DRAFT REPORT

Lot 3: Apple Value Chain Analysis

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BPV Consultancy & Research Services
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Contents

LIST OF ACRONYMS

ARDC	Agriculture Research and Development Center
BAFRA	Bhutan Agriculture and Food Regulatory Authority
BAIL	Bhutan Agro Industries Limited
BEA	Bhutan Exporters Association
CFBB	Corrugated Fibre Broad Boxes
CNR	College of Natural Resources
CSMI	Cottage, Small and Medium Industry
DAMC	Department of Agricultural Marketing and Cooperatives
DOA	Department of Agriculture
DSC	Druk Seed Corporation
EO	Extension Office
EU	European Union
EU-TCP	European Union Technical Cooperation Project
FCBL	Food Corporation of Bhutan Limited
FIs	Financial Institutions
IPPC	International Plant Protection Convention
LC	Letter of Credit
MoAF	Ministry of Agriculture and Forests
MT	Metric Ton
MoEA	Ministry of Economic Affairs
MoLHR	Ministry of Labour and Human Resources
NASEPP	National Seed and Plant Protection Programme
NPHC	National Post Harvest Center
NPPC	National Plant Protection Center
NSC	National Seed Center
RMA	Royal Monetary Authority
RNR	Renewable Natural Resources
RRCO	Regional Revenue and Customs Office
R&D	Research and Development
RTIO	Regional Trade and Industry Office
RGoB	Royal Government of Bhutan
VC	Value Chain
VCA	Value Chain Analysis

LIST OF TABLES

LIST OF FIGURES

ANNEXURE

EXECUTIVE SUMMARY

Apple production in Bhutan is concentrated in the western dzongkhags of Paro, Thimphu and Haa. Despite it being one of the major sources of cash income, apple industry has been facing many challenges, mostly due to factors such as shrinking land area for apple cultivation, triggered by urbanization; competition from other countries in both export and domestic markets; and poor quality of apple produced by growers. All of these factors have affected both the total production, which has decreased from 7,666 MT in 2012 to 6,587 MT in 2016 and the quantity of apple exported, which has decreased from 4,314.23 MT in 2013 to 3,789.90 MT in 2016.

There is an urgent need felt by the Ministry of Agriculture and Forests (MoAF) to improve both quantity and quality of apple production to enhance the apple trade. It is therefore proposed that an apple value chain study be carried out from production till the market to understand current issues and challenges; identify appropriate recommendations to address the constraints; and suggest ways to capitalise on the opportunities.

The following sections present detailed study of apple value chain in the country: background, situational analysis, market analysis, value chain mapping, value chain governance, financial analysis, issues and challenges, conclusion and recommendation.

(i) Background: Provides background on the introduction of apple in Bhutan and agro-ecological zones suited for apple production.

(ii) Situational analysis: Studies current area under apple cultivation, production and contribution to GDP.

(iii) Market analysis: Provides analysis of export, domestic and regional markets.

(iv) Value chain mapping: Describes major actors, supporters and influencers within apple value chain, their functions and popular marketing channels followed.

(v) Value chain governance: Describes relationships between actors, support services available and enabling regulatory frameworks and policy environment supporting apple production, export and diversification.

(vi) Financial analysis: Outlines cost of production, value creation, and revenue generated by various actors in the chain.

(vii) Issues and challenges: Presents issues and challenges at the input, production, harvest, postharvest, trading and marketing areas. It also highlights other challenges related to low capacity of local processing units, product diversification, NTBs, weak lateral agency coordination and institutional and HR capacities.

(viii) Conclusion: Concludes each section with key findings.

(ix) Recommendations: Recommends measures to improve production and productivity, identifies capacity development gaps, areas to strengthen harvest and postharvest facilities (storage and pack houses), improve market information, market diversification facilities), and suggests the need for inter-agency collaboration, strengthening private sector participation and finally highlights some legal and regulatory interventions to improve the chain.

Note: Training needs assessment and list of existing training materials are attached as Annex 2.

1. INTRODUCTION

1.1. Background

Bhutan is a small mountainous country in the Eastern Himalayas with a total geographical area of 38,394 square kilometres. It has an estimated population of 692,895, of which 34 percent reside in urban areas and 66 percent in rural areas (BLSS Report, 2017). Agriculture is the main source of livelihood for the farming communities in the rural areas. However, due to the rugged terrain, only 2.93 percent of the land is under agricultural use. Majority of Bhutanese farmers have small land holdings, with an average farm size of 3 acres and practice a self-sustaining subsistence integrated farming system (Katwal, 2013).

The country is broadly categorized into three climatic zones, which are sub-tropical in the southern foothills; temperate in the middle valleys and inner hills; and alpine in the northern mountains (Katwal, 2013). Due to its large altitudinal variation, Bhutan enjoys six agro-ecological zones:

- Alpine (3,600-4,600 meters)
- Cool Temperate (2,600-3,600 meters)
- Warm temperate (1800-2600 meters)
- Dry Sub-Tropical (1200-1800 meters)
- Humid Sub-Tropical (600-1200 meters)
- Wet-Subtropical (150-600 meters).

Apple is a deciduous fruit which is mostly grown in temperate regions. It originated in Europe and Western Asia, and gradually spread across the world. Apple trees belong to the family of "*Rosaceae*" and genus of "*Malus*". There are more than 8000 cultivars of apples all over the world. Apple trees can grow up to 15 to 16 feet tall. The wild apple trees can reach up to 40 feet. The size and the shape of the apple tree are determined by rootstock selection and trimming (pruning) method. Soil, climate and orchard management practices are common factors that influence the commercial farming of apple fruit (Asia Farming).

Apple is one of the most commercially grown table fruit crops in the world, after banana, orange and grapes. China, the United States of America and Turkey are the top three apple producing countries. China is by far the largest producer of apple, which produced 43 Million tons of apples in 2015-16 (USAD, 2017). Apple has excellent health benefits and hence it is recommended for daily consumption.

Apple as a horticultural crop was introduced in Bhutan in the 1960s during the reign of third King of Bhutan, Jigme Dorji Wangchuck, who saw great opportunity for Bhutan to produce horticultural crops due to its agro-ecological variations (Choden and Shahnawaz, 2015). Since then, apple has emerged as an important cash crop in the country, particularly for foreign exchange earnings through its export. The initial apple cultivar, *Malus domestica Borkh* was brought from northern states of India, namely Himachal Pradesh, Jammu and Kashmir. Later, in the 1980s, improved cultivars were brought from Japan (Dorji, P, 1999). However, there were many limitations such as difficulties in propagation, vigorous tree size and susceptibility to many pests and diseases.

With the growth of horticultural industry, different types of rootstock were introduced in Bhutan. Most of the trees were propagated on clonal roots, mostly Malling-Merton (MM106), developed and released by East Malling Research Station in England (RGoB, 2002). Apple is mostly grown in Paro, Thimphu, Haa, Chukha and Bumthang dzongkhags. The main apple varieties currently popular in Bhutan are Royal Delicious, Red Delicious and Golden Delicious.

1.2. Objectives of the study

The key objective of this consulting assignment is to strengthen the whole apple value chain in Bhutan to enhance production, marketing and income for farmers.

1.3. Methodology

The methodology adopted for the study is a combination of desk research and field work. Various data collection approaches were used for gathering data such as focus group discussions, consultations, key informant interviews, telephonic interviews and emails. The interviews were guided by a checklist and a semi-structured questionnaire.

Under desk research, existing literature and secondary data on apple were collected and reviewed. In order to authenticate information from desk research, field visits to main apple growing districts such as Bumthang, Chukha, Paro, and Thimphu were carried out. Relevant stakeholders in these districts such as apple growers, private nursery operators, agriculture officials, middlemen, exporters, wholesalers, retailers, and relevant individuals from processing units were met, apart from visiting the local markets, wholesale and retail shops. Consultations were also carried with Department of Agriculture (DoA), Department of Agricultural Marketing and Cooperatives (DAMC), National Post Harvest Center (NPHC), National Seed Center (NSC), National Plant Protection Center (NPPC), Agriculture Research and Development Center (ARDC), Yusipang, Bhutan Agriculture and Food Regulatory Authority (BAFRA), Bhutan Chamber of Commerce and Industry (BCCI), Bhutan Exporters Association (BEA), Food Corporation of Bhutan Limited (FCBL), Bank of Bhutan Limited (BOBL), and Bhutan Development Bank Limited (BDBL). A list of agencies visited and people met for the study is provided in Annex 1.

This apple value chain report is informed by findings from situational analysis, market analysis, financial analysis and the understanding of existing value chain map and marketing channels. Besides these, the report looks at value chain governance and other pertinent issues and challenges in the chain. Finally, it presents a SWOT analysis of the apple value chain, and suggests certain recommendations.

1.4. Limitations

Both desk research and data collection from the field encountered limitations. Some of the significant limitations were:

- Very limited study or research on apple has been carried out in the past in Bhutan. The available data are inconsistent and parameters used vary from year to year and within different reports, making it difficult to compare or carry out an in-depth trend analysis.

- Another limitation is the lack of disaggregated data in published documents. Most of the statistical documents, including RNR statistics do not provide apple specific data. For instance, specific data on land conversion, crop damage, and households engaged in apple

production, employment generated by apple, per capita consumption of apple, budget allocation and spending by government on apple are not available.

- Field verifications were carried out to substantiate the desk research. However, data in the field offices were not readily available, and those shared were inconsistent with the data at the head offices. In some instances, the Dzongkhag officials failed to provide information requested.

- There are many actors, supporters and influencers in the apple value chain with overlapping roles and functions. For the study, only major actors and their functionality and relations to the chain are discussed. Therefore, few minor actors and their relations to the apple value chain are omitted.

- Another significant challenge was the disclosure of information related to costs of operations and revenue generated by main actors in the value chain such as the agro-processing units. The consultant had to cross-check with many actors to determine a realistic figure to calculate costing for the study.

- Accessing apple information in other markets requires membership, making access to information difficult, as it is mostly subscription-based.

Due to all of these limitations, substantial time was spent on obtaining reliable and relevant data for the study.

2. SITUATIONAL ANALYSIS

2.1. Area under apple production in Bhutan

Apple is grown by most farmers in apple growing regions across Bhutan in their backyard farms for household consumption. However, apple production on commercial scale is mostly concentrated in the western part of the country and they range from small orchards with less than 100 trees to large commercial orchards with thousands of trees.

As per the Bhutan RNR Statistics 2016, the total land area under different agricultural use accounts for 2.93 percent. From this, only 0.05 percent (2,081 hectares) is used for apple production. The different agricultural land use types and their coverage are provided in Table 1 below.

Table 1: Area of land under different agricultural category

Category	Type	Hectares	Percent	Total (%)
Agriculture Areas	Wetland	31,911	0.83	2.93
	Dryland	68,255	1.78	
	Apple Orchard	2,081	0.05	
	Citrus Orchard	5,488	0.14	
	Cardamom Plantation	3,600	0.09	
	Arecanut Plantation	1,199	0.03	
	Other Horticulture	16	0.00	

Source: Bhutan RNR Statistics, 2016

Distribution of area under apple production in the major apple growing dzongkhags show Paro with the maximum land area under apple production (1,026 hectares), which constitutes 49.3 percent of the total area under apple production. It is followed by Thimphu with 902 hectares of land under apple production, constituting another 43.3 percent. Other dzongkhags such as Haa, Chukha and Bumthang make up the rest with 4.3 percent, 2.5 percent and 0.6 percent of land under apple production respectively.

Table 2: Area of land under apple orchard

Dzongkhag	Apple Orchard (hectares)	Percent (%)
Bumthang	12	0.6
Chhukha	53	2.5
Haa	89	4.3
Thimphu	902	43.3
Paro	1,026	49.3
Total	**2,081**	**100%**

Source: Adapted from Table 37, Bhutan RNR Statistics 2016

2.2. Apple production in Bhutan

Over the last five years (2012-2016), figures on total number of apple trees, apple production and yield in kilogram per bearing tree has been erratic but the number of bearing trees have

consistently decreased between 2012 and 2015, with a slight increase recorded in 2016. However, if we compare the figures of 2016 to that of 2012, it is observed that the total number of trees, bearing trees and production has all decreased. Possible reasons for this reduction are discussed in more detail in Section 7 under issues and challenges.

Table 3: Apple production and number of bearing trees

Year	Total number of trees	Number of bearing trees	Production (MT)	Yield kg/ bearing trees
2012	306,181	243,967	7,666	31
2013	322,063	236,051	8,032	34
2014	277,670	217,317	7,051	32
2015	240,526	179,474	5,308	30
2016	242,903	196,708	6,587	33

Source: Adapted from Agriculture Statistics (2012 to 2016)

2.3. Contribution of apple to GDP

The contribution of apple to the country's GDP is provided in Table 4. Apple's contribution to GDP is quite insignificant in the recent years, contributing less than one percent for the last five years.

Table 4: Contribution of Apples to GDP (Nu. Million)

	2010	2011	2012	2013	2014	2015	2016
GDP at Current Price	72,496.60	84,950	97,453	105,378.30	119,545.75	132,021.30	148,678.93
Apple Gross Value	289.45	1082.17	579.55	664.43	678.3	457.39	698.47
Percentage of GDP	0.40	1.27	0.59	0.63	0.57	0.35	0.47

Source: Bhutan at a Glance 2013-2017, National Accounts Statistics, 2017

3. MARKET ANALYSIS

Majority of apple produced in Bhutan are exported (62 percent). The main markets are India and Bangladesh. In both the markets, Bhutanese apples cater to lower segments of the population. If quality, certification and packaging are strengthened, there is good opportunity for Bhutan to capture high-end market that pay premium price. Given very minimal pesticides are used in growing apples in Bhutan, careful branding and marketing could open niche and high-end markets in both of these countries. In both Bangladesh and India, there is a burgeoning middle class with spending capacity, who are health conscious and demand more diversified and organic food. Bhutanese apple growers and exporters could target these segments of the market.

Apple related data for 2016 show that local market consumes 38 percent of apple produced in the country. Of this, 30 percent is consumed through local retail market and the other eight percent by processing units (details provided in Table 12, Figure 5). There is however a growing demand within local market for good quality fresh apples, which is mostly served by imports from other countries. If not for anything, improving the quality of our apple can substitute imports, at the least.

Further, there are regional markets that are not tapped at the moment. Therefore, the report looks at the export markets, followed by domestic and regional markets.

3.1. Export market

At the moment, apples from Bhutan are mainly exported to Bangladesh and India.

3.1.1. Bhutan's apple export to Bangladesh and India

The table below shows the amount of apples exported to Bangladesh and India and their value in the last four years (2013-2016).

Table 5: Export of apples to Bangladesh and India (volume and value)

Year	Total apple export (MT)	Bangladesh		India		% of Export to Bangladesh	% of Export to India
		Qty (MT)	Value (Nu in Million)	Qty (MT)	Value (Nu in Million)		
2013	4,314.23	1,315.4	51.4	2,998.8	47.3	30.49	69.51
2014	5,436.68	1,419.7	59.1	4,017.0	80.0	26.11	73.89
2015	3,487.84	1,430.7	61.4	2,057.2	40.4	41.02	58.98
2016	3,789.90	1,176.1[1]	39.7	2,613.8	88.4	31.03	68.97

Source: Bhutan RNR Statistics 2016 and Bhutanese Apples & Export Markets: A Brief Analysis 2016, DAMC

We observe that majority of apples from Bhutan are exported to India every year. On an average, export to India comprise of 69 percent and 31 percent to Bangladesh between 2013 and 2016.

[1] The Agriculture Statistics 2016 export figures for 'other than India' category is assumed as exports to Bangladesh.

3.1.2. Bhutan's apple export and value

In general, it is observed that the volume of apple export is influenced by total production. However, if we have a closer look at apple export and its value, it is observed that for 11 percent increase in apple export between 2012 and 2016, there has been 63 percent increase in the value. This indicates that Bhutanese apples are able to fetch more than double the price in its export markets in 2016 compared to 2012.

The reason for increase in the value of apple in 2016 is mainly due to political crisis in major apple growing region of India – Kashmir as reported by *The Economic Times*[2]. Due to this, Bhutanese apple increased its market share in India and Bangladesh. Moreover, due to the late arrival of Kashmir apple and frequent disruption in transportation, the supply from Kashmir took longer time, drying up the fruit and pulling down its price, which helped increase the price for Bhutanese apples.

