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Review of Mango Value Chain in Ethiopia

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Abstracts
Mango is one of the main fruit crop produced and exported in Ethiopia. The main objective of this review is to review mango production and marketing system with their respective constraints, to identify major actors along mango value chain and their respective functions along the chain and to review current status and potential opportunities of mango in Ethiopian economy. Accordingly, using of small scale irrigation, fertilizer application, use of farm yard manure, intercropping with other crops and mixed farming systems are the main mango production practices adopted in different parts of the country. In line with this, the main constraints of mango production are mentioned as irrigation water scarcity, pest and disease and technology limitation, limited access to mango varieties, and limited capacity in R&D. Marketing system of mango in Ethiopia is characterized by use of traditional transportation means such as donkeys, cart, human back and marketing is mainly oriented on local market. The main constraints of mango marketing are mentioned as lack of markets to absorb the production, low price for the products, poor product handling and packaging, imperfect pricing system and lack of transparency in market information system mainly in the export market. The main factors involved along mango value chain are input suppliers, producers, collectors, wholesalers, retailers and processors. Currently, mango sub-sector is a good entry point for tackling poverty and that the market for mangoes in Ethiopia is significant and growing. Distribution of pest and disease resistance and early maturing varieties is a method to increase production potential. Facilities like road, canal and transportation system should be improved for further dimension and to reduce the loss.
Keywords: mango, value chain, production constraints, spatial market

1. Introduction

Tropical and sub-tropical fruit can make a significant direct contribution to the subsistence of small-scale farmers by providing locally generate nutritious food that is often available when other agricultural crops have not yet been harvested. Fruit are a versatile product that, depending on need, can be consumed within the household or sold. Marketing fresh and processed fruit products generates income which can act as an economic buffer and seasonal safety net for poor farm households. Diversification into fruit production can generate employment and enable small-scale farmers to embark on a range of production, processing and marketing activities to complement existing income-generating activities (Clarke, et.al, 2011).

Mango (*Mangifera indica*) is a fleshy stone fruit belonging to the panes Mangifera, consisting of numerous tropical fruiting trees in the flowering plant family Anacardiaceae. Mango is native to the south Asia from where it was distributed worldwide to become one of the most cultivated fruit in the tropics. Mango is produced in most frost free tropical and sub tropical climates, more than 85 countries in the world cultivate mango. The total production area of mango in the world is around 3.69 million hectares. The total amount of mango production in the world was around 35 million tons by the year 2009 (FAO, 2009). Mango is one of the most widely cultivated and globally traded tropical and subtropical fruit trees in the world (Clarke, et.al, 2011).

Mango serves as a fruit crop and as a subsistence crop for family farms. As it ripens at the end of the dry season and at the start of the rainy season, the mango is a fundamental source of nutrition for rural populations (Vayssières et al., 2012). Mango fruit is an excellent source of dietary antioxidants, such as ascorbic acid, carotenoids, and especially phenolic compounds (Ma et al, 2011). Mango fruits are very much relished for their, exotic flavor and delicious taste. They are also an excellent source of dietary fiber, provitamin A and vitamin C. A fruit with many versatile properties has naturally found application for processing into several products (Elias, 2007).

Mango is a highly seasonal tropical fruit, very popular among millions of people in the tropics. It also occupies a prominent place among the best fruits of the world. However, it is in constant demand, there is a pre-harvest scarcity and at times a post-harvest glut for this fruit. To increase the availability of this fruit throughout the year, the surplus production must be processed into a variety of value-added products (Saxena and Arora, 1997; Srinivasan et al., 2000; Singh et al., 2005).

Approximately 50% of all tropical fruits produced worldwide are mangos. As there has been increasing demand

for mangos throughout the world, especially in the United States of America and in Europe, production has been increasing as well over the past decade (Department of Agriculture of Thailand, 1996: 2).

The amount of mango production in Africa during 2009 is 13.6 million tones (FAO, 2009). In Sub-Saharan Africa (SSA), growing both domesticated and wild fruit species on farms diversifies the crop production options of small-scale farmers and can bring significant health, ecological and economic revenues (Keatinge et al., 2010; Weinberger and Lumpkin, 2005). Dozens of Indigenous Fruit Tree Species (IFTs), although relatively unknown in global markets, are locally of large importance for food/nutrition security and income generation. Akinnifesi et al. (2008) showed the high potential of many wild fruit species from different African regions for undergoing domestication followed by successful on-farm production. Fruit markets in SSA are estimated to grow substantially due to economic and human population growth and increasing urbanization rates.

