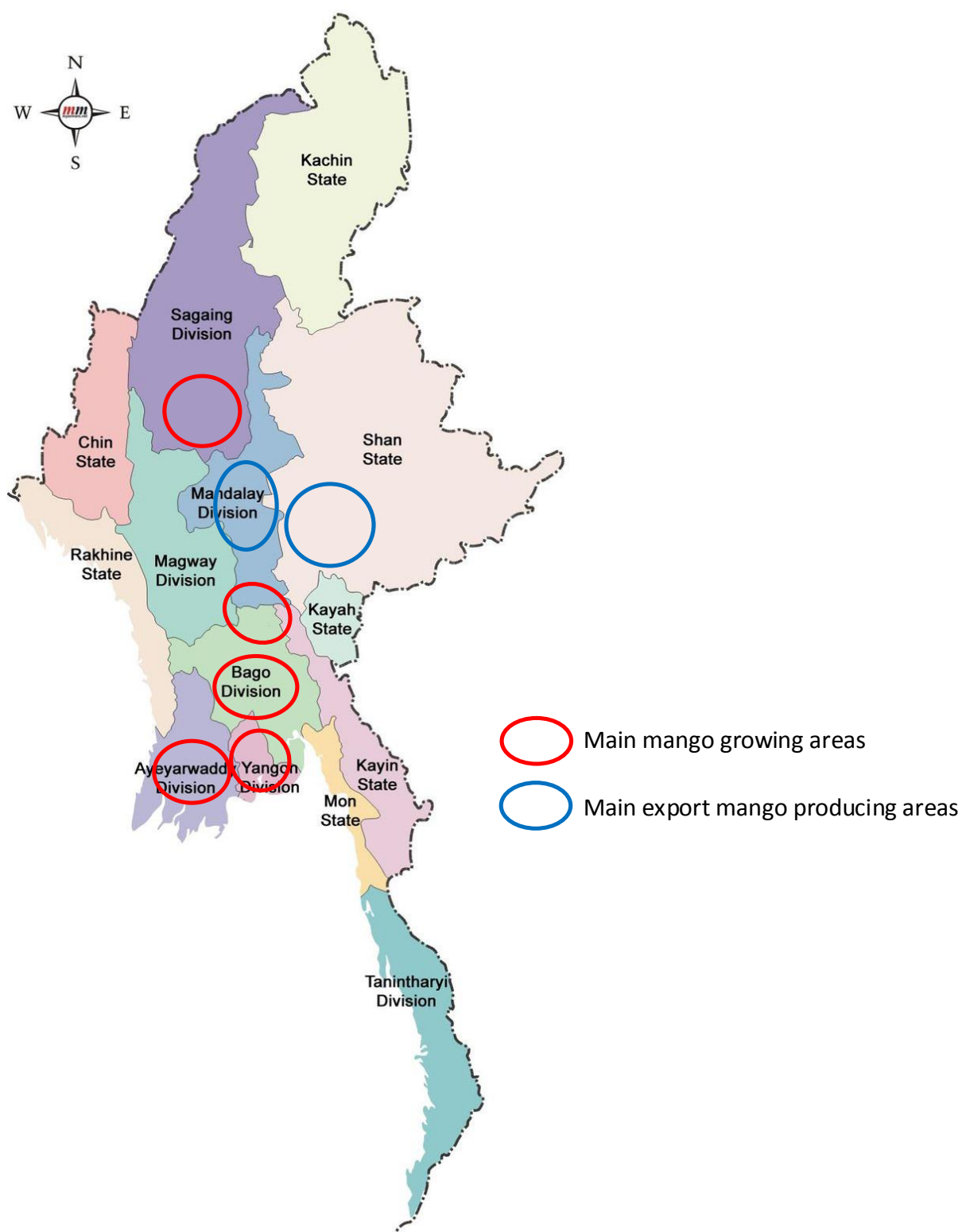


Figure 2 Main mango growing areas in Myanmar  
Source: Myat, 2012 and Pinterest, 2012

The main export market of Myanmar mango, including Sein Talone variety, is China via Muse border trade (Northern Shan State). A few exporters are exporting to Singapore market by overseas trade. In the Singapore market, the market price is stable and only a high-quality mango can be exported. The

export quantity of Myanmar mango to China market faced slight fluctuation between 2012 and 2016 with a decreasing trend (Figure 3).

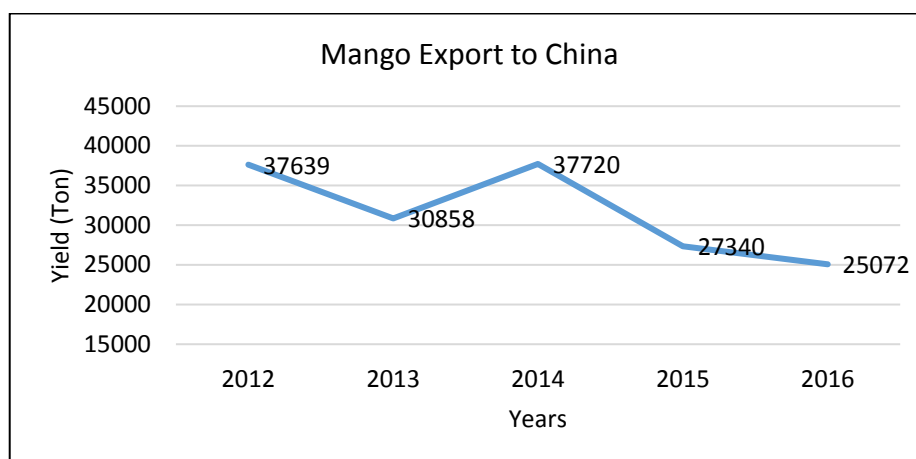


Figure 3 Myanmar mango export to China

Source: China Customs; North East Gate Wholesale Market, 2017

The buying prices of mango by Chinese buyers depend on the quality of exported mango. Myanmar mango has the potential to get a higher price if exporters are able to manage for high quality. In Muse border trade, Chinese buyers generally select only the excellent quality of mango (Myat, 2012). The export condition of Myanmar mango has to be considered as an important aspect for assurance of the competitiveness in the export market in the future.

### 1.3 Problem Description

In Sein Talone mango export chain, mango quality control process is an important phenomenon because mango is a perishable crop. Due to the increasing global demand for high-value agricultural commodities, Sein Talone mango production in Myanmar necessitates focusing on improving quality in order to get a better price from existing export market and to access new market opportunities. In Myanmar, mango farms have not been able to export premium markets consistently or in large quantities because of low product quality. The quality control of Sein Talone mango for export needs to be improved by developing product handling, post-harvest facilities and compliance with food safety certification in order to maximize the profit of farmers and new market access for exportation.

### 1.4 Problem Owner

The main problem owner considered in this research is Myanmar Fruit, Flower and Vegetable Producer and Exporter Association (MFVP) who supports the Sein Talone mango export chain and shows willingness and interest in solving the main problem for improving mango export quality.

### 1.5 Justification of the Study

Myanmar Sein Talone mango has much potential to compete in the international market because of its marvelous taste, color and nature. Sein Talone mango producers need to upgrade technology for systematic cultivation and improving quality for export. International standards, practices and certification systems need to be developed for penetrating not only to China market but also to other International markets in order to increase the livelihood of mango farmers through better profit from export.

There are some studies that concentrate on mango post-harvest handling practices although hardly any studies have highlighted on Sein Talone mango quality control for the export chain. Therefore, the target of this research study is to investigate opportunities and constraints for improving quality control of Sein Talone mango faced by exporting growers in Myanmar. This, in turn, will contribute to the development of quality control measures, certification schemes and effective interventions for the improvement of mango export quality in the future.

## **1.6 Research Objective**

- To identify opportunities and constraints for fresh mango quality control faced by exporting growers in order to recommend opportunities to Myanmar Fruit, Flower and Vegetable Producer and Exporter Association (MFVP) for improving mango export in Myanmar.

## **1.7 Research Questions**

### **Main Question**

1. What are the factors affecting fresh mango quality control for export?

### **Sub-questions**

1. What are the existing quality control systems?
2. What are the different quality criteria for fresh mango export in Asia (especially to China and Singapore)?
3. What are the certification systems used for mango production?
4. What are the differences between certified and non-certified farmers regarding market opportunities?
5. What are the supporting and hindering factors for improving fresh mango quality control for export?

### **Main Question**

1. What are the main supporting activities that contribute to a sustainable fresh mango export chain in the future?

### **Sub-questions**

1. What are the roles of key stakeholders regarding their existing support in the fresh mango export chain?
2. What kind of support from government and stakeholders is needed to improve mango quality control for export?

## **1.8 Conceptual Framework**

The core concept of this research is to improve quality control of fresh mango (Sein Talone variety) for export that can be divided in two different dimensions;

- (1) Assessing factors affecting fresh mango quality control for export and
- (2) Investigating main supporting activities that contribute to sustainable mango export chain through assessing existing quality control systems (including certification systems and export quality criteria) that followed by analyzing opportunities and constraints in view of different stakeholders (Figure 4).

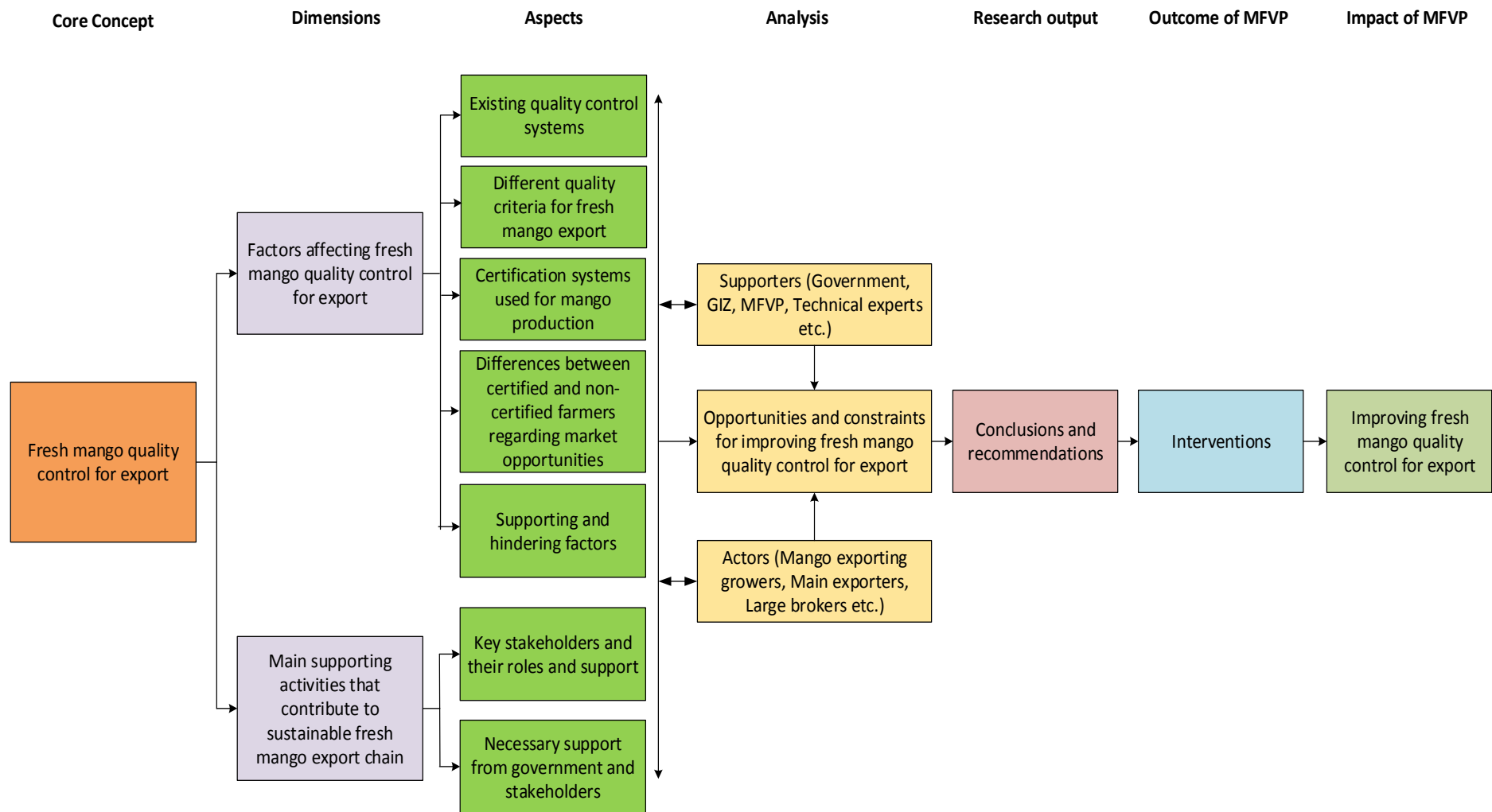


Figure 4 Research conceptual framework



## 2. LITERATURE REVIEW

### 2.1 Definition of Concepts

- ❖ **Value Chain** – A value chain expresses a series of activities from input suppliers to the consumer. This concept considers the aspect of adding value along the chain. Each of actors in the chain invests in the chain and supports the other actors for ensuring the chain functions are well-correlated (KIT, 2010).
- ❖ **Value Chain Actors** – Value chain actors are those who are directly involved in value chain activities. For example, farmers, wholesalers or retailers, consumers (Stein and Barron, 2017).
- ❖ **Value Chain Supporters** – Value chain supporters (or service providers) support activities of the value chain such as technological development, procurement, human resource management and infrastructure. They can play an important role though they are not directly involved in value chain activities (Stein and Barron, 2017).
- ❖ **Pre-harvest Technology** – A system of controlling technologies on the farm that exist before crop products are marketed such as the production of raw materials, soil cultivation, crop care and harvesting (Prange, 2012).
- ❖ **Post-harvest Technology** – Post-harvest technology involves all treatments or processes from harvesting to final products such as harvesting, handling, storage, processing, packaging, transportation etc. (Prange, 2012).
- ❖ **Quality** – Quality is specifically described as meeting or exceeding customer and consumer expectations (Luning and Marcelis, 2011).
- ❖ **Quality Criteria** – Quality attributes are noticeable by sensory observation or communicable the result of various product properties to the quality perception of customers and consumers. Intrinsic attributes/criteria are inherent and noticeable to the physical products (e.g texture, odour, safety and health). Extrinsic attributes correspond to the production and marketing features of a product (eg. sustainable of production, brand name, animal welfare) (Luning and Marcelis, 2011).
- ❖ **Quality Control** – A basic activity of food quality management with the aim of keeping product properties, production and human processes between acceptable tolerances. This is the continuous process of evaluating human and technology performances and taking corrective actions if necessary (Luning and Marcelis, 2011).
- ❖ **Quality Assurance** – A management method for ensuring all production processes/actions are well-functioned to provide adequate confidence in that product/service. Systematic actions include putting requirements on the internal quality management system, validating its effectiveness and verifying its actual performance. Examples of quality assurance standards are HACCP, ISO standards, GMP, PRP, BRC (Luning and Marcelis, 2011).

## 2.2 World's Top Import Market for Quality Mango

Mango consumption and demand is increasing significantly all over the world because of its nutritive value and health benefits. Mango production, quality assurance and trading become a generally widespread phenomenon all over the world. Mango import is increasing in the developed countries; especially in Europe and America. According to FAOSTAT 2006-2016 data, top ten mango importing countries involved; the USA, the Netherlands, UAE, Saudi Arabia, United Kingdom, Germany, Malaysia, France, China and Spain (Table 1). The USA is the top mango importer in the world, it imported 3.8 million tons of mangoes between 2006 and 2016.

Imports rates are in the increasing trend and account for Asia 31%, North America 29% and Europe 27% that contribute totally 1.1 million tons in 2016 (FAOSTAT, 2016). The importing of mango from each country is based on certain logistic/import linkages. The trade relationship in Asian countries is mostly their neighboring countries. A small unsteady quantity can occur according to their harvest seasons. China is the main mango importer of ASEAN countries, while Philippines, India and Pakistan export to the Middle East and a marginal amount to European countries (UNCTAD, 2016).

Table 1 Top ten fresh mango importer countries (tons) (2006-2016)

Countries	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
United States of America	292,377	295,231	297,499	287,402	320,591	367,594	364,799	424,451	373,195	390,718	446,587	3,860,444
Netherlands	112,291	111,830	127,659	113,894	142,546	156,277	141,662	146,987	161,419	173,506	189,731	1,577,802
United Arab Emirates	49,823	66,255	56,150	49,040	46,494	37,111	51,568	48,002	104,187	88,163	103,417	700,210
Saudi Arabia	48,330	45,660	49,245	38,583	58,250	63,497	70,390	57,858	63,668	64,823	46,106	606,410
United Kingdom	54,678	57,381	55,797	48,120	47,581	50,145	50,456	56,232	58,257	69,636	81,633	629,916
Germany	34,756	46,762	51,865	40,623	48,451	57,576	52,134	54,607	65,277	72,207	74,869	599,127
Malaysia	22,740	23,087	21,201	40,676	42,015	50,960	60,637	48,675	50,324	55,140	51,158	466,613
France	35,144	39,397	32,211	27,792	32,267	37,614	38,248	35,151	45,202	42,282	58,089	423,397
China	24,477	24,064	19,836	22,542	23,477	26,207	22,798	23,988	22,876	23,437	18,534	252,236
Spain	16,584	16,603	18,216	17,844	32,232	25,647	24,402	27,793	29,076	36,092	38,144	282,633
Total Production	691,200	726,270	729,679	686,516	793,904	872,628	877,094	923,744	973,481	1,016,004	1,108,268	9,398,788

Source : FAOSTAT, 2016

The majority of mangoes in Europe are imported. The quantity of mango import rose steadily at an average annual rate of 1.6% between 2008 and 2012. European Union's imported mangoes are mostly from developing countries. In 2012, EU's mango consumption ranged 185.6 thousand tonnes. The Netherlands is the largest importer of mango in the EU and accounts for 37% of total EU import volume (UNCTAD, 2016). In the Netherlands, 71% of the imported mangoes are re-exported mainly to Germany that represents 46% of export from Netherland. Germany is the second largest mango market in EU represents 21% import market share (CBI, 2014).

Table 2 shows the quantity of mango import in ASEAN and other neighboring countries. Among ASEAN countries in 2006-2016, Malaysia was the largest importer of mango with total import rate of 456,613 tons followed by Singapore (223,352 tonnes). Malaysia is the re-exporter to Singapore, Japan, Hong Kong and other countries in the Middle East. In the 2015-2016 period, mango import rate of Thailand increased significantly to 26,597 tons.

Table 2 Fresh mango importing quantities in ASEAN and other neighboring countries (Tons) (2006-2016)

Countries	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Malaysia	22,740	23,087	21,201	40,676	42,015	50,960	60,637	48,675	50,324	55,140	41,158	456,613
Singapore	16,027	19,405	18,415	21,479	18,232	20,920	22,715	21,233	22,507	22,083	20,336	223,352
Thailand	262	753	156	257	69	412	375	299	385	18,380	26,597	47,945
LaoPDR	694	2,079	4,852	6,457	15,956	7,591	507	893	1,782	3,562	6,412	50,785
Cambodia	2	1,523	1,282	1,273	3,401	3,287	5,734	4,415	1,243	3,723	4,156	30,039
Indonesia	966	1,088	969	821	1,129	989	2,052	387	233	-	-	8,634
Brunei Darussalam	425	707	248	175	153	172	82	671	748	984	68	4,433
Philippines	16	23	17	6	60	62	200	10	8	1	45	448
Myanmar	-	-	-	-	-	-	-	-	3,080	2,901	3,700	9,681
Vietnam	-	-	-	-	-	-	-	-	140,139	89,416	99,540	329,095
ASEAN Total	41,132	48,665	47,140	71,144	81,015	84,393	92,302	76,583	220,449	196,190	202,012	1,161,025
India	109	104	171	297	132	631	777	653	1,036	751	524	5,185
China	24,477	24,064	19,836	22,542	23,477	26,207	22,798	23,988	22,876	23,437	18,534	252,236
Bangladesh	2	0	0	0	0	0	0	4857	619	3135	908	9521

Source : FAOSTAT, 2016

## 2.3 World's Top Mango Productivity and Export

In the global market, the top ten mango producing countries include; India, Mexico, Thailand, Brazil, Peru, Pakistan, Ecuador, Philippines, Egypt and Guatemala (Table 3). During the 2011-2016 period, India was the highest mango producing country in the world with an increasing trend, followed by Mexico and Thailand. However, Mexico was the highest mango exporter in the world throughout the period with the export rate of 15% to 17% of total production. Mango consumption in India occupied a high position because India could export only 1.5% of total production.

Thailand reached the highest rate of export (7.3% of total production) in 2013 compared to other years. Peru increased the export quantity yearly and the highest export rate occupied up to 52% of total production in 2012 (Table 3). Similarly, Brazil and Ecuador increased the export quantity throughout the period. Mango production in Egypt rose significantly to 1.2 million tons in 2015-2016 although the export condition holds a similar place from 2014 to 2016 (Table 3). The majority of mangoes are produced in Asian countries and account for 72% of total world production, followed by Africa with 17% and Latin America with 10% (UNCTAD, 2016).

Table 3 Total production and total export of the world's top fresh mango exporting countries (Tons) (2011-2016)

Countries	2011		2012		2013		2014		2015		2016	
	Total Production	Total export	Total Production	Total export	Total Production	Total export	Total Production	Total export	Total Production	Total export	Total Production	Total export
India	15,188,000	229,192	16,196,000	214,640	18,002,000	263,918	18,431,330	210,668	18,527,000	173,814	18,779,000	193,383
Mexico	1,827,314	287,771	1,760,588	297,295	1,901,871	338,169	1,754,609	289,647	2,069,959	331,148	2,197,313	369,314
Thailand	2,793,640	152,285	3,295,586	196,441	3,421,213	252,904	3,597,589	246,676	3,331,113	218,816	3,432,129	183,290
Brazil	1,591,981	126,568	1,521,067	127,132	1,512,615	122,178	1,491,812	133,219	1,400,342	156,557	1,417,149	154,383
Peru	355,450	123,863	188,998	99,790	461,214	126,815	380,143	120,721	349,805	132,105	377,382	157,070
Pakistan	1,888,449	105,130	1,700,010	101,164	1,658,562	98,926	1,716,882	77,330	1,636,473	43,714	1,606,091	82,658
Ecuador	179,737	49,066	175,615	60,139	184,238	61,309	170,109	45,678	60,133	49,275	82,246	63,163
Philippines	800,551	30,565	783,420	24,076	831,224	20,879	899,014	36,105	917,005	23,195	827,075	20,618
Egypt	598,084	-	786,528	19,564	712,537	-	927,352	29,940	1,214,242	30,900	1,277,008	26,175
Guatemala	116,274	19,980	113,493	19,456	115,607	19,705	127,459	24,562	126,643	20,387	124,439	14,582

Source : FAOSTAT, 2016

Mango productivity and export condition of ASEAN and other neighboring countries from 2011 to 2016 is shown in Table 4. Thailand was the third largest producer of mangoes in the world and the largest producer and exporter within the ASEAN community with export rate (5-7%) of total production from 2011 to 2016. Thailand exports mango to many regions of the world including Europe, Middle East and Asia. Indonesia is the second highest mango producer in the ASEAN region although its exporting rate only ranged from 0.04-0.1% of total mango production (FAOSTAT, 2016).