The table below also shows that in 2012, the percentage of apple exported to that of total production was below 50 percent. However, from 2013 onwards, this percentage consistently remained above 50 percent. For the period 2013 to 2016, the percentage of apple export to that of total production rose to 63.5 percent on average.

Table 6: Apple export (volume and value)

Year	Total apple production (MT)	Exports (MT)	Exports value in million	Quantity of total exports in %
2012	7,666	3,410.33	49.23	44.48
2013	8,032	4,314.23	98.74	53.72
2014	7,051	5,436.68	139.07	77.13
2015	5,308	3,487.84	101.87	65.71
2016	6,587	3,789.90	128.1	57.54

Source: Adapted from Agriculture Statistics (2012-2016), Bhutanese Apples & Export Markets: A Brief Analysis 2016, DAMC, MoAF.

Having looked at the volume and value of Bhutan's apple export, it is important to understand what percentage of the export markets are served by it. To do this, the report first presents apple import data of our export markets - Bangladesh and India. The tables below provide the figures for fresh apple imported by these two countries in the last 16 years. In both the markets, we see that apple imports have increased despite some slag years in between.

3.1.3. Bangladesh's apple import

Apple import in Bangladesh nearly quadrupled from 66,000 MT in 2006 to 230,000 MT is 2016 (Table 7), indicating the huge market potential for fresh apple.

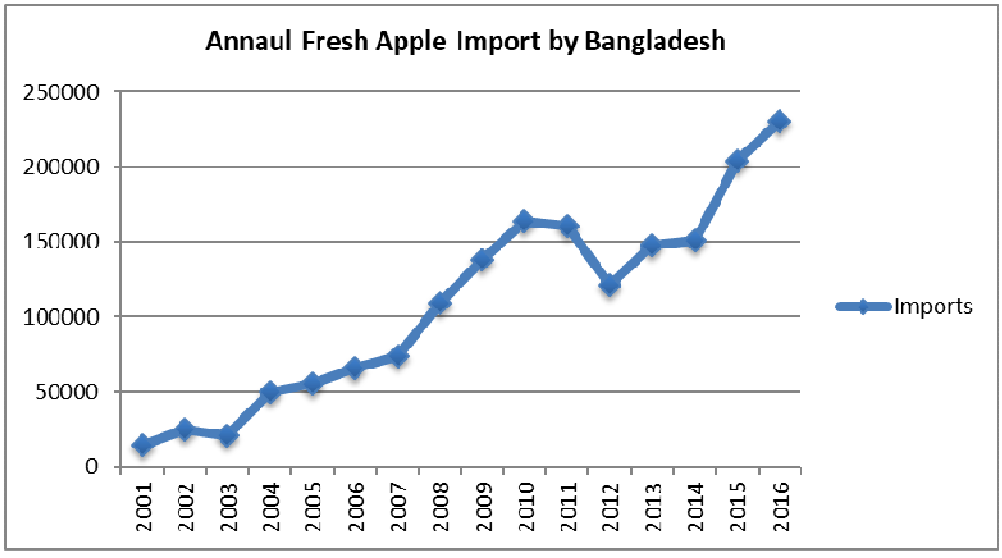
[2] Debasis Sarkar, 2 September 2016, "Kashmir crisis yielding indirect benefit for Bhutan's apple", The Economic Times, Siliguri, India.

Table 7: Annual fresh apple imports by Bangladesh

Market Year	Imports	Unit of Measure	Growth Rate
2001	14,400	(MT)	-
2002	25,000	(MT)	73.61 %
2003	21,100	(MT)	-15.60 %
2004	49,400	(MT)	134.12 %
2005	55,000	(MT)	11.34 %
2006	66,000	(MT)	20.00 %
2007	73,500	(MT)	11.36 %
2008	109,500	(MT)	48.98 %
2009	138,400	(MT)	26.39 %
2010	163,300	(MT)	17.99 %
2011	160,300	(MT)	-1.84 %
2012	120,900	(MT)	-24.58 %
2013	147,800	(MT)	22.25 %
2014	151,100	(MT)	2.23 %
2015	203,400	(MT)	34.61 %
2016	230,000	(MT)	13.08 %

Source: United States Department of Agriculture

Figure 1: Annual fresh apple imports by Bangladesh



The most popular apples among Bangladeshi consumers are Fuji and Gala, as well as Golden and to a lower extent, green apple. Apples are mostly imported from countries such as China, South Africa and Brazil (USDA, 2017). The table below show the major apple suppliers to Bangladesh and the varieties supplied.

Table 8: Varieties of apple import by Bangladesh from major suppliers

Supplier	Varieties
China	Red delicious, golden delicious, honey, red star, green and red gala, red and green qinguan, golden china, golden jiguan, dilshan
South Africa	Gala, royal gala, red delicious, golden delicious, pink lady, fuji, red gala
Brazil	Fuji, royal gala, gala, pink lady
New Zealand	Gala, royal gala, fuji, jazz
India	Red delicious
United States	Red delicious, golden delicious

In 2014, China was the biggest exporter of apples to Bangladesh, which had a market share of 68 percent, followed by India with 9 percent, South Africa and Brazil with 8 percent each, followed by other countries like France and the Netherlands (2 percent each), and rest by others.

3.1.4. India's apple import

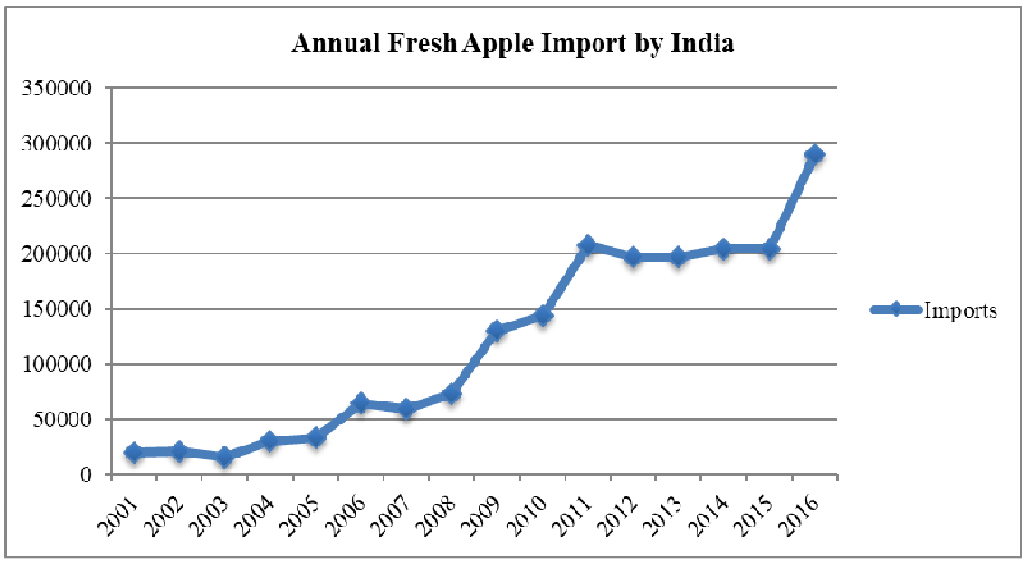
Likewise, apple import in India increased from 64,700 MT in 2006 to 290,000 MT in 2016 (Table 9), which is an increase of almost five times its original volume in ten years.

Table 9: Annual fresh apples imports by India

Market Year	Imports	Unit of Measure	Growth Rate
2001	20,000	(MT)	-
2002	20,800	(MT)	4.00 %
2003	16,200	(MT)	-22.12 %
2004	30,500	(MT)	88.27 %
2005	33,000	(MT)	8.20 %
2006	64,700	(MT)	96.06 %
2007	59,800	(MT)	-7.57 %
2008	73,600	(MT)	23.08 %
2009	130,300	(MT)	77.04 %
2010	144,000	(MT)	10.51 %
2011	207,600	(MT)	44.17 %
2012	197,100	(MT)	-5.06 %
2013	196,800	(MT)	-0.15 %
2014	204,300	(MT)	3.81 %
2015	204,700	(MT)	0.20 %
2016	290,000	(MT)	41.67 %

Source: United States Department of Agriculture

Figure 2: Annual fresh apples import by India



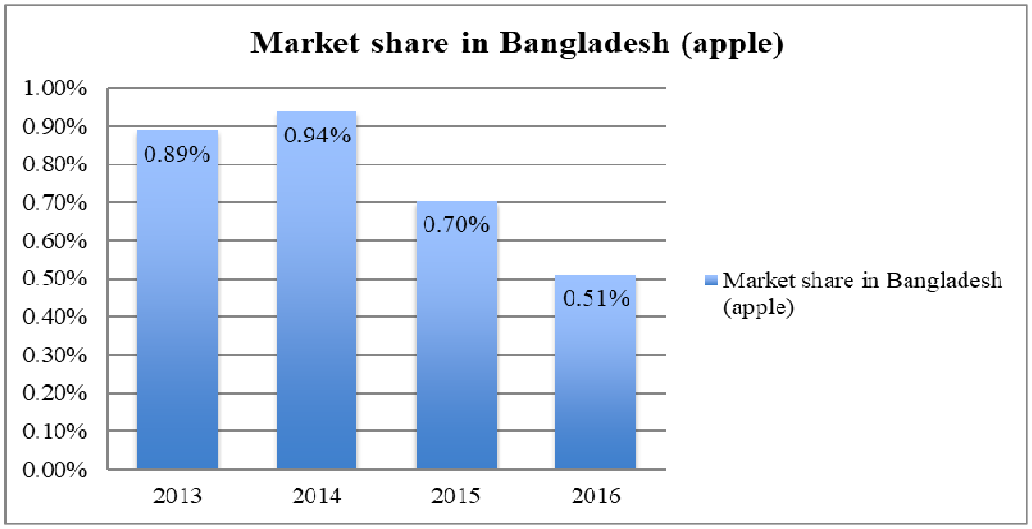
3.1.5. Bhutan's apple market share in Bangladesh

Table 10 and Figure 3 show the composition, in terms of amount and percentage of Bhutanese apples in Bangladesh market over the last four years (2013-2016).

Table 10: Market share of Bhutanese apples in Bangladesh

Years	2013	2014	2015	2016
Total apple imported by Bangladesh	147,800.00	151,100.00	203,400.00	230,000.00
Apples imported from Bhutan	1,315.40	1,419.70	1,430.70	1,176.10
Bangladesh apple market share (%)	0.89%	0.94%	0.70%	0.51%

Figure 3: Percentage of market share in Bangladesh



Apples from Bhutan comprise only 0.89 percent of the total import by Bangladesh in 2013. Although there was a slight increase in 2014 to 0.94 percent, it has decreased to 0.7 percent and 0.51 percent in 2015 and 2016 respectively. Bhutan is not producing Fuji and Gala, which is popular apple varieties demanded in Bangladesh markets.

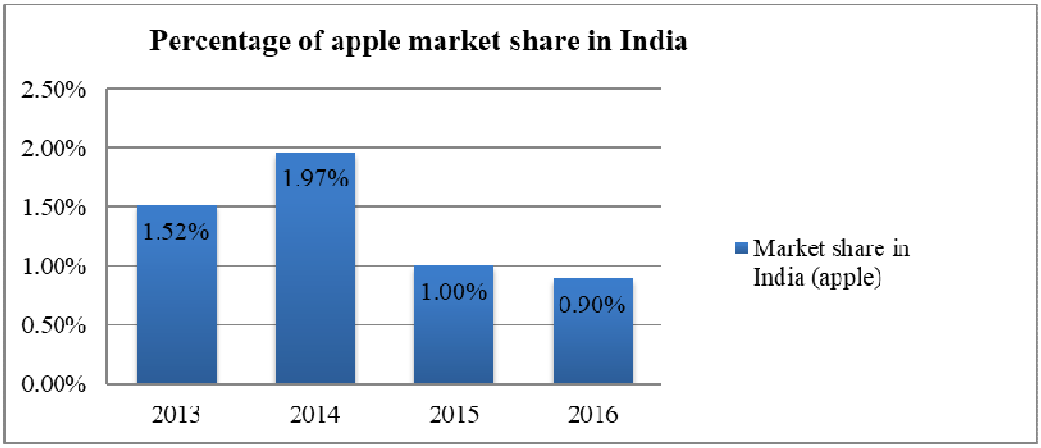
3.1.6. Bhutan's apple market share in India

Similarly, Bhutan's apple in Indian market constituted only 1.5 percent in 2013, which slightly increased to 1.9 percent in 2014. The market share decreased to 1 percent and 0.9 percent respectively in 2015 and 2016.

Table 11: Market share of Bhutanese apples in India

Years	2013	2014	2015	2016
Total apple imported by India	196,800.00	204,300.00	204,700.00	290,000.00
Apples imported from Bhutan	2,998.80	4,017.00	2,057.20	2,613.80
India apple market share of Bhutan (%)	1.52%	1.97%	1.00%	0.90%

Figure 4: Percentage of apple market share in India



This shows that apples from Bhutan serve a very tiny share of the export markets. Although, the study did not present the opportunity to meet Bangladeshi importers, talking to Indian importers presented some interesting insights into Indian market dynamics.

3.1.7. Apple market dynamics in India

From the discussions with Indian importers from Jaigoan, Bhutan's apple exports to India only reach few bordering, north eastern states of West Bengal and Assam. Majority (around 50 percent) of the apples exported to India goes to Alipur and Kooch Behar area, particularly Dalsingpara, Hashimara, Falakatta, Dhupguri, Mainaguri, and Siliguri, besides Jaigoan. Unlike Bangladesh, Indian markets prefer bigger apples. Indian importers import many varieties of apples from Bhutan. Royal Delicious (Raja) is the most preferred apple variety, followed by Red delicious. Besides these, other varieties such as Sikaichi (Tissue-cultured variety), Golden, Jonathan, Tetu and Jale are also imported. Most of the apples exported to India come from Paro and Thimphu, along with a small quantity from Haa.

Price of apple is determined by its quality. Good quality apples not only fetch better price but farmers/middlemen are paid upfront by the Indian importers and traders. However, for inferior quality, payments are done only when the apples are sold by these importer and traders. It is informed by the officials from BEA that at times Bhutanese farmers even barter their produce with importers/traders (who operate shops in Jaigoan[3]). This arrangement is beneficial for our farmers since it is impractical to bring apples back to Paro or Thimphu.

According to the BEA, Indian importers/traders operating in Bhutan work on small profit margin, especially in apple business. They make it up from trading in other agricultural produce such as orange, potato, cardamom, and chilly. The advantage of engaging Indian importers is their excellent connection with retailers in even very small village markets across the border. The BEA claims that without Indian traders, it would be difficult for Bhutanese apple exporters and farmers to penetrate Indian markets. Although, Bhutanese farmers and exporters are able to sell their products with the help of the Indian importers, prices are usually low due to quality of apples. In an interview with the Indian importers, it was indicated that apples from Bhutan that come into Indian market are inferior quality apples, usually the ones left after export to Bangladesh is met.

Although the exact quantity cannot be ascertained, it was informed by respondents in Phuntsholing that there is also informal apple trade taking place with India, particularly across Phuntsholing-Jaigoan border. During the apple season, small quantities of apple are reported to be carried across the border by people or in the back of small private vehicles, which do not get recorded in the trade statistics.

3.2. Domestic market

Domestic markets play an important role in apple utilization and it can be broadly categorized as local agro-industries and local retail markets. However, there are only a limited number of agro-industries and of these, only Bhutan Agro Industries Limited (BAIL), Thimphu and Fruit Processing Enterprise in Bumthang use local apples as raw materials for their products.