Ethiopia is agro-ecologically diverse and has a total area of 1.13 million km^2. Many parts of the country are suitable for growing temperate, sub-tropical or tropical fruits. For example, substantial areas in the southern and south-western parts of the country receive sufficient rainfall to support fruits adapted to the respective climatic conditions. In addition, there are also many rivers and streams which could be used to grow various fruits. Ethiopia has a potential irrigable area of 3.5 million ha with net irrigation area of about 1.61 million ha, of which currently only 4.6 % is utilized (Amer, 2002).

Total fruit production in Ethiopia is about 500 thousand tones. Fruits have significant importance with a potential for domestic and export markets and industrial processing in Ethiopia. The main fruits produced and exported are banana, citrus fruits, mango, avocado, papaya and grape fruits (Zeberga, 2010).

In Ethiopia mango is produced mainly in-west and east of Oromia, SNNPR, Benishangul and Amhara (Desta, 2005). Mango production in Ethiopia is in fluctuated conditions, because of occurrence of diseases, lack of proper management and also weather conditions (CSA, 2009). More than 47 thousand hectares of land is under fruit crops in Ethiopia. Mangoes contributed about 12.61% of the area allocated for fruit production and took up 12.78% of fruit production in comparison to other fruits growing in the country and the annual consumption of mango by the processing plant at full production capacity is 8.6 tones which is only 1.8% of the current production of mango (Elias, 2007). However, less than 2% of the produce is exported (Joosten, 2007). But, according to CSA (2013) cropping season mangoes contributed about 14.21% of the area of land allocated for fruit production and holds 14.55% of quintals of fruits produced in the country. Therefore, the main objectives of this review is to review mango production and marketing system with their respective constraints in Ethiopia, to identify major actors along mango value chain and their respective functions along the chain, to review current status and potential opportunities of mango in Ethiopian economy.

2. Mango Production in Ethiopia

The mango industry in Ethiopia is in its infant stage. However, mango is grown in many parts, especially in the Rift Valley, western and southwestern parts of the country. The national research system has developed a number of varieties but is not widely spread. Experiences from other countries in growing this crop will therefore contribute to the success and widespread of this fruit.

Mango is a perennial tree which can live more than fifty years and it is also the leading fruit produced in most parts of eastern and south-western Ethiopia both in area coverage and quantities produced. There are also ample garden mango trees in different parts of the country at farmer's holdings. The livelihood of most of these farmers is highly supplemented by the sale of mango fruits. The area coverage under mango in eastern Ethiopia has reached about 35% of the total acreage allotted for fruit production (Yeshitla, 2004).

According to FAOSTAT (2010) the total cultivated area for mango in Ethiopia is not more than 12, 000 hectares. The highest annual production estimate in the past five years is 180,000 Mt and more area coverage is expected in the south-western and other parts of the country due to more conducive climatic and edaphic factors. According to Yeshitela (2004) even if the farmer's livelihood is highly supplemented by the income from their mango trees, there is a declining trend in yield and quality of mango due to old age, poor management and seedling originated nature of the trees. However, there are exceptionally good yielding trees with best quality fruits. Apart from its economic importance, it is forest and environmentally friendly to fight against drought, use as shade and fire wood.

In the context of increasing the high value production of agricultural commodities, fruit tree and perennial crops play an important role. This commodity group includes tropical nuts, fruit trees, grapes, bananas, mango,

pineapple, papaya, passion fruits, apples and others. Except table banana, tropical fruit trees like mango, avocado and the like were not well known and considered as diet by most Ethiopians (Yilma, 2009).

However, Yilma (2009) indicated that the expansion of state farms in the past command economy and the prevailing expansion of private investors in different regions of the country have contributed a lot on the introduction of fruits as business. Otherwise, areas suitable for growing fruit trees are idle even near riverbanks where there is ample water supply for growth. Because of the long period establishment cost of fruit trees before fruit setting, knowledge limitations of food technology and market information, smallholders are not practicing other fruit trees except banana. In general, fruit production is still backward, the business is under developed and the private sector is not much attracted.