Table 4 Total mango production and total export of ASEAN and other neighboring countries (Tons) (2011-2016).

Countries	2011		2012		2013		2014		2015		2016	
	Total Production	Total export	Total Production	Total export	Total Production	Total export	Total Production	Total export	Total Production	Total export	Total Production	Total export
Thailand	2,793,640	152,285	3,295,586	196,441	3,421,213	252,904	3,597,589	246,676	3,331,113	218,816	3,432,129	183,290
Indonesia	2,460,570	1,485	2,774,784	1,515	2,514,187	1,089	2,733,508	1,149	2,176,448	1,243	2,184,399	473
Philippines	800,551	30,565	783,420	24,076	831,224	20,879	899,014	36,105	917,005	23,195	827,075	20,618
Vietnam	686,637	421	775,942	578	705,865	558	823,954	809	895,467	1,731	725,306	2,351
Malaysia	67,681	5,540	78,676	5,006	69,266	9,847	77,198	13,440	98,315	8,469	102,046	10,912
Cambodia	59,579	-	59,974	1	61,731	-	63,488	8	65,244	58	67,001	332
Myanmar	1,250	20	1,260	29	1,250	92	1,220	185	1,205	208	1,363	91
LaoPDR	4,208	-	4,400	-	4,538	-	4,704	6	4,721	81	4,858	79
Singapore	-	194	-	245	-	175	-	176	-	213	-	344
Brunei Darussalam	-	-	-	-	-	-	-	-	-	-	-	-
ASEAN Total	6,874,116	190,510	7,774,042	227,891	7,609,274	285,544	8,200,675	298,554	7,489,518	254,014	7,344,177	218,490
India	15,188,000	229,192	16,196,000	214,640	18,002,000	263,918	18,431,330	210,668	18,527,000	173,814	18,779,000	193,383
China	4,412,858	6,310	4,485,653	4,861	4,620,041	7,790	4,644,271	9,506	4,744,012	13,090	4,771,038	4,397
Bangladesh	889,176	-	945,059	-	956,867	308	992,296	376	1,018,112	-	1,161,685	220

Source : FAOSTAT, 2016

Mango production in Myanmar was the lowest among mango producing countries in the ASEAN region from 2011 to 2016 although its export rate was higher than that of Lao PDR throughout the period. Between 2011 and 2015, Myanmar mango export increased from 20 tons to 1,205 tons per year and decreased sharply to 92 tons in 2016. Cambodia produced a high quantity of mangoes without exporting between 2011 and 2013, however, the export quantity increased yearly up to 332 tons in 2016. The main export markets of Cambodia mangoes were France, Thailand, Vietnam and Korea (Vanny, 2017). The two largest mango growers in the world, India and China, produced 18 million tonnes (1% export of total production) and 4.7 million tonnes (0.1% export of total production) respectively in 2016 (Table 4).

Mango harvest seasons in ASEAN and other neighboring countries is shown in Table 5. Most countries in the ASEAN region harvest mangoes mainly from April to June. Among them, Thailand can produce mangoes almost the whole year round.

Table 5 Mango harvest seasons in ASEAN and other neighbouring countries

Country	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Thailand												
Indonesia												
Philippines												
Vietnam												
Malaysia												
Cambodia												
Myanmar												
Lao PDR												
India												
China												
Bangladesh												

Source: Myat, 2012

In Myanmar, mango harvesting starts from mid-February in the southern part through April to June in the central region up to September in Southern Shan State. Myanmar mango export may have a certain constraint for competition with Thailand, Philippines and Vietnam because these countries have similar mango harvesting period with Myanmar. Myanmar can export mango to China up to July and to Indonesia, Malaysia and Singapore in the late harvesting period (August to September) although it still has to compete with Thailand (Myat, 2012).

## 2.4 Certification Systems Used for Mango Trade

An increasing number of people are critical on the taste and food safety and they have a growing interest in food that is made according to good agricultural practices. The requirement of quality standards for food safety in crops production is becoming an important issue for both export and local food consumption.

The private standards include HACCP approach and ISO standards. The aim of the HACCP approach is supporting for better structuring of export and marketing of certain countries. The well-known certifications under the HACCP approach are GLOBAL GAP, BRC and IFS. GLOBAL GAP is a quality assurance standard for vegetables and fruits production. BRC and IFS standards are quality assurance demands in the retail sector. The ISO standards developed by the International Organization for Standardization, include two series; ISO9000 Quality management system and ISO14000 Environmental management system (Luning and Marcelis, 2011).

The Codex Alimentarius 7 international standards were established by a mixed programme of WHO and FAO. The Codex Alimentarius for standardization has drawn up several standards that relate to processed mangoes. There are also public standards issued by the public authorities of consumer countries to govern the import system. These rules are managed by USDA in USA and European Commission for the European market. In addition, there are some regulations on food safety, hygiene and organic produce. The environmental conditions of countries are not the same therefore the phytosanitary and sanitary rules are not necessarily the same (UNCTAD, 2016).

## **2.5 Certification System Used for Mango Production in Myanmar**

Myanmar started to develop Good Agricultural Practices (GAP) standard for agricultural production. Among the first 14 products under GAP protocol in Myanmar, mango is one of the products (Fresh Studio, 2017). GAP approach for agricultural production involves the establishment of guidelines for producers and operation personals, monitoring process and communication to downstream firms, consumers and the public through credible quality products. GAP is developed to define codes of sustainable agricultural production by protecting the environment and natural resources, quality assurance and safety. It also promotes the optimum use of resources such as fertilizers, pesticides, and water that can lead to eco-friendly agriculture (FAO, 2016A). GAPs rely on four principles (APO, 2016);

- 1) Economically and efficiently produce sufficient, safe and nutritious food
- 2) Sustain and enhance natural resources
- 3) Maintain viable farming enterprises and contribute to sustainable livelihoods
- 4) Upgrade the welfare of the workers

Myanmar GAP is based on ASEAN GAP guideline. ASEAN GAP is a voluntary standard for Good Agricultural Practices (GAP) for the production, harvesting and post-harvest handling of fresh fruit and vegetables in the ASEAN region. The purpose is to enhance the harmonization of the GAP standard within the ASEAN region. This will facilitate trade between ASEAN countries and global markets that can improve viability for farmers and help the sustainability of a safe food supply and the environment. The scope of ASEAN GAP covers the production, harvesting and post-harvest handling of vegetables and fresh fruits. The scope of ASEAN GAP does not cover the high-risk products for food safety, such as sprouts and fresh-cut products like shredded carrot. ASEAN GAP may be used for all types of production systems but not for certification of organic products or GMO-free products (AFOSP, 2016).

In Myanmar, the GAP standard has not been implemented successfully all around the country in the current situation. Government is providing GAP training for mango farmers (Thu, 2016). Government policy support for GAP, donors/partners involved in GAP, capacity-building activities for the understanding of GAP principles and requirements, learning from other countries' experiences and financial support for the investment of new product handling facilities are important for nationwide implementation of GAP program (Sein, 2016).

## **2.6 Overview of Mango Production Practices in Myanmar**

### **2.6.1 Pre-harvest Practices**

The major sources of planting material for Sein Talone mango production are; seeds and grafting. Farmers normally use Yin Gwe mango variety as a stock and graft with the scion of Sein Talone mango because the Yin Gwe variety has characteristic of resistance and easy adaptation to different parts of Myanmar. Mango growers use the planting materials by self-production and purchase from suppliers.

Chemical fertilizers and pesticides are normally used for soil fertility management and pest and disease control (Sein, 2016).

The orchard sizes range from less than 2 hectares to 40-120 hectares. However, there is a few large size landowners. The average farm size of mango production in Myanmar is 2-4 hectare. Planting spacings for mango production are varied; 30x30ft (914cmx914cm) or 20x20ft (610cmx610cm) or 15x15ft (457cmx457cm). Plant population is approximately 260 plants per hectare when planting with 20x20ft (610cmx610cm) spacing. The first harvest can be done after 3-4 years of initial field planting. Mango growers do the test to determine the maturity for harvesting by putting the fruit samples in water. In case the fruits do not float in the water, the growers determine to harvest all the fruit (Sein, 2016).

## 2.6.2 Post-harvest Practices

Based on different climate conditions and ecological zones, the mango harvest period varies in Myanmar (Table 6).

Table 6 Mango harvest seasons in Myanmar

Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mandalay, Sagaing, Magway, Rakhine												
Shan, Kayah, Nay Pyi Taw												
Yangon, Bago												
Ayeyarwaddy												
Thanintharyi												

Source: Myat, 2012 and Sein, 2016

In Mandalay, Sagaing and Magway regions, mango is normally harvested from April to June. Mango can be available from mid-June up to September in Shan State. Yangon and Bago areas harvest mangoes from mid-April to mid-June. Mango harvest period in Tanintharyi region is from February to March and April to May in Ayeyarwady (Table 6). Harvesting is normally done by using bamboo poles with the bamboo basket (Myat, 2012 and Sein, 2016).

Mango growers sell their mangoes in two possible ways. They sell mangoes that are on the tree stage to local brokers who visit the farm and estimate the price based on plant growth and potential yield. In another way, they harvest and sell them at the local market and export market via border trade. Brokers can generally earn better benefit than mango growers (Myat, 2012).

After harvesting, mango exporting growers manage post-harvest handling process for export. The graded export quality mangoes are packaged with a sheet of white paper and transported in paper crates or wooden boxes (Myat, 2012). In Mandalay region, the export quality mangoes are mostly produced and transported to China by using cargo truck through Muse border trade and to Singapore market by plane via Yangon International Airport (Koji, 2017). The brokers or exporters buy mangoes on trees three months before harvest with partial advance payments to producers. Furthermore, they use packing materials such as cardboard or plastic boxes for mango shipping (Koji, 2017).

## 2.7 Overview of Mango Value Chain in Myanmar

Mango value chain in Myanmar involves two different sub-value chains which serve different markets; domestic and export (Myat, 2012). In Myanmar, mango is mainly produced as a fresh fruit both for domestic and export market. The largest quantity of Myanmar fresh mango is exported to China via Muse border trade and 1<sup>st</sup>-grade mangoes are traded to Singapore. Furthermore, mango is also processed (value-added) as dried and frozen mango, mango puree, mango juice, mango candy, mango jam, mango leather and pickled mango (Fresh Studio, 2017).

### 2.7.1 Value Chain Actors and Functions

- ❖ **Input suppliers** – Input suppliers such as business companies and individual shops distribute farm input supplies (chemical fertilizers, pesticides, farm machinery etc.).
- ❖ **Mango growers** - Mango growers do crop management such as pruning, chemical control or organic control and soil and water management throughout the planting period. They do fruit grading in the farm after harvesting and manage transportation to export market or local market (Myat, 2012).
- ❖ **Local brokers** – Mango growers sell their mangoes in two possible ways. Selling mangoes to the local brokers on the tree stage versus growers harvest and sell them at the local market. The main functions of local brokers include collection, grading and wholesaling at the local market or wholesale market (Myat, 2012).
- ❖ **Local Processors** – Some large farm owners and processors possess facilities for grading and processing and they buy mangoes from smallholders. Local processors produced value-added products such as mango leather, mango juice, mango jam and mango puree (Eain, 2015).
- ❖ **Exporters** - Some exporters possess facilities for grading and packing and they buy mangoes from growers. The exporters and intermediaries (brokers) buy mangoes from growers and channel them to the brokers in Muse or other international markets. The two notable functions of intermediaries in the mango supply chain are; they connect small-scale producers to Muse and other international markets or domestic market and they finance the production and marketing process (Koji, 2017).
- ❖ **Local wholesalers** – Wholesalers in Yangon wholesale market, Mandalay market, Taunggyi market and Muse border trade perform wholesaling activity. After harvesting, local brokers, collectors and growers transport their mangoes to these wholesale markets for domestic marketing (Eain, 2015).
- ❖ **Local retailers** – Yangon wholesale market is a source for local retailers from lower Myanmar and Mandalay market is for retailers from upper Myanmar. Taunggyi market and Muse border trade are sources of retailers from the Southern Shan State. Retailing is done by retailers such as local markets, supermarkets and restaurants (Eain, 2015).
- ❖ **Local consumers** - In Myanmar, the demand for Sein Talone (Diamond Solitaire) mango is significantly higher in the local market as well as in export market than other varieties because of its adorable nature (Myat, 2012).
- ❖ **Brokers at border trade** - Myanmar merchants association plays the wholesale market in Muse (adjacent to Muse trade zone) which comprises 40 brokers who intermediate Myanmar



producers and Chinese importers. Chinese buyers and Chinese importers' agents visit daily across the border to participate in the daily auctions during the harvest season (April to June). Myanmar merchants (brokers) serve as the commission agents and auctioneers for suppliers and Chinese buyers (Koji, 2016 and 2017).

### **2.7.2 Main Supporters and Functions**

**Government** – Major government agencies responsible for fruit export are Ministry of Agriculture and Irrigation, Department of Agriculture and Plant Protection division and Ministry of Commerce, Trade Promotion Department. Plant Protection Division is responsible for setting up the rules of international plant protection standards for fruit export. Plant quarantine section, under the Plant Protection Division supports for issuing phytosanitary certificates for export of all kinds of crops (Yadanar, 2017).

**Yezin Agricultural University (YAU)** – In Myanmar, Yezin Agricultural University (YAU) is the only university with a higher level of education in Agriculture providing teaching, training, conducting academic research and extension services to the public. The University is implementing many projects in collaboration with International Cooperation agencies and Universities for Agriculture sector development in Myanmar (Yadanar, 2017).

**Myanmar Fruit, Flower and Vegetable Producer and Exporter Association (MFVP)** – MFVP is a semi-governmental organization collaborating with the Ministry of Commerce to improve horticultural crop production and trading (Yadanar, 2017). It supports and manages the value chain system by facilitating to the whole value chain. (Sein, 2013 and 2016).

**Non-governmental organizations (NGOs)** – There are some NGOs, International and local organizations, supporting mango value chain development in Myanmar. GIZ is a German-based international non-governmental organization that facilitates for strengthening value chain of tea and mango in southern Shan State in Myanmar (JICA, 2013). Win Rock International (Myanmar) is an international NGO that provides capacity development for technical knowledge to producers, farmer producer groups, agribusiness and community organizations in soybean, coffee and horticultural value chains to improve access to extension services and promotes market-based approaches (Winrock, 2014).

**Donor agencies** – Donor agencies that involve in and support for GAP standard and post-harvest activities in Myanmar are Food and Agriculture Organization (FAO) and AusAid. FAO works together with Myanmar Agriculture Service (MAS) to develop national GAP program and facilitates the establishment of a National Accreditation Body and a Certification Body for GAP products. AusAid provides GAP training programs to officials of MAS (Sein, 2016).

## **2.8 Overview of Opportunities and Constraints for Improving Mango Quality Control in Myanmar**

### **2.8.1 Opportunities**

Sein Talone mango has more potential than other varieties to increase the export because of its attractive nature including sweetness, color and appearance. The political improvement, the correlation between ASEAN countries and free from the sanctions of EU and US can contribute to the export development. The increase in foreign investment will have a positive effect on mango exporting in the future (Myat, 2012). Cooperation between the Ministry of Agriculture and Irrigation (MOAI) and United Nations Food and Agriculture Organization (FAO) has already begun to develop a certification system for permission to export to Singapore (OECD, 2014). This can lead to expanding market share in Singapore as well as in Russia and UAE market via Singapore. In the current mango export chain to China, the market can extend to the mainland of China and can have the better price if mango growers can produce improved quality mango (Eain, 2015 and Myat, 2012). In addition to extended growing areas, the mango growers can also look for the opportunity to expand to new markets (Myat, 2012).

### **2.8.2 Constraints**

Fresh mango is a perishable crop and exporting is a high-risk business. Among the large-scale mango producing and exporting countries in Asia such as India, Thailand, Pakistan, Philippines and Indonesia, Myanmar mango export is in high competition (UNECAP, 2016). Government management systems and government support are needed for infrastructure development and loan scheme. Trading policies and quarantine policies of the country have an effect on the mango export (Myat, 2012). Almost all of Sein Talone mango exporting farmers in Myanmar are not able to invest in post-harvest handling facilities like hot water treatment, cold room and cold chain logistics system because of high investment costs (FAO, 2016C).

Mango growers have inadequate knowledge about pre-harvest activities including good cultivation practices and pest and disease control. This can lead to low production and quality of mango. Postharvest losses of Sein Talone mango in Myanmar are still standing at a significant level (FAO, 2016C). Mangoes for the domestic market are mostly transported by using inappropriate containers such as wooden boxes, bamboo baskets, and paddy straw (Myat, 2012). For export market, only some mango farmers use appropriate packaged paper and cartoon boxes for transport (FAO, 2016C and OECD, 2014). In mango production, low productivity and lack of compliance with food safety standards and certifications generally limit market access for export (OECD, 2014). The transportation cost for this cross-border trade is considerable because of its distance and poor road conditions (Koji, 2016). The appropriate quality control scheme, certification system, post-harvest handling facilities and extension services are needed to ensure export mango quality for higher competitiveness in the export market (OECD, 2014).

The occurrence of diseases and pests can lead to low mango quality. Major mango diseases in Myanmar are anthracnose, stem end rot disease and powdery mildew disease. Seed weevil, thrips, aphids, fruit flies and pulp weevil are major pests that attack the mango trees (Myat, 2012 and Sein, 2016). Another constraint for mango quality improvement includes the fungus *Fusarium moniliforme* that can cause mango malformation. Floral malformation can lead to loss of fruit production and vegetative malformation can attack small plants and also mature trees (Sein, 2016).

### **3. RESEARCH METHODOLOGY**

#### **3.1 Description of Study Areas**

This research will be carried out in two main mango producing areas in Myanmar; Southern Shan State and Mandalay Region.

##### **3.1.1 Southern Shan State**

Shan State is located in eastern Myanmar mostly covered by hilly regions. It is bordering with China to the north, Lao PDR to the east and Thailand to the south. In Myanmar region, it is bordered by Kayah and Kayah States to the south and Sagaing and Mandalay Regions to the west (Figure 5). Shan State has the total area of 155,457.45 sq. km, covering almost 25% of Myanmar's total land area and it is the largest of all States and Regions in terms of area. Shan State has the total population of more than 5.8 million in 2014 that corresponds 11.3% of the total population of Myanmar, 74% live in rural areas and 24% live in urban regions (DOP, 2015B). Shan State area was sub-divided into Shan East (Kantung as center), Shan North (Lashio as center) and Shan South (Taunggyi as center). The State capital is Taunggyi and major economic sectors are agriculture, forestry and mining (UNDP, 2015). Shan State became a major region because of its location bordering with China next to economically important Yunnan Province where Myanmar's cross-border trade with China is greatly accumulated (Koji, 2016).

Agriculture is the major livelihood of people in Shan State where shifting cultivation is carried out in hilly regions. A variety of fruits and vegetables can be grown because of its temperate climate. The main crops grown in the highland region of Southern Shan State are paddy rice (monsoon paddy), maize, sugarcane, nigar, sunflower, various vegetables, groundnut, soybean, pigeon pea, tea, potato, rubber and mango. Mango is mainly grown as an important crop for the export market and domestic market in Southern Shan State. The areas selected for this study were Taunggyi and Yat Saut because these regions are the main Sein Talone mangoes producing areas of Shan State (Figure 5).

##### **3.1.2 Mandalay Region**

Mandalay region is located in central Myanmar with the total area of 29,686.25 sq.km bordered by the Union of Territory of Nay Pyi Taw to the south, Sagaing and Magway Regions to the west, Sagaing Region to the north and Shan State to the east (UNICEF, 2013). Mandalay Region had the total population of over 6.1 million that represents 12% of the total population of Myanmar. In Mandalay region, over half of the total population, 65%, live in rural areas and 35% live in urban areas (DOP, 2015A). There are 7 Districts, 28 Townships, 269 Wards, 1,416 Village tracts and 4,901 villages in Mandalay region. The climate of Mandalay region is hot semi-arid and duration of wet and dry seasons are nearly equal in the year. The capital city is Mandalay and the main economic activities are agriculture, forestry, industry, mining and tourism (UNICEF, 2013).

Agriculture is a primary source for economic development in this region. The crops grown in this region are rice, maize, wheat, sesame, legumes, peanut, cotton, tobacco, chilli and vegetables (EuroCham Myanmar, 2017). Mango is grown as an important crop for the export market and domestic market in that region. The study sites chosen for this research were Paleik and Amarapura Townships because these areas are the main mango growing areas of Mandalay region (Figure 5).