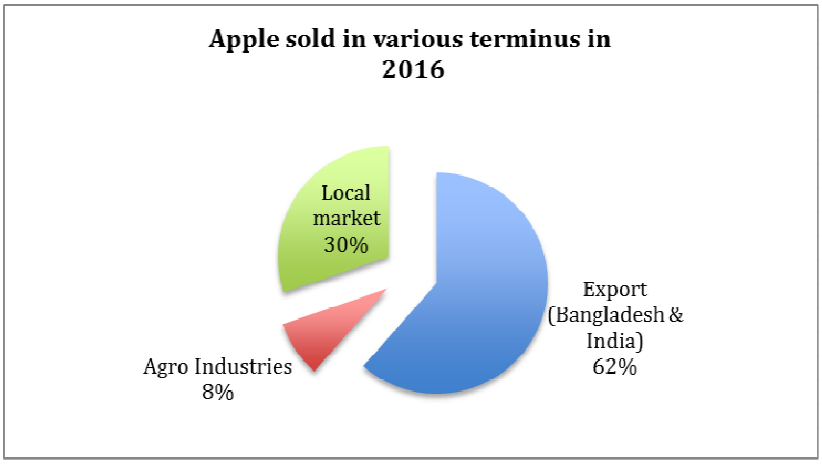
Nevertheless, it acts as a good market for inferior quality apples that cannot be exported. Farmers, wholesalers and retailers are also involved in selling apples directly to consumers at the retail markets. Historical apple utilisation data by local markets are not available. However, we get a rough sense of domestic apple utilisation from the 2016 data. The pie chart below shows the quantity of apple sold in 2016 to the three end markets, namely 1) export market (Bangladesh and India); 2) local agro-industries/processing units; and 3) local retail markets.

Table 12: Apple sold in various end markets in 2016

Particulars	Quantity MT
Exports to Bangladesh and India	3,790
Local Agro Industries (BAIL and Fruit Processing Enterprise, Bumthang)	508
Local market	1,862
Apple utilization for Year 2016	**6,160**

[3] Farmers take edible oil and other food items/goods from Indian importers as payment for their apples.

Figure 5: Apple sold in various end markets in 2016



As per the Agriculture Statistics 2016, although total apple production was 6,587 MT in 2016, volume traded in the same year was only 6,160 MT. From the total volume traded, export to Bangladesh and India was 3,790 MT and utilization by the BAIL was 454 MT (DAMC, 2017). Field finding indicate that out of 67 MT of apples produced in Bumthang in 2016, around 80 percent (54 MT) was utilized by the Fruit Processing Enterprise in Bumthang. This totals up the utilizations figures by processing units to 508 MT in 2016. The rest is assumed to be consumed in the local market. The percentage breakup of the pie chart in Figure 5 shows 62 percent of apples as being exported, 8 percent as being used by local agro-industries and the rest 30 percent as being consumed in the local market.

3.2.1. Growing domestic apple market

Apple import figures show a growing domestic market for apples. Apple import data since 2010 shows that both quantity and the value of imported apples have been steadily increasing. In 2010, Bhutan imported 51.35 MT of apples, which increased to 123.1 MT in 2016. Likewise, the value of apple imported in 2010 was Nu. 2.16 Million, which increased to Nu. 12.8 Million in 2016.

Table 13: Apple import by Bhutan (MT)

Year	Import of Apples	
	Quantity (MT)	Value (Nu Million)
2010	51.35	2.16
2011	24.47	1.48
2012	42.97	3.87
2013	43.63	3.36
2014	52.63	6.2
2015	73.25	7.94
2016	123.1	12.8

Source: Bhutan RNR Statistics 2016 and Bhutanese Apples & Export Markets: A Brief Analysis 2016, DAMC

Bhutan's apple import is not just during off-season but even during the apple season. For instance, in Bumthang town, vegetable wholesalers reported of importing apples from Falakatta and Burimari all year round. During the tourist season, around six to eight cartons of apples are

imported in a week. During other months they import around four cartons each. One carton contains around 20 kgs of apple which cost them approximately Nu. 3,000 and they sell the apples at around Nu. 250 per kilo, making a profit margin of approximately Nu. 2,000 per carton.

3.2.2. High-end domestic apple market

Data on per capita apple consumption and category of consumers are not available. However, interviews with growers as well as retailers in Bumthang reported that the main customers for imported apples are resorts, lodges and hotels, apart from a small cliental of local residents who purchase imported apples for religious offerings and personal consumption.

The prices for local apples vary in the domestic market. At the start of the apple season and towards the end of the season, prices become comparatively higher. It ranges from Nu. 150 to Nu. 200 per kg of apples in Thimphu and Paro. In Bumthang, local apples are sold between Nu. 60 to Nu. 100 per kg.

The retailers informed that they import apples from outside the country because the quality of local apple is poor. It is informed that if growers in Bhutan are able to produce superior quality of apples, they would be willing to stop importing apples from outside. Similarly, farmers in Thimphu and Paro also reported that high-end hotels and resorts demand imported apples during off-season and are able to sell at Nu. 3,000 to 4,000 per carton.

Tourist arrival in 2016 saw an increase of 35 percent, making the total number of international and regional tourists to 209,570 (TCB, 2016). Bhutan is also seeing a lot of new hotels that are being constructed each year. This presents a growing domestic market for quality apples in the country.

3.3. Regional market

Past reports show that small quantities of apples were exported to countries like Nepal, Thailand and Sri Lanka in 1992 and 1995. It was also reported that apples fetched good price in these countries. However, exports were short-lived and the exact reason for discontinuing it is not documented. It was assumed that it could be because of heavy competition from other countries and high cost involved in transporting Bhutanese apples to such export markets (Thinley *et al.*, 2008).

Further, in 1998, the then Agriculture Marketing Services (now DAMC) under Ministry of Agriculture and Forests conducted apple marketing trial to Sri Lanka. The trail was reported to be successful and people anticipated exports to Sri Lanka would pick up but it was discontinued due to high transportation costs as per the DAMC.

3.4. Findings on market analysis

In the recent years (2013-16), slightly over two-thirds of Bhutan’s apples were exported to India. There is an ever increasing demand for apple in both Bangladesh and India. Our apple market share in these two countries is currently below one percent and presents potential for Bhutan to expand its apple market share. Similarly, there is an increasing trend of apple import in the country, which can be substituted by local apple, if quality is improved. Potential for apple exports to other regional markets were found feasible by past studies (Thinley *et al.*, 2008) and could be explored further.

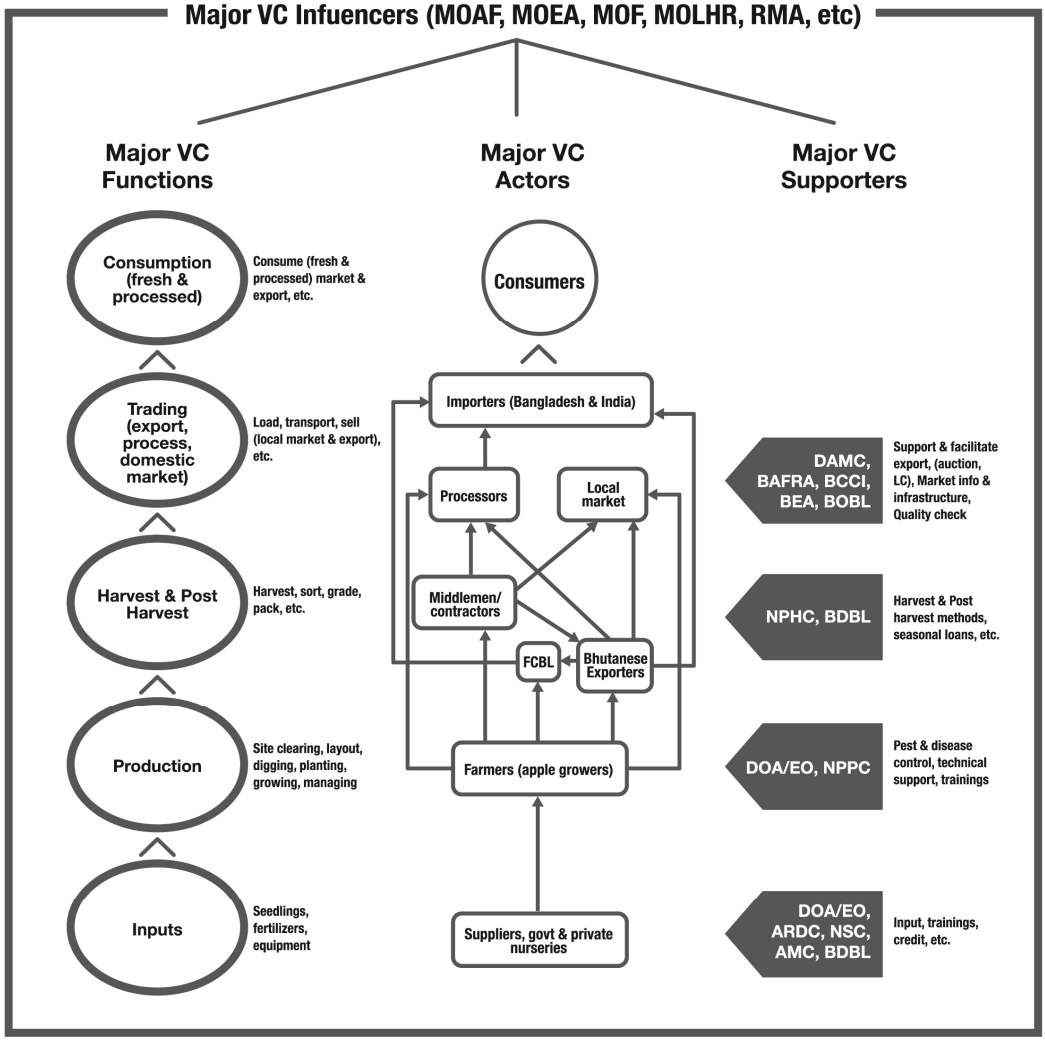
4. VALUE CHAIN MAPPING

In general, value chain (VC) describes the full range of activities required to bring a product or service through all stages, from producer to the final consumer.

4.1. Existing apple value chain map

The processes documented below illustrate existing apple value chain in Bhutan. It shows major value chain actors, supporters and influencers along with the functions they perform along the chain, starting from input till consumption.

Figure 6: Apple value chain map



4.1.1. Apple value chain functions

The main apple value chain functions are input, production, harvest and postharvest (harvesting, sorting, grading, and packing), trading (including transportation) and consumption.

4.1.2. Apple value chain actors

Value chain actors are those who directly deal with the production, processing, packaging, trading etc. of a product. Usually they own the product for some time as it travels along the chain (Roduner, 2007). The main apple value chain actors in Bhutan include input suppliers, growers, middlemen, exporters, importers/traders, processors, wholesalers, retailers and consumers. A small quantity of apple is also traded through FCBL auction yards to importers/traders, and therefore FCBL also acts as an indirect actor.

At the input and production level, input suppliers and growers are the main actors. When the apples are traded, the main actors are: 1) growers, middlemen, exporters, FCBL, and importer for external markets; and 2) growers, wholesalers and retailers for local markets. FCBL is currently an inactive actor in the apple value chain. In 2016, it auctioned only 13.9 MT of apples (valued at Nu. 385,390), which is 0.2 percent of the total apple production in Bhutan. FCBL auction yards charge 3 percent of the auction value as commission and it also reportedly takes seven to ten days to make the payments to growers/exporters after the auctions. Therefore, the use of marketing channel involving FCBL is very low, although it has the potential to play an important role.

If growers sell their apple directly to the end markets (exporters, agro-processing units and local consumers), they carry out harvest, postharvest and marketing activities. If growers sell their apple through middlemen and exporters, the main actors who carry out harvest, postharvest and marketing activities are the middlemen and exporters.

There is however no apple growers' association or farmers group. Apple growers association could be encouraged to improve collective bargaining power and to strengthen the apple value chain governance structure at the grassroots level.

4.1.3. Apple value chain supporters

Value chain supporters are people and agencies who provide services to the value chain actors, including improving capacities of producers and small agro-businesses; ensuring access to information, knowledge and know-how; and linking with markets. VC supporters never directly deal with the product, but their services add value to the product (Roduner, 2007). The main supporters in Bhutan's apple VC are government agencies such as ARDC, DOA, AMC, NSC, NPPC, NPHC, DAMC, and BAFRA.

Besides these, there are others supporters such as BCCI, BEA, and Financial Institutions which facilitate trade and exports, provide market information and financial services.

BEA supports and facilitates apple floor price fixing and organizing annual 'Apple Coordination Meetings' with relevant stakeholders. It also liaises with agencies outside the country to negotiate safe passage for Bhutanese exporters. BEA collects a commission of 0.25 percent of the Letter of Credit (LC) value from apple exporters. Currently, there are 15 apple exporters registered with the BEA, of which seven are active.

4.1.4. Apple value chain influencers

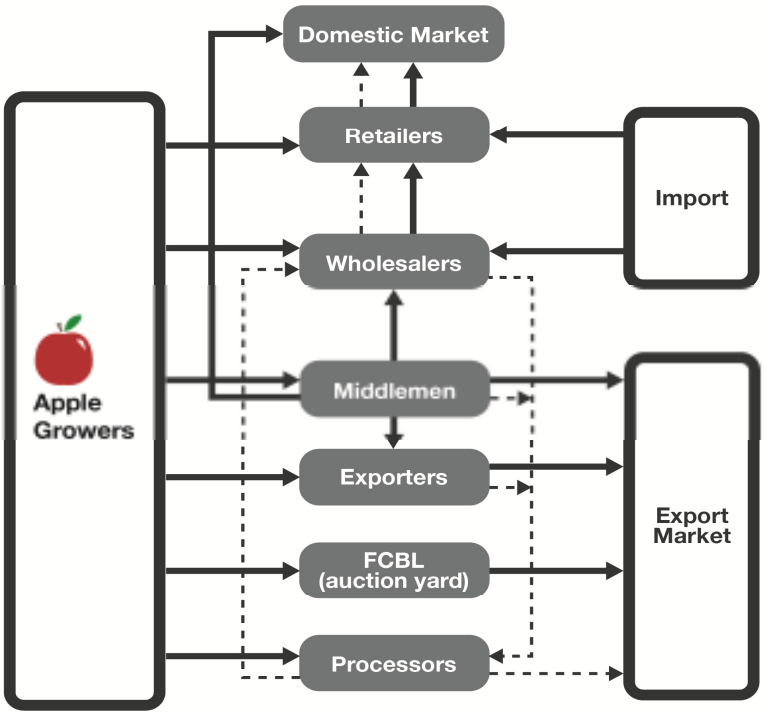
Finally, influencers are people, organizations and institutions that are responsible for setting up and managing the regulatory framework necessary to create an enabling business environment, lower cost of business transactions, and promote efficient business operation that lead to greater innovation and creativity (Roduner, 2007).

Influencers are involved in framing policies, regulations, enforcement, and quality control such as the Ministry of Agriculture and Forests (MoAF), Ministry of Economic Affairs (MoEA), Ministry of Labour and Human Resources (MoLHR), Ministry of Finance (MoF), and the Royal Monetary Authority (RMA), etc.

4.2. Apple marketing channels

Marketing channel is a business structure of interdependent actors, from product origin to the consumer with the purpose of moving products to their final consumption destination (Kotler & Armstrong, 2003). Marketing channel in Bhutan depends on the quality and quantity of apples being traded. The diagram below provides an overview of the movement of apples, from growers to the end consumers through various intermediaries.

Figure 7: Marketing channel for apples



Source: Adapted from Table 5, Commodity Chain Analysis Apple, RGoB and FNPP, 2008

Apple growers sell their produce in various ways: 1) through the middlemen and exporters, 2) to the local processing units, and 3) wholesalers and retailers. They may also sell it to the importers/traders through FCBL auction yard. The dotted lines in the diagram represent apple utilised by agro-processing units and finished products being sold to export markets or to local markets through distributors.

For fresh apples, one of the oldest and the most popular marketing channel is the sale of apples on orchard basis to middlemen or exporters. In this setup, farmers sell their apples while the fruits are still on the trees. Middlemen visit the orchard and inspect it twice before harvest - once around April during the flowering time and the other in June, during the apple fruiting season. After a rough inspection of the quality and quantity of apples in an orchard, the middlemen or exporters offer a lump sum price to the growers. Once the deal is struck, middlemen pay an

advance to the growers. The final payment is usually made a day before the apples are harvested or after the apples are exported depending on the credibility and relationship between the growers and the middlemen/exporters. In this marketing setup, harvest and postharvest activities are carried out by middlemen or the exporters.

5. VALUE CHAIN GOVERNANCE

Value chain governance is the relationship among buyers, sellers, service providers and regulatory institutions that operate to influence a range of activities required to bring a product/service from its inception to its end use (USAID, 2017). Coordination and relationship between actors in a value chain could be vertical and horizontal. The nature of the relationships and efficiency of transactions among various supporters or influencers affect the efficiency and competitiveness of the entire industry.

