International Journal of Agriculture Innovations and Research
Volume 7, Issue 1, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy):
Received: 12/08/2018 | Accepted on: 20/08/2018 | Published: 30/08/2018

Apple Value Chain Analysis in the Central Highlands of Ethiopia

Wudineh Getahun[1*], Agajie Tesfaye[1], Tadele Mamo[1] and Setotaw Ferede[2]
[1] Holeta Agricultural Research Center (HARC), Holeta, Ethiopia.
[2] Debrezeit Agricultural Research Center, Debrezeit, Ethiopia.
*Corresponding author email id: getawudineh@gmail.com

Abstract **– Apple value chain analysis was undertaken in the central highlands of Ethiopia with the objectives of identifying the value chain functions, actors, constraints, and to assess the value added along the value chain. Primary and secondary data were used, collected from 201 apple growing households, 2 commercial growers, 2 government nurseries, 5 experts, 11 traders and 24 consumers, and analyzed using descriptive and inferential statistics. The survey result indicated that the direct value chain actors were input suppliers, producers, traders and consumers and the associated functions were input supply, production, marketing and consumption. Apple growers retained the lowest (13%) net marketing margin while collectors and street venders retained the highest net marketing margin (26% and 28%), respectively. Apple growers added 19% of value while traders were responsible for the highest percentage of value addition (80.6%). The linkage among the value chain actors was weak, reflected in terms of limited horizontal coordination within producers, within traders and limited vertical coordination along the value chain, and lacked information transparency. Also, diseases and pests, poor quality seedlings, low productivity and poor quality harvest affected the value chain negatively. This implies that there is a need to make the value chain sustainable through setting innovation platforms and efficient extension service; adapting modern breeding approaches (classical & molecular selections) to generate durable disease resistance and good quality fruit trees, and strengthening of horizontal and vertical coordination within and along the value chain.**

Keywords **– Apple, Value Chain, Central highlands, Ethiopia**.

I. INTRODUCTION

In Ethiopia, fruit production has been dominated by tropical and sub-tropical fruit types which include banana, citrus, papaya, mango, avocado, lemon, etc mainly grown in the lowlands. While Ethiopian highlands are endowed with climate of low temperature (having diverse topography and agro-ecological zones covering about 50% area of highland with 2000-4500 m.a.s.l. altitudes), lands with mosaic of soils, and ample water resources suitable for the production of highland fruits like apple. Apple *(Malus domestica),* is moderate climate zone fruit tree and thus regarded as an exogenous crop to Ethiopia. It is introduced by Missionaries from abroad some 65 years ago [1]-[2]-[3]. It has phosphorus and sodium minerals, important in human nutrition which have a role in bone and teeth formation and other important body functions [4], and it is a good source of soluble carbohydrates such as starches, sugars and a fiber pectin, which helps to reduce cholesterol levels in humans by lowering the secre-tion of insulin [4]-[5].

Despite this nutritional advantage, previously apple production was restricted to some pocket areas of southwestern Ethiopia. Subsequently, its production has been expanded in several highland areas of Gamo Gofa, Sidama, Gedeo and Guraghe zones of SNNP region, North Shewa, Arsi and Addis Ababa Zuria of Oromia region, North Shewa, North and South Wello, North and South Gondar and West and East Gojam zones of Amhara region [6], through the support of government and non-government institutions, and private growers including smallholder farmers [7]. The major contributors in expanding temperate fruits production in the country are German Technical /International cooperation (GIZ /GTZ) in three regions (Amhara, Oromia and Tigray), Kalehiwot church in SNNP and lately Israel's Agency for International development Cooperation (MASHAV).

Currently, there has been a growing interest in high value agricultural commodities (include vegetables, fruits, Dairy, fish and spices) as a diversification strategy for increasing the incomes of small scale farmers in developing countries including Ethiopia and thereby attaining sustained economic growth and poverty reduction [8]-[9]. Moreover, Ethiopian development plans including the current Growth and Transformation Plan (GTP-II) have focused on greater commercialization of smallholder agriculture by promoting the production and marketing of high value agricultural commodities in general and horticultural crops in particular (including highland fruits like apple) that can be competitive in local and export markets [10].

Growing apple therefore is becoming an important horticulture activity in the highlands of Ethiopia which help farmers to balance their diets, serve as cash crops to generate incomes, diversify production, conserve soil and environment and create employment opportunities for many households including youths. Although apple growing is new for the Ethiopian farming community, it has been found as it is highly promising and financially feasible both in terms of fruits and seedlings production, and becoming an interesting business for both rural and urban smallholders [11]-[3]. The horticultural sector has received attention from the government of Ethiopia and non-governmental institutions operating in agriculture (rural and urban). Thus, the government is investing in research and development, and encourages smallholder fruit producers mainly for domestic and export markets [6]-[3]. Owing to these facts there is a rising home apple production and consumption in Ethiopia. Despite the rise in production and the preferences of consumers for apple, production and productivity in apple are still low to match

with the growing demand. The rise in demand for apple is mainly due to the transition to a wide urban middle-income class and lifestyle change of consumers in Ethiopia. Ethiopian fruit import in general, apple import in particular increased from 350 tons in 2007 to 50,000 tons in 2016 [1]-[12] excluding fruit syrup imports. All apple imports in Ethiopia come from China, America, Europe, South Africa and Israel [3].