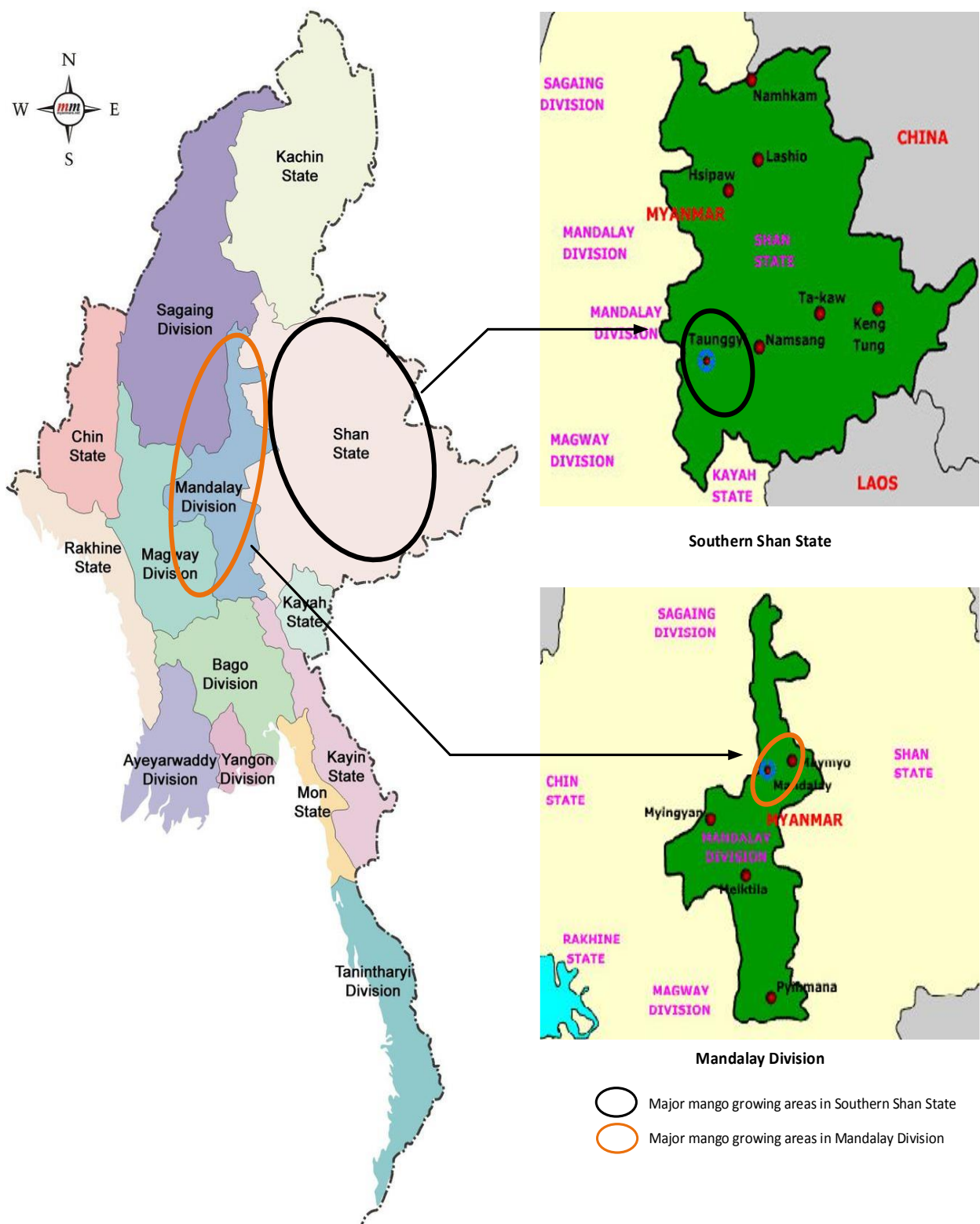


Figure 5 Map of study areas (Shan State and Mandalay Division) in Myanmar  
Sources : Map zones and Pinterest, 2012

### 3.2 Research Design

The research was started with a desk study for understanding and collecting of relevant secondary data. Primary data was gathered from field studies through interviews using checklists and observation followed by data analysis and formulating recommendations. Figure 6 shows the phases of research that went along with each other.

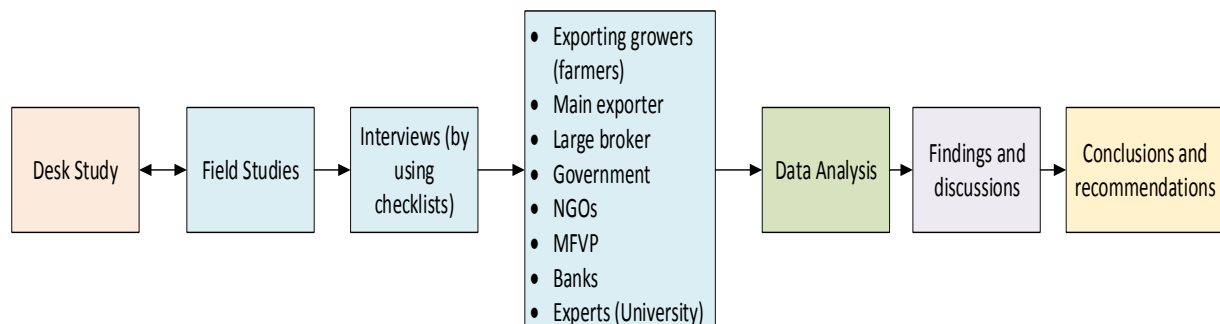


Figure 6 Research design

### 3.3 Research Strategy

In this research, a qualitative approach (case study) was used to capture opinion, reasons and experiences of various actors in the value chain. This descriptive research approach provided insights into the problem and helps to obtain an in-depth analysis of the reasoning behind the existing quality control scheme, marketing and exportation of fresh Sein Talone mangoes in target areas. The research methods included; desk study, interviews and direct observations. Data was triangulated through confirmation with each respondent on major responses after each interview, findings from literature search and affirmation with Central Executive Committee Member of mango cluster from each study area.

#### 3.3.1 Desk Study

The review of literature of various secondary data including theories, studies and reports was conducted before the field research to learn and focus on in-depth understanding of the background and general context of the research topic and that also helped for the formulation of the checklist. Moreover, this also supported additional information on topic and research methodology during research. As suggested by Laws et. al., 2013, the validity of research findings and supporting for recommendations were checked from secondary data by doing desk study.

#### 3.3.2 Interviews

Primary data was collected by doing in-depth interviews. As recommended by Laws et.al., 2013, the purposive sampling was used to recruit the knowledgeable and experienced respondents in order to obtain specific information about the group. In each study area, the selection of certified and non-certified exporting growers was based on their experiences of fresh mango export and their number of areas cultivated (hectare). The growers who have the highest exporting experiences and the largest mango cultivated area were chosen for the interview. The contact information of main exporting growers and main broker from border trade were obtained from Myanmar Fruit, Flower and Vegetable Producers and Exporters Association (MFVP). The snowball sampling method was used to recruit further respondents through information from primary respondents. This method is a non-probability sampling that can be used to conduct qualitative research when potential participants are inaccessible (Laws et.al., 2013).

There were 24 key stakeholders participated in these interviews; 4 non-certified exporting growers and 2 GAP-certified growers from each study areas (Mandalay and Southern Shan), 1 GLOBAL GAP certified farmer from Southern Shan, 1 main exporter, 1 large broker at Muse border trade, 1 respondent from MFVP, 1 respondent from GIZ, 3 respondents from government departments, 1 respondent from each financial institution (MADB and CB) and 1 expert from Yezin Agricultural University (Table 7). The detail of the interviewees' profiles is shown in Appendix 1.

Table 7: List of Interviewees

No.	Interviewee	Type of interviewee	Area	Date of interview	Type of interview
Exporting Growers in Mandalay Region					
1	A1	GAP Certified-exporting grower	Paleik township	5-Jul-18	Individual
2	A2	GAP Certified-exporting grower	Patheingyi Township	6-Jul-18	Individual
3	A3	Non-certified exporting grower	Amarapura Township	9-Jul-18	Individual
4	A4	Non-certified exporting grower	Amarapura Township	11-Jul-18	Group
5	A5	Non-certified exporting grower	Amarapura Township	11-Jul-18	
6	A6	Non-certified exporting grower	Amarapura Township	11-Jul-18	
Exporting Growers in Southern-Shan State					
7	B1	GAP Certified-exporting grower	Yat Saut	16-Jul-18	Individual
8	B2	GAP Certified-exporting grower	Yat Saut	16-Jul-18	Individual
9	B3	GLOBAL GAP certified exporting grower	Si Saing	17-Jul-18	Individual
10	B4	Non-certified exporting grower	Taunggyi	18-Jul-18	Individual
11	B5	Non-certified exporting grower	Yat Saut	19-Jul-18	Group
12	B6	Non-certified exporting grower	Yat Saut	19-Jul-18	
13	B7	Non-certified exporting grower	Yat Saut	19-Jul-18	
Exporter					
14	C1	Exporter	Yangon	26-Jul-18	Individual
Broker (Border Trade)					
15	D1	Broker (border trade)	Muse	23-Jul-18	Phone-interview
NGO and Association					
16	E1	Association (MFVP)	Yangon	2-Jul-18	Individual
17	E2	NGO (GIZ)	Taunggyi	18-Jul-18	Individual
Financial Institutions					
18	F1	Financial institution (MADB)	Yangon	31-Jul-18	Individual
19	F2	Financial institution (CB)	Yangon	27-Jul-18	Individual
Government Departments and University					
20	G1	Government (DOA)	Nay Pyi Taw	6-Aug-18	Individual
21	G2	Government (Regional Department)	Mandalay	12-Jul-18	Individual
22	G3	Post-harvest technology center	Mandalay	13-Jul-18	Individual
23	G4	Government (Regional Department)	Yat Saut	17-Jul-18	Individual
24	H1	Expert (YAU)	Yezin	2-Aug-18	Phone-interview

Currently, there is only one GLOBAL GAP certified farmer in Myanmar and the respondent was recruited for the research interview. Generally, exporters export a lower quantity of fresh mango compared to exporting growers. However, they have higher accessibility to other export markets than growers. Therefore, one exporter was recruited for research interview based on the highest export experiences, the highest number of countries exported and the business functions (exporting fresh mangoes and value-added products). The selection of respondents from supporting organizations was based on their current supporting functions.

Type of in-depth interviews included; individual interview, group interview and phone interview (Table 7). The type of interview depended on the respondents' availability, market condition in border trade (broker in border trade) and convenience of transportation.

The duration of an in-depth interview took about an hour depending on the respondent's opinions and experiences. The interviews were conducted in the respondent's home or workplace to create their comfort during the conversation as recommended by Laws et.al., 2013. After conducting each interview session, the transcription and data processing were carried out on the same day.

As recommended by Laws et.al., 2013, the interview was structured as follows;

- ❖ Short introduction and explanation of the research and purpose of the interview
- ❖ Explanation about the confidentiality of the interviewee's names and that data was used for research purpose only.
- ❖ Ask the permission of the respondents for recording the interview speech.

The interviews were conducted in Myanmar language using a checklist (Appendix 2). Open-ended questions were used for in-depth understanding of the reasons behind. Interviews were scheduled by appointments with respondents. During the interviews and field trips, the data was cross-checked by direct observations to collect more supportive information and to understand the general situation of study areas as recommended by Laws et.al., 2013.

Although for the research, it was planned to conduct two focus group discussions (one in each study area) with participants from individual interviews, the growers in each area requested to omit the focus group discussion. On behalf of having a full schedule on their farm management activities for other mango varieties, it was not convenient for them to have a group discussion again.

### **3.3.3 Data Processing**

Data processing was carried out by the grounded theory method. The steps include (Verschuren et al., 2010);

1. Organizing – Texts were organized within the specific labels that were identified as the key concept from each information.
2. Relevance – All relevant fragments were checked with a connection to research questions. Inappropriate fragments that were not related to research questions were put separately.
3. Open coding - Comparison between text and different labels and joining together the synonyms was done to refine the information.
4. Axial coding - The related labels with specified properties and dimensions were grouped into subcategories and then they were reassembled to have coherence for analysis.
5. Selective coding - All subcategories were grouped around the core categories that relate to the research dimensions.

### 3.3.4 Data Analysis

The processed data were analyzed using different analytical tools structured per research question as shown in Table 8.

Table 8 The overall research strategy

Research Question	Stakeholder	Tool for data collection	Tool(s) for data analysis
1.1 What are the existing quality control systems?	Exporting growers (certified, non-certified), main exporter, large broker, GIZ, MFVP	Interviews	Value chain map
1.2 What are the different quality criteria for fresh mango export in Asia (especially to China and Singapore)?	Exporting growers (certified, non-certified), main exporter, large broker, MFVP	Interviews	Quality criteria
1.3 What are certification systems used for mango production?	Exporting growers (certified, non-certified), main exporter, government, GIZ, MFVP	Interviews	Certification systems
1.4 What are the differences between certified and non-certified farmers regarding market opportunities?	Exporting growers (certified, non-certified), main exporter, large broker, government, GIZ, MFVP	Interviews	Value chain map
1.5 What are the supporting and hindering factors for improving fresh mango quality control for export	Exporting growers (certified, non-certified), main exporter, large broker, government, GIZ, MFVP, expert, banks	Interviews	PESTEC, SWOT, Stakeholder analysis
2.1 What are the roles of key stakeholders and their existing support in the fresh mango export chain?	Exporting growers (certified, non-certified), main exporters, large broker, main supporters, GIZ, MFVP, expert, bank	Interviews	Value chain map, Stakeholder analysis
2.2 What kind of support from government and stakeholders is needed to improve mango quality control for export?	Exporting growers (certified, non-certified), main exporter, government, GIZ, MFVP, expert, bank	Interviews	SWOT, PESTEC, Stakeholder analysis, Theory of change

- ❖ **Value chain map** – This is a descriptive and analytical tool that can be used to visualize the diverse roles and connections between participating actors in the chain and identify sources of innovation and improvement. It identifies key actors and their functional stages. This can also provide information from a macro perspective about situation and context and provide a systematic overview (Umberger, 2014). In this research, value chain map was used to visualize and analyze the existing functions that contribute to the quality control process, market opportunities differences between certified and non-certified growers and existing support activities of supporters along the value chain.

In this study, supporting and hindering factors and the necessary support of government and stakeholders were analyzed by using PESTEC, SWOT and stakeholder analysis. See below;

- ❖ **PESTEC** – This is an acronym for six sources of change; Political, Economic, Social, Technological, Environmental and Cultural. This is a powerful and widely used analytical tool for understanding strategic risk. This tool can identify the changes and effects of the external macro environment on a firm's competitive position (Sammot-Bonnici and Galea, 2015).



- ❖ **SWOT** – PESTEC analysis is used in conjunction with SWOT analysis. SWOT is the analysis of internal strengths and weakness, external opportunities and threats (Sammut-Bonnici and Galea, 2015).
- ❖ **Stakeholder analysis**
  - **Stakeholder matrix** can be used to analyze the stakeholder such as an agency, organization, group or individual who has a direct or indirect interest in an intervention, or who is affected positively or negatively by the implementation and outcome of it. Firstly, it is needed to identify key stakeholders. Then assess for each stakeholder functions and power relationships among stakeholders (Thomas and Muharemovic, 2011).
  - **Radian institutiogramme** is a visualizing tool to show the financial flow, information exchange, policies and products and services by using different color one-way or two-way arrows (one-way service or mutual) (Thomas and Muharemovic, 2011).
  - **Power and interest grid** can be used to describe the level of influence/power of stakeholders and their interest in intervention (Thomas and Muharemovic, 2011).
- ❖ **Theory of change** was used to visualize and analyze the recommendations regarding sustainability on improving mango quality control.

### 3.3.5 Validation of the Results

During the interview sessions, the major responses were confirmed, and feedback was asked to each respondent. For any additional data added by respondents, the researcher noted and read again for confirmation. After data processing, the major findings and results were confirmed with the Central Executive Committee Member of Mango cluster from each study area (Mandalay and Shan).

## 4. RESULTS

The overall objective of this research was to identify opportunities and constraints for fresh mango quality control along the mango export chain in two major mango producing and exporting areas in Myanmar; Mandalay and Southern Shan State. This includes the analysis of the role of key stakeholders in mango export value chain; actors such as exporting farmers (certified and non-certified) from both study areas, exporter, broker at Muse border trade and main supporters such as government, NGOs and financial institutions.

The results were formulated based on the findings collected through in-depth semi-structured interviews, observations as well as farm visits. This chapter is categorized into three sections as follows;

1. Findings of general information about Sein Talone mango in research areas
2. Findings of in-depth interviews with main actors
3. Findings of in-depth interviews with main supporters

Based on the research conceptual framework and in-depth interviews by using checklists, the sub-topics were categorized as follows;

- 1 Existing quality control systems
- 2 Different quality criteria for fresh mango export in Asia
- 3 Certification systems used for mango production
- 4 Differences between certified and non-certified farmers regarding market opportunities
- 5 Supporting and hindering factors for improving fresh mango quality control for export
- 6 Roles of key stakeholders regarding their existing support in the fresh mango export chain
- 7 Necessary support from government and stakeholders

### 4.1 Findings of General Information About Sein Talone Mango in Research Areas

#### 4.1.1 Mandalay Region

In many farms, the age of mango trees ranges from more than 30 years old. Major mango varieties producing in Mandalay areas comprise Sein Talone, Yin Kwal, Shwe Hinthar and Padamyar Ngamauk. The major export mango varieties of Mandalay area are Sein Talone and Shwe Hinthar. The average mango farm size in Mandalay region is 30 acres (about 12 hectares) but small-holder farmers have 1-2 acre (less than 1 hectare).

There are three harvesting periods of 'Sein Talone mango' in the Mandalay regions (from mid-April until mid-July) which depends on geographical condition. The first harvesting period starts from mid-April to mid-May in Eastern Amarapura, Eastern Patheingyi, Kyaukse Han Myint Mo. This is the earliest harvesting period in Myanmar and the growers normally get a higher price in this season. Sintgaing, Western Amarapura, Madaya and Tada-U areas harvest mangoes for the whole month of May. The last harvesting time, end of May to end of June, starts in Depayin Kwin area together with Southern Shan State.

'Sein Talone mango' from Mandalay region has a higher sweetness level, up to 22°Brix and less fibrous nature than other varieties. The fruits size produced from Mandalay region ranged from 250-350 gm per fruit. Farmers sort mango into three grades for exporting; Special (above 300gm), large (250-300gm) and small (less than 250gm). Mango sweetness level and fruit size depend on geographical and climatic conditions of growing areas.

#### 4.1.2 Southern Shan State

Generally, the age of mango trees in Southern Shan State ranged from 8 to 15 years. Most growers in Southern Shan State mainly produce Sein Talone and Yin Kwal varieties. One grower said that total mango cultivation area in Southern Shan State is approximately 15000 acres (6,000 hectares). Yat Sauk region is the biggest mango cultivation area in Southern Shan State ranging from 8000 to 9000 acres (3200-3600 hectares). In this area, Sein Talone variety is cultivated on approximately 5000 acres (2000 hectares) and Yin Kwal variety was almost 4000 acres (1600 hectares).

All respondents mentioned that the sweetness level of Sein Talone mango from Southern Shan State is around 12°Brix. The fruits sizes ranged from 280gm to more than 500gm per fruit. Most of the fruits are big size; between 350 to 500gm. Farmers sort mango into four grades for exporting; Special with star (above 500gm), A size (400-500gm), B size (350-400gm) and C size (280-350gm).

### 4.2 Findings of In-depth Interviews with Main Actors

#### 4.2.1 Existing Quality Control System

##### 4.2.1.1 Mandalay Region

All farmer-respondents from Mandalay area mentioned that they wrap the individual fruit with a paper bag in the fruiting stage (around 2 months after flowering) to improve fruit quality, prevent latex burns, protect mechanical damage (eg. scars, scratches) and pests (e.g-fruit fly, pulp and seed weevil) infestation. They said that bagging-fruits can get a higher price both in the local and export market.



Picture 1 Mango tree and harvesting of mangoes by using the ladder in Amarapura, Mandalay

The harvesting period of Sein Talone variety in Mandalay region is from mid-April to end of June. All respondents from Mandalay region said that they start pruning after harvesting and apply chemical fertilizers and pesticides. However, one non-certified respondent mentioned that pruning can be effective for young plants (around 7-8 years old) but it is not good for the mango trees that are more than 30 years old. One non-certified interviewee said that in the past, they needed to use chemical applications only 3 times per season, but in the present, they must control pests and diseases continuously by using chemicals throughout the season (until before fruit bagging).

### ***Non-certified Growers in Mandalay region***

Most non-certified respondents mentioned that they harvest the fruits manually using a ladder as described in Picture 1 and cut the pedicel (about 2 inches) together with fruit bag by using a fruit cutter. However, the other non-certified grower expressed the use of the harvesting method depends on plant height. He also uses bamboo picking pole for high plants.

According to responses of all non-certified growers, the process flow of the mango post-harvest handling is as follows in Figure 7.

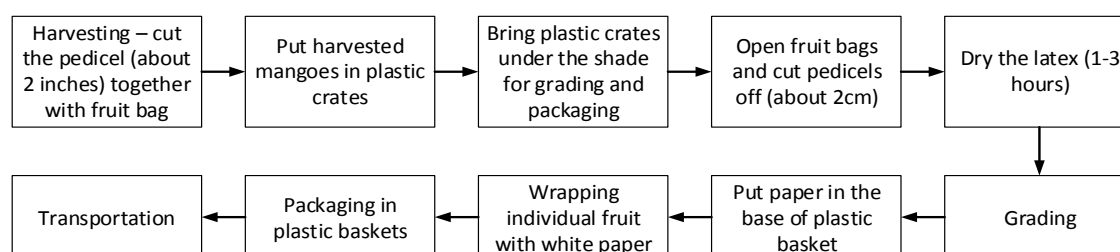


Figure 7 Process flow of mango post-harvest handling for exporting to China

Grading and packaging are mostly done under the shade in the field. One non-certified grower said that he builds a shade house in the field to prepare mangoes for export. For cutting the pedicel, there is a natural joint on the pedicel (about 2cm) in ‘Sein Talone’ variety and it is not necessary to cut, and one can easily remove the pedicel by hand from this joint. Moreover, he uses the removed fruit bag to absorb the latex on the pedicel.

Non-certified growers use 2.5 feet (76cm) high bamboo shelves covered with cotton sheets then put mangoes on the bamboo shelves for 1-3 hours to dry the latex. Grading is mostly done by eye-estimation (Picture 2). The packaged fruits are placed into plastic baskets with two layers (Picture 2) then covered with hard paper and closed with plastic basket cover. The baskets are then ready for transportation to the export market (Picture 2).



Picture 2 Grading and packaging prepared to send to Muse border trade (non-certified farm in Mandalay region)

### ***Certified Growers in Mandalay Region***

All certified respondents have similar practices of harvesting. They use bamboo picking poles because they think that manual harvesting using a ladder is not an effective method because it is time-



consuming and has high labor costs. Most interviewed certified growers use the same post-harvest handling practices as the non-certified growers, see Figure 7. The main difference between certified and non-certified respondents in post-harvest handling is that the certified respondents handle the harvested mangoes for grading and packaging on the bamboo sheet that is covered with a plastic layer (Picture 3).