The vertical linkages determine the movement of apple and its products to the end markets. It defines the way information, learning, and business services are transferred and shared between various actors along the chain. Horizontal linkages offer opportunities for enhancing economy of scale and lowering transaction costs through shared skills and resources. It also facilitates collective learning and risk sharing among the actors and supporters.

There are established linkages between apple growers and middlemen, middlemen and exporters, growers and processors, and processors and wholesalers. However, it is observed that while some vertical linkages are strong, others are not. Horizontal linkages are the least coordinated.

5.1. Relationship between actors

5.1.1. Relationship between growers and middlemen

Although informal, most middlemen have established operational areas. The relationship between most growers and middlemen span over a decade and it operates mostly on mutual understanding, trust and credibility. However, price and quality of apple harvest do influence the dynamics of the relationship. The growers have more influence over middlemen in determining price and business engagement.

5.1.2. Relationship between middlemen and exporters

Middlemen are small traders or farmers who operate on seasonal basis and are largely based in Paro and Thimphu, whereas the licensed exporters are well established and influential individuals based in Phuntsholing. There is an established relationship between middlemen and exporters as certain middlemen operate only for certain exporters. Depending on the marketing channel, middlemen are involved in negotiating price with the growers, harvesting, handling postharvest activities including transporting of apples to Phuntsholing. Exporters on the other hand, hold export license and operates LC account (particularly while exporting apples to Bangladesh). Exporters deal with export of various agricultural products as well as minerals, and have established offices and employees working for them.

5.1.3. Relationship between growers and processors

The relationship between growers and processors is not strong. Growers have little knowledge on processors' production capacity or annual demand of apple from them. Processors have very little confidence on the quality and consistency of apple supply by growers. Very little information is shared between the two. The processors invariably enjoy very strong influence over the suppliers. Processors can accept or reject apples being supplied to them because they can use apple concentrates as alternatives for their products. So, usually processors drive the price and quantity of apple demanded.

5.1.4. Relationship between processors and wholesalers/distributors

Processors have well established links with the wholesalers/distributors. In most cases, there is a fixed commission agreed to be paid to wholesalers or distributors by the processors. BAIL has currently 18 distributors in various dzongkhags who distribute finished products to retailers around the country. Here as well, processors enjoy more influence over the wholesalers with price, quantity, credit facilities, and dictate the terms and conditions of their relationship. Wholesalers have further established links with retailers and understand their requirements. Wholesalers have distribution schedules and transport facilities to cater to retailers' needs.

5.2. Supporters and their services

Institutional setups to support apple value chain are well established. For instance the ARDCs are responsible for carrying out research and trial for new cultivars. Seeds are released to NSC for propagation and distribution, which is also responsible for supplying fertilisers. NPPC supports pest and disease management and control, while NPHC is established to provide harvest and postharvest information and services. The DAMC is responsible for market information and marketing activities. BAFRA is setup for quality control and certification. The Department of Agriculture provides technical backstopping and field support through its extension offices, particularly on production. They are also responsible for providing farm machinery (AMC) and construction of farm roads to open up market access. There are other institutions such as BCCI, BEA, and Financial Institutions (BOBL and BDBL) that facilitate exports and fulfil financing needs of various actors.

It can be seen that institutions are well established to support the entire apple value chain from input to end market. However, lack of coordination, collaborations, information/resource sharing amongst and between various supporters weaken their effectiveness and efficiency to support the chain.

5.3. Influencers - policies and regulatory framework

Table 14: Policies and regulations relevant to apple VC

Existing Policies & Regulations	Relevance to Apple VC
Ministry of Agriculture and Forests (MOAF)	
Agriculture Development Policy (Tobgay, 2006)	• Sustainable development of arable agriculture. • Improvement of income, living and nutritional standards of the rural population. • Intensify the integrated approach towards achieving at least 70% self-sufficiency in food grains. • To maintain at least 60% of the country's area under forest cover. • Develop and promote high value low volume cash crops that offer comparative advantages over other crops.
RNR Research Policy of Bhutan 2011	• Horticulture Crops Research: generate and disseminate suitable technologies, information and knowledge to increase production, and enhance post-harvest handling, processing, and marketing of horticulture crops.
National Framework for Organic Farming in Bhutan (NFOFB) 2007	• Bhutan's vision is to develop organic farming as a way of life and become fully organic by 2020. • Promotes organic farming in terms of production, certification and export.

Pesticide Act of Bhutan, 2000	• Regulates the import, sale and use of pesticides. • The import of agrochemicals is a government controlled monopoly (farmers' requirements routed through dzongkhags) and comprised just about 0.2% of total imports.
Seed Act, 2000 and Plant Quarantine Act of Bhutan 1993	• Regulates import and export of agricultural seeds and plants to prevent plant pests and diseases.
Ministry of Economic Affairs (MoEA)	
1. EDP 2016 2. Trade Policies 3. Industries policies 4. CSI Policies	• Improve agricultural productivity and production to achieve national food security, supply raw materials to agro based industries and for exports. • Create enabling conditions to transform from subsistence to commercial production including postharvest value addition, processing and marketing. • Horticulture development is one of the priority areas under Agriculture (one of the five jewels of economic development). • Allotment of State Reserve Forest (SRF) land to prioritized strategic large stand-alone projects with cluster effects and public utility services. • Embassies and missions abroad to play more active role in economic diplomacy, multilateral and bilateral trading arrangements and have Trade Representatives. • Promotes the enhancement of fair trade, market access, convertible currency exports, efficient distribution of goods and services. • Promotes private sector development. • Promotes ease of doing business for CSIs.
Ministry of Finance (MOF)	
Sales Tax, Customs and Excise Act of the Kingdom of Bhutan, 2000	• No customs duty shall be levied on goods of Indian origin imported into Bhutan in accordance with the existing "Agreement on Trade and Commerce" between the Kingdom of Bhutan and the Government of the Republic of India.
Rules on the Fiscal Incentives Act of Bhutan 2017	• Income tax holiday of 10 years to CSIs and Co-operatives and RNR related enterprises. • High import tariff on based raw material and on inputs required for packaging materials (BCCI, 2013).
Ministry of Labour and Human Resources (MOLHR)	
Labour and Employment Act of Bhutan 2007	• No person shall employ a foreigner unless the employer has an approval of the Chief Labour Administrator to employ a foreigner. • Application of quotas for foreign workers in specified industries/occupations.
Royal Monetary Authority (RMA)	
Monetary Policy, 2017 Priority Sector Lending, 2017	• The RMA also accords high priority in financing the CSIs as the sector can play a crucial role in employment creation, income generation and in bringing regional balanced development. • The Priority Sector Lending (PSL) Guidelines is an integrated platform that will coordinate interventions from several Government agencies to stimulate the cottage and small industries (CSI) sector as an important driver of Bhutan's economic transformation through improved access to finance. • The PSL Guidelines organizes the CSI sector into two broad categories:(i) Agricultural CSI and (ii) Non-Agricultural CSI, while

	adopting a value-chain approach to financing, especially in Agricultural CSI by covering primary production (defined as agriculture proper, livestock and forestry activities) as well as other linked activities that add value to primary products through processing, packaging, marketing and sales.
Bhutan Standard Bureau (BSB)	
Bhutan Standards Act 2010	• Quality and standards testing and certification of processed food products. • Laboratory can test construction materials only and lacks infrastructure for testing of other products.
BAFRA	• Promote the quality, standard and safety of agro and forest based products. • Coordinates and liaises with national, regional and international agencies on regulation of quality and safety.

5.4. Findings on apple value chain governance

Regulatory frameworks and policies are in place and supports horticulture development in the country. Given the strong regulations around import and use of pesticides and government's push for organic farming, there is an opportunity to grow and market apples from Bhutan as niche product in future.

The supporters are well positioned and established, albeit some capacity issues particularly with postharvest management and handling of apple, standard setting, testing and certification. However, institutional collaboration, coordination, and information and resource sharing is poor and could be strengthened.

Linkages between actors are strong in some case like the relationship between processors-wholesalers/distributors and distributors-retailers etc. However, links between processors and growers are not so defined.

6. FINANCIAL COST AND BENEFIT ANALYSIS

In any value chain, various actors work towards satisfying the demand of a particular market (VSO ICS Report, 2015). Each actor makes a defined contribution to the value chain and in doing so, incurs cost and generates benefit out of the engagement. Evaluating and understanding the costs and benefits derived by various actors in the chain is important for targeting government interventions to strengthen and sustain it.

In order to carry out cost and benefit analysis of apple value chain, financial calculations are based on secondary research data, supplemented by information collected from various field interviews with relevant stakeholders. The main objective of carrying out the financial analysis is to understand costs incurred and benefits derived in monetary terms, and the value additions done by various actors in the chain.

As shown in Figure 6 above, apples move through various channels before it reaches final consumers. Depending on the marketing channels used, actors engaged in the chain change and so does the volume of apple that passes through a particular channel. Although numerous channels are presented in the diagram, for the purpose of the financial analysis, only key channels dealing with substantial volume of apple movement are considered. The analysis is therefore limited to growers, middlemen, licensed exporters and retailers.

Growers

- Channel 1: Growers sell the apples directly to the market by themselves, where they carry out harvest and postharvest activities, including transportation.
- Channel 2: Growers sell apples through middlemen on orchard basis, while fruits are still on the trees. Middlemen are responsible for harvest, postharvest and transportation activities.

Middlemen

- Channel 1: Once middlemen buy apples on orchard basis, they carry out harvest, postharvest and transportation activities and sell to various markets.

Licensed Exporters

- Channel 1: Licensed exporters buy apples directly from growers on orchard basis, without middlemen. Exporters carry out harvest, postharvest and transportation activities and sell to various markets.
- Channel 2: Licensed exporters buy apples from middlemen and export.[4]

Retailers

- Chanel 1: Retailers buy apples from wholesalers/middlemen and sells them at the local markets.

Although the functions of wholesalers and middlemen can be quite different in the strict sense, in the apple value chain, there are a very limited number of actors that can be categorised as wholesalers. Their functions in the chain are also insignificant and over lapse with the middlemen. Therefore, cost benefit analysis is only carried out for middlemen and not for wholesalers.

[4] In this scenario, exporters deal with only 62 percent of the total apple production.

6.1. Basis for costing

The financial analysis is first carried out for an acre of apple orchard with 110 trees on an average. From this, per kg calculation is derived. Apple utilization rate, both in amount and percentage for an acre of apple orchard is tabulated and presented below. Three broad segments of apple markets for Bhutan apples (export market, local processing market and domestic market for fresh apples) are considered for the financial analysis. The calculations are based on 2016 figures.

Table 15: Amount of apple sold to different markets in 2016

		Kg	Boxes
	Apples utilization from one acre of orchard	**4,000**	**200**
1	Export – Bangladesh and India (62%)	2,480	124
2	Local Agro Industries – BAIL & Fruit Processing Enterprise, Bumthang (8%)	320	16
3	Sold in Domestic Market (30%)	1,200	60

From an acre of apple orchard with 110 trees, apple utilization is approximately 4,000 kgs, which is 200 boxes of apples (one box contains 20 kg of apples) as reported by the middlemen and exporters in Paro and Thimphu. In 2016, 62 percent of apples were exported, 30 percent sold in the domestic markets and another 8 percent sold to the local agro industries/processing units. The entire financial analysis is therefore based on the apple utilization from one acre of orchard and percentage distributed to these three end markets.

6.2. Production cost

The cost of production for one kg of apple is taken as Nu. 14.5[5].

6.3. Harvest & postharvest expenses

The cost for apple harvest and postharvest activities, including transportation for an acre of apple orchard is presented below:

Table 16: Cost for harvest, postharvest activities (including transportation)

	Particulars	Amount (Nu.)
1	**Labour cost**	
	Harvesting, packing, sorting, grading, loading & unloading (200 boxes)	4,800
2	**Harvesting materials**	
	Plastic sheet, bags/sacks & others	2,080
3	**Packing**	
	200 wooden boxes (including transportation)	17,000

[5] Cost of production based on DAMC, 2017 report *titled 'Why are growers unable to tap the raw material demand of the local agro-industries?'*

	Nails, taps, fastening belt, clips, packing machine set	2,110
4	**Depot set up and other expenses**	
	Plastic sheet & ropes, etc.	6,700
5	**Transportation**	
	Transportation (Field to Depot & Thimphu or Paro to Phuntsholing)	4840
	Transportation charges to agro industries	240
	Transportation charges to local market	600
	Total	**38,370**

Total expenses incurred for harvest, postharvest and transportation of apples to Phuntsholing, agro-industries and local market from one acre of apple orchard comes to Nu. 38,370.

6.4. Expenses and revenue

Table 17: Revenue stream of apple growers

	Revenue Stream	Qty. (box)	Avg. Rate (BTN)	Amount (BTN)
A	**Apple growers sell apples to middlemen on orchard basis - indirect bidding**			**100,000**
	Growers directly sell to buyers without middlemen (takes up harvest & postharvest activities).			
	Number of boxes (good quality)	120	800	96,000
	Inferior quality apple (4 out of 124 exported, fetching less price)	4	300	1,200
1	Revenue for selling to exporters			97,200
	Sale to local processing unit:			
	BAIL pays Nu. 14.62/kg of apple	14	292	4,094
	Fruit Processing Enterprise Bumthang pays Nu. 7/kg of apple	2	140	280
2	Sale to processing unit			4,374
3	Sale in local market	60	1,600	96,000
B	**Total revenue of apple growers selling directly without middlemen**			**197,574**

Apple growers earn approximately Nu. 100,000 from an acre of apple orchard if they sell their apples on an orchard basis to middlemen through an indirect bidding process. However, if apple growers carry out harvest and postharvest activities, including transportation by themselves and directly sell the apples to buyers (exporters, agro industries and local market) without engaging middlemen, they earn Nu. 197,574 from an acre of apple orchard.

6.5. Expenses and revenue for apple growers

Table 18 below shows the revenue and expenses for apple growers when they sell their apples to two different marketing channels: 1) through middlemen, 2) without middlemen.

Table 18: Expenses and revenue for growers in two different marketing channels

	Channel 1	Channel 2
	Sale through middlemen	**Direct sale without middlemen**
Expenses	**(BTN)**	**(BTN)**
Cost of production for one acre of orchard (4000 kgs)	58,000	58,000
Variable cost (harvest, postharvest & transportation)	-	38,370
Total expenses	58,000	96,370
Revenue	**100,000**	**197,574**
Net revenue	42,000	101,204
Net profit per kg	**10.50**	**25.30**

The apple growers get better return adopting marketing Channel 2, where they carry out all harvest, postharvest activities, including transportation and also sell their apples to the market by themselves instead of selling apples through middlemen. When growers/farmers sell their apples on orchard basis (Channel 1), their net revenue is only Nu. 42,000 and profit per kilo is Nu. 10.50. In comparison, if they sell their apples directly by themselves without middlemen, their net earnings more than doubles to Nu. 101,204, which leaves them with a net per kilo profit of Nu. 25.30.

6.6. Expenses and revenue for middlemen

The revenue earned and expenses incurred by middlemen for one acre of apple orchard is as presented below.

Table 19: Expenses and revenue for middlemen

Expenses and revenue for middlemen	Amount (Nu.)
Expenses	
Payment to the orchard owner (one acre)	100,000
Variable cost (harvest, postharvest & transportation)	38,370
Total expenses	**138,370**
Revenue	**197,574**
Net revenue	**59,204**
Net profit per kg	**14.80**

In this market set-up, the net revenue for the middlemen from an acre of apple orchard is Nu. 59,204. The net per kilo profit for the middlemen comes to Nu. 14.80.

6.7. Expenses and revenue for exporters

The expenses and revenue for exporters are calculated for two different scenarios: 1) when exporters buy apples on an orchard basis, using an indirect bidding process, and 2) when they buy it from the middlemen.

Table 20: Expenses and revenue for exporters

	Exporter[6]	Without Middlemen	Through Middlemen
1	**Expenses**		
	Payment to the Orchard Owner (One acre)	100,000	-
	Payment of the Middlemen	-	97,200
	Variable cost (harvest & postharvest + transportation)	38,370	
	Establishment Cost (5% of revenue)	4,860.00	4,860
	Total Expenses	**143,230**	**102,060**
2	**Revenue**		
	Margin	248	6,080
	Revenue	197,574	97,200
	Total Revenue	**197,822**	**103,280**
	Net revenue/profit	**54,592**	**1,220**
	Profit per kg	**13.65**	**0.31**

The net margin for apple exporters when they buy from middlemen is very small compared to when they buy and sell apples without them. Per kilo profit exporters make from directly engaging with growers is Nu. 13.65. It is only Nu. 0.31, when they buy through the middlemen.