Until now there are very limited previous studies specifically on apple production, marketing and diseases [11]-[13]-[6]-[3]. However, no study has been carried out on the value chain of apple focusing on all aspects of the chain, and the information on value chain actors and activities are not clearly known. This calls for the need to study the whole ranges (value chain) of the highland fruit sector. Therefore, the objectives of this study are to identify value chain actors, functions, constraints and to assess the value added along the value chain, and finally map the value chain.

II. Methods

A. *Study Area*

The study was conducted in major apple growing areas of Ethiopia, specifically at Izha district from Gurage Zone of SNNP region, Degem and Hidebu Abote districts from North Shewa zone and Welmera district from Addis Ababa Zuria of Oromia region. These districts are purposively selected in consultation with highland fruit researchers and zonal level agricultural experts based on their current potential in apple production.

B. *Data Collection Techniques and Sampling*

For this study, both primary and secondary data were collected. To collect primary data, household survey, focus group discussion and key informants with value chain actors and personal observations at each segment were done. A well structured questionnaire for apple growers and semi-structured interviews using a checklist were used as a guide to focus group discussion and interview traders, input suppliers, experts and consumers as well as producers. A three stage sampling was adopted for selecting apple growers. First, study districts were purposively selected based on apple production potential. Second, study *kebeles* (*Kebele* is the lowest administrative unit in Ethiopia) were selected randomly from a list of apple growing *kebeles* in consultation with district level agricultural office experts. Last, a random selection of apple growing households was done to administer the questionnaire. The study addressed 201 apple growing households, 2 commercial growers, 2 government nurseries, 5 experts, 11 traders (include super markets, fruit venders and importer) and 24 consumers. Secondary data was collected from published and unpublished sources. The survey was conducted during 2015/16 production season.

C. *Data Analysis*

Descriptive and inferential statistics were used to summarize the socio-economic characteristics of the households, agronomic practices, profit margins, value added and constraints. Percentages in frequency distribution, mean, standard deviations, tables and figures were used to present the data and the study results.

III. Theoretical Framework

Throughout the past decades, there has been extensive theory building in the field of value chains [14], reproduced in several definitions and analytical approaches. The value chain (VC) approach involves the full range of activities and services required to bring a product or service from beginning (production or field) to end (consumption or fork) through transactions at local, national, regional or global level [15]. Value chain analysis is a linked set of value added activities [16]. It encompasses input provision, production, trading, processing and consumption processes. In other words, it includes process actors like input providers, producers, traders, processors and consumers as actors [17]. At a start, growers grow commodities and consumers consume at the end. Growers who are involved in the value chain have little negotiating power and make little money and had no incentive to advance their products while the traders face risks for low quality produce purchase [18]. Traders can easily make contacts with another traders and consumers, and farmers can decide prices by forming producer groups/ association. According to [18], value chain actors in the agriculture sector are classified as direct who are commercially involved such as input suppliers, producers, processors, traders and consumers and indirect who provide technical and financial services such as research and extension, and financial institutions. There are other critical dimensions in value chains which are considered as an incentives and governance. These are product flow, financial/economic flows and information flow. Both product flow and financial flow go in opposite directions while information flow goes into two directions.

The general but not specific representation of value chain functions that is performed to produce goods and services to make available for the end users has shown in the following Fig. It denotes the system that encompasses different value chain actors, enabling institutions, relations, flows (product, finance and information) that can make possible to produce goods and services, and transfer these products from producers to consumers.

International Journal of Agriculture Innovations and Research
Volume 7, Issue 1, ISSN (Online) 2319-1473

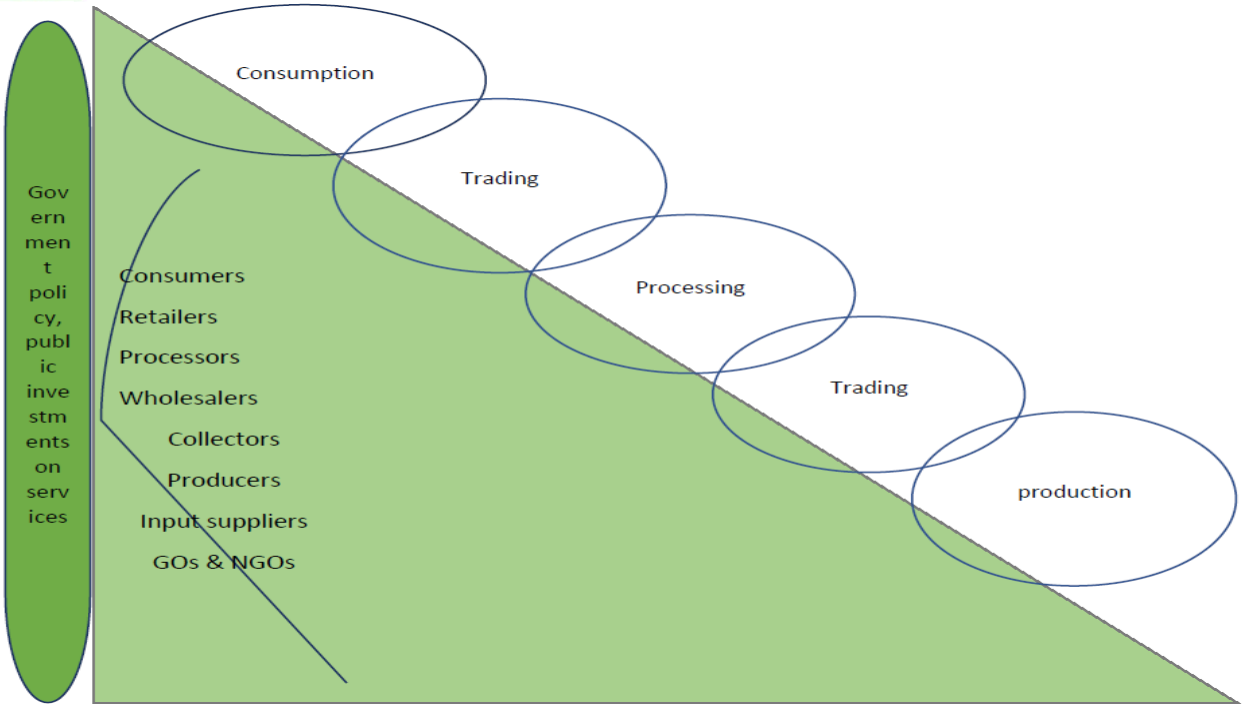

Fig. 1. Modified Value chain functions and actors adapted from Emana, 2010.