CSA (2013) showed as mango is one of the second potential fruit crop produced in Ethiopia next to banana which is the first fruit crop produced in large quantity.

Table 8: Summary of major fruit crops produced in Ethiopia in 2012/2013 cropping season

Fruit crop	**Area in hectare**	**Production in quintal**	**Productivity/quintal**
Avocados...	8,938.24	256,331.64	28.68
Bananas	36,012.19	3,025,022.32	84.00
Lemons	754.23	55,167.50	73.14
Mangoes	**8,808.64**	**697,507.30**	**79.18**
Oranges	2,999.21	357,458.39	119.18
Papayas	2,752.08	386,943.15	140.60
Pineapples	215.69	-	-

Source: CSA, 2013, Agricultural Sample Survey Result

Area, Production and Yield of Mango at Regional Level

Table 9: Summary of mango production in regional states of Ethiopia

Regions	**Area in hectare**	**Production in quintal**	**Productivity**
Tigray	118.20	-	-
Afar	-	-	-
Amhara	246.85	10,408.67	42.17
Oromia	3,789.47	284,065.79	74.96
Somali	33.52	3,776.26	112.66
Benishangul-Gumuz	652.56	51,411.10	78.78
S.N.N.P	3,375.89	343,910.27	101.87
Gambela	180.41	-	-
Harari	367.24	331.69	0.90

Source: CSA, 2013, Agricultural Sample Survey Result

2.1. Mango Production practices in Ethiopia

Most of the time Ethiopian farmers did not give attention to spacing. Orchards growth were not well spaced, some orchards are nearer to each other and the others are very far from one orchard to the others, according to the oldness of the frees age most of the farmers had no knowledge about spacing. Space plays significant role for all activities, absence of proper spacing create difficulties for production (Seid and Zeru, 2013). However, tree spacing appears to be an important consideration in mango production (Olaniyan, 2004).

Smallholder's farmers use irrigation to produce mango. However, the amount of water and the source is different. However, significant numbers of mango producers in Ethiopia use river water and a small portion of smallholders use pound water. The yield is greater in river water irrigation than pond water irrigated crops. The quantity and quality of water available is on factors that determine the yield. Frequency and amount of irrigation need depends on soil type, property, climate & others (Seid and Zeru, 2013). The same study showed that fertilizer application (either organic or inorganic), irrigation (either river water or pond water), pest and disease control and wind break and pruning are the mango production practices adopted by the smallholder farmers in the area. However, use of fertilizers, i.e., both organic and inorganic fertilizer (some innovative farmers use organic fertilizer) and use of inorganic fertilizer for the mango production purpose is rare).

Similar study conducted by Ayelech (2011) indicated that FYM principally transported from homestead to the field mostly during the dry season and spread in the bottom of each tree in circular form. The assessment highlighted that chemical inputs entirely evaded neither for fertilization nor for pest treatment. Thus, its FYM

rate of application is minimal to improve soil fertility but with positive impact on environment, i.e., reduction of soil pollution and check on air and water pollution. The same study indicated that smallholder farmers in the area intercrop mango with maize, taro, ginger, chat, cabbage and banana at early stage.

2.2. Harvesting of mango

Mango harvesting stages in Ethiopia are harvesting fully ripe fruit, harvesting partially ripen fruit and harvesting unripe fruit. Harvesting the fruit after peak maturity result in shorten shelf life and fruit deteriorated quickly. This is supported by finding of Rosals (2005) who found that loss of fruit increases dramatically after harvest as the fruit maturity increased. Methods of harvesting adopted by the smallholder farmers in Ethiopia are hand picking, cut by scissor and using stick. Hand picking method of harvesting produce can maintain good quality of fruit and protect the fruit from mechanical damage. Hand picking can produce the fruit with stem and reduce fruit bruising and damage but stick structure result in fruit dropping and leave the fruit without stem which facilitate fruit bruise and mechanical damage (Seid and Zeru, 2013).

