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# Chapter 10

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## Comparative analysis of mango value chain models in Benin, Burkina Faso and Ghana\*

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# Table of Contents

<b>1. Introduction</b>	<b>317</b>
1.1 Objectives and research questions	317
1.2 Overview on high value crops	317
<b>2. Methodology</b>	<b>319</b>
2.1 Sample choice	319
2.2 Data collection methods	319
2.3 Methodology for assessment of value chain models	320
<b>3. Mango sector in Benin, Burkina Faso, and Ghana</b>	<b>321</b>
3.1 Benin	321
3.2 Burkina Faso	322
3.3 Ghana	324
3.4 Summary	325
<b>4. Typology of value chain models</b>	<b>326</b>
4.1 Degree of external interventions	327
4.2 Level of internal resource exchange	327
4.3 Level of smallholder cooperative action	328
<b>5. Case studies in Benin, Burkina Faso and Ghana</b>	<b>328</b>
5.1 Case studies selection	328
5.2 Description of the case studies	330
A. Case study 1: Traditional market chain model – Benin	330
B. Case study 2: Intensive contract-farming model – (ITFC) Ghana	331
C. Case study 3: Dangwe West mango producer association – Ghana	332
D. Case study 4: Strong base model - Burkina Faso (COOPAKE)	333
E. Case study 5: Semi-intensive contract farming – Burkina Faso	335
<b>6. Assessment of the chain models</b>	<b>336</b>
6.1 Market efficiency	336
6.2 Business performance	337
<b>7. Conclusions and recommendations</b>	<b>340</b>
<b>8. References</b>	<b>343</b>

# 1. Introduction

## 1.1 Objectives and research questions

This chapter investigates the mango value chains in the West African region. Mango (*Mangifera indica* L.) is a high-value crop that is traded on domestic, regional - and increasingly international - markets. As such this value chain can be seen as exemplary for examining the issue of fostering smallholder-inclusive value chains, enhancing sustainable entrepreneurship, and allows for conclusions about the development of different models of value chains in sub-Saharan Africa.

The largest share of mango production is traded and consumed fresh; the remainder is mostly processed into dried mango or juice/pulp. Over 90 percent of mango production is grown by smallholder farmers with low investment capacity (Vayssières *et al.* 2008). We have selected three West African countries (Benin, Ghana and Burkina Faso) that produce mangoes under generally similar climatic conditions. All three countries are potential suppliers to the European markets because of their relative proximity. Different value-chain models have developed in recent decades in these countries, regarding supply to European markets, relationships with partners in the chain and the level of upgrading of mango production and processing.

The case studies take into account the fact that smallholders are highly heterogeneous, both within and across locations; therefore, conclusions for policy and institutional support are possible which account for different circumstances. By comparing some of the most typical models, we will provide insight into opportunities that exist for smallholders to benefit from value-chain development of high-value products.

The general objective of this chapter is to analyse and compare the mango value chains in Benin, Ghana and Burkina Faso.

More specifically, we will try to answer the following questions:

- What are the currently existing value-chain models for mango sectors in Benin, Ghana and Burkina Faso?
- What are the implications of these chains on the socio-economic position of smallholders?
- What can we learn with respect to institutional innovations and policy interventions in support of smallholder market participation?

## 1.2 Overview on high value crops

The liberalization of trade and the increasing integration of the global economy offer opportunities to generate higher income to many people around the world. These developments also offer consumers better access to higher quality and increasingly differentiated final products (Kaplinsky, 2000). One of the most important new opportunities for many developing countries is the increased demand for non-traditional high-value agricultural crops on international markets.

The agrifood system currently faces many challenges. Increased population and urbanization, as well as better education in health and nutrition, is leading to an increasing consumer preference for healthy processed and ready-to-eat products in both developing and developed countries. In industrial countries the demand for specialty products and year-round supply of fruits and vegetables is increasing (World Bank, 2008). Trade and investment liberalization and the trend toward export-oriented trade policies have played a role in stimulating countries worldwide to diversify the traditional export commodities

such as cocoa, coffee and sugar, by exploiting their comparative or competitive advantages in the export of high-value crops. High-value crops are products obtained from horticulture (fruits, vegetables and flowers), livestock rearing, fisheries and organic products. The main importing countries of fresh fruit and vegetables are France, Germany, the Netherlands and the United Kingdom.