6.8. Expenses and revenue for retailers

The study shows that 30 percent of the apples produced are sold in the local market. In most cases, the middlemen are also the wholesalers who sell the apples directly to the retailers. There are a very limited number of wholesalers who buy apples from middlemen and supply to retailers. Even if there are stray cases, the volume of apples handled are negligible and so it does not warrant separate study, and so they are not discussed in this report.

For the calculation of expenses and revenue for retailers, Nu. 80 per kg is taken.

[6] When exporters buy directly from farmers, they are dealing with 4000 kg of apples from an acre. When they buy from middlemen, only 62% of 4000 kg is handled by them. The rest is sold to agro industries and local market.

Table 21: Expenses and revenue for retailers

	Retailers	Amount (BTN)
1	**Expenses**	
	Payment to wholesaler/middlemen	48,000
	Transportation and other expenses	500
	Total expenses	48,500
2	**Revenue**	**96,000**
	Net revenue	**47,500**
	Profit per kg	**39.58**

The share of net revenue that retailers make is Nu. 47,500. This works out a profit of Nu. 39.58 per kilo for the retailers.

6.9. Margin for each actor

Per kilo profit margin for main actors in the apple value chain is tabulated below in Table 22.

Table 22: Per kg profit for different actors

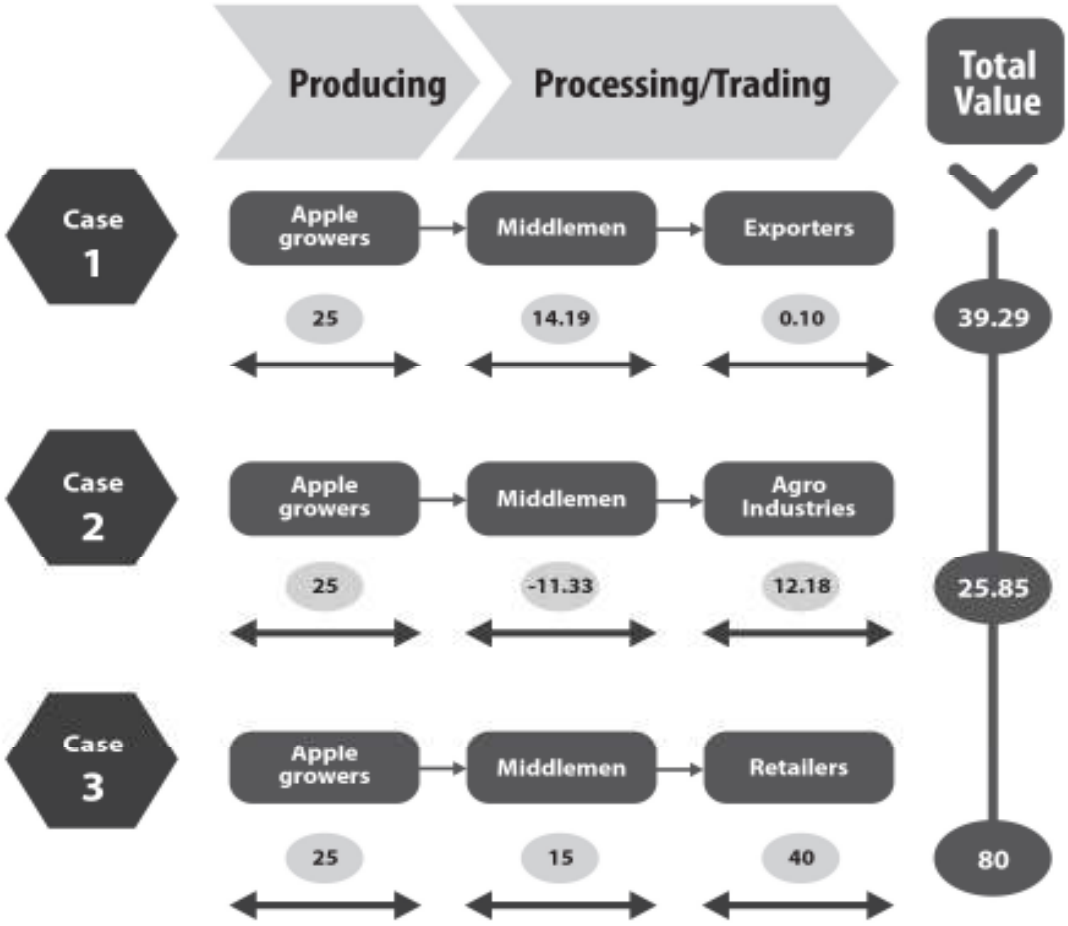
	Actors	Amount (BTN)
1	**Farmer**	Profit per kg
	Sale at farm gate	10.50
	Sale to Exporter delivered at the border	25.30
	Sale to the Processing Unit	-
2	**Middlemen**	14.80
3	**Exporter**	
	Directly from farm	13.65
	From Middlemen	0.31
4	**Retailers**	39.58

It shows that retailers make the highest margin (Nu. 39.58/kg) in the chain. In the case of growers, it is more profitable for them to harvest and sell the apples themselves (Nu. 25.30/kg), rather than through the middlemen (Nu. 10.50/kg). Likewise, for exporters, it is much profitable for them when they buy and sell apples directly from growers (Nu. 13.65/kg) compared to buying and selling apples using middlemen (Nu. 0.31/kg).

6.10. Value addition

The process of changing or transforming a product from its original state to a more valuable state is value addition (TSRD, 2014). Value addition in apple entails washing, sorting, grading, packaging, processing, cooling, or any other types of process that differentiates the product from its original form. Figure 8 below shows value addition by main actors in the apple value chain in Bhutan.

Figure 8: Value addition in three different scenarios



In the first scenario, where 62 percent of apples are exported, the value addition for export is Nu. 25 by the farmers, Nu. 14.19 by middlemen and Nu. 0.10 by the exporters. In the second scenario, value addition by middlemen when selling the apples to processing unit is negative by Nu. 11.33 per kg. This is because after sorting, grading and packing, best apples are exported and only low quality apples which cannot be exported are brought to the processing units. Value creation, when apples are sold to domestic consumers is highest by retailers, which is Nu. 40.

7. ISSUES AND CHALLENGES OF APPLE VALUE CHAIN

A weak link in the value chain can be a bottleneck and severely damage the competitive advantage of a product. Following are some of the issues and challenges faced by actors at various levels of the apple value chain.

7.1. Issues at the input level

The knowledge and skills in pest and disease handling by growers are low. Agriculture officers in the dzongkhags confirmed that they have not been able to provide regular training to growers as in the past, due to lack of budget.

7.2. Issues at the production level

At the production level, main issue faced is loss of orchards to other land use, poor orchard management, low level of knowledge and skills of farmers and timely support from agriculture extension officials. Inadequate pollinizers and loss of apples to wild animals are some of the other factors effecting growers at the production level.

7.2.1. Loss of orchards to other land use

With rapid urbanization, loss of apple orchards to human settlement is unavoidable. Landowners find it easy and economically more rewarding to construct a house in the apple orchard and rent it rather than grow apples. Although conversion of land registered as apple orchards to other forms of land use is restricted by government regulations, people can pass them on to their children as inherited properties. In such cases, if an individual does not have land or a house registered in his/her name, they can convert certain portion of the orchard land into dry land and construct a house. This contributes to apple orchards being fragmented or lost to urbanisation. It is also reported that farmers purposely neglect their apple orchards so that it becomes easy for them to approach authorities for land conversion.

Shift in farmers' preference to grow other crops that generate fast income is also reported by dzongkhag agriculture officials as a factor contributing to low apple production. It is informed that farmers prefer growing potato, vegetables and other crops than apple. In places like Bumthang and Chukha, apples are mostly grown on lands which are not suitable for other crops. In these dzongkhags, apple is considered a minor crop and therefore, less attention is given to it by farmers as well as agriculture officials.

7.2.2. Poor orchard management

Apple orchard management has direct implication on the quality and quantity of apple produced. Existing apple orchard are neglected and not managed properly and some of the contributing factors are due to the following:

- Most orchards are left in the hands of the caretakers. These caretakers are paid a minimal monthly salary and the income from the harvest is taken by the orchard owners. There is neither incentive nor knowledge and skills with the caretakers to properly manage the orchards. In some cases, the orchards are leased out to an entirely different person.

  Although, there is no study done in this area, it is suspected that this situation could be due to young generation who inherit apple orchards but neither have the knowledge nor the time

and interest to invest in them[7]. As they work in office jobs or are involved in other businesses, the orchards are mostly managed by either caretakers or leased out.

- It was reported by respondents at Focus Group Discussions in Paro and consultation with middlemen in Thimphu (Hongtsho and Yusipang) that most of the apple trees are planted in the 1960s and 1970s, which have crossed premium fruiting age and rehabilitation initiatives have been slow. There is also the problem of sluggish expansion of new apple orchards.

7.2.3. Low adoption of training by farmers

There are apparent gaps between trainings provided and received. For instance, agriculture extension officers inform that they have provided orchard management trainings and demonstrations in their dzongkhags. However, farmers from the same dzongkhags informed that they lack knowledge and skills on simple techniques of spraying chemicals. The farmers seemed unsure of the procedures of pesticides/chemicals use. They also expressed the need for training on pruning techniques and related skills involved in appropriate care and management of apple orchards.

The main reasons for these gaps could be due to the following:

- Poor attendance by households during trainings organised.
- Poor information dissemination within household members. A member of a household may attend the training but he/she may or may not necessarily share the information and knowledge that they have gained from the training to other members.
- Low adoption rate of training received by growers.

7.2.4. Inadequate pollinizers

Apple is cross-pollinated and hence adequate pollinating trees are critical to apple yield and quality. It is also important to ensure compatibility of the pollinizers with apple varieties in the orchard. Planting adequate pollinators, which are evenly spread in an orchard, is also equally important to ensure pollination. A study carried out in main apple growing dzongkhags in early 2000 showed a low percentage of pollinizers which varied between 1-10 percent, while the recommended percentage is between 15-20 percent (RGoB, 2002). Knowledge on the importance of pollinizer in an orchard is limited among growers that were met during the field visits. It was reported that when NSC supplies apple seedling, they make sure enough pollinizer are supplied together. However, in the field, there seem to be less pollinizer in the orchards and some respondents in Paro suspected that people may be chopping down the pollinating trees as they bear sour apples.

7.2.5. Destruction by wild animals

Another reason for decrease of apples trees and apple production is due to destruction caused by wild animals. Agriculture statistics, 2016 documented that crop damage by wild animals is second most constraining factor for agriculture production, after labour shortage (Agriculture Statistics, 2016).

[7] This view was expressed by respondents met during field visit in Paro.

Wild animals like deer, wild pigs, and bears were reported in all the apple growing dzongkhags. During the field visits, it was observed that some orchards were badly damaged by wild animals. Possible prevention against wildlife depredation is electric fencing. The NPPC distributes electric fences through the Dzongkhag Agriculture Offices to the farmers at subsidised rate or through cost sharing modalities. Eligibility for receiving cost sharing support depends on size of the orchards - at least 1 km in diameter. Electric fencing can cost approximately Nu. 30,000[8] for a kilometre. However, farmers with small land holdings are neither able to afford such investment nor meet the cost sharing criteria as their orchards are far apart.

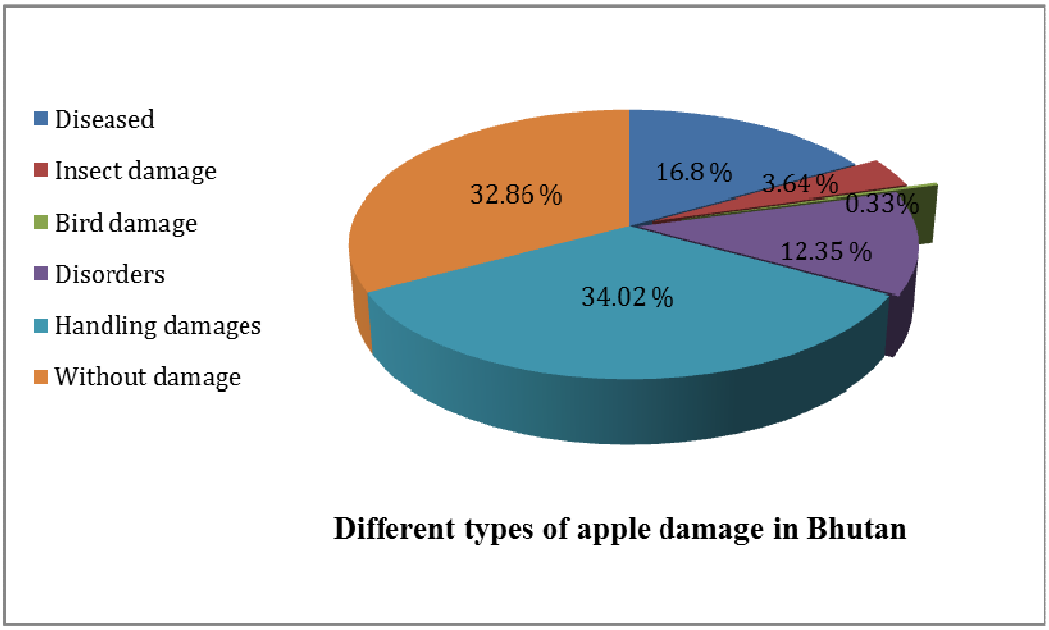
7.3. Pre-harvest, harvest and postharvest losses

Loss of apples can be due to various reasons and can occur during pre-harvest, harvest and postharvest stages. Apples could be damaged by pests such as insects, birds, wild animals, and plant pathogens like fungi, bacteria, virus etc. or disorders due to nutrient deficiencies or toxicities in the soil. It could be also caused by insufficient moisture and water content in the soil, which may be due to insufficient rain or snow, as very few irrigation systems are used for apple orchard in Bhutan. There are other natural calamities such as droughts or hailstorms during flowering seasons that also severely impact production. Even if these pre-harvest conditions are right, farmers can still lose their apples during harvest and postharvest stage due to poor harvesting know-how and poor postharvest handling and management such as grading, packing, treatment, storage and transportation.

As per a study carried out by the NPHC in 2009-2010, pre-harvest damage contributed to 33.32 percent of apple loss. Diseases damaged the fruits up to 16.8 percent followed damages caused by disorders, insects and birds with 12.35 percent, 3.64 percent and 0.33 percent respectively. Harvesting and field transportation has been reported as the highest cause of damage, accounting for 34.02 percent. The study also indicated that only 32.86 percent of apples in Bhutan reach the depots without damage. The percentage breakup of apple damage in Bhutan, caused by various factors is as illustrated in the diagram below.

[8] Costs of electric fencing could vary depending on type and materials used.

Figure 9: Types of apple damage in Bhutan



Source: NPHC, 2009-2010

Harvest and postharvest handling of apples in Bhutan is done manually, either by involving family members, neighbours or through hired workers engaged by the farmers/exporters. Shortage of workers is highlighted as one of issues faced by the growers as well as the exporters during harvest. The level of their skills also has a lot of bearing on the harvest and postharvest damages. It is reported that poorly trained workers resulted in not only damaging the fruits but also cause a lot of stress to the trees, which impact production in the following year.

Premature harvest

Another problem at harvesting stage is the reported harvest and export of apples before it is fully matured. Although no study is carried out on what percentage of apples are sold before its maturity and its impact on the market, it is obvious that such practices not only lead to lower income for the farmers but has long-term reputational impact in the market.

Japanese apple experts, who are currently working in Hirosaki-Bhutan Apple Project, carried out a quality assessment of Bhutanese apple in September, 2016 and concluded that the fruits have been harvested much before it reached its physiological maturity. The Japanese experts pointed out that had the fruits been harvested a month later, in the month of October, the taste would have been much better. However, the most popular practice is for farmers to sell apples to the exporters while the fruits are still on the trees, where exporters determine the harvesting month, which is usually in September. This preference is driven by the desire to beat the arrival of apples in the export markets from other countries.

The current apple harvesting practice of climbing the trees and shaking them is not the best way to harvest apples as it damages both the fruits and the trees. Further the current harvesting equipment used like thin gunny bags and bamboo baskets without any inner lining causes a lot of damage to the apples. Harvesting ladders are not used as farmers find it too tedious and time consuming to use it.