Another study conducted by Ayelech (2011) showed that harvesting usually start after fruit dropping-which is principal maturity index. In consent to this line, producers conduct harvesting subsequently to the maturity index. This nature assists producers to let hang the fruit on the tree before harvest unto best search for markets that can pay better prices. The assessment further depicted that harvesting is largely executed by child labor by climbing on the tree. But use of picking hooks, shaking of trees and knocking down fruits with wooden sticks are also exercised in the study areas; but at lower rate. The later practices cause fruit droppings that may cause physical injury at any time. FAO (2005) which indicated cuts, punctures and bruises has increased ethylene production and hastened fruit softening and ultimately caused mechanical injuries and decay.

2.3. Constraints of Mango Production in Ethiopia

The major issue restraining the development of the mango industry in Ethiopia is the lack of organization like a farmer organization or cooperative amongst mango growers. Due to the highly seasonal nature of the mango crop, and also the tendency to prioritize food security with grain crops, mango growing is not the main livelihood activity for most farmers, and is generally considered a complementary activity to other farming practices (James, et.al, 2008).

SNV in collaboration with consultants from Global Development Solutions identified the major constraints and opportunities in mango production. The major Constraints of mango production in Ethiopia include:

- ✓ Lack of knowledge, skills and facilities in production, harvesting and post harvest handling
- ✓ Limited mango varieties, and limited capacity in R&D and extension services to promote improved and marketable mango varieties introduction;
- ✓ Prevalence of mango fruit diseases and pests (Timoteos, 2009)

Seid and Yimer (2013) indicated that irrigation water scarcity, pest and disease and technology limitation are the major factors influencing the production of mango in Ethiopia.

2.4. Major causes of mango products loss

The major causes of mango produce loss in Ethiopia are birds, wind, wounding, microorganisms and maturity stage. From those birds are more challengeable cause during maturity stage and wind is so problematic starting from fruiting to harvesting stage of the produce (Seid and Zeru, 2013). Major loss of mango occurs during harvesting and before harvesting time, because of harvesting methods and maturity stage and also wind and birds. Loss of mango produce also occurs during harvesting and storage because of use of inappropriate harvesting materials and inadequacy of storage facility.

2.5. Mango market characteristics in Ethiopia

Study conducted by (Tigist, .et al, 2009) in southern Ethiopia indicated that although investments in larger private and state enterprises is slowly picking up southern Ethiopia , the significance for local and the regional (Djibouti and Middle-East) markets is still limited. The largest part of the smallholder production is only partly marketed in the local fresh fruits markets. Potential in both local and export markets, fresh or (semi)-processed is high, but a multitude of factors related to the supply, quality and institutional arrangements in the value chain result in high transaction risks and related costs. As result of this, only a limited number of small farmers are involved in organized marketing and hardly any institutional arrangements in the oligopsomic wholesale markets exist. The marketing structure of mango is has only a few dominant buyers. A small number of fruit wholesalers in Addis Ababa decide on the price and indirectly on the volume of supply to the Addis Ababa retail shops. They use middlemen to influence market equilibrium and farm gate prices for their own benefit. Because of poor

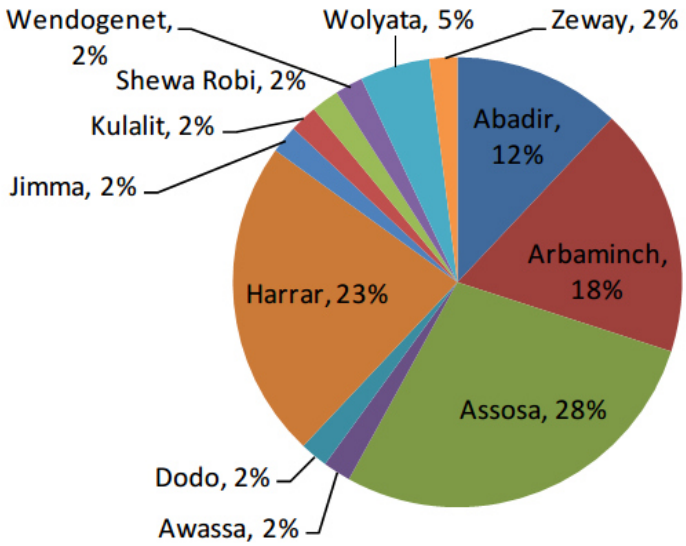
institutional strength, producer organizations have not been able to challenge this situation (Timoteos, 2009).