Brazil, Chile, China and Mexico are strong players on the export markets for these high-value crops, but sub-Saharan African (SSA) countries such as Ethiopia, Kenya, Madagascar, Senegal and South Africa are also gaining access to selected markets (Swinnen *et al.*, 2007; Labaste, 2005). In addition, demand for processed horticulture products is growing in domestic and regional<sup>2</sup> as well as international markets.

Statistics show that the volume of exports of fresh fruits and vegetables from selected SSA countries to the European Union (EU) has increased from 1998 to 2009 (Bruinsma, 2008). For example, Kenya exported approximately 134 000 tonnes of fresh fruits and vegetables in 2006/2007. The main products include green beans, snow peas, okra, chillies, mangoes and cut flowers. Large investments have been made in the cut-flower, pre-packaged fresh fruits and vegetables sectors, following demand in European markets.

The development of value chains in many other SSA countries faces different constraints which threaten the position of SSA producers on the world market, such as the high costs of certification, and high transaction costs along the chains (e.g. due to poor infrastructure and transport, or to informal taxes). The quality and quantity of horticulture products from many SSA countries is highly heterogeneous, resulting in a poor reliability of supply. In order to overcome quality heterogeneity and increase efficiency of production, some countries have made the transition to large-scale production for some of their crops. This is creating employment opportunities, but frequently leads to exclusion of smallholder producers from export value chains.

Another challenge is strong competition from countries in Asia and South America which have lower production costs and better economies of scale. An example is the export of fresh pineapples from Côte d'Ivoire to Europe. Exports increased from the 1970s to the 1980s, with a peak of 193 775 tonnes in 1986. At that time, Côte d'Ivoire accounted for 95 percent of total pineapple imports in Europe. However, in the early 1990s large companies such as Dole and Del Monte, which had plantations in Central and South America, penetrated the EU market with a new pineapple variety (MD2). The predominantly small-scale producers in Côte d'Ivoire had to compete with large companies benefitting from economies of scale and at the same time had to respond to increasingly stringent market requirements. Consequently, Côte d'Ivoire pineapple exports fell. The sector is slowly regaining a position on the international market with the introduction of its own pineapple brand and the introduction of a tracking and tracing system. This example shows the vulnerability of EU export dependence and the need to be able to respond quickly to changes in the market (Ruben *et al.*, 2007).

As in the case of Côte d'Ivoire, most developing countries face constraints that prevent agricultural commodity chains from being flexible and being able to take full advantage of new or changing market opportunities. Furthermore, targeting exclusively international export markets at the expense of alternative markets need to be reconsidered. Frequently, export markets are targeted because of their higher prices, while in fact their high costs, risks, and low competitive advantage would make it more sustainable and profitable for producers to engage in domestic or regional markets.

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<sup>2</sup> West African region.

These constraints can force smallholders into positions that are economically suboptimal. The inclusion of existing smallholders in new or alternative value chains (e.g. new products, technologies, institutional innovations, organizational systems) could enable them to capture higher returns, but only when this is in line with potentially available resources, equitable distribution of benefits and institutional conditions (see e.g. Maertens and Swinnen, 2007; Minten *et al.*, 2006). Moreover, a better economic position for smallholders can have a significant spin-off to off-farm economic activities such as processing, transport or packaging.

Strategies for achieving inclusion of smallholders in new or alternative value chains are diverse, and depend on the characteristics of the producers. Contextual issues and producer access to resources (e.g. inputs, technology and skills) result in heterogeneity among the producers (cf. Hunt and Morgan, 1995). Therefore, it is necessary to customize value-chain models according to the characteristics of the producer, in order to increase the sustainability of the chain and reduce the risk of producer exclusion.

## 2. Methodology

In order to answer the research questions, we will start with a general description of the mango sector in each of the three countries. This will be followed by presentation of a simplified typology of chain models that include smallholder producers. We will discuss some of the most typical models in the three countries, and present the selected case studies. Finally, we will assess the case study models based on selected indicators, so that we can compare the implications for smallholders.