Picture 3 Mango packaging to Muse border trade (Left) and mango packaging to Singapore via exporter (Right) (Certified-farm in Mandalay region)

One certified-respondent discussed in detail about his pre-harvest practices. The respondent uses chemicals, 15 to 20 times per season, for farm management. Control of MRL is done by using the instructed/recommended amount of chemicals and PHI as described on the label of farm chemicals. In Mandalay area, the time of mango picking is mostly decided by experience; normally 120 days after flowering. The practice of irrigation is based on weather condition. Generally, mangoes trees are irrigated 1-2 times per month from around end of October to March and irrigation is stopped at the time of flowering.

One of the two GAP-certified respondents mainly focuses on production of value-added products. She started the business from 2015 in the own small-scale processing factory in order to reduce waste and explore new export market opportunity (Picture 4). The respondent said that they do farm management such as weeding and cleaning regularly. Sein Talone mango is used for processing of high-valued products such as puree and frozen products. This certified-grower exported fresh Sein Talone mangoes to Singapore in 2010-2011 but the respondent stopped exporting to Singapore because of high investment cost (cost for Singaporean inspector, transportation etc.).



Picture 4 Processing facilities in processing plant of Certified-respondent in Paleik, Mandalay

This respondent also explained about post-harvest handling techniques of fresh mango production that are exported to Singapore. This is shown in Figure 8.

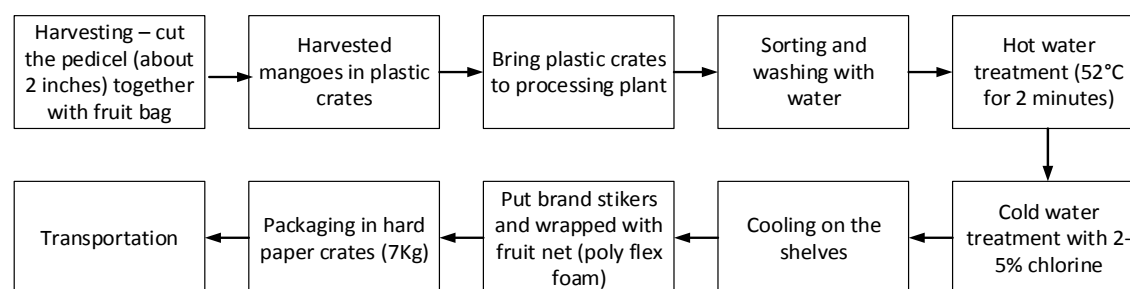


Figure 8 Process flow of mango post-harvest handling for exporting to Singapore

All farmer-respondents in Mandalay region stated that they harvest mangoes in the early morning and prepare packaging and grading for the whole day. They use a truck for mango transportation. They transport mangoes in the evening to protect from high temperature.

#### 4.2.1.2 Southern Shan State

Similarly, with farmers in Mandalay, all farmer-respondents from Southern Shan State also mentioned that they wrap individual fruit with paper bag in the fruiting stage (around 2 months after flowering). The slightly different flowering periods within the same farm can lead to harvesting unequal maturity fruits. Farmers ensure the harvesting of equal maturity fruits by marking color on the fruit bags with color-spray that can differentiate easily the fruits for picking.

Farmers normally decide harvesting time by taking 4-5 samples of fruit and putting them in the water. If the fruits do not float in the water, they determine the fruits are ready to harvest. All respondents from Southern Shan State said that they start pruning after harvesting and they apply pesticides and chemical fertilizers.



Picture 5 Mango trees in certified grower's farm in Yat Saut, Southern Shan.



### ***Non-certified Growers in Southern Shan State***

All non-certified respondents mentioned that they use a bamboo picking pole (with hook and basket/container at the top) for harvesting.

Most non-certified interviewees have a similar post-harvest handling process for exporting to China with non-certified respondents from Mandalay region as shown in Figure 7. They use 7'X4' wooden shelves for drying the latex for 1-3 hours. Grading is done by measuring 2-3 fruits per time with digital balance. One of the 4 non-certified respondents has a large shade building in the farm for grading and packaging of mangoes (Picture 6). The other non-certified respondents manage packaging process under the bamboo shade-house in the farm.



Picture 6 Grading and packaging in large shade building to send to Muse border trade (Non-certified farm in Taunggyi, Southern Shan)

### ***Certified Growers in Southern Shan State***

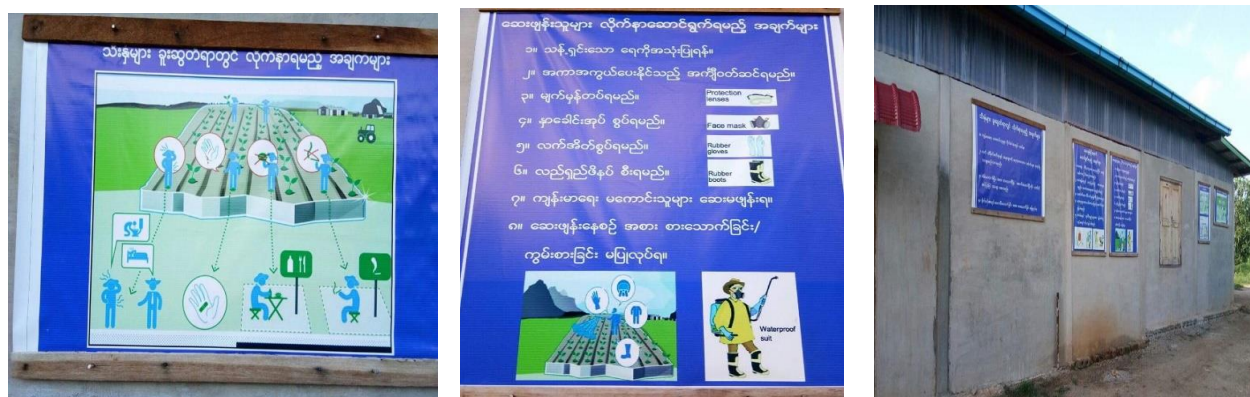
All GAP certified interviewees in Southern Shan have similar practices of mango post-harvest handling with Mandalay region as shown in Figure 7.



Picture 7 Grading and packaging of certified-grower in Yat Saut, Southern Shan

The main differences between GAP certified and non-certified respondents in Southern Shan include the certified respondents handle the harvested mangoes for grading and packaging on wooden shelves instead of grading under the shade in the field. In grading, they measure individual fruit weight

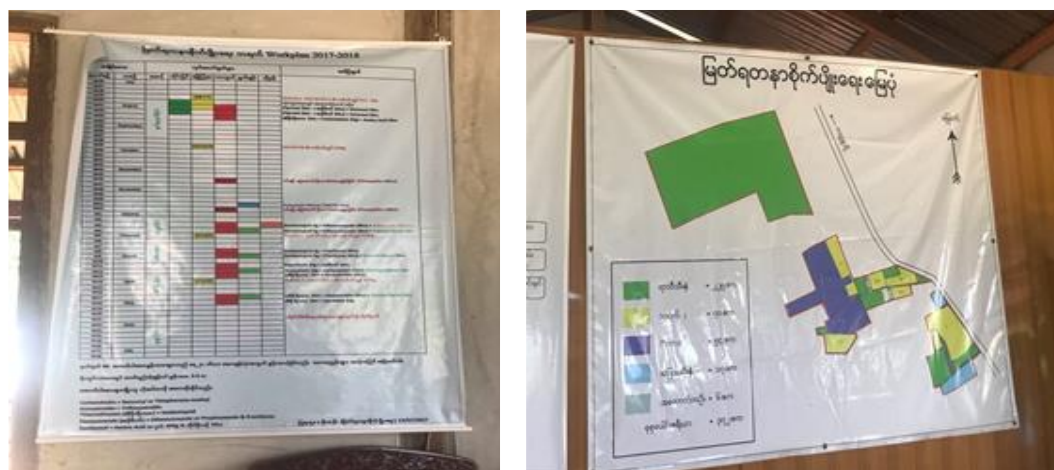
by using digital balance for ensuring equal size (Picture 7). The certified-respondents also have farm instruction posters about harvesting and chemical handling posted on their ware-houses (Picture 8).



Picture 8 Farm instruction posters for harvesting and chemical handling (certified grower's warehouse in Yat Saut, Southern Shan)

### **GLOBAL GAP certified Grower in Southern Shan State**

The GLOBAL GAP certified farmer instructs the activities of pre-harvest control by putting farm work-plan including instruction (chemicals dosage and time of application according to the mango growing period) in the farm office (Picture 9).



Picture 9 Farm work-plan (Left) and farm map (Right) (GLOBAL GAP certified farm in Southern Shan State)

The post-harvest handling processes in accordance with the GLOBAL GAP standard are controlled in the warehouse. Warehouse floor and farm harvesting materials such as fruit cutters, plastic crates and transport machines are washed with clean water before mango harvesting time. When harvesting, this farmer uses long fruit cutters (Picture 10) and puts harvested fruits into plastic crates.





Picture 10 Long fruit cutters for harvesting (Left) and separate color baskets for graded fruits (GLOBAL GAP certified farm in Southern Shan State)

Primary grading is done at the time of harvesting in the field by separating with different color crates. Damaged, rotten and malformed fruits are not allowed into the warehouse.



Picture 11 Grading in a warehouse by using wooden shelves (Left) and balance (Right) (GLOBAL GAP certified farm in Southern Shan State)

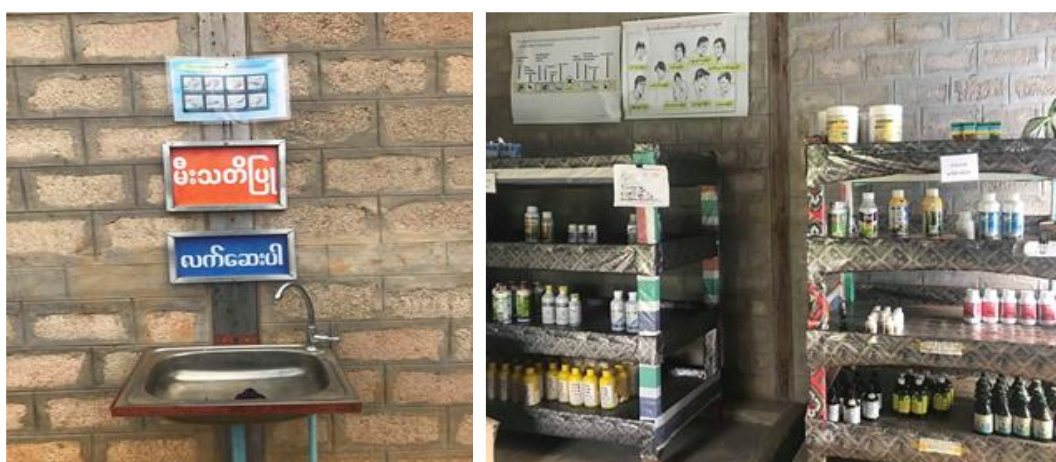
Grading and packaging are done on wooden shelves and balance machines are used for grading (Picture 11). The graded fruits are separated per grade in different color plastic baskets and put in a separate room (Picture 10). Fruits are packed in plastic baskets for local and China market and hard paper crates for exporting to Germany. Transportation to local and China market is done by using a truck. Transportation to Germany market is done by using air-con express to Yangon International Airport and the export by oversea flight.

The instructions for fruit cutting, safety instructions for chemical handlings and early warning signs are posted on the wall of the warehouse (Picture 12).



Picture 12 Instructions posters of chemical handling (Left) and product handling (Right) (GLOBAL GAP certified-farm, Si Saing, Southern Shan)

The hygiene of fruit handling and workers' safety are the first priority and workers are trained for safety and hygiene practices. Workers must use face-masks, hand gloves and protective clothes when using chemicals. Hygiene practices such as hand washing and nail cut are well trained to operational workers (Picture 13). Operational inspection is done by the Farm Manager. There are a chemical storage room, a fertilizers storage room and a farm materials storage room (paper crates, stickers, baskets, fruit bags).



Picture 13 Hand washing facility with instruction (Left) and chemical storage room with handling instruction (Right) (GLOBAL GAP certified farm, Southern Shan State)

#### 4.2.1.3 Exporter

The respondent who only export but does not grow the mango herself, mangoes are bought mainly from Bago, Mandalay, Sagaing and Southern Shan State. Currently, the respondent is mainly focusing on production of value-added products (mango puree and dried mango) by processing in her own processing factory located in Nay Pyi Taw in order to reduce post-harvest losses and have benefit from rejected and low-quality fruits. The respondent said the cold storage facility is used only for storage of processed-products and it is not used for fresh mangoes. She said temperature variance on mango can seriously affect fresh mango quality because of lack of cold chain facility for transportation.

The respondent mentioned her general view on quality control practices of mango farmers. Farmers in current situation have more awareness about quality than previously and commonly they can produce quality-fruits although new market opportunities still need to be developed.

#### **4.2.1.4 Broker at Border Trade**

The broker stated that farmers' awareness of pre and post-harvest handling is better than in the past.

#### **4.2.2 Different Quality Criteria for Export**

##### **Exporting Growers**

All farmer-respondents (certified and non-certified) in both study areas answered that their major export market is China. All growers have similar reasons for exporting to China that include high purchasing power of Chinese marketers/buyers and better price than in the local market. They can sell all harvested mangoes in the border area so that they can overcome exceeding supply in local market. Farmers sell their mangoes at the Muse border by means of an auction. Chinese buyers daily visit brokers and check 5-10 fruit baskets as samples and then they determine the price according to mangoes quality.

In border trade, there is no specification for fruit size, fruit quality and maximum residue limit (MRL). The price difference depends on the fruits: Chinese buyers give a high price if the mango quality is high. After buying from growers, Chinese buyers re-pack the mangoes with their logos and sell in the local Chinese market by means of Kg. Farmers stated the general quality preference of Chinese buyers as follows;

- Large size fruit with equal maturity (above 350-400gm/fruit)
- No physical injuries and no latex on the fruit
- Packed in a basket (16kg/basket)
- Color should be a mix of pale green and yellow (they do not prefer fully yellow color fruits)
- Well-packaged
- No hot-water and cold-water treatment because these treatments can cause early ripening and damage upper hairy layer of the fruits

The certified-farmer respondents from Mandalay area have more experience on fresh mangoes export to Singapore, Thailand and Hong Kong markets through the exporter. One respondent sells mangoes to the exporter (0.25-0.5 ton) by selecting the special quality and he receives a better price than when selling on China market.

The respondents in Southern Shan who have connected with the exporter said that the exporter's demand is still low. They sell approximately 2% of their total production and the exporter selects only good quality fruits and the buying pattern (demand) is not on a regular basis. Exporters also buy low-quality mangoes with low price for processing.

The GLOBAL GAP certified respondent exported 140Kg to Munich, Germany in this year (2018) by selecting extra-class size fruits without spots and injuries. Fruit size, date of harvesting, log number and date of packaging were described on labels together with the logo. He mentioned the general preference of German market includes GLOBAL GAP certificate, small size mango (250-350gm/fruit) and a little sour taste. Moreover, growers have to follow European market's specification regarding fruit size and number of fruits. He also shared his knowledge about quality requirements in other countries. The Japan market needs vapor heat treatment and frozen products and the American market needs a radiation test.

## **Exporter**

The exporter said that the importance of mango quality is different in local and export markets. Generally, quality is not a major factor for local market. However, there are specific requirements for mango quality for export and it is mainly determined by fruit color, freshness, sweetness (°Brix) and fruit size. The fruits selection criteria of the exporter include; fruits with no physical injuries, no spots, no latex, 2cm stalk and fruits that were controlled with fruit bags in the fruiting stage. The respondent buys all mangoes that meet the required quality from the growers who are already aware of the requirements of export markets. The exporter stated that the Singapore market needs high-quality mangoes compared to China.

## **Broker**

Chinese buyers determine the price depending on mango quality. The buyers inform the price only to the broker by showing digits on their calculator. The broker makes the choice for the highest bid price in the auction to sell the mangoes to Chinese buyers. The respondent mentioned the same about the quality preference of Chinese buyers as described by mango growers. The major clients include Chinese wholesalers and retailers for selling in China local market. There is a very low percentage of supermarket buyers. In the border trade, Sein Talone mango farmers from Southern Shan State sell the largest quantity among other sellers from Northern Shan, Mandalay, Sagaing, Kachin and Bago regions.

### **4.2.3 Certification Systems Used for Mango Production**

#### **Exporting Growers**

Both certified respondents from Mandalay region and one out of 2 certified-respondent from Southern Shan who participated in interview achieved GAP certificate in 2016, 2017 and 2018. One respondent from Southern Shan got GAP in 2017 and 2018. This respondent explained insufficient hygienic control and unsystematic farming practices such as lack of systematic farm record, storage of chemicals with farm materials and inappropriate distance between toilet and farm are major factors of failure for meeting GAP guideline in the first year, 2016.

The validity of the GAP certificate is one year (one production season). One respondent said there is no limitation about the number of cultivation area for which the GAP certificate can be applied. All certified respondents in both research areas described the GAP certificate application process as follow;

- Submission of application to respective township agriculture department along with farm maps together with farm number.
- In the first year, township agriculture department collects soil and water samples from the mango farm to investigate the existence of harmful minerals.
- District and State or Regional agriculture departments pre-check the farming practices for 1-2 times and inspector team from DOA, Head Office inspect for the final check. Inspection is carried out from land fertilizer application to flowering and fruiting stage.
- Township agriculture department collects 3-5 fruits as samples to test the chemical residue in the laboratory of Plant Protection Department in Yangon

The GLOBAL GAP certified farmer achieved GLOBAL GAP in 2017 and 2018. The respondent stated that GLOBAL GAP guidelines are basically not much different from Myanmar GAP which is based on the ASEAN GAP standard. The former certification is more concerned with safety practices compared to the latter. The GLOBAL GAP certification body is the Control Union (third-party organization). This

organization provides trainings, guidelines, procedures and control points to comply with the GLOBAL GAP standard.

The respondent explained the requirements for GLOBAL GAP application. These include risk assessment and control procedures, MRL test result of the ISO-certified laboratory from the Netherlands and sanitary and phytosanitary (SPS) certificate from Plant Protection Department of Myanmar. An inspector from the Myanmar representative office of Control Union checks the farm and products for one time. The estimated cost for GLOBAL GAP certificate application is Euro 1,400-1,500 including agency fees, transportation and accommodation costs for the inspector.

#### **Exporter**

Certification is not necessarily crucial in the current situation of mango exporting. In consequence of insufficient certification system for crop production in Myanmar, the respondent can determine the export market which has no specification for certification as the priority.

#### **Broker**

In the current situation, China market has no specification for certification and MRL for exportation. They buy all the mangoes and the price difference depends on fruit quality.

### **4.2.4 Differences Between Certified and Non-certified Farmers Regarding Market Opportunities**

#### **Exporting Farmers**

All interviewees from both research areas reviewed the current export condition of Sein Talone mango. The current major export market of Myanmar Sein Talone mango is China and other markets include Singapore, Hong Kong and Thailand. In both the local and export situation, there is no separate market that specifically demands the products with GAP certification. In China market, price is determined by buyers depending only on fruit quality such as fruit size, color, free of physical injuries and supply condition. Similarly, certification is not necessary for exporting to Thailand, Hong Kong and Singapore. The Hong Kong market demands MRL test result and Singapore market prefers the fruits that are treated with hot and cold water.

Despite an insufficient market demand for GAP certificate in the current situation, all certified respondents in both research areas have similar objectives of GAP certificate application. The reason is certification is a kind of license that can guarantee their products are safe and qualified in the market. They are practicing the production of quality products that comply with standardization and they would like to connect to new export markets in the future. The GLOBAL GAP farmer stated the main reason for GLOBAL GAP certification is developing linkages to new export markets. This is the major priority even though price differentiation is commonly relying on fruit quality, marketing skill and handling and packaging system. All certified farmers have the plan to apply for GAP certificate in the coming years.

Some non-certified respondents started trying to apply for GAP for the next harvesting with the aim of better market opportunity. However, one respondent has no intention to undertake certificate application because it is a cost and time consuming without having a better market opportunity.



## **Exporter**

The respondent buys all mangoes which meet the required quality from the growers who are already aware of the requirements for export markets and have GAP certification. The buying price still depends on the mango quality.

## **Broker**

The respondent stated that a GAP certificate is not a major requirement for trading in border trade in the current situation. Chinese buyers are not concerned about certification and mango quality is the critical aspect for price differences between farmers.

### **4.2.5 Supporting and Hindering Factors**

#### **Exporting Growers**

Most respondents mentioned that Myanmar Sein Talone mango has a high potential for exporting and the market price is higher than Yin Kwal variety because of its adorable nature. China started Sein Talone mango production in this year. However, Myanmar Sein Talone mango is better in taste and color because of favorable climate condition in Myanmar for Sein Talone mango production.

The major pests and diseases include fruit fly, seed weevil and fungus diseases (e.g powdery mildew, anthracnose). Respondents from Southern Shan stated that nowadays, most farmers can manage seed weevil problem in Shan State because of the help of survey results on its life cycle. Therefore, they can use required chemical and hygiene practices in farming. One of the two certified-respondent from Southern Shan state discussed that they have a problem of a different flowering period in the same farm because of low quality variety and improper propagation technique used in plant reproduction.

All respondents in both study areas informed their investment cost is relatively high because of high input costs (eg. farm chemicals), fruit bagging costs, labor costs for fruit bagging and harvesting, plastic baskets charges, transportation cost, 5% commission fees to brokers at border trade and duty fee etc. The price of registered chemicals with Myanmar labels are much higher (more than 50%) than unregistered chemicals with the same active ingredient (AI). High labor cost is one of the major problems for commercial growers as a result of the labor shortage. They stated that various types of traditional mango processing practices are used in different mango growing areas that do not comply with food safety practices because of lack of processing facilities, insufficient technology and high investment cost (eg. electricity-bill and labor cost etc.).

Exporting respondents from Southern Shan State mentioned that increasing awareness about the production practices that should comply with GAP and the production of high-quality fruits in the current situation. However, it is still needed to improve the quality control system for better market opportunities because of the lack of packing house with post-harvest handling facilities. Some farmers do not emphasize fruit grading and they put good quality mangoes on the upper layer of the basket to cover unqualified mangoes.

Two respondents discussed their experience in GAP certificate application. The laboratory testing facilities of the certification body for chemical residue test are insufficient for all kind of farm chemicals (e.g lack of test-liquid for Carbaryl chemical group). One respondent stated that in the last year, some farmers could not get certification in time in the Mandalay region.