IV. Results and Discussion

A. *Apple Production Practices*

On the average, the sample household allocated 0.03ha of land for apple growing and some households also grow peach, plum and pear together. Apple growers incurred a production cost of 1002 Birr to produce 146 kg of fruits with a unit cost of 7 Birr, about 77% of the sample households used manure (on average 140kg), the majority (53%) of the households used intercrop mainly vegetables (89%) like cabbage, onion and potato), only about 8.5% and 4.5% of the households used DAP and Urea fertilizers respectively, 4% of the households used fungicide to their apple trees, about 82% of the households used irrigation on regular basis but not frequently while the remaining households did not used irrigation because they lacked irrigation water sources. About 11%, 9%, 96%, 12%, 56%, 42%, 23% and 80% of the sample households used deflowering, defoliation, hoeing, thinning, mulching, pruning, training and recommended spacing, respectively (Table 1). The study results revealed that a few growers gave due emphasis on most of agronomic practices while most of the households gave less attention on the majority of agronomic practices. This is in line with the findings of [3], found the majority of the farmers did not used agronomic practices, indicating the need to encourage and help farmers to practice recommended horticultural agronomic practices.

Table 1. Descriptive statistics of inputs and practices used by households (N = 201).

Variables	Unit of measurement	Mean	SD
Land given to fruit production	hectare	0.031	0.051
Inputs used (in terms of production cost)	ETB	1002.29	1550.63
Manure used (N=155)	kg	139.53	304.63
Use of intercrop	%	53	
Households(HHs) who used DAP	%	8.5	
HHs who used Urea fertilizer	%	4.5	
HHs who used fungicide	%	4	
HHs who used irrigation regularly but not frequently	%	82	
HHs who used deflowering	%	11	
HHs who used defoliation	%	9	
HHs who used hoeing	%	96	
HHs who used thinning	%	12	
HHs who used mulching	%	56	
HHs who used pruning	%	42	
HHs who used training	%	23	
HHs who used appropriate spacing	%	80	

International Journal of Agriculture Innovations and Research
Volume 7, Issue 1, ISSN (Online) 2319-1473

B. *Utilization of Apple Fruits by Farmers*

The study has shown that the majority (68%) of the produce was for sale and the rest 22% was consumed at home. There was a considerable amount (13%) loss of fruits caused by birds (59%), diseases (14%) such as apple scab and powdery mildew, insects (12%), physical injury (4%), combination of one another (4%) and other causes (7%) mainly due to poor transportation and packing (Fig. 2). This finding is in line with the findings of [7], reported about the problem of disease and associated loses, and the findings of review of Mango value chain in Ethiopia conducted by [19]. The growing of apple was somehow profitable with a profit margin of 1886 Birr, on average much higher than the average cost of production (1002 Birr) manly from labor costs (Table 2) and this finding is line with the findings of [11], reported the profitability of apple production sector.

Table 2. Utilization of apple fruits by the smallholder households.

Variables	Unit	Minimum	Maximum	Mean	Std. Deviation
Produce	kg	0	855	145.9	180.2
Consumed	kg	0	400	33.4	60.8
Sold	kg	0	790	99.3	143.2
Harvest loss	kg	0	300	19.5	38.2
Selling price	Birr	15	50	19.8	9.0
Revenue	Birr	0	42750	2888.6	1621.4
Production cost	Birr	43	14110	1002.3	1550.0
Profit	Birr	-43	28640	1886.3	
Percentage sold	%		92	68	
percentage loss	%		35	13	

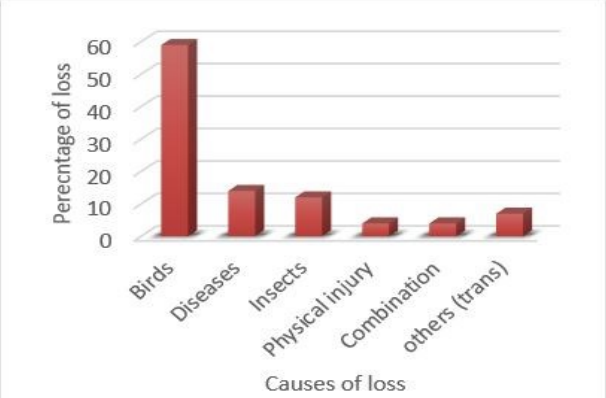

Fig. 2. Major causes of apple fruit loss.