Sorting, Grading and Packaging

Sorting, grading and packing of fresh apples are mostly carried out manually. There is very limited knowledge and awareness amongst farmers on the benefits of using pack house facilities. Farmers consider it as additional cost. This has implications on the quality of apples that is being exported. The Indian importer met in Phuntsholing during the field visits reported that in their opinion, quality of apple grading and handling has impacted demand for Bhutanese apples in Indian markets in the recent years. It was pointed out that this problem will need to be addressed in order to increase the market for Bhutanese apples in India. Similar observations were reported by *Kuensel* recently[9].

Packaging of fresh apples as well as processed products is poor in Bhutan. It is informed that poorly packed fresh apples from Bhutan are accepted since it caters to lower income bracket of the export market in both Bangladesh and India. However, if we want to attract elite segment of these markets and expand our apple markets, we need to not only improve the quality of our apples but also our packaging, presentation and branding.

Most of the farmers and exporters do not use corrugated fibre broad boxes (CFBB) as they regard it impractical. They feel that CFBB can accommodate comparatively less apples as it has to be arranged in the platter with uniform apple size. Farmers and exporters do not prefer using CFBB as they are not strong enough to hold apples if it comes in contact with water, because they start to disintegrate.

Transportation

Apples are transported from field to depot at the back of open tractors, pickup trucks or other trucks with only a thin lining of plastic sheet or hay to cushion the apples. If the apple orchard is located away from the roads, it is transported by farmers on their back in sacks and bamboo baskets to the make-shift collection points. Due to poor means of transportation, substantial amount of apples are damaged.

Storage of apples

One of the weak links in the apple value chain is lack of storage facilities. For instance, when there are strikes, blockages and other problems across Phuntsholing border, exporters do not have a place to store their produce. The trucks loaded with apples are sometimes driven back up to Ganglakha or Gedu (about 45 kms), which are located at higher altitude, where it is much cooler to prevent damage. At times, the exporters have to park their trucks for days till the problems are resolved before they can export their goods. This not only adds to the cost but farmers and exporters also suffer loss due to damage to their produce. It has been informed that when apple export market is low, the storage facilities that we currently have are inadequate.

Apple growers in Bumthang reported that they store their apples at home in plastic buckets, bamboo baskets, wooden boxes and in carton boxes when they are not able to sell their apples to the processing unit or in the market. Lack of proper storage facility has been identified as a bottleneck by farmers in Bumthang.

[9] Reported by Rajesh Rai, Kuensel Reporter in his article titled 'BAIL buys apples from farmers as export markets shrinks' on 11 November, 2017 (p5).

Generally, apples are not stored by the farmers for long in Bhutan for fear of perishing. They feel that adequate cold storage facilities at affordable price could facilitate them in storing their apples when there is glut in the market and sell them when they are offered better price.

There are some existing cold storage facilities in Paro, as well as at Wangsisina in Thimphu and in Phuntsholing. However, these facilities have limited space and not all farmers' needs can be met when required. Apple export market this year for instance suffered, and farmers and exporters wanted to use the cold store facilities. However, they found that the facilities were not enough. Therefore, they tried selling the apples to the local processing units like the BAIL. However, BAIL has also only a limited processing capacity and they are unable to lift the supply in the market. As a result, apples are damaged and farmers lose interest in apple production in such situation.

7.4. Trading and marketing

7.4.1. Access to finance and other services

For apple business, the main credit facilities required by the farmers and exporters are term loans and seasonal loans. These loans could be for orchard development, procurement of materials for electric fencing to protect orchards from wild animals and seasonal loans to pay for harvesting, sorting, packing and transporting the apples.

Stringent collateral requirements, terms and condition, and cumbersome procedures of financial institutions are seen as hindrance to access finance by farmers and exporters. It is reported that farmers and exporters borrow money from family, friends and even informal lenders to fulfil their financial needs. Few middlemen/exporters informed that they borrowed money from informal lenders at a monthly interest rate of 3 percent. Although interest rates are high with informal lenders, their terms and conditions are much flexible and the process is much faster. Farmers can mortgage their cars, house, land, and other valuable possessions as security for their loans. They can also bring a guarantor and procedures are very simple. Therefore, farmers find it very convenient and comfortable to borrow from informal lenders rather than the FIs. This situation is confirmed by RMA Annual Report 2016, where it indicates that loans disbursed by commercial banks to agriculture sector constitute only 6 percent of the total portfolio of the banks. Therefore, accessibility of affordable and adequate credit facilities for apple orchard development is also seen as a limiting factor at the input level.

7.4.2. Marketing information constraints

Effective marketing starts with a strong knowledge of customers and satisfying their wants better than the competitors. Market research and information is important for all the stakeholders in apple value chain starting from farmers to policy makers. Lack of up-to-date and reliable market information required to support different actors in the chain to make informed decisions is one of the weak links.

Many stakeholders also seemed unaware of the market situation and the factors that impact apple exports positively or negatively. For example - Bhutan has been exporting apples to Bangladesh for many years and everyone seems to know that big apples are not preferred in Bangladeshi market. However, nobody has tried to find out why it is so. The US Department of Agriculture has reported that this preference is mainly because medium sized apples are convenient for gifting during religious festivals. Such information can be important for our growers and exporters to be able to adapt to the market needs to stay competitive.

7.5. Few local fruit processing units with low capacity

There are only a few fruit processing units in Bhutan. The most prominent ones are Bhutan Agro Industries Ltd. (BAIL) in Thimphu, Bhutan Fruit Products Private Ltd. (BFPL) in Samtse, Bhutan Milk & Agro Ltd. (BMAL) and Zimdra Food Private Ltd. (ZFPL) in Phuntsholing, and Fruit Processing Enterprise in Bumthang. These factories produce a range of products and they are mostly sold in the neighbouring cities of India and Bangladesh apart from the local market.

Table 23: List of fruit processing units and their main products

Sl. No	Processing Unit	Location	Products
1	Bhutan Agro Industries Ltd. (BAIL)	Thimphu	Fruits juices, fruit-based drinks, pickles, jams, mineral water
2	Bhutan Fruits Product Private Ltd. (BFPL)	Samtse	Fruits based drinks, jams, sauce, ketchups and pickles
3	Fruit Processing Enterprise	Bumthang	Magpie apple brandy, apple juice, apple cider, apple wine and apple vinegar (organic)
4	Zimdra Food Private Ltd. (ZFPL)	Phuntsholing	Fruit based drinks, mixed fruit juice, apple & mango juice
5	Bhutan Milk & Agro Ltd. (BMAL)	Phuntsholing	Fruit based drinks, milk & mineral water

From the above fruit processing units, BAIL in Thimphu and Fruit Processing Enterprise in Bumthang are the only processing units that use local apples. BAIL uses apple from Thimphu, Paro and Haa as raw materials. In April 2017, DAMC carried out a study on raw material demand by local agro industries in the country in 2016. It shows BAIL is the largest buyer of locally grown apple (454 MT) amongst the processing units. Fruit Processing Enterprise in Bumthang sources apples from Bumthang itself and it utilised 54 MT of apples in 2016. BAIL pays the farmers Nu. 10 to 20 per kilo of apples, while the enterprise in Bumthang pay Nu. 4 to 10 per kilo of apples. In both cases, the price is dependent on the quality of apples supplied.

Rest of the processing units use apple concentrates imported from China and India. When interviewed, the processing units informed that the main reason for importing concentrates from other countries is because of the ill-organised, inconsistent and weak supply chain in the country for fresh produce. The processing units are not willing to invest in pulp machines and other extractive machinery because of the uncertainty of quality and quantity of apple that farmers in Bhutan can supply for viable business operation.

7.6. Issues related to product diversification

In a paper presented by Sonam Tobgay (2006) at the International Association of Agricultural Economists Conference in Australia, the main constraints to agriculture diversification in Bhutan identified were: 1) traditional farming practice, 2) low farm productivity, 3) inadequate infrastructure, 4) weak institutional base for farmers groups/associations, 5) lack of information, 6) transport constraints, and 7) inadequate linkages between producers and markets.

Some of the issues hindering diversification within apple value chain are low volume of fresh apple utilisation by local agro-processing units. Only BAIL and Fruit Processing Enterprise in Bumthang are known to value add using local apples. The enterprise in Bumthang produces

juice, cider, vinegar, brandy and wine out of fresh apples. BAIL produces only juice and jam. Other processing units do not use fresh apples at all for their products, due to unreliable apple supply chain. However, data on annual fresh apple utilised, quantity of finished products produced and revenue generated by these two local processing units are not available.

Product diversification is important as it provides opportunity for value addition. The NPHC has the national mandate for product diversification. It has a unit dedicated for product development and it has supported interested entrepreneurs to produce apple candy and apple marmalade in the past but it was reported by NPHC that these business start-ups did not succeed due to lack of market. NPHC could coordinate with the DAMC to study availability of market and potential for business operation in future.

Government policies (CSMI Policy 2012, CSMI Development Strategy 2012-2020, and EDP 2016) promote the development of micro, small and medium industries. The CSMI policy, strategy and action plan stipulate that government facilitate CSMI start-ups by providing easy financing, licensing and taxation options. Although we have supportive policies in place, the institutional structures take time to adjust to policy changes and this can stifle entrepreneurship and innovation, if not addressed on time. For instance, a group of young entrepreneurs wants to start an apple chip manufacturing unit. They have a very good business plan, well developed proposal, their products have been tested and they have even been recognised with awards for their enterprising business proposal. However, it has taken them more than a year to get departmental clearances, government lease land, financing, and to obtain business license.

7.7. Non-Tariff Barriers (NTBs)

Another impediment in apple trade is the NTBs. Bhutanese consignments have to pass through Changrabandha (India) and Burimari (Bangladesh) border. Changrabandha is a land border crossing point and a defunct rail transit point on the Bangladesh-India border in Cooch Behar district in the Indian state of West Bengal. The corresponding point on the Bangladesh side is Burimari in Lalmonirhat District in Bangladesh. All exporters exporting goods to Bangladesh by land have to go through this border points and they face various NTBs.

Few pertinent NTBs are:

- Limited clearing time at the two transit points of Changrabandha and Burimari. When consignments are cleared from one transit point, it is stuck at the other point as the processing counters have closed. Exporters have to wait till the counters open the next day.
- Traffic congestion at Burimari and Changrabandha and poorly managed clearing points escalate transportation costs for exporters. It is reported that it takes four to five days for clearing consignments through a small stretch of 70-100 km of border crossing.
- Lengthy and cumbersome documentation and procedural requirements.
- Collection of various donations and undocumented fees by various groups on the way.

7.8. Weak lateral agencies coordination

Apart from these issues and challenges in the value chain, the study also shows weak coordination within lateral agencies, which are responsible for providing input and support to farmers and exporters.

Institutional setup required to support apple industry in the country is in place. However, coordination, collaboration and resource and information sharing between various agencies responsible for providing input and support services suffer serious drawback. Uncoordinated

inputs, no matter how big, although well intended but carried out in silo is bound to produce less result compared to a small intervention that is well coordinated and executed.

7.9. Human resource and institutional capacity

Lack of fund is stated as one of the reasons for not being able to conduct trainings required for improving orchard management, harvest and postharvest handling, pest and disease management by concerned agencies. It was also reported that in the past, apple related trainings were conducted on household basis. A person each from every household could participate in the trainings. Since 2014, due to budget cuts, now only a very few trainings are conducted, and that also for a select group of people.

7.10. SWOT Analysis

Table 24: SWOT Analysis

Strengths	**Opportunities**
• Temperate climatic condition favorable for growing apples. • Bhutan has a pristine environment and potential of producing high quality apples. • Strong policy support from the government to promote apple production. • Lead agencies taking right steps such as changing cultivars and initiating rehabilitation programs. • Most of the agro processing units in the country have advanced technology with ISO 22000 & HACCP certification. • Growing private sector interest to engage in various stages of the apple value chain.	• Although land for apple cultivation is decreasing over the years, value of apple exports has increased. • High apple demand in the neighboring countries like Bangladesh and India. • Studies find suitable land available for expanding production. • Government policies support organic production and apples from Bhutan could cater to upper or new segments of the existing markets or new markets. • Opportunity to develop and promote in-country processing units.
Weaknesses	**Threats**
• Best practice not followed by farmers in apple production - harvest and postharvest handling and management. • Use of conventional harvesting practices, tools. • Poor sorting, grading, packing, transportation and labeling. • Poor coordination and sharing of information within the apple value chain. • Limited access to affordable finance. • Poor and inconsistent quality and quantity of apple produced. • High harvest and postharvest losses. • Shortage of skilled & unskilled labour. • Inadequate R&D.	• Rapid urbanization and reduction in area of apple orchards. • High cost of production and transportation. • High competition in destination markets. • Access to a very limited export market – only Bangladesh and India. • NTB (Non-Tariff Barrier) across the border.

8. CONCLUSION

Apples production is concentrated in western Bhutan, mostly in Paro and Thimphu with more than 90 percent of the total land under apple cultivation found in these two dzongkhags. There is a declining trend for total number of apple trees, bearing trees as well as production, particularly in the last five years. Inadequate supply of inputs, rapid urbanisation, poor orchard management and changing preference of farmers for fast income generating crops, inadequate pollinizers, and destruction by wildlife are attributed as the main factors for this situation. Apple's contribution to GDP is at 0.47 percent in 2016.

Apple export from Bhutan is mostly to Bangladesh and India. In 2016, from the total of 3,779.9 MT of apples exported, 69 percent were exported to India and 31 percent to Bangladesh. Due to the declining production, volume of apple exported is also declining. However, the volume of apple exported as a percentage of total production has increased in the last three years, along with price of apples in the export markets.

There is a rapidly growing market for fresh apples in Bangladesh and India. This growth is serviced by countries like China, South Africa, Brazil, Argentina, France, Australia, New Zealand, the Netherlands and USA. Bhutan has not been able to take advantage due to poor quality apples produced by growers. In 2016, Bhutan's apple served only 0.51 percentage of Bangladesh's apple market and 0.9 percent of India's apple market, indicating apples from Bhutan has not done well in both of our export markets in the recent years.

In the recent years (2013-16), there is an increasing trend of apple import in the country. If the local apple quality is improved, this local market demand, which is mostly high-end hotels and resorts, can be met by our own apples.

Apple value chain mapping shows different actors, supporters and influencers, performing various functions along the chain – starting from pre-production to consumer markets. Movement of apples follow three major marketing channels:

- **Growers** selling their apples through middlemen, exporters or the three end markets (export, local processing units and local market).
- **Middlemen** sell their apples to the three end markets.
- **Exporters** buy apples directly from growers and sell them to three end markets or buy apples from the middlemen and export. The most popular marketing channel is growers selling apple through middlemen using indirect bidding process.

In 2016, export markets utilised 62 percent of the total production, while local market and local processing units utilised 30 percent and 8 percent respectively.

Value chain governance present evidences of strong regulatory frameworks and policies that supports promotion of apple production, export and diversification. There are established institutional structures that support the apple value chain from input supplies to end market. However, coordination, collaboration, information and resource sharing among supporters need to be strengthened.

Given the strong regulations around import and use of pesticides and government push for organic farming, there is an opportunity to grow and market apples from Bhutan as niche products in future.

Financial analysis shows that both apple growers and exporters get better return when they sell apples to the market by themselves without engaging middlemen. However, there is an equal risk associated with it. The highest margin in the chain is made by the retailers. Value creation is largest for retailers when apples are sold to domestic markets.

There are numerous **challenges and issues** confronting apple value chain. At the input level, varieties of apple, disease and pest management knowledge and skills, and affordable and adequate credit facilities are some of the key issues. At the production level, loss of orchard to other forms of land use, growers preference for other quick income generating crops, poor orchard management skills and knowledge, inadequate pollinizers, and destruction by wild animals come out as main challenges. Harvest and postharvest loss of fruits is also high due to poor skills of farm hands, and the low use of sorting, grading, and packing. Study in the past show only 32.86 percent of apples reach depot undamaged. There is also the problem of premature harvesting, coupled with poor and inadequate transportation and storage facilities.

Other inherent systematic issues include, lack of budget for training and awareness creation. There are trading and marketing challenges as well challenges related to access to finance, poor market information, very few processing units and weak private sector participation in the chain are some of the other issues within the chain. There are other external challenges as well, mostly from NTBs and lack of lateral coordination within supporting agencies. Supporters are seen competing for resources and therefore not collaborating with each other. Capacities of extension personnel are low and function with poor morale.