The exporting growers analyzed the current market situation. The local market demand is low and unstable because it depends on seasonality and climate condition. In the season of Myanmar ceremonies, the market demand is commonly high because people use fresh Sein Talone mangoes especially for donation in Myanmar ceremonies and pick it as a dessert. In the rainy season, market demand is quite low because people generally stop eating fresh fruit in cool weather. Moreover, despite the accessibility to China market through border trade with a high market demand, the price is unstable, and it is determined by Chinese buyers. Chinese buyers set the weight for each mango basket should be 16Kg and a lower weight can get the lower price. In addition, the market price is significantly low in this year because China also produces Sein Talone variety starting from this year. Some farmers stated that they also have exchange rate loss by reason of buying with Chinese currency. Exporters demand is also unstable and price changes according to China market. The Global GAP farmer stated that the German market offers the next demand.

Many respondents mentioned the current transportation system is not competent for fresh produce. The transportation service needs to improve because it takes 20-24 hours on the way and that can affect the mango freshness. Most respondents are not interested in a loan with the reason that the application is complicated and time-consuming. Some farmers use the loan from unofficial lender with 3-6% monthly interest rate.

### **Main Exporter**

The exporter discussed the current situation of the export market. China is the only export market opportunity for farmers. When available Sein Talone mangoes are in Singapore market, the market price of other mango varieties in Singapore generally decrease. The respondent discussed the difficulties of mango exporting. The main factors include residue problem, lack of quality standardization, low amount of exportable quality mangoes, insufficient financial support from the government for both farmers and business companies, insufficient support for post-harvest and processing facilities, and insufficient entrepreneurs to explore new markets.

### **Broker**

The broker said that there is no problem for border trading because it has been active as a legal trading point since 1980.

## **4.2.6 Roles of Key Stakeholders Regarding Their Existing Support in The Fresh Mango Export Chain**

### **Mango Exporting Growers in Mandalay Region**

All respondents in Mandalay region stated that GIZ is the main supporter for mango value chain in current situation supporting with a 2-years project (2017-2018) in Mandalay region. GIZ mainly provide technical trainings for mango growers such as mango cultivation, GAP techniques, pests and diseases control. Government provides GAP certification started in 2016. MFVP provide an opportunity for market development by organizing yearly Myanmar Mango Festival started from 2015. Mango contest was organized in the festival. Two non-certified growers stated that they won the prize for every year in this mango festival.

**Mandalay mango cluster** – The Mandalay mango cluster was organized by MFVP and provides technical trainings such as GAP, food safety and environmental conservation, quality fruit production, IPM trainings, mango processing technologies with the support of FAO.

## **Mango Exporting Growers in Southern Shan State**

All respondents from Southern Shan State mentioned that their mango production techniques have improved significantly under the guidance and support of GIZ with a 5-years project (2013-2018) in Southern Shan State. GIZ supporting functions for mango farmers in Southern Shan State include; trainings and capacity building on mango production, quality control, GAP awareness and practices, pests and diseases control, farm management and mango processing techniques. MFVP coordinates with GIZ and support for market linkages. MFVP organizes Myanmar mango festival with mango contest started from 2015. The government provides GAP certification and some farmers received GAP awareness trainings provided by Regional Agriculture department.

***Mango clusters in Shan State*** – There were 7 mango clusters in Shan State. Taunggyi mango cluster, Yat Saut mango cluster and Nyaung Shwe mango cluster are included in Mango Southern Shan State. One GAP certified grower discussed in detail about the functions of Yat Saut mango cluster that is composed of approximately 270 farmers. In this cluster, the farmers who have a passion for applying GAP certificate and loan program are organized and apply loan and certification together. They share the information about the certificate application process, loan application and market information within the group.

Yat Saut mango cluster also has a credit system with contracts for farmer members in purchasing of plastic baskets and fruit bags. Moreover, they also created an online communication group using a social media application (Viber) for effective connection within the cluster and it is also useful for sharing market information and providing technical advice with each other. In the mango harvesting season, they organized and created a negotiable environment between farmers and the transport channel (car gate) for the quantity of mangoes for transportation and transportation charges. They transport their mangoes to the export market (Muse border) by means of organized marketing with the individual brand name. In addition, the cluster also assigns the responsible person in each village area for management purpose.

## **Main Exporter**

The respondent said that the government is providing GAP certificate and phytosanitary certificate for export. The Ministry of Commerce is supporting for trading functions such as trade policies and export/import trade data.

## **Large broker (Muse border trade)**

The respondent estimated that there are 30 brokers in Muse border trade who perform as intermediaries and commission agents between mango growers and Chinese buyers. The respondent said that the government provided open trade with China through border trade zone which started around 1980. Major fruits that are traded in Muse border include mango, watermelon, cucumber, pineapple and Indian jujube.



## **4.2.7 Necessary Support from Government and Stakeholders**

### **Exporting Growers**

The interviewees discussed that improving mango quality is important for future exportation. Government support is needed for trainings on relevant farm management technology according to the main crop of the region, regular farm visit. Providing post-harvest handling facilities (eg packing house) could lead to improvement of mango quality for the international market. The current transportation system is insufficient because of its distance and poor road conditions. Therefore, better facilities are needed.

Some respondents mentioned that the price of imported chemicals becomes higher (about 50-70%) after registering and labeling with Myanmar language. In addition, farm chemicals should be described in Active Ingredient (AI) instead of a trade name. Moreover, the monitoring of farm inputs (eg. fertilizers and chemicals) quality is needed because the expiry date is not posted in some chemicals.

One grower expressed a broader sharing of information about GAP guideline and a faster certification process are necessary for improving GAP certification system. Most interviewees mentioned that mango cultivation areas have expanded and increased production although mango export farmers only depend on China market's demand and the market condition is difficult for long-term profit. Moreover, AQAIQ check for exporting to other countries with oversea flight is unapproachable at farmer level. Therefore, government support for stable market opportunities for legal trading is necessary, for example, a G to G agreement with the trading partner. In addition, market information about demand and quality requirement of the export country is important to adjust and manage the harvested quality and quantity for meeting market demand.

### **Exporter**

The exporter stated that new market opportunities are a crucial requirement for improving export.

### **Broker**

The broker discussed his idea about the necessary support from the government. Research activities for quality control, extend shelf-life of Sein Talone mango and protection of major pest and diseases need to be improved. Apart from having a good taste of Sein Talone mango, the main problem is shorter shelf-life than other varieties. Improved technology including pre-harvest management such as pruning and post-harvest treatment such as the hot-water treatment and fungicide treatment are important aspects to raise export to other international markets. Furthermore, the current transportation system is not efficient because it is time-consuming and can affect fruit quality.

## **4.3 Findings of In-depth Interviews with Main Supporters**

### **4.3.1 Existing Quality Control System**

The informant from MFVP stated that 70-80% of mango farmers in Myanmar use fruit bagging to control pest infestation and mechanical damage and fruits that are controlled with fruit bags in the fruiting stage can get a higher price (almost double) because of good quality. Generally, farmers have more awareness about quality control and farm management practices compared to the previous situation. The cold chain system is not common in Myanmar in current situation.

The informant from GIZ discussed in detail about her view on quality control practices in both study areas. In Mandalay region, most mango farmers generally perform traditional farming practices and still need to improve awareness of quality control. However, the informant has a different view on mango quality control in Southern Shan State. Farmers' awareness of pre and post-harvest handling practices has improved there. Currently, farmers can produce good quality fruits because they probably follow the suggestions for farm management. Despite this, raising farmers' motivation for GAP application still needs to improve in both study areas.

### **4.3.2 Different Quality Criteria for Export**

The informant from MFVP stated that almost 95% of Sein Talone mangoes are exported mainly to China through Muse border. In the local market, the market price is not highly different according to fruit quality, and mangoes are mostly sold by retailing, therefore, growers have to wait to return their investment. Approximately 80% of farmers export their mangoes to China by themselves. In China market, Chinese marketers buy all mangoes and price difference is mainly depending on fruit quality and there is no specification for fruit size, quality and residue level (MRL). In Singapore market, AQSIQ check is necessary for export. Some growers export to Thailand through Tarchi Leik border although this is not a legal trading zone.

### **4.3.3 Certification Systems Used for Mango Production**

All informants mentioned that GAP certification system based on ASEAN GAP standard is carried out in Myanmar from 2016 with the purpose of ensuring food safety. In the current situation, there are 15 products under GAP protocol in Myanmar, mango is one of the products.

The respondents from government departments discussed in detail about Myanmar GAP. GAP comply on four principles; food safety, quality, environmental conservation. GAP approach involves the establishment of Myanmar GAP guideline, raising awareness and monitoring and communication to downstream farms. Almost all guidelines in Myanmar GAP are adjusted with ASEAN GAP. The validity of GAP certification is one year so covering one production cycle. The authorization of using only registered chemicals which are labeled with Myanmar language is an additional guideline in Myanmar GAP to control illegally-traded chemicals and to ensure the application of right dosage and ingredients.

Based on the information from all respondents, the overall application process of GAP certificate can be summarized as in Figure 9.

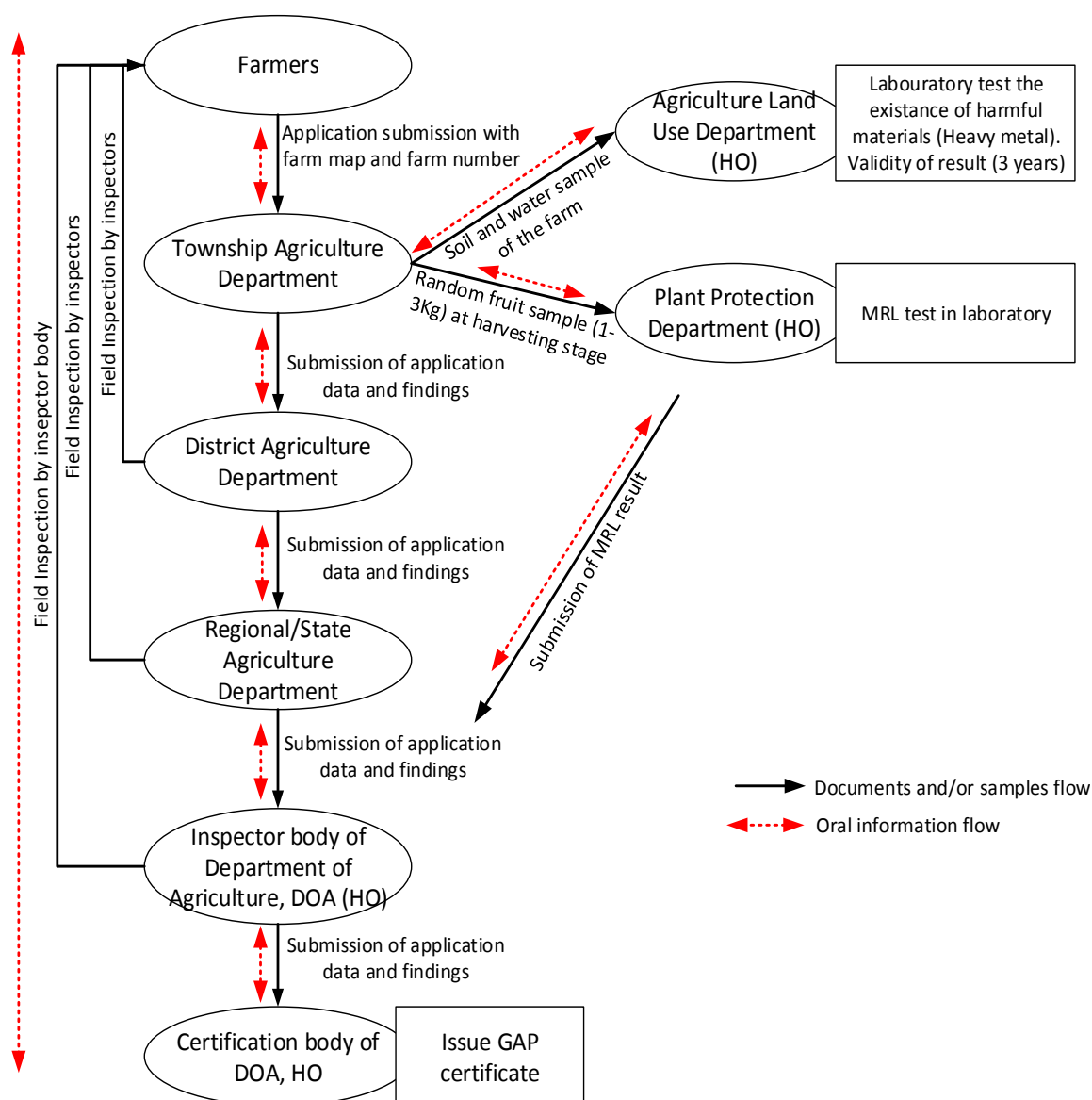


Figure 9 Flow Chart of GAP Certification Process in Myanmar

Source: Information from interviews with key stakeholders in Sein Talone mango export chain, 2018

The interviewees from the government department mentioned that the ‘certification body’ of the Department of Agriculture (DOA) issues GAP certificate for the farms that comply with GAP standard in farming practices and MRL test result. Duration of the complete process of GAP certification is difficult to define because inspection is carried out after harvesting until next harvesting stage (at least 2 inspections). Laboratory testing for MRL lasts only 1-2 days. Moreover, DOA plans to develop MRL laboratory testing facilities in Yezin and Mandalay regions.

The following Table 9 describes the number of GAP certified farmers in Myanmar from 2016 to 2018 based on the information from the interview with the informant from DOA.

Table 9 Numbers of GAP certified farmers in Myanmar (2016 to 2018)

Region	No. of GAP Certified Farmers		
	2016	2017	2018
Mandalay	4	6	16
Southern Shan State	19	12	20
Sagaing	4	7	20
Nay Pyi Taw	-	-	1
<b>Total number of GAP certified farmers</b>	<b>27</b>	<b>25</b>	<b>57</b>

Source: Interview with an informant from the Department of Agriculture, 2018

#### 4.3.4 Differences Between Certified and Non-certified Farmers Regarding Market Opportunities

Most informants said that there is no difference between certified and non-certified growers regarding market opportunities in the current situation. The GLOBAL GAP certification is also challenging for farmers because of its cost. The informants from government sector discussed the GAP system is about standardized farming practices with systematic farm records to guarantee safe and quality food. This system can improve better market opportunities in the future and farmers are required to be able to access these prospects when they exist.

#### 4.3.5 Supporting and Hindering Factors for Improving Fresh Mango Quality Control for Export

The informants from the government sector mentioned that farmers' awareness about farm management has improved and is practiced whether they apply GAP certificate or not. Some farmers have insufficient knowledge about GAP, they may consider the cost for GAP application. When G to G program is applied, the government will promote and recommend GAP certified products for exporting.

The informant from GIZ stated that generally, farmers can manage to harvest good quality fruits although still insufficient post-harvest management facilities (eg. packing house) for quality control exist.

Some informants stated the major difficulties for improving mango export chain. These are insufficient government support for new market opportunities, lacking quality standards, post-harvest losses and financial difficulties of farmers. High production and improved government interest in horticulture sector development are the main opportunity for mango value chain development. According to an expert from YAU, research activities of university member and research institutes, funding for research activities and research on mango quality control need to be promoted.

The informants from financial institutions mentioned that the major difficulties for a loan support function are; insufficient evidence about ownership and collateral requirements like documents that need to be provided by farmers, inappropriate financial statement (profit and loss) of farm business, and distances between Head office and farm areas for monitoring process. The major supporting factor includes regular payment of interest and installment of current loan-provided farmers.

#### **4.3.6 Roles of Key Stakeholders Regarding Their Existing Support in The Fresh Mango Export Chain**

According to the information described by respondents about their roles and functions in the chain and the other stakeholders' responses, the role of key stakeholders can be summarized as follows;

##### **Government**

**Department of Agriculture (DOA)** – The Ministry of Agriculture, Livestock and Irrigation (MOLAI) develop the policies for the improvement of the agricultural sector in a sustainable way by using qualified seeds, conducting good education, research and extension and amendment of agricultural laws and regulations. The Department of Agriculture under MOLAI started issuing GAP certification in 2016. An Accreditation body, certification body, inspector body, laboratory testing body, advisory body and auditing body are organized for the establishment of Myanmar GAP guideline with suitable quality assurance, raising awareness for unique knowledge and skills, monitoring and recommending adjustments to the production process, competence to audit and issue certification.

The two major activities include inspection in accordance with GAP guideline according to the crop and coordination with international organizations for value chain development of crops. The Horticulture and Biotechnology division provides technical training programs related to GAP, post-harvest technology, mango production, fruit propagation techniques and pesticide handling.

In general, the government's support for import/export includes National Export Strategy and Consumer Protection Law. Seed Law and Pesticide Law also support for protecting negative environmental impacts resulting from agricultural production.

**Township and District Agriculture Departments** – Township and District Agriculture Departments under DOA provide GAP awareness trainings and farm checks by inspectors for farms that apply GAP mainly in pruning, fertilization and fruit bagging stage. Training programs are targeted for various crops and are provided specially on the major crop of the region.

**Post-harvest Technology Training Center (PTTC):** PTTC, under the Department of Agriculture, was established in 2014 at Htone Bo Farm, Patheingyi Township, Mandalay Region by cooperation between Korea and Myanmar. The capacity building activities include; monthly trainings to farmers about post-harvest handling, processing techniques, GAP practices with the aim to increase awareness on food safety, labor health and environmental conservation and 2-3 trainings per month to 30 government staff for GAP practices and field inspection. All interested persons (farmers, brokers, business staff and organic producers etc.) from every area can participate in the free of charge trainings and 30-35 participants are allowed for each training. The announcement for trainings is mostly done 3 months before the training date by advertisements in newspapers.

##### **Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)**

GIZ is a German-based international non-governmental organization that facilitates strengthening value chains of mango and tea in Southern Shan State, Myanmar. GIZ implemented a 5-year project (2013-2018) with value chain approach in Southern Shan State namely “Strengthening the capacity of the private sector in Myanmar”. The main functions consist of trainings for mango production management, mango processing techniques, mango quality control, study visits to other countries, GAP awareness and GAP practices, consultation for GAP certificate application, organization strengthening, logistic linkages, market linkages and linking farmers with financial institutions. This organization has the plan to provide market linkages for mango farmers in Shan State after completing

the existing project of mango value chain development. GIZ also supports a 2-year project (2017-2018) in Mandalay region for mango sector development with the same approach.

### **Myanmar Fruit, Flower and Vegetable Producers and Exporters Association (MFVP)**

MFVP is a semi-governmental organization established in 2006, collaborating with the Ministry of Commerce to improve horticultural crop production and trading. MFVP is a member-based organization including fruits and vegetable producers, crop traders, distributors, wholesalers, exporters and service providers. MFVP is a certifying body for organic products. The capacity building programs of MFVP includes; coordination with Ministry of Agriculture and FAO for 3 years project from (2007-2010) for mango production techniques, fruit bagging practices, fruit fly protection techniques, GAP awareness and mango leather processing in Mandalay region, collaboration with GIZ for 5 years project (2013-2018) on mango value chain development such as trainings on increasing the production, post-harvest handling practices for improving fruit quality and awareness on GAP in Southern Shan State and MFVP has a research program on seed weevil infestation with Plant Protection Division and GIZ.

Marketing support functions consist of market linkages directly between growers and consumers through trade fairs and farmer markets, safe food from safe farm program to achieve a stable market for organic products and safe food and organizing Myanmar mango festival to improve international awareness of quality and taste of Myanmar mango (MFVP, 2016).

### **Yezin Agricultural University (YAU)**

Yezin Agricultural University (YAU) is the only university with a higher level of education in Agriculture in Myanmar, providing teaching, training, conducting research and extension services to the public. The Department of Horticulture in YAU provides horticultural related skills to university students and conducts academic research activities and postgraduate research for fruit sector. YAU is also a member of the advisory committee for developing the GAP guideline. Horticulture section at Yezin Central Agriculture Research Institute, under the Department of Agriculture Research, performs research activities on Sein Talone mango such as research about pruning techniques, chemical usage etc. with the objective of early flowering to produce off-season and high yielding quality fruit.

### **Financial Institutions**

**Myanmar Agricultural Development Bank (MADB)** – MADB plays an important role among the government institutions supporting the development of agriculture, livestock, and rural enterprises. MADB depends on Myanmar Economic Bank (MEB) funding that subsidized financial sources to MADB. MEB places the five-year loan of 200 billion Kyat to MADB with interest rate of 8.5%. Therefore, MADB can lend at 9% interest rate to clients which is below market rate.

MEB can provide loan for the mango farmers particularly for post-harvest production costs because the revenue of mango cultivation is only after 5 years. Mango farmers can get the loan under the MEB 2-step loan program with 9% interest rate and 1% service fee from total loan amount. Each mango farmer can get a loan for a maximum of five hundred million Kyat with one-year loan duration.

Collateral requirements such as farm registration and ownership, certificates of business ownership, fire insurance and fixed assets like buildings and land, is needed for loan application. Decision on the loan amount depends on the collateral information that farmer can provide for loan application. Farmers have to submit loan application with a farm registration book recommended by Land Record Department and a recommendation from the Representative of the village and township, the farm

map and farm history, the business plan, profit and loss statement (3-years), special proof of ownership and joint guarantee etc.

The credit decision-making process consists of field monitoring of the business condition and checks on collateral information and the loan process duration depends on the completeness of the documents provided. The respondent from MADB said one mango farmer from Taunggyi area received a loan of twenty million Kyats with a one-year loan duration in this year.

**Cooperative Bank (CB)** – CB bank is a private bank established in 1992. CB bank is providing loans for farmers who are the member of SME. There are two types of loan systems; loan with collateral records and loan without collateral records that mango farmers can get with a 1-year loan duration. Farmers can receive a loan for a maximum of twenty million Kyats without a collateral record with a recommendation of SME and SME member card.

A maximum loan amount of 6.5 hundred million Kyat can be received with the collateral system. Collateral requirements such as farm registration and ownership, certificates of business ownership, fire insurance and other fixed assets like buildings and land, is needed for loan application. The interest rate is 13%. The repayment is divided into three-month based or six-month based installments with monthly interest and compulsory deposits at the end of each year. Farmers who are members of SME and run the business for more than 1 year can be eligible for loan application and apply with business license, business plan and profile, profit and loss statement (3 years) and joint-guarantee.