### 2.1 Sample choice

In order to allow for a comparison of the effects of different value-chain business models on the position of producers, ideally we would select a homogeneous sample of smallholders. The scope of this study covers several different countries, however, so it was impossible to select a fully homogeneous sample, because contextual factors such as climate and soil conditions influence the performance of the producers in the chain.

In order to make a valid comparison, we have used the following criteria for the selection of the smallholder producers:

- The acreage of the mango orchard does not exceed 10 ha;
- Mango is produced with a commercial objective;
- The mango orchard consists of predominantly improved mango varieties ( $\geq 50\%$ ).

More details on the exact sample size for each case study are presented in section 6.1.

### 2.2 Data collection methods

Data from smallholders were collected through administration of semi-structured questionnaires and focus group discussions during the period from 27 February to 11 March 2010. The semi-structured questionnaire for the smallholders is composed of a series of open-ended and closed questions. It includes several components, including smallholder characteristics, investments made in mango production over the past five years and efficiency of commercialization, as well as information on the

organization of the chain, and perceptions on current situation and trends. For focus group discussions and interviews with other stakeholders in the chain, an interview guide was prepared with open questions. This enabled an informal but guided conversation with respondents.

### 2.3 Methodology for assessment of value-chain models

In our assessment of value-chain models, we assume that a chain has a positive effect on the socio-economic position of smallholders if:

- it is successfully linking the farmers to markets;
- mango production is a profitable business for smallholders.

In order to measure these characteristics we have selected a number of key indicators. The scope of this study did not permit interviewing a representative sample of smallholders in each value chain, which would allow in-depth statistical analysis. Therefore, we have applied informative research methods. Indicators on economic and financial profitability are generally difficult to measure with a small sample size,<sup>3</sup> and it is also difficult to draw comparisons between different countries. Prices, costs and purchasing power vary greatly between countries. For this reason, we have selected a number of indicators which can be measured by surveying the perceptions of the smallholders in the chain models.

The table below shows the indicators and proxies that have been selected to assess the chain models.

**Table 1. Model indicators for analyzed value chains**

Characteristics	Indicator	Proxy
1. Successfully linking farmers to markets	1. Market efficiency	Fruit losses at farmgate
2. Profitable business for smallholders	2. Business performance	a. Level of investment b. Contribution of mango farming to total income c. Perception of current situation and trends

#### 1) Market Efficiency

This indicator highlights the effectiveness of the smallholder producer at reaching outlet markets. If farmers are able to add value to their full production, they can reach market more efficiently. Therefore we have calculated percentages of fruit lost as well as the perceived reasons for losses.

#### 2) Business performance

##### *a. Level of investment in mango production*

This indicator has been selected because it demonstrates the importance of mango production for the farmer. It demonstrates the farmer's devotion to the business, how s/he is judging the expected income and the risks, and to what extent s/he is dependent on mango production. Therefore, if we assume that producers only invest when they judge mango farming to be a profitable activity, their willingness to invest can be used as a proxy for business performance. To measure the level of investment, we asked producers whether during the past five years they have made investments such as weeding, pruning of trees and making a fire belt, which can be considered to be the basic field maintenance activities. In addition, we asked them whether they have made any additional investments, such as treatment

<sup>3</sup> Not all respondents were able to answer all questions in the questionnaire, or questions were not of sufficient quality to be included in the analysis.

against pests and certification of the fruit, which require specific resources. The sum of these answers (0=no, 1=yes) we have used to calculate an index, which we can use to compare the different groups of smallholders.<sup>4</sup>

We have counterbalanced this index with two additional indexes showing the extent to which the investments have been subsidized by business partner/government/non-governmental organizations (NGOs) (0=no, 0.5=partly, 1=yes), which will allow us to calculate the Net Investments (actual farmer investments). Also, we have asked the respondents to what extent this subsidized investment was by request of the producers themselves (0=no, 1=yes).

We base this approach on the recent observation of development practitioners<sup>5</sup> that highly subsidized interventions to support smallholder inclusion in value chains may have “quick wins” but do not guarantee the sustainability of the intervention. This means that after projects end, the gains for small producers may fail to continue because of a lack of ownership and market distortion in local input and service markets.