Another study conducted by James et.al (2008) indicated that the production level however, the value chain is quite rudimentary with mainly subsistence level cultivation, harvesting and post-handling techniques that limit the quality of the fruit. Upstream there are also issues with most grading and packaging being undertaken following a long road journey to the capital, undermining not only the quality of fruit but also the potential value generated at the farmer level. At the wholesale level in Addis Ababa, market traders dominate the landscape and operate in ways that make it difficult for new entrants to enter the market. Addis wholesalers have strong relationships with the traders based in Assosa and these two levels of the value chain account for most of the final retail price. Given the roles they play, it appears that there is not a proportionate addition of value in the chain, and that is where opportunities lie for improving farmer level value capture in the chain.

2.5.1. Mango marketing, Market outlets and transportation means

It is common in Ethiopia that majority of mango producers sell their products at nearby local market. Most of the time mango producers sell their produce to consumers and sometimes to retailers because of the market fluctuation and lack of marketing infrastructures. The other reason is maturity stage and harvesting time of mango fruit is similar. This condition increase the supply at that time and the demand is less compare to that of the supply. In this situation the price of the fruit become less and less and as result of this farmers are obliged to sale their produce at local market (Seid and Zeru, 2013). In addition to this, farm gate sale of mango is also common in Ethiopia. The main sales channels of mango in Ethiopia include direct sale to consumer, hotels, large retailers and supermarkets, wholesalers and small retailers and kiosks (James, et.al, 2008). During marketing of mango, smallholder farmers use pack animal, human back, cart and car as means of transportation to deliver their produce to final sale. Mango producing farmers in Ethiopia use basket, can, plastic box and wooden box to pack mango in order to keep safety and post harvest loss of mango during transportation (Seid and Zeru, 2013).

2.5.2. Spatial market share of mango in Ethiopia



Source: A. Aithal and J. Wangila/ICRAF, 2006

Figure 3: spatial market share of mango in Addis Ababa wholesale market in Ethiopia

2.5.3. Marketing constraints

The production, marketing and consumption of mango fruits are restricted due to improper handling, inadequate transport and storage facility, disease problems, and sensitivity to low storage temperature (Baldwin and Mitra, 1997). Growing and marketing of fresh fruits like mango in Ethiopia are complicated by post harvest losses both in terms of quality and quantity between harvest and consumption. The quality of fresh fruit depends up on the harvesting activities, post harvest handling, transportation and storage (Haider and Demisse, 1999). Compared with other temperate fruits, tropical and subtropical fruits such as mango are currently with great problem in storage and transportation because of their perishable nature (Baldwine and Mitra, 1997).

According to Alazar (2007), the following are the major constraints of mango marketing in Ethiopia

- ✓ Lack of markets to absorb the production

- ✓ Low price for the products,
- ✓ Large number of middlemen in the marketing system,
- ✓ Lack of marketing Institutions safeguarding farmers' interest and rights over their marketable produces
- ✓ Lack of coordination among producers to increase their bargaining power
- ✓ Poor product handling and packaging
- ✓ Imperfect pricing system
- ✓ Lack of transparency in market information system mainly in the export market
- ✓ Prevailing informal transaction in the export system

2.6. Mango value chain in Ethiopia

The concept of value chain encompasses the issues of organization and coordination, the strategies and the power relationship of the different actors in the chain. Value chain refers to the full range of activities that are required to bring a product (or a service) from conception, through the different phases of production, to delivery to final consumers and disposal after use. Further, a value chain exists when all the stakeholders in the chain operate in the way to maximize the generation of value along the chain (Kaplinsky 1999, pg. 121; Kaplinsky and Morris 2001, pg. 4). This definition can be interpreted in a narrow or in a broad sense. In the narrow meaning, a value chain includes the range of activities performed within a firm to produce a certain output. This might include: the conception and design stage, the process of acquisition of input, the production, the marketing and distribution activities, the performance of after-sale services, etc. The 'broad' approach to value chain looks at the complex range of activities implemented by various actors (primary producers, processors, traders, service providers, etc) to bring a raw material to the retail of the final product. The 'broad' value chain starts from the production system of the raw materials and will move along the linkages with other enterprises engaged in trading, assembling, processing, etc.