A credit committee decides the amount of loan. This amount depends on provided collateral information and business plan. The credit decision-making process consists of field monitoring of business condition and a collateral check. Process duration can last 1.5-2 months and depends on the completeness of documents provided. After deciding on loan amount, the application is submitted to Myanmar Insurance (MI) and the customer needs to pay 3% premium fee to MI. After approval from MI, CB bank transfer money to the client. For the farmers who pay the regular interest and installment, CB bank can provide a loan extension for the next year and MI can reduce the premium fee to 2.5% for subsequent years.

The respondent from CB said 12-18 mango farmers from Yat Sauk research area received a loan of 15-20million Kyats individually with one-year loan duration in last year.

Based on the field observations and in-depth interviews with the main stakeholders, the mango value chain of the two areas is presented in Figures 9 and 10.

### Mango Value Chain Map (Mandalay Region)

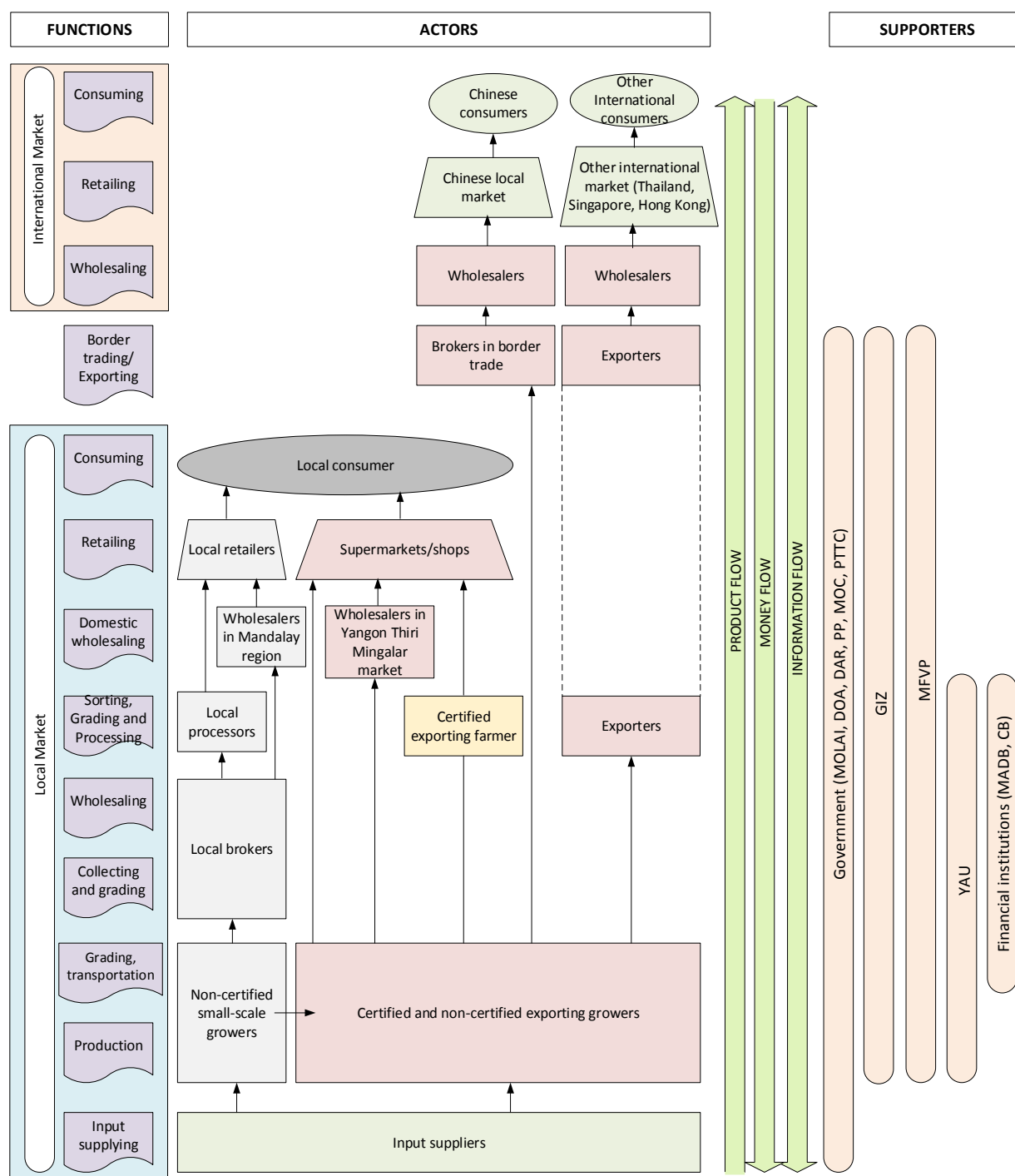


Figure 10 Mango value chain map (Mandalay Region)

In Figure 10, it is shown that in Mandalay region, most small-scale mango growers sell their mangoes to local brokers (who act as an intermediary) on the tree stage and/or growers harvest mangoes and sell them to local processors and wholesalers at Mandalay region who perform domestic wholesaling. Some growers do the small-scale retail function by selling their mangoes at their home.



Some large-scale farmers source mangoes from small-scale growers to transport to Yangon wholesale market. Most large-scale growers connected Yangon wholesale market for distributing their mangoes and some of them sell their mangoes to supermarkets in Mandalay and Yangon region. Large-scale farmers sell their mango mainly to China market.

### Value Chain Map (Southern Shan State)

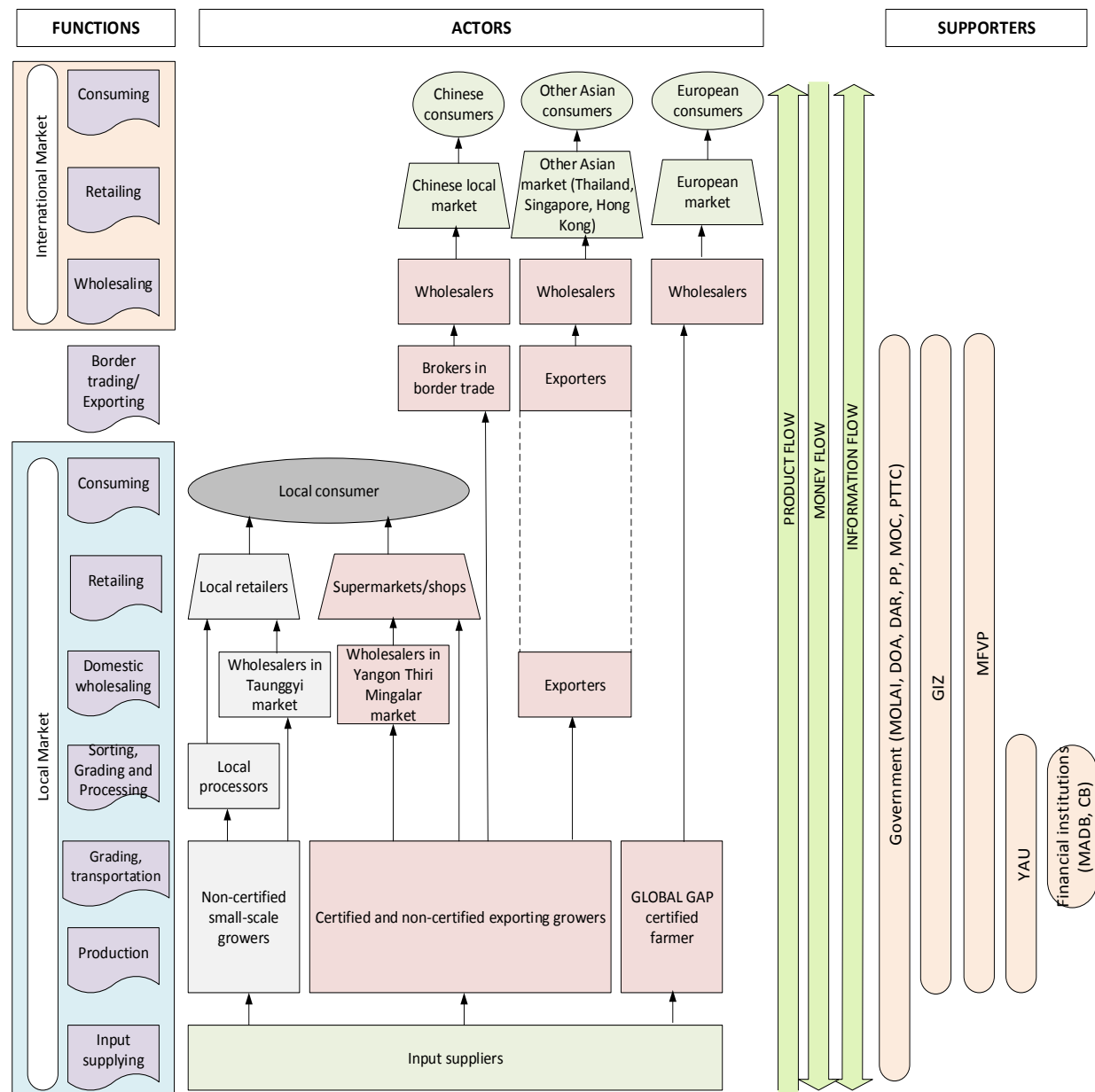


Figure 11 Mango value chain map (Southern Shan State)

Small-scale growers in Southern Shan seem to have a shorter chain than those in Mandalay region because they sell their mangoes directly to local wholesalers in Taunggyi market who perform domestic wholesaling. Most large-scale growers are connected to Yangon wholesale market for distributing their mangoes and some of them sell their mangoes directly to supermarkets in Yangon region. Large-scale farmers sell their mango mainly to the China market (Figure 11).

#### **4.3.7 Necessary Support from Government and Stakeholders**

The respondents from the government sector indicated that all actors in the chain should have awareness of food safety knowledge and consumption of safe-food that are produced according to GAP. According to the expert from YAU, the major requirements for mango export chain include; better coordination and collaboration between government and other stakeholders, emphasize more on research activities for mango quality improvement, and on sufficient financial support.

Most interviewees mentioned that the government needs to set a standard and policy for mango export and create new market opportunities for legal export. The government can support the mango export chain with a political framework such as an action plan for mango in National Export Strategy. In addition, technical knowledge sharing, regular farm visits, providing necessary advice and better infrastructure (like electricity, transportation) are important aspects to meet export quality.

Respondents from financial institutions discussed their ideas about important requirements for the export chain. These are increased financial support opportunities from other organizations or institutions like NGOs' microfinance support and new market linkages. Additionally, government support for GLOBAL GAP certification such as financial support and new market linkages are necessary.

## 5. DISCUSSION

This chapter presents the analysis of some specific topics based on the information reviewed in the literature and in-depth interviews conducted during the field work.

### 5.1 Analysis on Existing Quality Control Systems

The respondents from Mandalay region have more experience in mango producing, marketing and exporting than respondents in Southern Shan State. The practices of pre-harvest handling are different between Mandalay and Southern Shan State relying on the mango cultivation areas and the weather condition of fruit growing seasons.

As recommended by DOA (2016), pruning should be done yearly and start in its early life of the mango trees. Old trees can often be rejuvenated by a moderate to heavy pruning. Pruning can remove expired or diseased branches/woods, maintain the plant height for easy harvesting, open the canopy for good ventilation, control pests and diseases and regrowth the healthy branches. It has been observed that the growers from Southern Shan adopted pruning and quality control practices on disease and pest control.

However, the practice of pruning has yet to be improved in Mandalay region because of the old-aged mango trees. Old trees can often buildup pests and diseases and it is difficult to cover the whole tree when spraying (DOA, 2016). Some farmers in Mandalay region can face low productivity because of old-aged mango trees. Moreover, the requirement of continuous pests and diseases control in Mandalay region seems to be the result of less pruning. In addition, old trees are often difficult for harvesting.

Mango harvest condition can differ depending on market requirement and distance of the market. Mangoes must be fully mature before harvesting and should be harvested in a green mature stage. Mango harvesting time can be decided by 'dipping in the water' method. Putting mango samples in the water and if the fruits do not float, the fruits can be determined as ready to harvest (DOA, 2017). As suggested by DOA (2017), it has been realized that mango growers in Southern Shan have the good controls for harvesting compared to growers in Mandalay region because growers in Southern Shan practice the selective harvesting by marking color-spray on the fruits bags and testing with 'dipping in the water method before harvesting. However, these practices infrequently used in Mandalay area. Most mango growers in Mandalay area may have the willingness to get a high market price by delivering their mangoes to the market in the early harvesting season (mid-April) as the earliest harvesting period in Myanmar. Furthermore, most growers from Mandalay areas use bamboo picking pole for harvesting and they do not have enough control for harvesting equal maturity mangoes.

Esguerra and Rolle (2018) recommended that efficient handling practices are necessary to meet the requirements of the target market and protect the fruits from injuries during harvesting, packaging and storage. The recommended time for harvesting is from 9:00am to 3:00pm to minimize the latex flow. Post-harvest handling operations should be under the shade in the mango field, in a collection center or in a packing house to protect from the sun and rain. Delatexing on plastic or steel mesh racks for 30 minutes is needed to be done to protect the fruits from latex burn. Post-harvest handling areas and the surroundings should be kept clean all the time, and pets and animals should be kept away from the packing area. Good personal hygiene of workers is essential. FAO, 2017 suggested that a packing house facility is necessary for quality control of mangoes for export. The packing house should be well ventilated, protected from the infestation of fruit flies and other diseases and it should have a water tank for washing fruits.

As recommended by Esguerra and Rolle (2018) and FAO (2017), most respondents in both study areas have sound awareness of post-harvest handling operations although the handling practices are unsystematic and in non-hygienic condition. Grading and packaging process are done under shade because of lack of packing house facilities. Insufficient capital for investment is the major hindering factor for growers to access improved post-harvest operations facilities.

Grading is a crucial process in the quality control system for differentiation of fruits quality according to market requirements (DOA, 2017). Noticeably, grading practice of Mandalay region is mostly depending on experience by eye-estimation of mango size without using any weighing machine to measure weight. Despite most growers in Sothern Shan State measure individual fruit weight by using a digital balance for ensuring equal size, some growers in both study areas fill the good quality mangoes in the upper layer of the basket to cover the low-quality fruits. This practice leads to breakdown of the trust between supplier and buyer and results in a low market price. A systematic grading system should be improved in Myanmar. The mango quality standard is necessary for improving export quality mango.

Quality control is a continuous process throughout the supply chain. Quality improvement involves documentation, measurement and analysis of improving the functioning of a system. Food safety, quality standards and traceability systems are typical quality aspects to meet the market demands of consumers in international markets (Luning and Marcelis, 2011). GAP certification system has been implemented in Myanmar started from 2016 while the application pool is small in the current situation.

The main differences between certified and non-certified farmers on farm management and quality control observed in this research include;

- ✓ farm hygiene and food safety practices to prevent the direct contact with the ground
- ✓ farm cleaning and weeding practices
- ✓ systematic chemical storage
- ✓ appropriate distance between toilet and farm
- ✓ control of MRL level by using the recommended amount of chemicals and PHI described on labels of chemicals
- ✓ knowledge and practice of systematic farm record and
- ✓ awareness about labor health and hygiene

Certified-farmers are more concerned on farm hygiene and record keeping than non-certified farmers.

## **5.2 Analysis on Accessibility of Market and Market Information**

In the current situation, mango export farmers only depend on China market's demand because of high purchasing power of Chinese marketers/buyers and better price than in the local market. However, the market condition of China market is difficult for long-term profit. The market price is not stable and could not be controlled because it depends on market supply and demand condition.

Other export markets include Singapore, Hong Kong and Thailand through exporters. Accessibility to other export markets is highly depending on exporters' demand. The quantity of mangoes that exporters trade is still low and their buying pattern is not regular. Therefore, it seems to be convenient for small-holder farmers. Exporters can have better profit than farmers because they are capable of managing the export with better facilities such as flight transportation, AQSIQ check etc. Moreover, exporters may have a great knowledge about the export quality criteria demanded by the individual export countries. They also have higher investment capital for post-harvest handling and processing facilities than the growers.

It has been observed that there are certain differences between certified and non-certified growers in farm management and control of MRL although there is no difference regarding market opportunity in the current situation. Even though, some non-certified growers and all certified-growers show their willingness to apply GAP certificate in coming years. Therefore, the intention of mango growers on export to the international market is high and it can be seen as an opportunity for improving mango export in Myanmar.

In consideration of export market accessibility, the mango seasonality of competitors is also important to review. The harvesting period of Myanmar is similar to Thailand, Philippines and Vietnam. Thailand can harvest mangoes almost the whole year (from March to November) (Myat, 2012). Moreover, China started Sein Talone mango harvesting in July and there is some overlapping with the harvesting time in Southern Shan State. Therefore, research activities on off-season production of Sein Talone mango is important to be considered as an urgent aspect.

Fresh mango is a perishable crop and exporting is a high-risk business. For this reason, efficient marketing information flow on the supply of mango, demand and quality requirement of export market and prices is very important in mango producing and trading.

### 5.3 Value Chain Analysis

#### 5.3.1 Problem Analysis on Main Causes and Effects

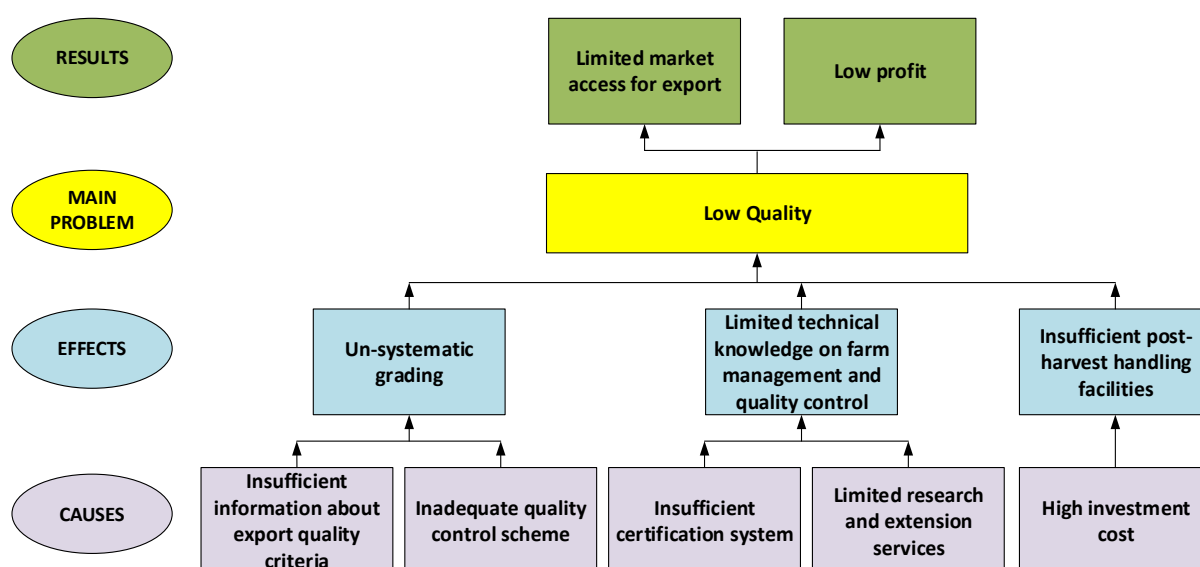


Figure 12 Problem tree of Sein Talone mango export in Myanmar

The problem analysis was used to identify the major causes, effects and results of the main problem. The main problem for Sein Talone mango export in Myanmar is low quality of mango in the export market affected by limited technical knowledge on farm management and quality control, insufficient post-harvest handling facilities and un-systematic grading of mango. The main causes are insufficient information about export quality criteria, limited research and extension services, inadequate quality control scheme and certification system for mango production. This is resulting in the low profit of farmers and limited market access for export of Sein Talone mango (Figure 12).

### 5.3.2 Analysis of Challenges and Opportunities for Mango Export Development with PESTEC and SWOT Analysis

The PESTEC and SWOT analysis of challenges and opportunities for mango export development in Myanmar is described in Table 10.

Table 10 Analysis of challenges and opportunities for mango export development

PESTEC	SWOT			
	Strength	Weakness	Opportunities	Threats
<b>Political</b>	<ul style="list-style-type: none"> <li>✓ Government policy support for export (Export/Import Law, Consumer Protection Law, National Export Strategy)</li> <li>✓ Policy support for environmental protection (Pesticide Law, Fertilizer Law)</li> </ul>	<ul style="list-style-type: none"> <li>✓ Insufficient implementation of laws and procedures</li> <li>✓ Absence of clear strategy on mango export</li> <li>✓ Poor infrastructure (transportation, logistics and electricity)</li> </ul>	<ul style="list-style-type: none"> <li>✓ Improved interest of government on horticulture sector development</li> <li>✓ Government willingness in further development of GAP certification</li> </ul>	
<b>Economic</b>	<ul style="list-style-type: none"> <li>✓ Myanmar is in ASEAN free trade region</li> <li>✓ Expanded mango cultivation areas</li> </ul>	<ul style="list-style-type: none"> <li>✓ Inadequate business and marketing knowledge of farmers</li> <li>✓ Low profit of mango farmer</li> <li>✓ Limited formal financial services</li> <li>✓ Limited support for new market opportunities</li> </ul>	<ul style="list-style-type: none"> <li>✓ Willingness of international buyers to pay a high price for the excellent quality</li> <li>✓ Assured export market (China)</li> </ul>	<ul style="list-style-type: none"> <li>✓ Price instability</li> <li>✓ High market competition with neighboring countries (India, Thailand, Philippines and Vietnam)</li> </ul>
<b>Social and Cultural</b>	<ul style="list-style-type: none"> <li>✓ Experienced mango growers</li> <li>✓ Yat Saut mango cluster is well organized</li> </ul>	<ul style="list-style-type: none"> <li>✓ Large number of unorganized mango farmers</li> <li>✓ Low motivation of some farmers to apply GAP certificate</li> </ul>	<ul style="list-style-type: none"> <li>✓ Sharing of information by experienced and knowledgeable farmers</li> </ul>	<ul style="list-style-type: none"> <li>✓ Less mango eating in rainy season and cold weather in the local market</li> </ul>
<b>Technological</b>	<ul style="list-style-type: none"> <li>✓ Increased awareness of growers on quality control and GAP practices</li> <li>✓ One farmer in Myanmar started GLOBAL GAP certification</li> </ul>	<ul style="list-style-type: none"> <li>✓ Insufficient production and post-harvest technologies and facilities</li> <li>✓ Insufficient information about export quality in terms of market demand for exporting</li> <li>✓ Residue problem because of insufficient knowledge about chemical use</li> </ul>	<ul style="list-style-type: none"> <li>✓ Technical support of NGOs (GIZ, MFVP)</li> </ul>	<ul style="list-style-type: none"> <li>✓ Currently limited adoption of GAP practices</li> </ul>
<b>Environmental</b>	<ul style="list-style-type: none"> <li>✓ Different regions deliver different quality with their own strengths</li> </ul>	<ul style="list-style-type: none"> <li>✓ Generally ageing trees especially in Mandalay area</li> <li>✓ Difficulty in setting National standard because of different natural quality</li> </ul>	<ul style="list-style-type: none"> <li>✓ Sein Talone mango is a variety therefore it is well adapted to local climate (agronomic-sustainability)</li> </ul>	<ul style="list-style-type: none"> <li>✓ Pests and diseases</li> </ul>

The Table 10 above describes the challenges and opportunities for the development of mango export in Myanmar using a combine PESTEC and SWOT analysis. In general, the government's policies supporting the export/import process to ensure consumer protection, protecting negative environmental impacts resulting from agricultural production. However, these policies need to implement effectively with adequate monitoring process and national export strategy is not directly relative to mango export development.