#### ***b. Contribution of mango farming to total income.***

Traditionally, smallholders are involved in the production of a mixed portfolio of staple food crops, cash crops and livestock. The contribution of mango production to the total income will point to the importance of the crop for the producer and therefore indicate the business performance of the smallholder.

#### ***c. Perception of current situation and trends***

The perception of the smallholders about their current mango farming activities, their satisfaction with their income from mango production and their vision of their future as mango producers will give us additional information about the satisfaction of the producers with the remuneration they receive for their activities within the chain. We have proposed a number of statements to the smallholders and asked them whether they agreed or not (not true at all=-2, not true=-1, indifferent=0, true=1, very true=2).

## **3. Mango Sector in Benin, Burkina Faso and Ghana**

Below we briefly describe the general context of mango production in the three countries studied. We review the economic environment, followed by an overview of the mango sector in each country.

### **3.1 Benin**

#### **A. Policy framework/macro-economic context**

Benin has a coastal West African economy, based on the agriculture sector which employs around 80 percent of the population. Approximately 65 percent of the population lives in rural areas and relies on small-scale agriculture for income. Farmers suffer from a limiting environment and income levels are usually insufficient to invest in quality inputs such as seeds, fertilizer or farm machinery (UNDP, 2008).

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<sup>4</sup> We have tried to limit the variable that some investments are more relevant in other countries.

<sup>5</sup> See for example the M4P approach (DFID and SDC, 2008).

Cotton is still one of the main export commodities, despite falling prices on the world market and inefficiencies in the value chain. Industry is underdeveloped and restricted to simple import substitution products and basic agro-industrial factories. In the 1990s, the government commenced the privatization of state enterprises such as breweries and textiles, tobacco, cement and petroleum producers, which has significantly reduced government spending and increased foreign direct investment.

## **B. Mango sector**

Substantial volumes of mango are produced in Benin, which are mainly sold domestically but also regionally to Niger and Nigeria. Reliable data are absent but FAO estimates the area covered with mango<sup>6</sup> to be 2400 ha in 2008 with an annual production of 13 000 tonnes (FAOSTAT). The mango is produced by smallholders who usually have a mixture of mango varieties in their orchards.

The main area of production is situated in the north of Benin. In the 1990s the government of Benin established a large factory to process pulp/juice of mango and other fruits and vegetables. After a few years of limited production, the factory was privatized, but because of inefficiencies and management issues, the factory has since closed. Initially the government promoted the plantation of mango orchards to ensure provision of raw material; therefore in the zone of the factory many plantations can still be found.

The main fraction of commercialized mango is traded within the country, mostly to urban markets in the south. A small fraction is traded to Niger and Nigeria in bulk for low prices, especially to regions where food insufficiencies exist. Benin does not currently export mango to Europe and only a marginal amount of mango is processed into juice or dried mango for the domestic market.

High losses of mango are reported in Benin. In 2006 Boueyi *et al.* observed that much fruit is lost before the end of the marketing trail, often even at the farmgate because producers are unable to find buyers and an acceptable price. Fruit fly infestations are also causing heavy losses in mango production, both in terms of fruit quality and yield. In Benin (department of Borgou), loss averages in 2006 varied from 20 percent in the beginning of April to more than 50 percent in June (Vayssières *et al.*, 2008). The high infestations can be linked to increasing populations of *Bactrocera invadens*, a new invasive fly species coming from Sri Lanka. Research and initial experiments with control methods such as biological pesticides, baits, weaver ants and parasites have shown promise. However, producers in Benin currently have no access to these inputs.

Mango producers in Benin are not organized and face constraints, such as lack of access to credit and technical support, as well as high losses, which restrain the effective linkage of the producers to new markets and reduce the potential creation of value from mango.

## **3.2 Burkina Faso**

### **A. Macro-economic context**

Burkina Faso is a landlocked country bordered by Benin, Ghana, Ivory Coast, Mali, Nigeria and Togo. It has enjoyed good social and political stability for nearly two decades, and the country has undergone a process of democratization and structural reforms (UNDP, 2009). Burkina Faso benefits from a sizeable annual amount of Official Development Assistance (ODA), which was 15 percent of Gross Domestic Product (GDP) in 2007, a percentage that has increased steadily since 2004 (when it was 12%) (UNDP, 2009).