2.6.1. Core Value Chain Stages

Inputs, sources of Input Supply and production

Agricultural inputs are important elements for production and productivity. As a result the typical inputs utilized for production of the mango were seed/seedling, labor, land, and compost/manure. The major sources of inputs for mango production in Ethiopia are farmers by, own endeavors, agricultural offices and markets. In general the sources of inputs for mango production in Ethiopia are agricultural development offices, markets, agricultural research institutes, own stocks, IPMS, and other farmers (Ayelech, 2011).

Similar study by Timoteos (2009) showed that most of the farmers have plant two types of local varieties, which are not identified by names. These local varieties are fibrous and have large kernels compared to the ratio of fruit flesh. Most common varieties of Mango available in Ethiopia are Kent, Keitt, Tommy Atkins, and Apple Mango (FAO, 2010). The source of varieties of mango in Ethiopia can be categorized into two major groups: exotic and endemic ones. State farms and newly emerged private commercial farms usually use exotic varieties (Tommy Atkins), while the small farm holders are mainly confined to local or traditional varieties (such as kent, keitt, etc) (Elias, 2007).

A summary of the main issues faced at this point in the chain are outlined below as depicted by the James et.al, 2008**:**

- ✓ Uncharacterized, non-commercial hybrid varieties
- ✓ Poor cultivation, harvesting and post-harvest handling techniques and processes
- ✓ Poorly resourced Agricultural Research Institutes and dearth of agricultural extension support in mango production
- ✓ Underdeveloped market information feedback loops, leaving farmers with very little understanding or incentive for improving their productive capacity or quality
- ✓ No commercial nurseries offering improved varieties)

Collecting/Bulking

The role of collection and bulking in the industry has largely been taken by the small number of large traders who supply their mango to the markets. The traders organize teams of 'brokers' to pick mangoes at the farms and then pack them onto trucks which leave directly for marketing. Whilst this is an effective operation for the traders, it does mean that farmers are unable to derive further value from their crop through effective picking, grading, packaging, bulking and marketing (James et.al, 2008).

Sorting and Loading

Sorting and loading of mango produce are principally carried out on farm gates and at primary procurement

centers through premises of primary procurers (Local collectors). Thus, it is sorted according to consignment needs of collectors where under-grades such as: Shrunken, smaller sizes, with splits and punctures are reasonably expelled from transactions. But under-grads are commonly consumed in farming household as best child foods and culinary uses (Ayelech, 2011).

Exporting of mango fruit

At present, very little mango is exported from Ethiopia with only 4 tonnes exported in 2006 at a value of less than US$1000 according to FAO. This represents a significant decline since 2002 when 811 tonnes were exported at a value of US$675,000 (US$832 per tonne). This appears to have been a particularly high value year however, as the longer term average price for mango exports has been approximately US$323 per tonne. One of the main reasons for the drop in mango exports has been the variable quality of Ethiopian mango exports on arrival in overseas countries. It was reported that Et-Fruit (the state owned Ethiopian Fruit marketing agency) had been exporting mangoes to countries such as Djibouti, Saudi Arabia and UAE but had lost some of those contracts due to the poor quality of the shipments on arrival. This situation highlights the key challenges faced in trying to develop the export market for Ethiopian mangoes: Under-developed packaging and cold chain for exporting, high cost of freight to overseas countries, competing product from Egypt and South Africa and Minimal production of commercial varieties (FAO, 2009).

Consumption of mango in Ethiopia

In Ethiopia, the domestic market, consumption is largely in its fresh form due to the fact that the cost increment for processing and packaging would make it beyond the purchasing power of the vast majority of the Ethiopian consumer group (low-income). However, since 1997 the demand for canned fruits in Ethiopia has increased by 7% suggesting there is a sufficient domestic market for canned mangoes to be produced (Tiruneh, 2009).