Economically, even though Myanmar is in the ASEAN free trade region, mango farmers have limited market access for export. Knowledge barriers in mango export particularly in the business and marketing knowledge and limited support for new market opportunities inhibit the export development. The willingness of international buyers to offer a good price for excellent quality mangoes support the farmers' motivation to produce high-quality mango. Additionally, the GLOBAL GAP certified mango grower already exported to the European market, making it more opportunity for farmers to learn the improved farming practices and interest in quality standards for premium market opportunities. However, Myanmar mango export may have a certain constraint for competition with neighboring countries (such as India, Thailand, Philippines and Vietnam) because these countries have similar mango harvesting period with Myanmar.

Regarding social and cultural aspects, there is a large number of experienced mango growers especially in Mandalay region that can support the learning environment for less experienced farmers. On the other hand, their concepts of conventional farming practices may become hindering factors for adoption of improved technology. Low interest of mango growers for GAP certification served as a considerable hindrance for mango export. The well-organized Yat Saut mango cluster can serve as a pioneer group for developing farmers producer group (farmer cooperative) which can encourage better supply chain functions. Nevertheless, a large number of mango growers in the communities, especially in Mandalay region, still have an insufficient organization for better cooperation.

Technologically, some organizations and research institutions have started projects and researches in developing the technical knowledge of mango production. Technical support mainly comes from GIZ and coordination program with MFVP that can improve farmers' awareness about mango production technology, quality control systems and GAP practices, especially in Southern Shan area. But, issues in insufficient post-harvest handling facilities and insufficient knowledge about chemical use resulting chemical residue problem are still needed to upgrade for a nation-wide GAP certification scheme.

Environmentally, Myanmar has a favorable climate condition for Sein Talone mango production. Also, the strength of having different mango quality in each study area (high sweetness level of mango from Mandalay and large size of mango from Southern Shan) can be considered as a very important opportunity for marketing because this can lead to having new market opportunities by meeting different markets' requirements. Nevertheless, aging trees, especially in Mandalay region, need improved farming technologies for regeneration. Moreover, government and other organizations may have difficulty in setting quality standard because of different natural quality of mango in both study areas.



### 5.3.3 Stakeholders Analysis

#### Stakeholders Analysis with Stakeholder Matrix

The following Table 11 describes the analysis of stakeholders' roles and functions, level of influence on the chain and the necessary factors for value chain development.

Table 11 Stakeholder matrix

Stakeholder	Influence over the chain (Low, Medium, High)	What is important for the stakeholder?	How could the stakeholder contribute to the value chain?	How could the stakeholder block the value chain?
<b>Government</b> (through different institutions) ✓ MOLAI ✓ DOA ✓ PTTC ✓ PP ✓ DAR ✓ MOC ✓ MADB ✓ YAU	High	✓ Extension services	✓ Providing extension services	✓ Insufficient production and post-harvest technology, and facilities
		✓ Research and development	✓ Linking research with production in order to adopt new techniques	✓ Insufficient research and development activities and funding
		✓ GAP certification	✓ Raising GAP awareness, field inspection, laboratory testing, certificate issue	✓ Ineffective GAP awareness training – need specifically (crop by crop)
		✓ Financial support (loan)	✓ Government loan with lower interest rate (9% per year) than private loan	✓ Loan is provided only for post-harvest production cost (for mango) ✓ Complex and long process
		✓ Trade	✓ National export strategy ✓	✓ National export strategy is not directly related with mango export
		✓ Laws and regulations	✓ Rules related with food safety, pesticide law, seed law, fertilizer law	✓ Food safety inspection are slightly unclear. The import, labelling, sales and application of chemicals is need to adherence Pesticide Law and Fertilizer Law
		✓ Infrastructure	✓ The highway roads generally have access to good transport infrastructure ✓ For export, airport in Yangon provides adequate infrastructure	✓ Long transport and time consuming ✓ High transportation cost
<b>Private Sector</b> ✓ Agro-chemicals companies and input suppliers	✓ Medium	✓ License for formal import	✓ Repacked and labelled for usage of agro-chemicals	✓ Conduct intensive marketing of agro-chemicals. ✓ Training on the safe usage of chemicals is not normally provided
✓ Local brokers, local wholesalers and local retailers	✓ Medium	✓ Price	✓ Basic visual quality check and grading	✓ Low price, Low demand

Stakeholder	Influence over the chain (Low, Medium, High)	What is important for the stakeholder?	How could the stakeholder contribute to the value chain?	How could the stakeholder block the value chain?
✓ Local processors	✓ Medium	✓ Price ✓ processing facilities	✓ Processing and manufacturing value-added products	✓ Conventional methods and inefficient food safety practices of small-scale processors
✓ Exporters	✓ High	✓ High price	✓ Strong influence on quality requirement and grading	✓ Insufficient information sharing about quality requirement of export country
✓ Brokers at Muse border trade	✓ High	✓ Commission fee	✓ Commission agent between growers and Chinese buyers	
<b><u>Financial Institutions</u></b> ✓ Private bank (CB Bank)	✓ Medium	✓ Financial support (loan)	✓ Financial services provide loans with interest rate (13% per year)	
<b><u>NGOs and associations</u></b> ✓ GIZ ✓ MFVP -	✓ High	✓ Knowledge sharing ✓ Capacity improvement of farmers	✓ Play adequate influence along value chain through information sharing, providing updated information and extension services	✓ NGOs provide services for duration of the project, funding is available for limited periods
✓ Mango clusters - Mandalay - Yat Saut	✓ Low ✓ Medium	✓ Organizing of mango growers	✓ Knowledge sharing ✓ Negotiation power (Yat Saut)	✓ Large number of unorganized mango farmers
<b><u>Mango growers</u></b>	✓ Low	✓ High production ✓ High profit and income ✓ High product quality ✓ Organization into farmer group	✓ Mango cultivation, harvesting, quality control	✓ Inadequate quality control system ✓ Inadequate awareness of business management and quality management ✓ Inadequate organizing of farmers into farmer producer group

### Stakeholders Analysis with Power an Interest Grid

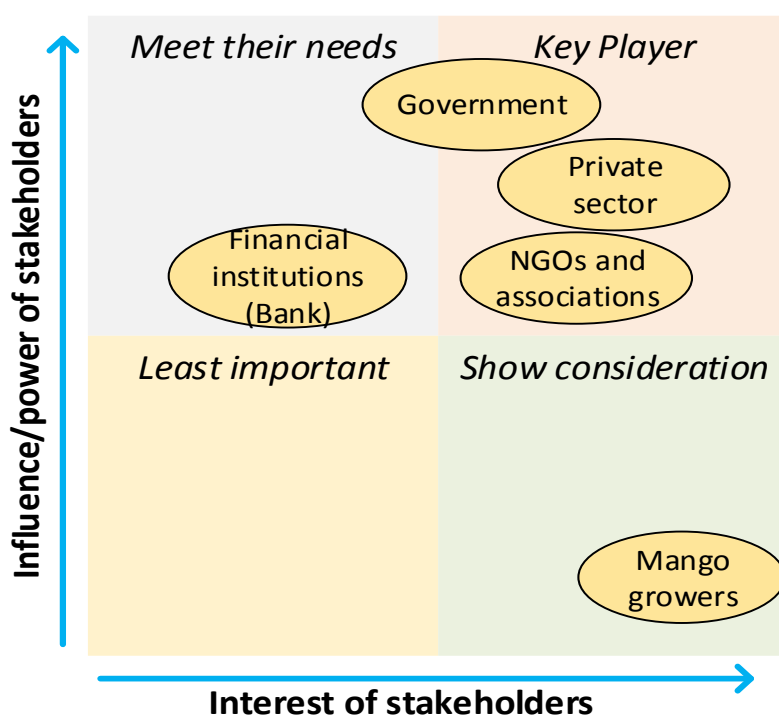


Figure 13 Stakeholders analysis with power and interest grid

According to the stakeholder analysis with stakeholder matrix (Table 11) combined with the level of their power and interest (Figure 13), the key player in the value chain is the private sector (including input suppliers, local brokers, local wholesalers, local retailers, local processors, exporters and brokers at Muse border trade). They play a major role in the market and they can influence on pricing and market structure of products. Exporters are the key actor for export of mangoes to international markets. They have a strong influence on quality requirement of product. They have the highest level of interest in value chain because they can make a profit by trading and value adding of mango.

The highest level of influence/power on value chain is the Government because it has policy influence along the value chain.

Financial institutions also play a vital role, but their interest in providing loan to mango farmers is considerably low. Interest of NGOs and Institutions for value chain development is significantly high and they can play adequate influence along value chain through providing updated information about relevant laws and policies, capacity building through technical trainings, sharing evidence-based learning and supporting for effective implementation.

Farmers have a significant interest in production. Although they have limited knowledge of quality development, post-harvest facilities, marketing concept, basic financial literacy and record keeping, negotiation and partnership building. These factors cause farmers to have low influence along the value chain and to have limited market access for a stable profit.

## Relationship and Information Flow between Stakeholders

The relationships and information flow between stakeholders, by means of political ties, financial and products and services are shown in the following Figure 14.

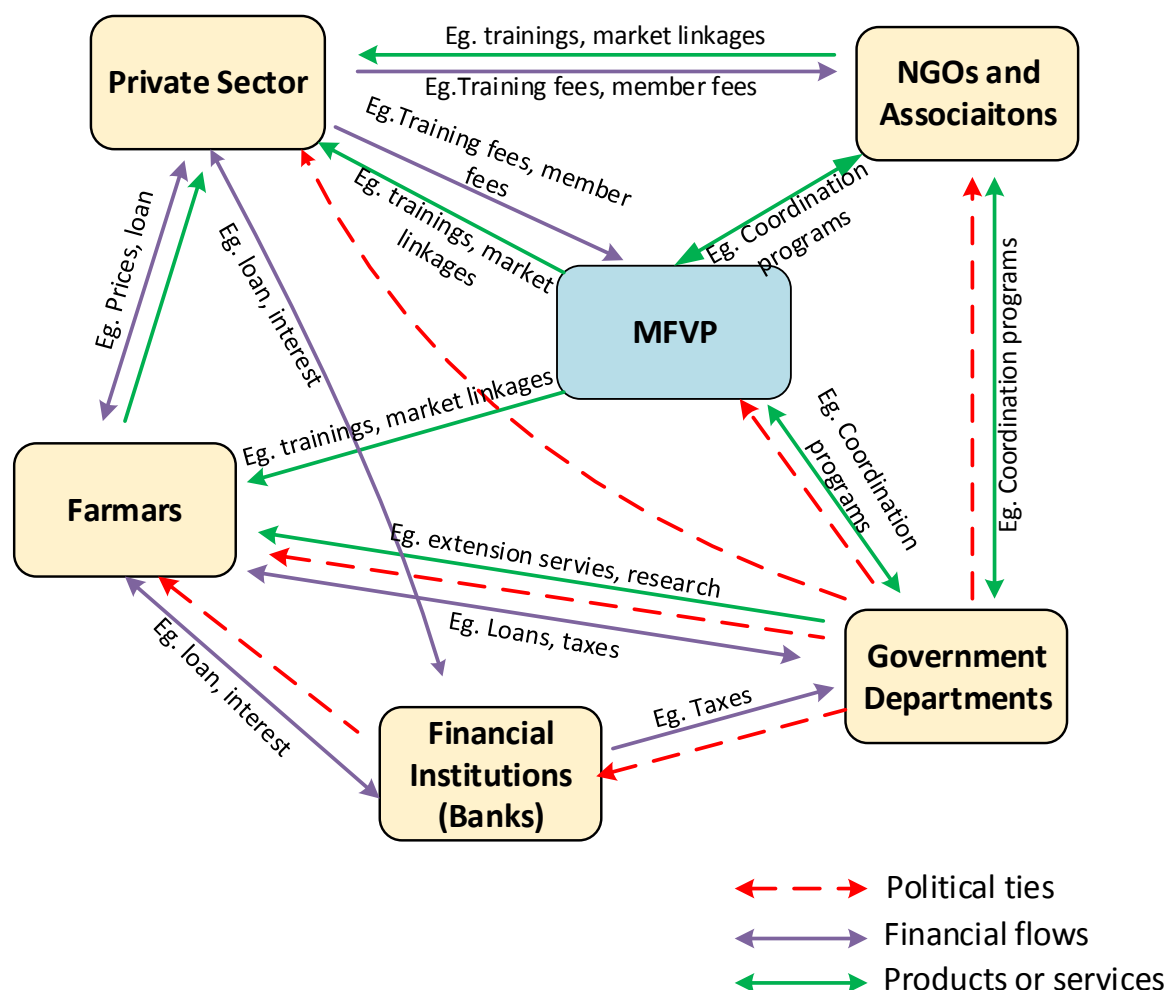


Figure 14 Relationship and information flow between stakeholders (Radian Institutiogramme)

Information sharing about quality requirement of export markets is necessary for mango growers. Stakeholders are responsible for creating awareness and training farmers on different cultivation techniques such as sustainability and quality management. Regarding training and knowledge extension, not only they create awareness among farmers about the best mango production practices (such as GAP), pest and disease control but also, they empower farmers for quality management. This provides for better understanding of farmers about sustainable production and the benefits of sustainability.

## 6. CONCLUSIONS

This chapter presents the conclusions about the situation of Sein Talone mango export chain in Myanmar in term of factors affecting fresh mango quality control for export and main supporting activities that contribute to sustainable fresh mango export chain in the future.

### 6.1 Factors Affecting Fresh Mango Quality Control for Export

Among ASEAN regions and other neighboring countries, Myanmar mango export is in a lower position with a decreasing trend. Low quality of mangoes because of poor post-handling practices and limited market access are the main problems in Sein Talone mango export chain.

#### *Existing Quality Control System*

Generally, farmers' knowledge and awareness on appropriate mango pre-harvest practices and pest and disease control have been improved and they can manage to harvest quality mangoes. Since most farmers currently have more than 10 years' experience in mango production especially in Mandalay region, they barely making profit from the production because there is a reliance on traditional farming practices. Knowledge and concept improvement in grower level are important to improve mango exporting.

#### *Different Quality Criteria for Fresh Mango Export in Asia*

Exporters buy mangoes from different mango growing areas by selecting high-quality mangoes for export mainly to Singapore, Hong Kong and Thailand. Some exporters implement the proper post-harvest processing operations to produce value-added products with the purpose of reducing post-harvest losses and having benefits from rejected mangoes.

In the current market trend, quality is not crucial for marketing in the local market. Basic quality criteria such as fruits with large size, free of injuries, diseases, spots and damages are necessary. In China market, it has been observed that there is a similar aspect of basic market requirement as in the local market. However, the excellent quality attributes are essential for international markets. Generally, farmers are not concerned with quality management because they have an assured export market (China) with basic quality requirements.

#### *Certification Systems Used for Mango Production*

Myanmar government implemented GAP certification system for 15 crops starting from 2016. Among these crops, there are 9 horticultural crops and mango is one of them. It can be considered that government interest in supporting the development of horticultural sector has been improved.

#### *Differences Between Certified and Non-certified Farmers Regarding Market Opportunities*

There is no difference between GAP certified and non-certified farmers in terms of market opportunities, therefore low motivation of farmers on GAP certificate application has been observed. Certification of mango production with HACCP (GLOBAL GAP) is not approachable to farmer level. This is because the facilities for ensuring hygiene and food safety standards to the implementation of HACCP are inadequate and the application cost is highly expensive for farmers.

### ***Supporting and Hindering Factors for Improving Fresh Mango Quality Control for Export***

Myanmar Sein Talone mango has delightful natural characteristic including fibreless pulp, adorable aroma, yellowish color, sweetness and juiciness nature. Moreover, the climatic condition of Myanmar is favorable for Sein Talone mango production. Despite these strengths, there are challenges in inadequate research and development activities, insufficient financial support, technological barriers and poor infrastructure for transportation, quality control process, post-harvest handling and processing facilities in mango export chain.

## **6.2 Main Supporting Activities that Contribute to Sustainable Fresh Mango Export Chain in the Future**

### ***Roles of Key Stakeholders Regarding Their Existing Support in the Fresh Mango Export Chain***

Among the stakeholders in the mango export chain, the Government has the highest level of influence/power on the value chain because it has policy influence along the value chain. Regarding export improvement, the government can support the mango sector with political framework such as action plan for mango export in National Export Strategy.

The government is supporting as a certification body for the Myanmar GAP standard that is based on ASEAN GAP guideline to give an opportunity for trading GAP-certified products locally and internationally. The purpose of ASEAN GAP is to enhance the harmonization of GAP standard within the ASEAN region (AFOSP, 2016). The GAP approach involved the establishment of a Myanmar GAP guideline, raising awareness and monitoring and communication to downstream farms.

There is technical support from GIZ and the coordination program with MFVP that improved farmers' awareness about mango production technology, quality control systems and GAP practices, especially in Southern Shan area.

### ***Necessary Support from Government and Stakeholders***

In the current export condition, mango growers have limited market access for export. Therefore, government support for stable market opportunities for legal trading is necessary, for example, G to G agreement with trading partners. The major requirements for mango export chain include; better coordination and collaboration between government and other stakeholders, emphasize more on research activities, capacity building on farm management and GAP standards, providing post-harvest handling facilities, knowledge of business and marketing strategies still need to be developed for sustainability. In addition, it has been realized that efficient information sharing on required quality criteria of the exported country is essential to compete with other mango producing countries in the international market in terms of fruit quality.

## 7. RECOMMENDATIONS

This chapter presents recommendations for problem owner (MFVP) to start working on improving the sustainability of mango export chain. Recommended short-term and long-term plans for MFVP to intervene in the problem of mango supply chain area are as follows;

### Short-term Recommendations

#### ***Establishment of Farmer Producer Groups***

- ❖ Strengthening the existing mango clusters for better coordination through capacity building on organization management and team building.
- ❖ Organization of mango farmers into producer groups (PGs) in each mango cultivation region for collective marketing with that can lead to have high bargaining and negotiation power in the supply chain.
- ❖ Promote collective marketing with 'branding scheme' for PGs. Branding can guarantee consistency, traceability and quality of products produced that can attract and retains customers in both local and international markets.
- ❖ Creating a learning and sharing environment within PGs and with the other groups through exchange visits can increase knowledge transfer and innovations that result from evidence-based learning.

#### ***Capacity Development of Mango Farmers***

- ❖ Interventions carried out using a participatory Farmer Field School (FFS) approach. It is a group-based learning process that takes place in a field, involving farmers in assessing, planning, implementing and analyzing results through a guided process for sharing and learning (FAO, 2016 C).
- ❖ Support trainings for capacity development of target farmers on GAP practices and quality management with facilitation by Community Facilitators trained by MFVP and coordination with government technical departments.
- ❖ Strengthening capacity of farmers on financial record system that is a compulsory evidence for loan application such as financial statement, profit and loss statement and auditing documents through trainings with financial experts from private banks and MADB.

#### ***Partnership with Key Stakeholders***

- ❖ Information sharing about mango sector and existing problems recognized from evidence-based learning to the government departments through coordination meetings and information sharing seminars for ensuring effective government's strategic plan and policies.
- ❖ Accelerating research activities on mango quality control by collaboration with government departments and university.
- ❖ Facilitating linkages through organizing meeting between PGs and the private sector (local processors, exporters) for quality assurance and marketing support written agreements (contracts) to have a strong commitment.
- ❖ Facilitating the government departments in the process of establishing quality control standards and procedures through coordination and participating in public/private joint-discussion.
- ❖ Linking other non-governmental organizations who are working on mango value chain development and other implementing partners to share and learn from their experiences.
- ❖ Supporting awareness and provide updated information to farmers about relevant laws, policies and market information at the local level via MFVP website and publications documents.



### **Capacity Development of MFVP Project Team**

- ❖ Strengthening technical capacity of staff members through technical partnership with universities and research institutes.

### **Long-term Recommendations**

#### **Promoting Quality Management**

- ❖ Promoting quality control of GLOBAL GAP mango production to farmers for high-quality mango export to US, EU and other premium export markets.
- ❖ Capacity building of farmer PGs with respect to quality control accordance with GLOBAL GAP standards.

#### **Market Linkages**

- ❖ Facilitating market linkages between PGs and the clients from US, EU and other export markets by sharing information about market requirements and trading process.

## **7.1 Suggested Business Model for MFVP**

A suggested business model for MFVP as shown in Table 12.