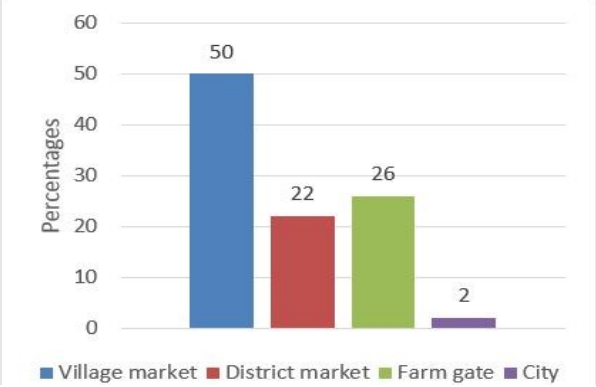

Fig. 3. Common market outlets.

C. *Apple Fruit Marketing*

The annual apple production is estimated to be 5,000 MT (metric tons) from 35, 000 growers [3], the total produce from the sample households was 29 MT (N = 201) of which 68% (20 MT) for sale and 20% (5.5 MT) for home consumption. As already mentioned, due to very high domestic market demand, the country has been importing fresh fruits from abroad and it is growing on average more than 30% [20]. Fig. 3 and 4 present marketing of domestic apple fruits was taking place at village markets (50%), district markets (22%), farm gates (26%) and central market (2%), indicating the existence of undeveloped markets. Selling at farm gate level was not preferred by growers; however, it was often done because they need immediate cash at hand or they have very limited access to markets. Sample farmers sold their fruits mainly to traders (66%) such as collectors and retailers, local consumers (27%), supermarkets (4%) and others (3%). Concerning the role of gender in decision making process to sell, about 46% of the household head, 40% of both household head and spouse, 10% of the spouse and 4% of the youths made decision to sell apple fruits (Fig. 5).

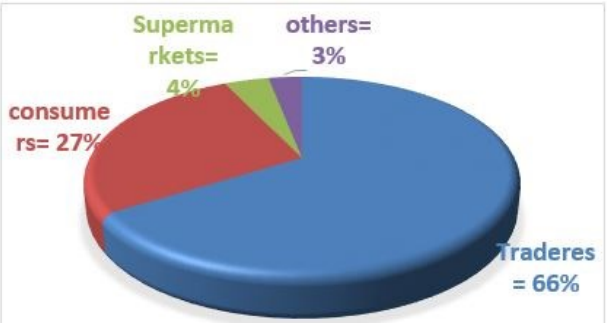

Fig. 4. Major buyers of apple fruits.

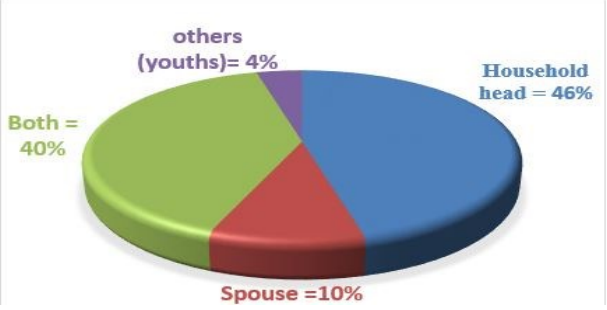

Fig. 5. Gender role in decision making to sell apple (%).

D. *Apple Fruit Marketing Channels*

The survey identified nine apple marketing channels. As mentioned earlier, most of the domestic demand is covered with imported fresh fruits reach consumers through five channels to reach the final end users (consumers) and the domestic apple fruits reach consumers through four marketing channels, only 4% and 2% of the produce reach end users through whole sellers and supermarkets, respectively while the majority of apple reach consumers through traders (collectors, whole sellers and street venders). The majority of apple imports reach the final consumers through channel 1 and 2 while the domestic apple reach the end users through channel 6 followed by channel 7.

1. Farmers→Collectors→Street Venders→Consumers
2. Farmers→Consumers
3. Farmers→Street Venders→Consumers
4. Farmers→Supermarkets→Consumers
5. Imports→Supermarkets→consumers
6. Imports→ Shop venders→Consumers
7. Imports→Super markets→Star Hotels→Consumers
8. Imports→Shop venders→Star Hotels→Consumers
9. Imports→Street venders→Consumers

E. *Marketing Margin of Domestic Apple*

The process of collecting cost and price data, and estimating appropriate margins is one of the key challenges in any value chain analysis. This study tried to estimate marketing margins. Table 3 presents the distribution of selling prices, price shares and margins at each of the value chain segments. The results revealed that growers retain the lowest share of final price (25%) and the net margin of 13%. Traders (collectors and street venders) retained a higher marketing margin of 26% and 28% respectively, indicating margins are different along the value chain suggesting the need to link growers with fruit markets such as central city markets and super markets.

Table 3. Distribution of margin and value along the main actors of domestic apple fruits.

Main function & actors	Price (Birr/kg)	Final price share (%)	Production/ intermediate costs (Birr/kg)	Cost to price ratio (%)	Net margin (%)
Production Growers	20	25	Total variable cost = 6.90	34.5	13
Collecting Collectors	50	62.5	Fruit price = 20 other costs = 4 Total = 24	48	26
Trading Street venders	80	100	Fruit price = 50 other costs = 2 Total = 52	65	28

F. *Value Addition of Domestic Apple Fruits*

Value is instilled in the chain when the commodity passed through different marketing segments by the respective actors, and it is related to transformation costs, quality, delivery time and place [21]. According to [22], value is the difference between the selling price of the output and the purchase price of the inputs including the transaction costs to bring the product from conception to consumption. Comparable study presented that distribution of value added over several direct actors is strongly related to the supremacy of the chain actors and depends on the position and bargaining power, information asymmetry among chain segments and production technology used [23]-[24]. Table 4 presents the distribution of value added for domestic apple fruit in the study area. The average production cost was 7 Birr/kg and sold on the average price of 20 Birr/kg. The result shows that street venders (retailers) were responsible for the highest value added (41.8%) and the lowest value by growers (19.4%), while street venders (retailers) and collectors added value 41.8% and 38.8%, respectively. This indicates that growers are the most price takers and the least profitable actors in the value chain. This finding is in line with the findings of value chain analysis of potato conducted by [23], found traders added more value than producers. Therefore, there is an urgent need to innovate and develop the value chain in such a way that all the actors fairly benefit (particularly growers) from the value chain.