An internal report by DAMC on *"Ongoing Apple Export, 2017"* highlights that big competitors like China and India are investing more and more in their apple industry and unless Bhutan revamps its own apple value chain by improving the way it produces, handles, transports, and markets its apple, there is high risk of losing even the small market share Bhutan enjoys at the moment.

9. RECOMMENDATION

Having looked at the issues and challenges that confront various actors within the apple value chain in Bhutan, some interventions to help strengthen apple value chain are suggested in the table below, which is followed by more detailed explanations.

However, some of the suggested interventions require further research and validation, and therefore agencies concerned should not interpret it as technical recommendations for immediate adoption.

Table 25: Strategic areas of interventions to strengthen apple value chain

Strategic areas of intervention	Particular activities	Expected output
Research and development	• Develop and introduce productive cultivars (long-term)	• Improved and productive cultivars introduced
Production	• Rehabilitate old orchards (short to medium-term) • Identify new areas suitable for improved cultivars (medium-term) • Plant apples in new areas (long-term)	• Apple production increased • Farmers income increased
Harvest, Postharvest and Processing Units	• Identify and train growers and other actors on harvest and postharvest techniques (short-term) • Sensitise/create awareness on use of appropriate facilities, technologies and tools (cold storage and pack houses) (short-term) • Strengthen local processing units (medium to long-term)	• Harvesting skills enhanced • Sorting, grading and packaging improved • Harvest and postharvest losses reduced • Value addition increased
Strengthen agriculture extension services	• Provide exposure visits, refresher programs (short-term) • Strengthen linkage between farmers and extension offices (short-term) • Improve on-time quality inputs, including pest and disease control (short to medium-term) • Build capacity of extension officials (short to medium-term) • Increase orchard demonstrations and trials (short to medium-term) • Develop horticulture database (medium-term)	• Extension services improved • Better orchard management techniques adopted • Information on crops documented and used
Strengthen marketing	• Provide timely market information related to price, markets, competitors, externalities (short-term) • Carry out market assessment (short-term) • Improve product visibility, improve branding (short to medium-term) • Explore new markets (long-term)	• Farmers and exporters better informed • Risk of market uncertainties reduced • Markets expanded
Enhance lateral coordination and	• Carry out multi-stakeholder meetings and consultative workshops (short-term) • Facilitate and support the entry of private	• Cooperation and collaboration improved between lateral agencies.

institutional setup	sector engagement (nurseries, cold storage, pack house, and establishment of MSMEs – processing areas), share of information (short to medium-term)	• Local MSMEs strengthened • Employment generated

9.1. Strengthen inputs for apple production

New varieties of apple with high production potential could be researched and introduced. Research centres, seed centres, extension offices, and growers should collaborate in initiating this change, particularly considering the large apple markets in the neighbouring countries.

Bangladesh is Bhutan's export market for apple that generates foreign exchange earnings. Given, that *gala* and *fuji* are the most popular apple variety among Bangladeshi consumers (USDA, 2017), research and trials could be done on these international apple varieties. Further, if Bhutan intends to grow organic apples as per the organic farming policies, *Beauty of Bath, Liberty, Jonafree, Macfree and Williams Pride* are some of the varieties that the ARDC in collaboration with other relevant agencies such as National Soil Services Center could explore potential for development. These are disease resistant trees that are easily managed and require very less chemical input. Apart from others, Golden Delicious is known to be the pollinator for the above organic varieties and Bhutan has already got this pollinating variety in our orchards *(The Old Farmer's Almanac)*. Talking to an orchard owner, it is found out that *Beauty of Bath* is grown in few private orchards in Thimphu and Paro. The fruits are of right size for Bangladesh market and have the right colouration and taste as well.

Most of the orchards are old and have crossed productive age. Rehabilitation efforts have not kept pace and needs serious attention, if apple as a cash crop has to be promoted. Land holding in Bhutan is small, fragmented and not easily accessible. Research and trials could be carried out to ascertain if the above mentioned cultivars are feasible to be introduced in Bhutan. Manang district in Nepal, which enjoy similar topography and soil conditions are successfully rehabilitating their orchards with *Italian Fuji* variety[10], which is a smaller but more productive apple tree. It is reported that the farmers are highly satisfied as the saplings started bearing fruits within shorter period of time, which normally takes about five to six year to bear fruits with the conventional cultivars used in Manang area.

To improve apple quality in Bhutan, besides carrying out trials with different apple varieties, apple orchard care and management practices will need to be improved. Growers will need to not only upgrade their technical know-how but improve harvest and postharvest handling of apples, including appropriate packaging, labelling and transportation (NPHC, 2009-2010). Capacity building interventions by the DOA must target appropriate participants (not absentee owners but growers, caretakers and individuals who are actually involved in managing the orchards).

9.2. Enhance productivity

Having adequate pollinizer in apple orchard is important for the productivity of the apples. However, many farmers are not aware and they do not have the required number of pollinizer in their orchard. Pollinizers bear sour apples and farmers have reportedly chopped the trees down out of ignorance. Apple need pollinating trees, at least two to three different cultivars with overlapping bloom periods. Sensitising growers on the benefits of planting pollinating trees is very critical. Planting several cultivars will also ensure having fruit to market throughout the

[10] www.myrepulica.com/news/21664/ - Jumla farmers

harvest season because they mature at different times. So, better awareness and sensitization on such basic requirements would contribute to increasing the productivity of apples.

9.3. Increase apple production area

A study carried out by the College of Natural Resources (CNR) in 2015, using the following physiographic parameters: 1) elevation (1800-3000 meters), 2) slope (2-30 degrees), 3) aspect (south facing), and 4) land use and land cover (shrub areas) concluded that there is potential for further expansion of apple cultivation in the western districts of Paro, Thimphu and Haa. The study identified a total of 1770 hectares of land in these three dzongkhags as suitable for apple cultivation (Choden and Shahnawaz, 2015).

The study was based on spatial datasets i.e. Digital Elevation Model and Land Use Land Cover data of 1994 and 2010. Although it does not provide information on how much of the identified land area is under private or government ownership, the study identified shrub land that could be used for expanding apple cultivation. However, ground validation may need to be carried out by the MoAF in liaison with the National Land Commission to ascertain ownership status because expansion of apple production in private land will be a personal choice of the land owners. Research may also need to be done to ascertain how much of the apple orchards are being lost to other land use forms so that it informs the MoAF of the rehabilitation rate necessary to augment the opening of new land areas for apple cultivation. Although, the RNR statistics do not provide altitudinal data of fallow land that can ascertain potential for growing apple, fallow lands could offer another possibility for opening up new areas for growing apple in the country.

9.4. Capacity development and demonstration

Apple orchard management training in the apple growing dzongkhags will need to be provided from time to time to the extension officials. It could be seen in some dzongkhags that extension officials who have come on transfer do not have any knowledge and experience on apple as they were exposed to other crops in their previous work station. Refresher programs and orientation to new crops in a particular work jurisdiction may be essential so that they are able to provide support and assistance to the farmers when they needed. Exposure visits within Bhutan or outside the country could be beneficial for them to learn new approaches and techniques.

In the past, trainings and demonstrations were usually carried out to cater to all farmers. A "focus village training and production" model could be initiated where only targeted participants are trained. A particular orchard or village can be selected as model to demonstrate the impact of scientific intervention. Once few successful demonstrations are carried out in one or two villages, this can be replicated to other villages.

A dedicated apple focal person with the required technical skills and knowledge in orchard development, production and management could be appointed in the major apple growing districts to support extension activities.

9.5. Improve harvest and postharvest handling

In order to ensure better taste and maximum shelf life, apples should be harvested when they are fully matured and at the right time. Harvesting apples and exporting them before they fully mature will shrivel the fruits and impact their taste. Late harvest will result in easy flesh damage, making fruits easily susceptible to decay. It is not advisable to harvest apples when the sun is harsh, as it increases post-harvest respiration. It should also not be harvested in rain as it could increase the risk of transferring harmful pathogens from the fields to store houses and pack

houses (NPHC, 2017). Harvesting immature apples should be discouraged by concern agencies because such practices negatively impact market for Bhutanese apple. Both growers and exporters need to be sensitized on it.

In order to improve the quality of apples, workers hired during harvesting season should be trained on proper harvesting, sorting, grading and packing techniques. In order to reduce apple damage during harvesting, appropriate tools and techniques need to be employed. Conventional practice such as climbing trees and shaking the fruits has to be discouraged. Training combined with proper awareness on cost and benefit of using appropriate gears while harvesting apple should be provided to farmers. Consultation with farmers show that they do not prefer the use of harvesting ladders as it is too tedious, time consuming and adds to their labour costs. Information dissemination, demonstration and exposure to use of light harvesting ladder, use of apple harvesting poles with net and soft bags to collect apples can be done with the help of audio-visual aids and not necessarily take farmers on exposure trips outside the country.

9.6. Develop storage facilities

Storage facilities play an important role in balancing supply and demand in the market. Storing certain amount of apples during peak season could reduce glut in the market where farmers may be forced to sell their produce at a lower price. Apple as a seasonal fruit can flood the market, immediately after the harvesting phase and may be short in supply during the other times, resulting in import dependence to fulfil the demand. Therefore, storage facilities have important role to play.

There are however, conflicting views on the need for more cold storage facilities in the country. A study carried out by the Department of Industry in 2015, recommends the establishment of storage facilities to reduce crop damage, ease market distress and help free farmers and exporters from being trapped by syndicates across the border[11]. However, officials from some departments within the MoAF feel that the present cold storage facilities available in the country are underutilised even at subsidised rates and therefore building additional facilities are unwarranted.

Consultations with farmers, traders and businessmen in the field show that the underutilisation of current facilities in some cases is due to their location, which is not conducive. It also adds to farmer' costs as they have to transport the apples from their farms to the storage facilities by hiring trucks. Few private individuals have tried to venture into cold storage business but found it very difficult to obtain departmental clearance as well as financing from the banks. A rapid study carried out by the DAMC in September 2017 suggests that cold storage option is just a quick fix to market failure. The agency argues that a defined market has to be there at the end of the storage period if the venture has to be profitable because cold stores require substantial investments and it must be done after proper feasibility studies.

Given this divided opinion, it clearly warrants closer scrutiny by NPHC on this issue. A detailed cost benefit analysis may be required to clear the above ambiguity. Farmers as well as private individuals interested to take up cold storage facilities will benefit from the study, besides assisting government to make strategic decisions about providing technical and facilitation support.

[11] DOI, MoEA 'Detailed Feasibility Report: Fruit & Vegetable Cleaning, Grading and Packaging Unit in conformity with RGoB's Vision of Achieving Economic Self-Reliance', June 2015

9.7. Use of pack houses

After harvest, apples need to be prepared for sale. Apples need to be washed, graded, packed and stored, ready for the market. Availability and use of pack houses for sorting, grading and packing will not only curb wastage but increase export potential. Past studies show that due to poor pack house facilities, fruits and vegetables from Bhutan are not able to fetch premium price in the export markets (RGoB, 2015). Similar sentiments were shared by importer consulted in Phuntsholing. It was reported that demand for Bhutanese apples deteriorate each year because of poor grading and postharvest handling and management.

However, during a visit to the NPHC, it was found out that the pack house at the center is lying idle, even when services are offered free of cost. The farmers and exporters underestimate the benefit of proper sorting, grading and packaging and more efforts need to go in from NPHC's side to create awareness. Farmers do not want to take the trouble of taking their produce to the pack houses as they see it as additional work and cost.

A detailed feasibility report on fruit and vegetable cleaning, grading and packaging unit in Bhutan carried out by the Department of Industry under the MoEA in 2015, shows that establishment of such units in Bhutan are feasible. However, the cost and benefit of the facilities will need to be disseminated to farmers so that they are not willing to invest in using the services to get better return for their produce.

9.8. Market information

Market information and its timely dissemination are equally important to every actor in the value chain. Not limiting to these, market information could include the following:

- Current policies;
- Trade agreements;
- Demand and supply conditions;
- Consumption pattern/preferences of markets;
- Markets, market segments, quantity required, calorie intake potential;
- Prevailing prices;
- Transportation and handling costs;
- Weather conditions, strikes and blockages across the borders;
- Local processing units, capacities and products.

The information could be provided using social media and other modern communication channels or outlets such as SMS, WhatsApp, Chat groups, besides conventional mediums like radio, television, and newspapers.

The DAMC in collaboration with relevant agencies such as MoEA, BCCI, FCBL etc. could explore institutional linkages with corresponding ministries, departments, agencies, chambers, unions, associations, and institutions to understand market dynamics in the export markets, shifts in preferences, and long-term policies and trends that may impact our farmers. Further, the DAMC in collaboration with Trade Officers attached to Embassies, Missions and Liaison Offices could actively explore new market opportunities, collect market information and act as a conduit to establishing institutional linkages with relevant ministries, agencies, authorities in Bhutan's export markets, particularly in Bangladesh and India.

9.9. Market diversification

Having few buyers has many disadvantages. It will not only make the exporting country captive but it could also create conducive conditions for buyers to promote monopsonistic market situation. So expanding existing markets and exploring new markets needs to be actively explored to diversify market and to prevent from falling into syndicate traps.

9.9.1. Expanding existing markets

Currently, Bhutanese apples are catering to lower segment of the population in both Bangladesh and India. Expansion of our apple market to middle and upper segments of population in these countries could be explored further. A study carried by the United States Department of Agriculture in 2015, concludes that although Bangladesh is generally viewed as a price-sensitive market, there are niche segment opportunities for high-value agricultural products, particularly in more affluent urban centres like Dhaka and Chittagong. Middle to upper class consumers are gradually demanding more diversified foods, including imported fruits such as fresh apples. Bangladesh has a population of over 160 Million and the top 20 percent of the population in terms of income accounts for an estimated 41.4 percent of total consumption (USAD, 2017).

As volume of apple production in Bhutan is small, we could adapt low volume high value approach. In order to tap into high end market, Bhutan could explore its unique selling point (USP) to differentiate its apples from its competitors. For example, apples from Bhutan could be marketed as "Happy Apples", grown in pristine environment with low chemical input. Accordingly, farmers need to be educated and trained in organic farming and necessary steps taken to promote organic brand in market destinations.

9.9.2. Exploring new markets

Studies have been carried out to explore new markets in the past in countries such as Nepal, Thailand and Sri Lanka. The study showed that there was good demand in these countries and the apples fetched good price. However, exports have not picked up and a definite explanation is not provided anywhere for not pursuing further. Therefore, possibility of exporting apples to other countries including those covered by past studies could be looked into by DAMC as a long-term measure, after exploring expansion into medium and higher segments of the existing markets.

If we expand our market share and penetrate into higher segments of existing markets or new markets, Bhutanese apple value chain must be able to deliver superior quality of apples, more efficiently to be competitive. Further, in order to ensure that quality of Bhutanese apples meet the standard of international markets, setting standards and international certification of our apples have to be carried out. Accordingly, adequate infrastructure like pack houses, cold storage and transport facilities will need to be put in place upstream as well as downstream. Appropriate transportation with temperature control facilities could support the delivery of apples to far-off markets.

9.9.3. Expanding domestic market for apple

Apart from exploring international market, we should also look into increasing sales in our domestic market. We have already seen that the import of apple has been steadily increasing over the last five years in both quantity (roughly 51 MT in 2010 to 123 MT in 2016) and value (around Nu. 2 Million in 2010 to Nu 12 Million in 2016).

Bhutan's apple import is not just during off-season. It has been importing apples from other countries even during the apple season. For instance, in Bumthang town, vegetable wholesalers reported of importing apples from Falakatta and Burimari all year round. It is found out that the main customers for these imported apples are hotels, lodges and local residents who purchase the apples for religious offerings and personal consumption. Similarly, farmers in Thimphu and Paro also reported that high-end hotels and resorts demand imported apples during off-season and are able to sell at Nu. 3,000 per carton.

From the above, we can see that if the quality of apple can be maintained, there are demands from high-end clientele within Bhutan. Further, sale of apples to institutes like schools, hospitals and monasteries can also be explored. As much as we need to focus on exports to earn foreign exchange, there are also costs attached to it. So exploring domestic markets can also solve some of the issues that our apple growers face currently, not being able to export their produce.