Table 12 Suggested business model for MFVP

<b>Key Partners</b> <ul style="list-style-type: none"><li>▪ Government</li><li>▪ Financial institutions</li><li>▪ NGOs and associations</li><li>▪ Mango growers</li></ul>	<b>Key Activities</b> <ul style="list-style-type: none"><li>▪ Capacity building programs</li><li>▪ Facilitating for new market linkages</li></ul> <b>Key Resources</b> <ul style="list-style-type: none"><li>▪ Human resources (Project team/staff and trainees)</li><li>▪ Financial resources</li><li>▪ Research information</li><li>▪ Update information from key partners</li></ul>	<b>Value Proposition</b> <ul style="list-style-type: none"><li>▪ Sharing information from learning of MFVP's activities and key partners</li><li>▪ Assessing, monitoring and evaluation of farmers' understanding and output</li><li>▪ Outreach activities to the community</li></ul>	<b>Customer Relationships</b> <ul style="list-style-type: none"><li>▪ Market linkages</li><li>▪ Contracts and agreements</li><li>▪ Quality standards</li></ul> <b>Channels</b> <ul style="list-style-type: none"><li>▪ Indirect channel (through partnership with key partners)</li></ul>	<b>Customer Segments</b> <ul style="list-style-type: none"><li>▪ International market</li><li>▪ Exporters</li><li>▪ Companies (food and beverage)</li><li>▪ Supermarkets</li></ul>
<b>Cost Structure</b> <ul style="list-style-type: none"><li>▪ Office rent and fix assets</li><li>▪ Publications and printing costs</li><li>▪ Professional services and consultancies</li></ul>		<b>Revenue Streams</b> <ul style="list-style-type: none"><li>▪ Selling of fresh mangoes, value-added products (local and export)</li><li>▪ Quality products</li><li>▪ Grants from different partners/donors</li></ul>		
<b>Social and Environmental Cost</b> <ul style="list-style-type: none"><li>▪ Staff salaries and allowances for volunteers</li><li>▪ Communication costs</li></ul>		<b>Social and Environmental Gain</b> <ul style="list-style-type: none"><li>▪ Market linkages</li><li>▪ Mango production with GAP standards of mango farmers</li><li>▪ Collaboration between stakeholders</li></ul>		

## 7.2 Theory of Change

The recommendations here above comply with the theory of change regarding sustainability as illustrated in Figure 15 below.

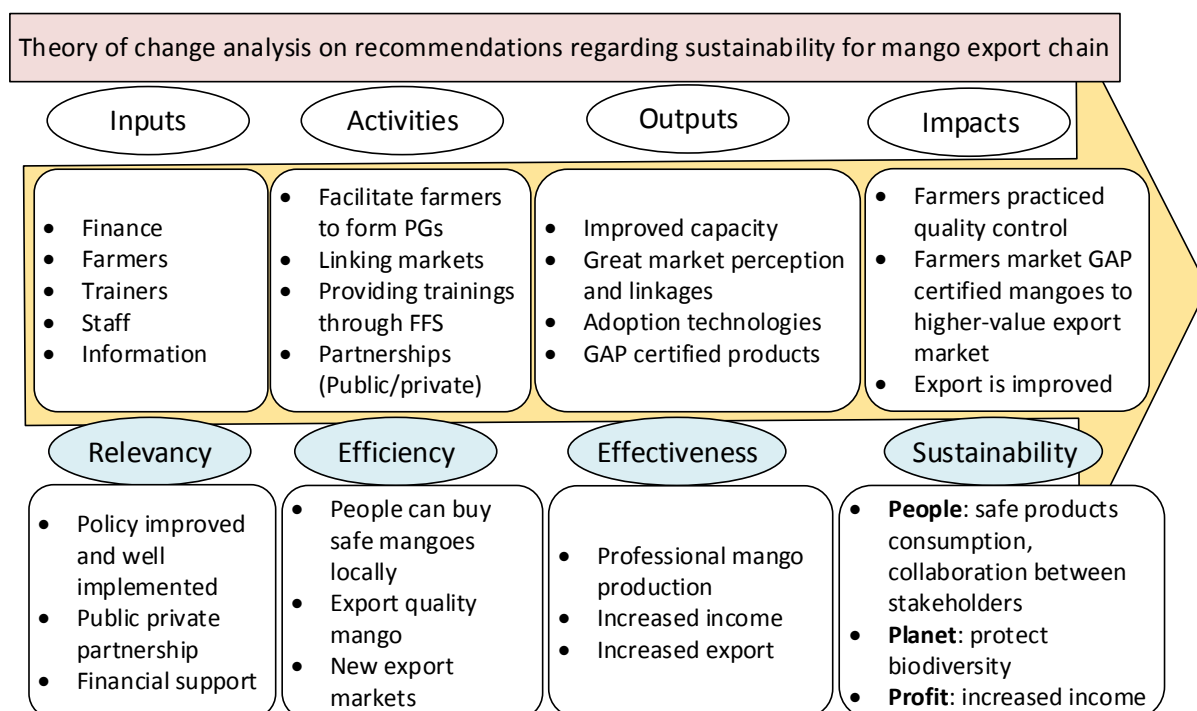


Figure 15 Theory of change analysis on recommendations regarding sustainability for mango export chain

**People** – The recommendations will lead to strong collaboration between different stakeholders of the mango value chain in Myanmar to strengthen the mango supply chain and improve vertical and horizontal integration of the chain (SDGs 17). Through this framework, the model is able to develop continuity and reliability of mango supply to local and international consumers who will receive the safe mango products (SDGs 12).

**Planet** - Environmental sustainability will be assured owing to the cultivation of the Sein Talone mango variety which is also cultivated with GAP standards. GAP guidelines assure the application of the recommended rate of chemicals and ensure the harvested fruits are below MRL. Therefore, these are safe for human and biodiversity (SGDs 15).

**Profit** – Farmers and producer groups will benefit from the export as both income and productivity will increase due to best production practices and more market opportunities for the Sein Talone mango in Myanmar. This will contribute to increased productivity of Sein Talone mangoes, resulting in improved livelihood of farmers (SDGs 1).

### **7.3 Suggestions for Further Research**

There are some studies in Myanmar that concentrate on mango post-harvest handling practices although hardly any studies have highlighted on Sein Talone mango quality control for the export chain in Myanmar. The following research studies still necessary to be explored for mango sector development in Myanmar.

- Study on practices of mango quality improvement during post-harvest phase
- Research for mango off-season production
- Factors affecting on further improvement of GAP certification system
- Market research on new potential export markets in Asia
- Analysis of customers' preferences in the local market regarding color, size and price

Collaboration and coordination between the Department of Agriculture, Yezin Agricultural University, Department of Agricultural Research, MFVP, GIZ and stakeholders of mango value chain is mandatory for these research activities.

## 8. Reflection

It is obvious that conducting a research project is not always a straightforward process and I have learned a lot from this activity. I will do a reflection on lesson-learned and the challenges I faced and experienced during my thesis work. This can be discussed with sub-sessions according to processes starting from planning to thesis writing.

### 1. Defining Problem Description, Research Objective and Research Questions

It has been observed that the research should be based on the main problem of the sector in order to develop effective recommendations for further implementations. To identify the main problem, I contacted and introduced the mango farmers through Facebook page (Myanmar mango market and technology development group). I asked 5-6 exporting farmers from the group via messenger about their main problems in the field areas. I also asked the main exporter (page Admin) about major challenges. I also contacted the Chairperson of MFVP. They supported information on their major difficulties. It has been recognized that farmers are facing the challenges in quality control and exporter has challenges in accessing new market because of low-quality mangoes. I decided to assess 'opportunities and constraints' for improving mango quality control by conducting qualitative in-depth interviews with key stakeholders.

Based on the main problem, I developed research objective. I got experiences in formulating research questions that the researcher has to answer after conducting research. Research questions should be specific and manageable on result formulation while conducting research in a given timeframe. I have been realized that the main research questions are directly related to formulate recommendations and sub-questions are supporting for collecting data to answer the main research questions. Finally, I have developed 2 main research questions and 7 sub-questions.

### 2. Research Methodology

**Literature Review** – I faced some challenges in Literature search. Data about mango cultivation, mango harvesting and the research paper from Myanmar are rarely posted on the internet. For this, I requested the lecturer from Yezin Agricultural University on existing academic research. I have seen that the research activities on mango post-harvest handling, mango quality control and mango value chain development need to consider as urgent requirements. I got mango export and mango production data from FAO STAT website. The data on fruits and vegetable production, export/import are not sufficiently implemented, and it is difficult to access. Statistical information about mango production and export need to improve. To access the mango pre and post-harvest practices, I learned from manual books; Mango cultivation practices published by DOA and post-harvest handling practices of fruits and vegetables developed by Post-harvest Technology Training Center from its. Overall, publication of technical data and information sharing on crops cultivation, post-harvest procedure, GAP practices and GAP application process in Myanmar have to develop.

**Research Framework** – I developed research framework based on main aspect of research and research sub-questions.

**Planning and checklist** – I prepared a schedule based on the convenience of transportation because I conducted two areas; Mandalay and Southern Shan. These areas are a far distance from my place and far from each other. I prepared checklist depending on stakeholders' role and research questions. The checklist is the important notes in conducting in-depth interviews. I formulated it early and reviewed several times to get enough information on the required data.

### 3. Interviews

After having a contact list of the focal persons of each study area from MFVP, I started interviews in each study area. I contacted all the contact persons and made the appointment for interviews before going to their farms. First of all, I started the research in Mandalay area. I conduct 4 individual interviews and one group interview with 3 non-certified farmers in Mandalay. In the group interview, only one grower in group had enough motivation to share information. The other 2 growers answered just a short-conservation at the start of interview. I explained the objective of research; the respondent names are in confidential and data will be used only for research purpose. Then they started to motivate to answer questions and provide enough information. Therefore, introduction of research objective and explanation on confidentiality is very important in research activities.

I have been realized that sharing experiences and update information with each other, answering questions through discussion and confirmation the answer with each other are the major advantages of group interview. In individual interviews, all certified-respondents in Mandalay have willingness to participate and support information. All respondents in Southern Shan have well-motivation to share information, support field visits and sharing their experiences.

One of the challenges that I faced during the research interview in both study areas is that the answers given by farmers about 'supporting functions' of government. Most growers said that government support on technical sharing is insufficient. Some farmers said there is no provide for capacity building such as trainings from government. However, when interviews with government respondents such as regional agricultural departments and post-harvest technology training center said that they provide trainings for GAP and farm management practices. Quickly, I realized that I have to look for the reason behind for answering differently between farmers and government respondents. I asked government respondents on the way of supporting trainings and announcement about trainings. The main reason is that government support with extension services started improving in current situation compared to the previous situation, trainings are mostly on general guidelines, need to specific according to crop type and their field visits are mostly for GAP applied farms. Moreover, the trainings from post-harvest training center are focusing on all the actors in the chain from the whole areas in Myanmar though the 30-35 participants are allowed to attend for each training and training announcements are mostly posted only in the newspaper. Therefore, extension services from government sector need to provide in effective and accessible manner.

I have been recognized that on-the-spot analysis during interviews, concerning on the required information and avoiding the repeated questions on already answered information are important aspects for researchers because the respondents may give a lot of information by talking the whole story.

Another challenge is that I have planned to conduct one focus group discussion in each study area for triangulation of my main findings based on the analysis. Nonetheless, farmers in both areas requested to omit focus group discussion because they have a full schedule with their harvesting and farm management activities. Therefore, I have decided to check the main findings with Central Executive Committee member in each mango cluster for ensuring research reliability and validity. I have been learned that the confirmation and asking the feedback from each respondent after each interview, cross-check the answers and asking confirmation from the representative person is required for research accuracy.

#### **4. Data Analysis and Thesis Writing**

In the analysis process, I have been organized required information based on transcriptions. I noted the 'Label' with the key concept in each related answer and put the number of respondents that answer the same information under the same label. In this process, I have learned that transcription is the most basic and important for the further analysis process. In addition, placing the information under related research questions is also very important for relevant analysis. In analysis, the researcher has to think the reason behind and critical analysis of the main causes and effects on each major finding.

In the thesis writing process, academic writing skill, presenting the information in a clear, specific and understandable design are the most important aspects. The reporting of the most important information is also important for a strong thesis report.

#### **5. Overall Impression**

Generally, I have not done the qualitative research before. This research has given me a lot of knowledge and experiences on how to conduct it. It was a good research and I have satisfied on the output of my work. These experiences in the field and knowledge from different people during my data collection contribute to the development of my knowledge and it will help me in the future career.

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## APPENDICES

### Appendix 1 : Profile of the interviewees

No.	Interviewee	Type of interviewee	Area	Functions	Date of Interview	Type of interview
Exporting Growers in Mandalay Region						
1	A1	Certified-exporting grower	Paleik Township	<ul style="list-style-type: none"> <li>✓ Mango production (2006)</li> <li>✓ mango processing (2018)</li> <li>✓ Area – 9ha</li> <li>✓ Executive committee member of Mandalay mango cluster</li> </ul>	5 July 2018	Individual
2	A2	Certified exporting grower	Patheingyi Township	<ul style="list-style-type: none"> <li>✓ Mango production (1993)</li> <li>✓ Mango exporting (2000)</li> <li>✓ Area -14ha</li> <li>✓ Executive committee member of MFVP (Mandalay)</li> </ul>	6 July 2018	Individual
3	A3	Non-certified exporting growers	Amarapura Township	<ul style="list-style-type: none"> <li>✓ Mango production (1980)</li> <li>✓ Mango exporting (1993)</li> <li>✓ Area – 6.5ha</li> </ul>	9 July 2018	Individual
4	A4	Non-certified exporting growers	Amarapura Township	<ul style="list-style-type: none"> <li>✓ Mango production (1987)</li> <li>✓ Mango exporting (1993)</li> <li>✓ Area – 16ha</li> <li>✓ Executive committee member of MFVP (Mandalay)</li> </ul>	11 July 2018	Group
5	A5	Non-certified exporting growers	Amarapura Township	<ul style="list-style-type: none"> <li>✓ Mango production (1990) with export experience at least 15 years.</li> <li>✓ Area – 10ha</li> <li>✓ Executive committee member of MFVP (Mandalay)</li> </ul>	11 July 2018	Group
6	A6	Non-certified exporting growers	Amarapura Township	<ul style="list-style-type: none"> <li>✓ Mango production (1990)</li> <li>✓ Mango export (1997)</li> <li>✓ Area – 6ha</li> </ul>	11 July 2018	Group
Exporting Growers in Southern-Shan State						
7	B1	Certified exporting grower	Yat Saut	<ul style="list-style-type: none"> <li>✓ Mango production (2011)</li> <li>✓ Mango export (2016)</li> <li>✓ Area – 8ha</li> <li>✓ Executive committee member of Yat Saut mango cluster</li> </ul>	16 July 2018	Individual
8	B2	Certified exporting grower	Yat Saut	<ul style="list-style-type: none"> <li>✓ Mango production (2007)</li> <li>✓ Mango export (2013)</li> <li>✓ Area – 17ha</li> <li>✓ Executive committee member of Yat Saut mango cluster</li> </ul>	16 July 2018	Individual
9	B3	GLOBAL GAP certified exporting grower	Si Saing	<ul style="list-style-type: none"> <li>✓ Mango production (2003)</li> <li>✓ Mango export (2010)</li> <li>✓ Area – 230ha</li> <li>✓ Executive committee member of MFVP Southern Shan</li> </ul>	17 July 2018	Individual
10	B4	Non-certified exporting grower	Taunggyi	<ul style="list-style-type: none"> <li>✓ Mango production (2002)</li> <li>✓ Mango export (2013)</li> <li>✓ Area – 48ha</li> </ul>	18 July 2018	Individual
11	B5	Non-certified exporting grower	Yat Saut	<ul style="list-style-type: none"> <li>✓ Mango production (2002)</li> <li>✓ Mango export (2016)</li> <li>✓ Area – 8ha</li> <li>✓ Executive committee member of Yat Saut mango cluster</li> </ul>	19 July 2018	Group

12	B6	Non-certified exporting grower	Yat Saut	✓ Mango production (2002) ✓ Mango export (2016) ✓ Area – 6ha ✓ Executive committee member of Yat Saut mango cluster	19 July 2018	Group
13	B7	Non-certified exporting grower	Yat Saut	✓ Mango production (2002) ✓ Mango export (2016) ✓ Area – 4ha	19 July 2018	Group
14	C1	Exporter	Yangon	✓ Mango export (2010) ✓ Owner of fruits and vegetables export company	26 July 2018	Individual
<b>Broker at Border Trade</b>						
15	D1	Broker (border trade)	Muse	✓ Large broker (Muse border trade) – around 1990	23 July 2018	Phone-interview
<b>NGOs and Associations</b>						
16	E1	Association (MFVP)	Yangon	✓ Chairperson of MFVP	2 July 2018	Individual
17	E2	NGO (GIZ)	Taunggyi	✓ Program Specialist of GIZ	18 July 2018	Individual
<b>Financial Institutions</b>						
18	F1	Financial institution (MADB)	Yangon	✓ Deputy Manager	31 July 2018	Individual
19	F2	Financial institution (CB)	Yangon	✓ Financial Controller of SME program	27 July 2018	Individual
<b>Government Departments</b>						
20	G1	Government (DOA)	Nay Pyi Taw	✓ Deputy Director General in Horticulture and Biotechnology Division	6 August 2018	Phone-interview
21	G2	Government (Regional Department)	Mandalay	✓ Deputy Manager (Amarapura)	12 July 2018	Individual
22	G3	Post-harvest Technology Training Center	Mandalay	✓ Trainer (Processing Technology)	13 July 2018	Individual
23	G4	Government (Regional Department)	Yat Sauk	✓ Township Manager (Yat Sauk)	17 July 2018	Individual
24	H1	Expert (YAU)	Yezin	✓ Lecturer in Horticulture Department, YAU	2 August 2018	Phone-interview

A=mango growers in Mandalay, B=mango growers in Shan, C=exporter, D=broker, E=NGOs, F=Financial institutions, G=government, H=expert

## Appendix 2: Check Lists

### 1. Exporting growers (Certified, non-certified), main exporter and MFVP

Topic to be covered	Important Points
<ul style="list-style-type: none"> <li>Existing quality control systems</li> </ul>	<ul style="list-style-type: none"> <li>Production systems</li> <li>Post-harvest handling practices</li> <li>Awareness of quality control</li> <li>Market (local, export) (how, who, why)</li> </ul>
<ul style="list-style-type: none"> <li>Different quality criteria for export</li> </ul>	<ul style="list-style-type: none"> <li>Access to market</li> <li>Export quality criteria (by export country)</li> </ul>
<ul style="list-style-type: none"> <li>Certification systems</li> </ul>	<ul style="list-style-type: none"> <li>Certification for export (by export country)</li> <li>Application process</li> <li>Certified body</li> </ul>
<ul style="list-style-type: none"> <li>Differences between certified and non-certified farmers regarding with market opportunities</li> </ul>	<ul style="list-style-type: none"> <li>Access to market</li> <li>Local vs export (price, market opportunities)</li> <li>Value chain</li> </ul>
<ul style="list-style-type: none"> <li>Supporting and hindering factors</li> </ul>	<ul style="list-style-type: none"> <li>Current government support and trade policy</li> <li>Technical, economic, market access, facilities, support, infrastructure, policies</li> <li>Areas to be improved</li> </ul>
<ul style="list-style-type: none"> <li>Key stakeholders and their roles and support</li> </ul>	<ul style="list-style-type: none"> <li>Current support and functions and willingness</li> <li>Other supporters, functions</li> <li>Easy to access</li> </ul>
<ul style="list-style-type: none"> <li>Necessary support from government and other stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>Technical, market linkages, facilities, financial, infrastructure, policies</li> </ul>

### 2. Government, NGOs, Expert

Topic to be covered	Important Points
<ul style="list-style-type: none"> <li>Certification systems</li> </ul>	<ul style="list-style-type: none"> <li>Certification for export (by export country)</li> <li>Application process</li> <li>Certified body and functions</li> </ul>
<ul style="list-style-type: none"> <li>Differences between certified and non-certified farmers regarding with market opportunities</li> </ul>	<ul style="list-style-type: none"> <li>Access to market</li> <li>Local vs export (price, market opportunities)</li> <li>Value chain</li> </ul>
<ul style="list-style-type: none"> <li>Supporting and hindering factors</li> </ul>	<ul style="list-style-type: none"> <li>Current government support and trade policy</li> <li>Technical, economic, market access, facilities, support, infrastructure, policies</li> <li>Areas to be improved</li> </ul>
<ul style="list-style-type: none"> <li>Key stakeholders and their roles and support</li> </ul>	<ul style="list-style-type: none"> <li>Current support and functions and willingness</li> <li>Other Supporters, functions</li> <li>Easy to access</li> <li>Future plan</li> </ul>
<ul style="list-style-type: none"> <li>Necessary support from government and other stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>Technical, market linkages, facilities, financial, infrastructure, policies</li> </ul>

### 3. Financial institution (Bank)

Topic to be covered	Important Points
<ul style="list-style-type: none"> <li>Supporting and hindering factors</li> </ul>	<ul style="list-style-type: none"> <li>Current government support and trade policy</li> <li>Technical, economic, market access, facilities, support, infrastructure, policies</li> <li>Areas to be improved</li> </ul>
<ul style="list-style-type: none"> <li>Key stakeholders and their roles and support</li> </ul>	<ul style="list-style-type: none"> <li>Current support and functions and willingness</li> <li>Amount of money</li> <li>Procedure for loan application</li> <li>Individual or group application</li> <li>Other Supporters, functions</li> <li>Easy to access</li> <li>Future plan</li> </ul>
<ul style="list-style-type: none"> <li>Necessary support from government and other stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>Financial, policies</li> </ul>

#### 4. Large brokers (Muse border trade)

Topic to be covered	Important Points
<ul style="list-style-type: none"> <li>Different quality criteria for export</li> </ul>	<ul style="list-style-type: none"> <li>Current functions in the chain</li> <li>Access to market</li> <li>Export quality criteria</li> <li>Consumer preference</li> </ul>
<ul style="list-style-type: none"> <li>Differences between certified and non-certified farmers regarding with market opportunities</li> </ul>	<ul style="list-style-type: none"> <li>Access to market</li> <li>Local vs export (price, market opportunities)</li> <li>Value chain</li> </ul>
<ul style="list-style-type: none"> <li>Supporting and hindering factors</li> </ul>	<ul style="list-style-type: none"> <li>Current government support and trade policy (China border trade)</li> <li>Technical, economic, market access, facilities, support, infrastructure, policies</li> <li>Areas to be improved</li> </ul>
<ul style="list-style-type: none"> <li>Key stakeholders and their roles and support</li> </ul>	<ul style="list-style-type: none"> <li>Current support and functions and willingness</li> <li>Other Supporters, functions</li> <li>Easy to access</li> </ul>



### Appendix 3: Pictures Showing Interviews with Selected Stakeholders



Picture 1 : Interview with GAP certified-grower in Mandalay region



Picture 2 : Interview with GAP certified-grower in Southern Shan State





**Picture 3 : Interview with GLOBAL GAP certified grower in Southern Shan State**



**Picture 4 : Group interview with non-certified growers in Mandalay region**





**Picture 5 : Group interview with non-certified growers in Southern Shan State**



**Picture 6 : Interview with respondent from Post-harvest Technology Training Center, Mandalay region**



**Picture 7 : Interview with respondent from Regional Agricultural Department, Yat Saut, Southern Shan State**