Table 4. Distribution of value addition for domestic apple fruits.

Type of value added	Variables by actors	Growers	Collectors	Street Venders	Consumers
Financial/ economic	Average selling price (Birr/kg)	20	50	80	
	Average cost of transformation	7	24	52	
	Gross value added (Birr/kg)	13	26	28	
	% of total value added	19.4	38.8	41.8	
	Total value added	67			
Product /other forms of value added		• Produce • Little store	• Transport • Little grading	• Transport • Storing • Grading • Packing	• consume

G. *Sources of Seedling Materials, Extension and Credit Services*

The study identified that apple seedling materials have been produced mainly in public nurseries, commercial private nurseries and farmer-based mini nurseries (seedling bed) owned by some business oriented smallholder farmers. The survey revealed that about 10% (n = 19) farmers produced rootstocks and grafted seedlings in their fruit gardens to generate additional income. The survey found that commercial private and public nurseries were better managed and some of the public nurseries were financially supported by NGOs whereas farmer-based nurseries were poorly managed. Nursery operators used Ana, CP29, BR, Crispin, Princesa, and Dorset golden, Granny smith and Galla cultivars as a scion and MM106, MM111, M9 and M7 as a rootstock. The sources and origins of these planting materials were well known by commercial private nursery operators while most farmers did not know the sources and origins. It was found that the cost of producing a single apple seedling ranges from 17-20 Birr and sold for 50 Birr with a profit of 30 Birr/grafted seedling of age 1-2 years. This implying that growing of apple seedlings is a profitable business and this finding is in line with the findings of [11]. Besides, there was an introduction of grafted apple seedlings from abroad mainly from Spain. Growers reported that apple seedlings came from Spain are good quality and more productive than locally produced seedlings.

Table 5 shows the different sources of seedling materials and extension services. Grafted seedlings of apple have been collected and distributed mainly by governmental and non-governmental institutions (NGOs). The survey found that about 38%, 25%, 8% and 29% of the sample households obtained grafted seedlings from NGOs, Ministry of agriculture, research institutions and other farmers respectively. Extension is believed to be an important instrument to deliver agricultural services to farmers and help them to increase production and improve productivity. The survey found that 61% of the sample households ever received trainings on orchard management and 58% of the households received extension services during 2016. It is also found that 15% of the growers did ever need credit to expand their apple production.

The survey also found that seedlings distributed by NGOs from farmer-based nurseries of Chencha are susceptible to disease and failed to bear fruits for long periods of time mainly due to poor grafting techniques and source materials. Shortage of land for rotation and for separate growing of rootstocks and scion wood, insecure land rights, market fluctuation, smuggling of poor quality seedlings by middle men and lack of quality certification and regulation are identified the major constraints faced by commercial private nurseries. Lack of model nurseries that can serve as a source of knowledge and true to type quality planting materials also affected apple production. Thus, the survey results imply that there is a need to set model nurseries and link farmer-based nurseries with better managed commercial private and public nurseries.

Table 5. Proportion of households by sources of seedling materials & other services.

Sources of seedling materials	N	Percentage
Non-governmental organizations	201	38
Ministry of Agriculture at different level jointly	201	25
Research institutions	201	8
Other farmers who raised seedlings	201	29
Did you get extension contact in 2015/16 (yes/no)	yes	58
Did you ever get training on apple management (yes/no)	yes	61
Did you ever need credit (yes/no)	yes	15

H. *Apple Value Chain Map*

The apple value chain map is presented in Fig. 6. The survey identified the major apple value chain actors include input suppliers, producers, traders, consumers and enablers. It is found that most of the apple fruits were from imports, and the majority of domestic apple was from smallholder growers and a little from commercial farms. In this value chain, there was no processing segment. Imported apple reached to consumers mainly through shop venders, supermarkets and street venders whereas the domestic apple was mainly through street venders. It is also found that the domestically produced apple market was not well-structured and organized as compared to the imported apple market that lacked information, transparency and coordination.

Input suppliers

Input suppliers are the first most important actors in any agricultural value chain. Apple growers used agricultural inputs like seedlings, labor, fertilizers, manure and traditional farm implements. These inputs are supplied by government and non-government institutions, individuals and growers themselves. Traditional farm implements were supplied by individual suppliers. However, there was lack of improved farm implements such as grafting and pruning tools due to lack of responsible suppliers.

Producers

The majority of apple growers are smallholder farmers. Currently, there are also a few emerging commercial private apple growers throughout Ethiopia. In one of the study site, in Izha district, growers are organized in apple producers cooperative although the cooperative was not found effective to benefit growers because it was easily manipulated by their leaders. Poor quality seedlings, disease such as wool aphids, powdery mildew and apple scab, insect pest, birds, low productivity and poor market were identified the major constraints affecting apple production segment.