9.9.4. Offseason marketing

In 2005 and 2006, MoAF carried out an off-season apple marketing trial. It showed that if the quality is good, Bhutanese apples can compete with apples coming from other countries, in both domestic and export markets[12]. To take advantage of higher prices offered during the off-seasons, apple growers could market their apples during the off-seasons. For instance, price of imported apple is between Nu. 150 to 200 a kilo in Thimphu and Nu. 250 a kilo in Bumthang.

Both farmers and DAMC are apprehensive of off-season marketing at the moment. DAMC's recent study raises questions on the size of domestic market and its absorption capacity. It is also not able to ascertain what percentage of apple should be exported during the season and what percentage to be cold stored for off-season marketing. The report also highlights the need for carrying out in-depth research on the viability of developing and maintaining cool-chain from the production areas right through to the market.

Since past trials found off-season marketing viable, DAMC could carry out more detailed study to determine the real potential, benefits, challenges and risks associated with introducing this marketing strategy and encourage and sensitize farmers on its benefits.

Table 26: Apple season in India

States	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Arunachal Pradesh												
Himachal Pradesh												
Jammu & Kashmir												
Manipur												
Uttaranchal												

Lean season

Peak season

Source: Directorate of Horticulture/Agriculture of Respective States/UT's

The apple season in India starts from July to October. Bangladesh do not grow apple but imports it throughout the year. There are opportunities for Bhutan to expand its apple export to these markets a lot more than what is perceived possible at the moment.

[12] Commodity chain analysis, apple, October 2008, MoA, RGoB & FAO-Netherlands Partnership Program

9.9.5. Product diversification

Coordination and collaboration between NPHC and DAMC should be strengthened to support product diversification initiatives, particularly in the area of product identification and development based on reliable market information to benefit business start-ups.

CSMI entrepreneurs with viable business plans needs to be facilitated and procedural requirements should be relaxed, unless the business operation has severe social-cultural or environmental impact. Government could put pressure on financial institutions to support viable business models, without having to fulfil collateral requirements, particularly small business start-up. Product diversification should also be accompanied with business protection from competing import products in the form of tax holidays, and incentivising local processors to use fresh apples rather that importing concentrates from outside.

9.9.6. Maximize supplies to agro-industries

As of now, only two agro-processing units use fresh apples produced in Bhutan, while other units entirely depend on concentrates. The main reason for this is weak supply chain in the country. Growers and the DOA could strengthen the supply chain by improving the quality of apple produced, improving harvest and post-harvest handling, as well as packaging and transportation.

Besides this, the government could regulate import of concentrates. Concentrate import could be allowed only after lifting certain percentage of fresh local apples by the processing units. The DAMC could negotiate better price with the processing units for farmers along with assurance from processing units for utilizing a minimum threshold of fresh apples from growers who conform to the requirements of the processing units. These measures could increase apple utilisation and supplies to local agro-industries.

9.9.7. Involve FCBL to enhance marketing

A very small volume of apple passes through the FCBL at the moment. Farmers and exporters reportedly do not use the FCBL channel to market their apple due to delays in payments. The FCBL could make the payment modality more effective by shortening the turn-around time and encourage more farmers and exporters to sell their apple through them. The FCBL could work with relevant agencies such as the NPHC to see the viability of establishing a small pulping unit near the FCBL. This could also incentivise farmers and exporters to use the FCBL channel because they could take the rejected apples straight to the pulping unit and minimise loss or wastage.

9.10. Collaboration between lateral agencies

To improve effectiveness and efficiency of support services, coordinated efforts will need to be fostered for instance between the following:

1. RDCs, Extension Offices and NSC
2. NPHC and DAMC
3. NPPC and Extension Offices
4. BAFRA and Bhutan Standards Bureau
5. BCCI, BEA and FCBL
6. MoAF and MoEA

Central agencies, research institutions, and extension offices need to also strengthen their data collection, documentation, management and data sharing. Standard information collection and management protocols will need to be put in place to avoid duplication and to record reliable data for policy intervention. Collaborating agencies should pull resources and work together to meet common objective of supporting farmers enhance their livelihood.

9.11. Strengthen private sector participation

Government could look into encouraging private sector involvement in nursery development and supplies, providing cold storage services, pack house services, and product development and processing. Government agencies with both commercial and social mandates were set up because private entrepreneurs were not forthcoming in the past. However, as private sector starts picking up, government functionaries should take up facilitation and regulatory roles, focusing on technical backstopping and establishing standards that meet international market requirements. Young entrepreneurs with good business ideas should be encouraged and facilitated.

9.12. Legal and regulatory interventions

- Regulation could be put in place to obligate processing unit operating within Bhutan to mandatorily use certain volume of fresh apples while producing apple related products rather than importing raw materials from other countries.

- Processing units should also have legal obligation to maintain proper book-keeping so that input and output data can be documented for policy interventions in future.

- High import tariff for inputs required for packing materials and high value addition requirements for processing units to be eligible for tax exemptions could be looked into to support CSIs.

  RMA could monitor closely the banks agriculture lending portfolio to broaden credit facilities to RNR sector, particularly if the project proposals have product diversification and value addition elements.

9.13. Other interventions

Financing to the agriculture sector as a whole constitute only six percent of the FIs' loan portfolio. However, the recent Priority Sector Lending (PSL) introduced by the government is expected to deepen agriculture lending and support small farmers and businesses. As agriculture is a priority sector in the PSL scheme, it is hope that some of the issues faced in terms of access to finance in the apple industry could be resolved.

Similarly, on the NTM issues, the RGoB is already working with the government of India and Bangladesh to minimise the NTBs as informed by the NTM Desk Officer at the BCCI.

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ANNEX 1: LIST OF PEOPLE MET FOR APPLE VALUE CHAIN STUDY

Place	Officials and Respondents Met
Bumthang	**Apple Growers** 1. Ms. Phurba, Jalikhar, Bumthang 2. Ms. Ugyen Lhaden, Tamshing, Bumthang 3. Ms. Tshering Lhaden, Pongkhar, Bumthang 4. Ms. Kinley Wangmo, Pongkhar, Bumthang
	Agriculture Officers, Bumthang 1. Ms. Chandra Kumar Rai, Assistant DAO, Bumthang 2. DAO, Bumthang consulted through telephone and emails
	Wholesaler & Retailers, Customer • Ajit Tamang, Rinzin Wangmo Shop, Fruit and Vegetable Wholesaler, Chamkhar, Bumthang • Jigme Lhaden, Bumthang Vegetable Market
	Fruit Processing Enterprise 3. Sangay Dorji, General Manager, Fruit Processing Enterprise, Bumthang 4. Ms. Jigme Seldon (out of station, interviewed through telephone)
	Apple Expert 1. Mr. Fritz Maurer, Bumthang
Chukha	
	District Agriculture Officers 1. Mr. Gem Tshering, Agriculture Extension Officer, Chukha Dzongkhag 2. Mr. N. K. Archarya, ADAO, Chukha Dzongkhag 3. Mr. Surja Kumar Mongar, Agriculture Extension Officer, Chukha Dzongkhag
Paro	
	Middlemen/Apple Contractors 1. Ms. Chimi Wangmo, Apple middle person, Paro 2. Mr. Phurpa, Apple contractor/middleman, Paro 3. Mr. Karma, Apple contractor/middleman, Lango, Paro

NPHC

1. Mr. Dechen Tshering, Chief Postproduction Officer, National Post Harvest Center

National Seed Center (NSC)

1. Sonam, Program Director, National Seed Center (NSC)
2. Thukten Dolma, Horticulture Officer, NSC
3. Ugyen Tshering, Agriculture Officer, NSC
4. Dorji Wangda, Marketing Officer, NSC

District Agriculture officials

1. Delma, Sr. AEO
2. Yeshi Dorji, Sr. AEO
3. Chorten Tshering, Sr. AEO
4. Gem Dorji, Sr. AEO
5. Wangdila, ADAO
6. Karma Rinchen, AESII

Private Nursery

1. Mr. Jambay, Alpine Seed, Paro

FGDs with Apple Growers

1. Dophu Dem, Grower, Shari
2. Ugyen Lham, Grower, Shari
3. Chimmi Om, Trader, Shari
4. Dajo Dem, Grower, Shari
5. Rinchen Norbu, Grower, Shari
6. Sonam Pelki, Grower, Shari
7. Pelden, Grower, Shari
8. Chencho Dema, Grower, Hungrel
9. Tshering Lham, Grower, Hungrel
10. Chencho, Grower, Shari
11. Tsenchog, Grower, Tsentog
12. Sangay Dorji, Grower, Tsentog
13. Kipchu, Grower, Shari
14. Tshering Choki, Grower, Shari
15. Thinley Dorji, Grower, Hungrel

	16. Dorji Khandu, Grower, Shari 17. Phajo, Grower, Shari 18. Tashi Penjor, Grower, Dotey 19. Thinley, Grower, Shari 20. Tshering Dorji, Grower, Shari 21. Kezang, Grower, Shari
Phuntsholing	
	Bhutan Exporters Associations 1. Mr. Yeshi Tshering, General Secretary, BEA, Phuntsholing 2. Ms. Tshering Lhamo, Finance Officer,
	FCBL 1. Mr. Bhim Raj Gurung, FCBL, Phuntsholing
	Indian Exporters (FGD) 2. Mr. Rajesh Chaklader 3. Mr. Mohammad Kalai 4. Mr. Purnia 5. Mr. Indra 6. Mr. Nawabsal
	Fruit Processing Unit 1. Mr. Anup Gupta, Manager Finance, Zimdra Food Pvt. Ltd, Phuntsholing
Thimphu	
	Bhutan Agro-Industry Limited (BAIL) 1. Mr. Galey Tenzin, General Manager, Farmers' Support Department 2. Mr. Leela Dhar Pokhrel, General Manager (Marketing), 3. Mr. Ugyen Dorji, General Manager, Departments of Works
	Agriculture Production Division, DoA 1. Choney Zangmo, Agriculture Production Division, MoAF **NPPC** 1. Mr. Doe Doe, National Plant Protection Center, Semtokha, Thimphu **BAFRA** 1. Sonam Dorji N, RQO/focal person for Agriculture, BAFRA, MOAF, Thimphu

2. Kubir, Food Safety Officer, BAFRA, MoAF, Thimphu

DAMC

1. DG, DAMC, MoAF, Thimphu
2. Chief, MDD, DAMC, MoAF, Thimphu
3. Chief, MIRD, DAMC, MoAF, Thimphu
4. Chief CDD, DAMC, MoAF, Thimphu

1. Mr. Kencho Tshering, Apple Contractor/Middleman), Thimphu

BDBL

2. Ms. Pema Choden, BDBL, Thimphu
3. Tshering Nidup, Loan Officer

BCCI

1. Phub Tshering, Secretary General, BCCI
2. Kesang Wangdi, Deputy Secretary General, BCCI
3. Tshering Lhaden, NTM Desk Officer, BCCI
4. Namgay Bidha

RDC, Yusipang

1. Mr. Kesang Tshering, Officiating Program Director, Research and Development Center, MoAF, Yusipang

District Agriculture officers

1. Mr. Dhodo, District Agriculture Officer, Thimphu Dzongkhag
2. Ms. Nidup Zangmo, Agriculture extension Officer, Kawang Gewog, Thimphu
3. Ms. Pema Lhaden, Agriculture extension Officer, Chang Gewog, Thimphu
4. Tenzin Galay, Dzongkhag Land Record Officer, Thimphu
5. Mr. Kinley Dorji, Agriculture extension Officer, Geney Gewog, Thimphu

Private sector

1. Mr. Tshering Dorji, Druk Tshoki Noryang Fruit Pvt. Ltd, Thimphu
2. Mr. Bikash, Druk Tshoki Noryang Fruit Pvt. Ltd, Thimphu
3. Mr. Ugyen Dorji, Olakha

Apple growers

1. Apple growers in Yusipang and Hongtsho

ANNEX 2: TRAINING NEEDS ASSESSMENT AND TRAINING MATERIALS

Based on the apple value chain study, training needs assessment of the extension staff and marketing focal personnel in the dzongkhags are identified. It is followed by a list of existing training materials to support the development of capacity of above mentioned field staff.

Training need assessment mapping

Sl #	Participants	Training areas
1	Dzongkhag Extension Staff	1. Orchard Management • Fertilizer & manure use • Pruning, tree training, and fruit thinning • Pest and disease handling 2. Harvesting apples • Fruit testing, and harvesting • Use of appropriate gears and techniques 3. Postharvest operations • Sorting, grading and packing • Use of appropriate materials, tools and equipment
2	Dzongkhag marketing focal personnel	**Collection of market information and timely dissemination** • Market situation (demand and supply) • Factors that impact apple exports • Consumption pattern, market preferences • Prevailing prices • Transportation and handling costs • Weather conditions, strikes and blockages across the borders • Local processing units, capacities and products

Existing training materials

Training area	Existing training materials
Orchard management	**Apple Manual of Department of Agriculture, MoAF 2002** The apple manual has all the details from site selection, planting preparation, planting, plant propagation, fertilizer & manure use, training, pruning, white washing of steam, pest management, harvest and postharvest operations, and planting material standards.
	Pest information, reporting and pest alert (NPPC) Pests of Bhutan – Information, Identification and Management of Agricultural Pest in Bhutan. NPPC website: http://pestsofbhutan.nppc.gov.bt/crop-and-pest-identification/crops/apple/#sthash.VQoMRWzr.xUNaTtIr.dpbs
	Training apple for maximizing productivity, DoA – Brochure
	Leaflets and Posters on pest and disease handling (on management practices for apple diseases) – NPPC

Harvest and Postharvest Operations	1. Apple manual of DoA, 2002 • Details on maturity indices for common cultivars of apples and methods of harvest are provided. • Postharvest activities on sorting and pack house operations, storage and transportation including loading and unloading. 2. Postharvest handling operations and management of apples. An extension Materials, NPHC, Bondey, Paro, 2017. (The manual is available both in Dzongkha and English versions)
Market Information	• Smallholder Horticultural Production and Business Trainer's Manual – www.snv.org/public/cms/sites/default/files/explore/download/rarp_2016-horticulture-trainers-manual.pdf • Horticultural marketing - a resource and training manual for extension officers – (http://www.fao.org/docrep/s8270e/S8270E01.htm)

To assist the extension staff, group exercises will be carried out during the workshops to assist and guide them on the following marketing topics:

- Identification of market information required by various actors;
- How to collaborate with other agencies/trade attaches to obtain market information;
- Timely dissemination of marketing information; and
- Use of appropriate media channels for information dissemination.

ANNEX 3: ACTIVITY CALENDAR (APPLE VALUE CHAIN)

Month	Activities
January	• Pruning • Thinning • Cleaning orchard floor
February	• Complete winter pruning • Top-working and grafting • Apply Tree Spray Oil (TSO) where scales and lichens are present • Spray pesticides to control pests such as wooly aphids
March	• Irrigate orchards as necessary • Apply fertilizers
April	• Carry out mulching • Spray pesticides to control pests and diseases • Middlemen/Exporters make visit prospective orchards to observe flowering
May	• Irrigation and mulching • Spray pesticides to control apple rust and petal fall • Spray nutrients as required
June	• Remove water shoots • Weeding around tree trunks and clean orchard floor • Clear the apple orchard surroundings to control wild animals • Top-dress and spray fungicides to control apple scab, premature leaf fall and to support fruit development • Middlemen/Exporters carry out rough inspection of quality and quantity of fruits in orchards and negotiate price with growers • If a deal is struck, pay growers an mutually agreed advance
July	• Remove water shoots • Carry out field budding if required to change varieties • Harvest early varieties such as Jale and carry out postharvest activities and transportation • Commence export and supply to local market • Spray pesticides to control apple fruit borer and fungicide to control apple scab
August	• Harvest early varieties • Carry out postharvest activities and transportation • Carry out export, supply to local market • Spray fungicide to control apple scab
September	• Main harvest, postharvest activities, transportation, export, supply to local market • Clean orchard floor
October	• Harvest golden delicious and other late varieties • Spray urea after harvest in case of premature leaf fall • Complete export, postharvest and transportation activities
November	• Collect fallen leaves and compost them after treatment
December	• Make basins around tree trunk, clean orchard floor, and white wash tree trunks

Source: Adapted from Apple Manual, 2002. IHDP, DRDS, Ministry of Agriculture, Royal Government of Bhutan