Processing

The mango fruit processing industry in Ethiopia is very weak, considering the substantial amount of fruit that is grown in the country. One of the reasons for this is the highly developed processing industries in other countries which are able to export into Ethiopia and sell the final product at low cost. Indeed, there were a number of imported, long-life mango juice brands available throughout Ethiopia and is certain to act as a competitive entry barrier for domestically produced juice (James, et.al, 2008). Key challenges for developing a fruit processing sector in Ethiopia as indicated by James et.al (2008) include:

- ✓ Lack of technical knowledge in processing
- ✓ Low level of technical support for maintenance
- ✓ Low capital base from which to invest
- ✓ Many low priced mango juice imports

2.6.2. Mango Value Chain Actors and Their Functions

Study conducted by Ayelech (2011) in Jimma zone of Ethiopia indicated that market participants along mango value chain in the study areas are producer, local collectors, wholesalers, retailers, processors and final consumers of the product. Producers are the primary or first link actors who cultivate and supply mango to the market. Local collectors are farmers or part time traders in assembly markets who collect mango from farmers in village markets for the purpose of reselling it to wholesalers, retailers and consumers. They use their financial resources and their local knowledge to bulk mango from the surrounding area. Wholesalers are known for purchase of bulky products with better financial and information capacity. They are major actors in the channel and they purchase mango either directly from farmer or local collectors. They procure and consign large amount of mango to the regional market and to terminal markets. Retailers are the ultimate actors in the market chain that purchase and deliver mango to consumers. Processors are those value actors like cafes, restaurants and juice houses which change mango fruit into processed goods like juice. Consumers are those households who bought and consume mango. They are individual households who bought the commodity for their own consumption only. James et.al, (2008) study of mango value chain in Ethiopia identified mango value chain actors as mango producers/growers, wholesalers (local mango collectors, regional mango collectors/bulkers), retailers, processors such as hotels and consumers. According to Bezabih (2010) the major actors in the mango value chain are the producers, traders and consumers. The producers are mainly smallholder farmers who supply the product to the local traders, cooperatives, retailers and consumers. The traders sell to Ethio-fruit, wholesalers, retailers or consumers.

2.6.3. Mango value addition in Ethiopia

Mango fruits are very much relished for their, exotic flavor and delicious taste. They are also an excellent source of dietary fiber, provitamin A and vitamin C. A fruit with many versatile properties has naturally found

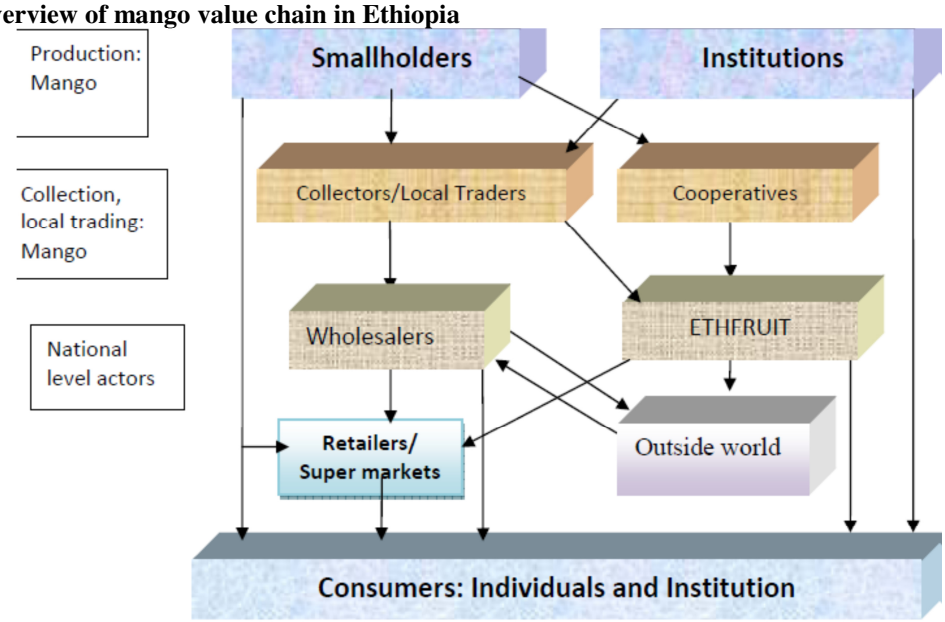
application for processing into several products. Mango could be processed in to wide diversity of products. Mangoes are processed at two stages of maturity. Green fruits are used to make chutney, pickles, slices and dehydrated products. Ripe mangoes are processed as canned and frozen slices, purée, juices, nectar, jam, jelly and various dried products (Elias, 2007).