Traders

Different types of traders participated in the apple marketing. Collectors include individuals from rural and urban areas played a great role in collecting apples from growers and sold to venders (retailers). Farmer cooperative (only in Izha district) collects fruit from its members and sell to another individual collector. Some collectors bought apple at the farm gate price while the fruits are on the trees and harvested by themselves. The survey found two types of fruit venders; these are shop venders and open market/ street venders. Most of the domestic apple fruits are reaching the end users through street venders. Importers sold most of their stock to shop and street venders followed by supermarkets, some of the supermarkets reported that they can import some fruits from abroad. Traders were complaining about the poor quality of domestic apple mainly due to premature harvest.

Consumers

Consumers are end users in the value chain. There are different categories of consumers found in the value chain. These are urban and rural dwellers, rich individuals and diabetes, and institutions (mainly star Hotels and their customers). Consumers in the towns/ cities usually buy apple fruits from shop and street venders while customers in village markets buy fruits from growers. Rural consumers did not get fruits throughout the year, because they depend on the domestic seasonal supply of apple fruits whereas urban consumers get it throughout the year due to year-round importation of apple. However, due to high prices, most of the urban consumers could not afford to buy and a few rich people and diabetes consume more of the imported apple. Consumers also complained about the poor quality of domestic apple fruit.

Enabling Environments

Enabling environments are crucial for the apple value chain. These include existing government policies and strategies in agriculture such as Agricultural Development Led Industrialization (ADLI), land use, Agriculture Growth Programs I and II (AGP-I and II), special focus on high-value agricultural commodities through easing the process of investments, provision of infrastructures such as roads and irrigation facilities; markets, information and extension services. However, the survey found that there were no specific extension services on apple production provided for apple growers. In the study areas, growers much more expected these enabling environments to be more placed, efficient and supportive to strengthen the sector. They also need more advisory services and institutions that provide farm equipment and crop protection inputs.

International Journal of Agriculture Innovations and Research
Volume 7, Issue 1, ISSN (Online) 2319-1473

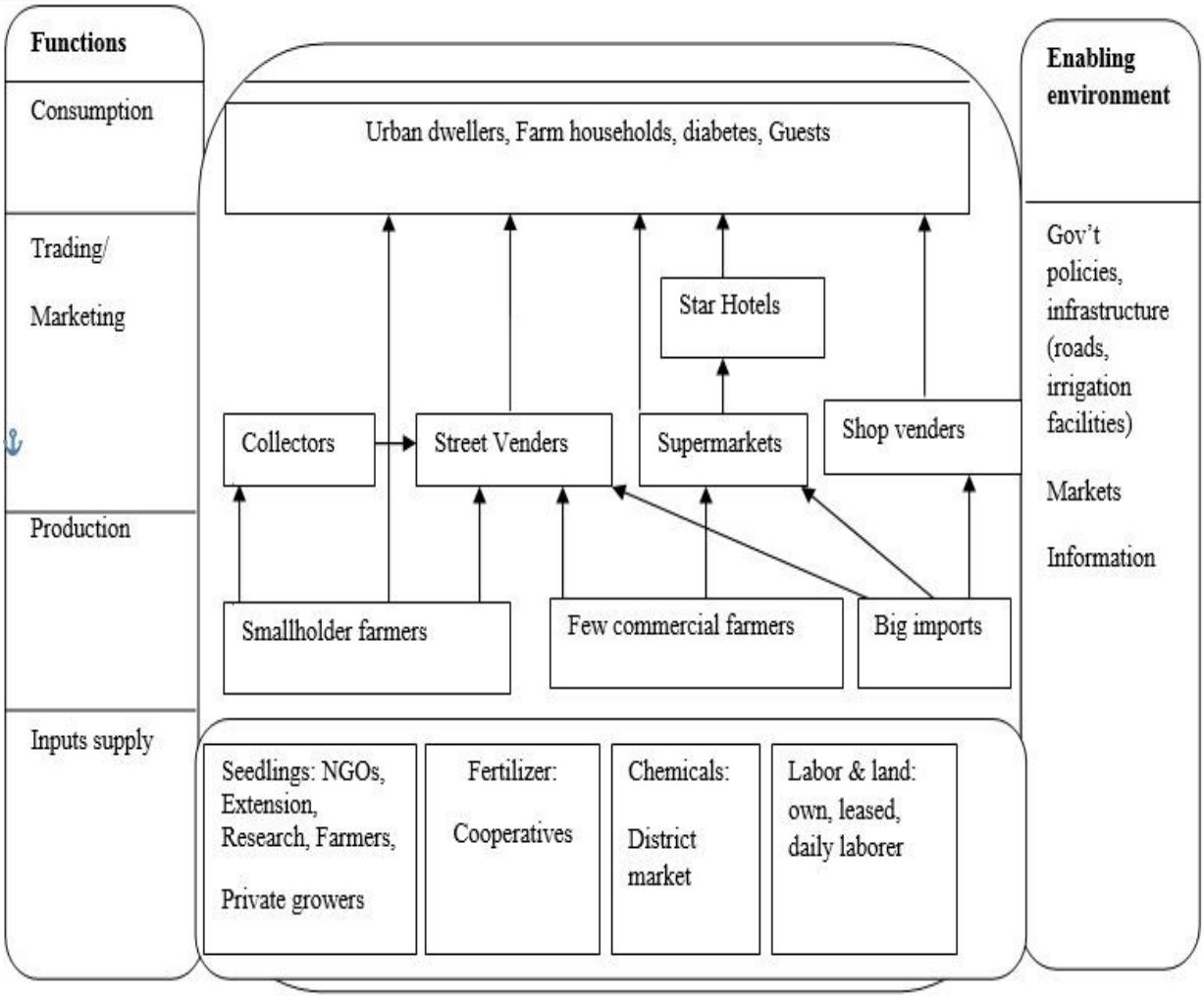

Fig. 6. Apple value chain map.

I. *Linkages of Value Chain Actors*

The value chain actors are expected to interact among each other and make linkages based on the flow of the products. All the direct value chain actors are equally important to govern the value chain. Their interaction and linkage determine the level and flow of products and transaction costs. The survey found that traders particularly collectors and venders are the dominant value chain actors because they are found more networked and have better information on the demand for, supply and price than growers. Farmers usually have limited market and price information than traders since the flow of information is behavioral and attitudinal in nature, thus farmers are mainly price takers. Traders are found in a better position to communicate with the rest of the value chain actors via telephone calls and able to determine prices that can affect producers and consumers. Since apple farmers had limited horizontal coordination to develop economies of scale, they lacked negotiating power to set prices due to their scattered small scale production. The survey results imply that there is a need to strengthen the linkages among the value chain actors through innovation approaches and set platforms.

J. *Constraints and Opportunities in Apple Value Chain*

Identifying constraints and opportunities is one of the specific objectives of any value chain studies. Because value chain analysis helps to identify constraints at each of the value chain segments in an intense and brief manner. The survey identified a number of constraints and opportunities of apple value chain. Table 6 presents the summary of constraints and opportunities at each of value chain actors, and highlighted possible intervention areas to solve the constraints. The opportunities denote to the outside favorable circumstances that are in favor of highland fruit production in the study area. These include suitable climatic conditions, technical and innovative knowledge is available from national and regional institutes (extension and research), supportive policy (investment opportunities in the area of high value commodities like vegetables and fruits), the expansion of big towns and cities and change in the life style of the people drive high demand for both fresh fruits and juices.

International Journal of Agriculture Innovations and Research
Volume 7, Issue 1, ISSN (Online) 2319-1473

Table 6. Constraints, interventions and opportunities of apple fruit value chain.

Value chain functions	Constraints	Interventions	Opportunities
Input supply	• Shortage of improved & quality seedling sources (scion & rootstock) • Lack of farm tools and pesticides • Lack of specialized personnel • Smuggling of poor quality seedlings • Poor quarantine systems • Unpredicted demand • Poor documentation & quarantine systems • Land shortage for rotation • Lack of well-organized technical manuals with different languages • Profit seeking behavior of seedling market players	• Establishing model nurseries as seedling and knowledge sources • Organizing rural cooperatives to supply farm tools and inputs • Set quality standards & quarantine • Prepare nursery manuals	• High demand for quality seedlings • Suitable climate • Cheap labor • Supportive agricultural policies and strategies
Production	• Low productivity • High incidence of diseases and insect pests (apple scab & powdery mildew) • Birds attack • Weak markets and information • Poor quality planting materials • Shortage of irrigation water & facilities and traditional practices • Lack of coordination among the value chain actors • Lack of specialized extension services • Lack of incentive for commercial farms • Lack of well-organized technical manuals with different languages	• Increase productivity through agronomic and pest management • Make research and extension efficient • use modern breeding approaches (classical & molecular selection) for quality fruit & durable disease resistance • Develop value chain innovation • Facilitate knowledge sharing mechanisms • Prepare manuals in major languages • Improve quality & reduce waste	• Unfulfilled demand for fruits • Diversification and nutrition • Climate friendly • Soil conservation practices • Irrigation potential • Enabling policy environments • Potential for processing • Potential for rural income generation • Potential of export
Trading	• Small production & unorganized growers • Seasonal production • Poor quality fruits (early harvest & lack of grading) • Lack of transport and packing facilities • Limited market information • Lack of storage facilities	• Aggregation & marketing (establish collecting centers with grading systems) • Increase production • Provide appropriate transportation and packaging services	• Availability of domestic fruits • High market demand for fruits • Change in lifestyles • Potential for processing
Consumption	• Limited availability, economic constraints, affordability, high prices • Lack of knowledge & information on nutrition • Poor quality of domestic fruits	• Increase supply • Increase quality • Provide price and nutrition information	• Increased income • Change of lifestyle

V. Conclusion and Recommendations

This study tried to analyze apple value chain in the central highlands of Ethiopia. Apple value chain actors are identified as input suppliers (include NGOs, extension, research, farmers, private inventors and cooperatives), producers or suppliers (include smallholder farmers, a few emerging commercial private farmers and imports), traders (include individual collectors, street venders, shop venders, supermarkets and star Hotels) and consumers. In addition to these value chain actors directly involved in the transformation of the product enabling environments that influence the value chain are policies and strategies (Agriculture Growth Programs) on agriculture particularly on high value agricultural commodities, provision of infrastructures like roads and irrigation facilities and easing the process of investments on the sector. Most domestic apple was sold at the village market and both collectors and street venders played more in apple marketing, and retained a higher marketing margin. Apple growers retained the lowest (13%) net marketing margin while collectors and street venders retained the highest net marketing margin (26% and 28%), respectively. Apple growers added 19% of value while traders were responsible for the highest percentage of value addition (80.6%). This implies that growers are the most price takers and the least profitable actors in the value chain. The apple value chain lacks information transparency and collaborative practices among the role-players. The linkage among the value chain actors is weak, reflected in terms of limited horizontal coordination within producers and within traders, limited vertical coordination along the value chain. The overall value chain is constrained by several factors that require a harmonized effort by all

supporting institutions and direct value chain actors. Poor quality seedling production and distribution, and lack of quarantine and quality standards are key factors constraining input supply segment, low price and productivity of fruit, disease and pests including birds are constraints to growers and poor-quality fruit, low and seasonal production of fruits are some of the constraint facing traders and consumers.