Table 10: Utilization of mangos for processing and by products utilization

Green Fruits	Ripe Fruits	Waste	
		Peel	stone
Chutney	Slices in syrup	Pectin	Starch
Pickle	Juice , nectar , pulp, squash	Syrup	Fat
Slice in brine	Jam , jelly	Aroma concentrate	
Dehydrated slices or powder	Fruit bar, powder Aroma concentrate	Colorant	
Beverages	Fruit concentrate	Biogas	

Source: Elias, 2007

2.6.4. Overview of mango value chain in Ethiopia



Source: Bezabih, 2010

Figure 4: Mango Value Chain in Ethiopia

3. The current status and potential opportunities of mango in Ethiopian Economy

James et.al, 2008 found that the mango sub-sector is a good entry point for tackling poverty and that the market for mangoes in Ethiopia is significant and growing. The same study also showed that mango value chain can spur development, introduce technologies, create employment and reduce poverty among the communities.

Mango fruit crop has significant importance with a potential for domestic and export markets and industrial processing. Mango was selected for technical assessment for viability of product development from other fruit crops. Currently mango is considered as potential crops for export and local market. The crop is being promoted by the Fruit and Vegetables and Horticulture Development Department of the Ministry of Agriculture and Rural Development (MoARD) and The Netherlands Development Organization (SNV) in its program to support Business Organizations and their Access to Market (BOAM). Furthermore, mango crop was selected as potential commodity for investment based on two overriding yardsticks which are 'potential market opportunity' and 'outreach to small holder farms' (Elias, 2007). In addition to this, currently mango in Ethiopia has the following attributes:

- ✓ High added value either through agro-processing or knowledge
- ✓ High market value
- ✓ Long term comparative advantage
- ✓ Enhanced group activities and position of women
- ✓ Social acceptance and support by government polices

SNV's BOAM programme is supporting the introduction of new and faster technology (top-working) to change

the old mango trees into improved and marketable types (Timoteos, 2009). MoARD identified Mango as one of the fruits and vegetable products with potential for export and aimed to increase the land under mango cultivation to reach more than 12,000 ha in the selected regions of Oromia, SNNPR, Amhara and Tigray. The current area covered by mango in Ethiopia is estimated to be about 3000 ha and it is planned to plant 9, 835 ha in the immediate future, and replace gradually the old mango stock. Awash Melkasa Agriculture Research Institute (AMARI) has adapted three varieties brought from Florida Research Center, namely Tommy Atkins, Kent and Keitt (BOAM, 2006).

4. Conclusions and Recommendations

Mango is one of the second potential fruit crop produced in Ethiopia next to banana which is the first fruit crop produced in large quantity and produced mainly in-west and east of Oromia, SNNPR, Benishangul and Amhara regional states. Currently, mango sub-sector is a good entry point for tackling poverty and that the market for mangoes in Ethiopia is significant and growing and mango value chains is spurring development, introduces technologies, create employment and reduces poverty among the communities. Moreover, mango fruit crop has significant importance with a potential for domestic and export markets and industrial processing. However, the production, marketing and consumption of mango fruits are restricted due to improper handling, inadequate transport and storage facility, disease problems, and sensitivity to low storage temperature.

Farmer awareness about spacing of orchards, pruning, fertilizer application, access of new varieties and pest and disease control is very low. In order to increase the production of mango, many actions have to be taken. Training about agronomic practices such as proper spacing, time of pruning, methods and time of fertilizer application, identification of pest and disease and control mechanism, methods and time of harvesting, kind of packing materials used, are vital to increase the productivity of mango. Distribution of pest and disease resistance and early maturing varieties is another method to increase production potential. Facilities like road, canal and transportation system should be improved for further dimension and to reduce the loss.

Structured market arrangements and strengthened local market actors (producers' organizations) are highly needed so as to increase the volume of sales in the formal markets and add to the income of the smallholder producers.

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