Based on the information and analysis provided above, we suggest that the value chain actors should work hand in hand in a coordinated manner through establishing innovation platforms to increase production and productivity. Aggregation and marketing at a community level is crucial through establishing collecting centers, grading, packing and transporting. Major extension support should provide considerable technical assistance to apple growers in the study area to improve agronomic practices and plant protection management at the farm level to produce quality fruits which fit quality requirements by consumers. Apple diseases are reported as common problems in the study area. Therefore, there is a need to adapt modern breeding approaches of classical and molecular selections for quality fruits and durable disease resistance.

ACKNOWLEDGMENT

The authors would like to thank all the apple value chain actors for their kindness and patience in providing the relevant information. Government finance by Ethiopian Institute of Agriculture Research is highly acknowledged.

REFERENCES

[1] Hayesso, T., 2008. Hope in apples. Agriculture, fruits and vegetables. Ethiopia.

[2] Ashebir, D, Dechers, T, Nyssen, J., and Bihon, W., 2010. Growing apple (*MALUS domestica*) under tropical mountain climate conditions in Northern Ethiopia. Cambridge University Press, 46 (1): 53–65.

[3] Girmay, G., Menza, M., Mada, M., and Abebe, T. (2014). Empirical study on apple production, marketing and its contribution to household income in Chencha district of Southern Ethiopia. *Scholarly Journal of Agricultural Science,* 4(3): 166-175.

[4] Farid, A.F., and Neda, A.F., 2014. Evaluation and determination of minerals content in fruits. *IJPAES*, 4(2):160-166.

[5] Boyer, J., and Liu, R.H., 2004. Apple phytochemicals and their health benefits. *Nutrition Journal*, 3(5): 1-15.

[6] Melke, A., and Fetena, M., 2014. Apples (Malus domestica, Borkh) phenology in Ethiopian Highlands: Plant growth, bloomimg, fruit development and fruit quality perspectives. American journal of experimental agriculture. 4(12) : 1958-1995.

[7] Fetena, S., and Lemma, B., 2014. Assessment on major apple diseases and insect pests in Chencha and Bonke Woredas of Gamo Gofa zone, Southern Ethiopia. *Scholarly Journal of Agricultural Science*, 4(7): 394-402.

[8] MoA (Ministry of Agriculture)., 2014. Growth and Transforma--tion Plan II, 2015-2020. Draft document.

[9] MoFED (Ministry of Finance and Economic Development)., 2012. Ethiopia's Progress towards Eradicating Poverty: An Interim Report on Poverty Analysis Study (2010/ 11). Addis Ababa.

[10] FDRE (Federal Democratic Republic of Ethiopia)., 2016. Growth and Transformation Plan II (GTP II) (2015/16-2019/20). National Planning Commission, Volume I, Addis Ababa, Ethiopia.

[11] Yeshimebet Ayele Tegenie, 2014. Economic Analysis of Apple Fruit Production in Tiyo District of Arsi Zone, Ethiopia. *International Journal of Agricultural Science and Research*, 4 (6):165-170.

[12] ERCA (Ethiopian Revenues and Customs Authority), 2017. Import and export data.

[13] Alemu, KT., 2014. Potato value chain in Ethiopia: Cases of Sinan and Bigugn didtricts in East Gojam. *Time journals of agriculture and veterinary sciences*, 2(6):114-124.

[14] Lazzarini, SL, Chaddad, F.R., and Cook, ML., 2001. Integrating supply chain and network. *Journal on chain and network science*, 1(1): 7-22.

[15] Kaplinsky R., and Morris, M., 2001. *A* Handbook for Value Chain Research. A report prepared for the International Development Research Center (IDRC). www.ids.ac.uk/ids/ global/pdfs/ vchnov01.pdf (Accessed on June 2018)

[16] Soosay, C., Fearne, A., and Benjamin Dent, B., 2012. "Sustainable value chain analysis – a case study of Oxford Landing from "vine to dine"", Supply Chain Management: *An International Journal*, 17(1): 68 - 77

[17] GTZ (German Technical Cooperation)., 2007. Value Links Manual – The Methodology of Value Chain Promotion. 1st ed. Eschborn, Germany. 221pp.

[18] Kit, MF., 2006. Chain empowerment: supporting African producers to develop markets. Royal tropical institute, Amsterdam; Faida market link, Arusha; and international institute of rural reconstruction, Nairobi.

[19] Honja, T., 2014. Review of Mango Value Chain in Ethiopia. Journal of Biology, Agriculture and Healthcare, 4(25): 230-239.

[20] ATA, and USAID., 2016. Trends in import demand for fresh fruits in Ethiopia. Final report. Addis Ababa, Ethiopia.

[21] Trienekens J.H., 2011. Agricultural Value Chains in Developing Countries. A Framework for Analysis. *International Food and Agribusiness Management Review*. 14(2): 51-82.

[22] Faris, A., 2016. Review of Avacado value chain in Ethiopia. Industrial Engineering Letters. 6(3): 33-40.

[23] Tadesse, B., and Bakala, F., 2018. Value Chain Analysis of Potato: The Case of Sheka Zone, Southwest Ethiopia. *International Journal of Horticulture & Agriculture*, 3(1):1-10.

[24] Getachew, D.W., Zemedu, L.S., and Eshete, A.W., 2016. Mushroom value chain analysis in Addis Ababa, Ethiopia. *Journal of Agricultural Extension and Rural Development*, 8(8):130-140.