<sup>6</sup> FAO Statistics for product group "Mango, Mangosteen and Guava". The latter two products are produced marginally in Benin.



Despite development efforts, at least 50 percent of the rural population lives below the poverty line. Sixty-seven percent of the total population depends on agriculture and animal husbandry and 86 percent of all jobs and income in Burkina Faso are generated by agriculture. Cotton is the biggest income-generating crop for export (World Bank, 2009).

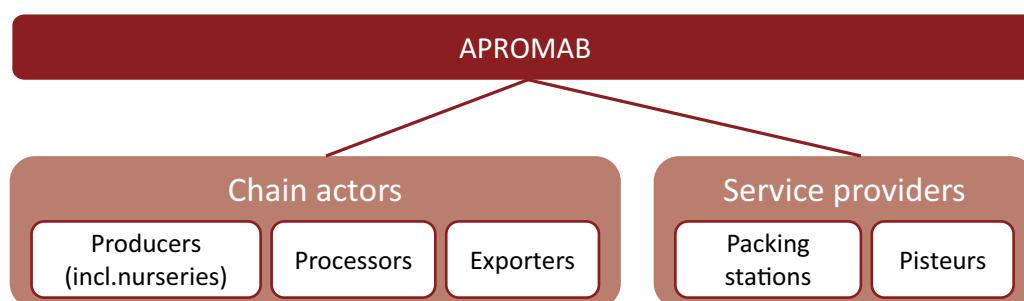
The country is extremely vulnerable to climatic variability; the erratic rainfall pattern regularly leads to food shortages. The production of mango is less vulnerable to drought than other crops, such as maize and cotton, and mango does not exhaust soil nutrients as much as cotton does.<sup>7</sup>

## B. Mango sector

Besides cotton, mango is one of the few exportable crops produced in Burkina Faso. Mango production is part of the traditional farming system and is mostly grown on small-scale farms. Different quality grades of mango are exported from Burkina Faso: organic and/or fair-trade certified mango as well as conventional mango. Also, a substantial share of mango is processed into dried mango, juice and pulp, for domestic and export markets.

The mango sector in Burkina Faso is generally structured as follows: in the villages the producers are organized in village farmer groups and several groups together form a cooperative. Several co-operatives together in turn form a union and finally the unions become a (usually national) federation. In Burkina Faso, an official federation for mango producers does not exist; however the Union of Vegetable and Fruit Producers (UFMB) operates formally as a federation.

**Figure 1. Composition of APROMAB**



In addition to this, in 2006 the *Association des Professionnels de la Mangue au Burkina (APROMAB)*, was created, which is a communication and lobby platform composed of representatives of all major chain activities (see Figure 1), as well as service providers (packing stations, “pisteurs<sup>8</sup>”). The establishment of APROMAB has been promoted by support programs such as the World Bank and the Dutch development organization SNV.

*PAFASP* The Agricultural Diversification and Market Development Project (*Projet d’Appui aux Filières Agro-Sylvo-Pastorales, PAFASP*), is a six-year project that started in 2006 and received

<sup>7</sup> However as transfer of CO<sub>2</sub> from the atmosphere, we have to note that CO<sub>2</sub> sequestration does not represent a long term carbon sink and therefore does not contribute to long term reduction in greenhouse gas concentrations.

<sup>8</sup> Pisteurs are wholesale traders who usually collect mangoes at the farmgate and sell to exporters and retailers.

USD 66 million in financing from the World Bank. The project objective is that by the end of 2012 the total volume of exports on the international and inter-regional markets for four selected products, including mango, will achieve significant increases.

For mango producers, the program provides subsidies of 65 percent for field maintenance, 95 percent for training and 90 percent for phytosanitary treatments. To control fruit flies, PAFASP has procured a biological product and invested in training of technicians. The project has also financed large infrastructures, such as packaging and cold storage facilities in Bobo-Dioulasso, to improve the export product safety system.

In Bobo Dioulasso, a major town in the mango production zone, three major packing stations have been established. One of these is funded by the PAFASP project, and was built to serve all fruit and vegetable chain actors in the region. It is the largest station in the area, with modern equipment for proper sorting, grading and packing. The building is currently rented by a private company and has handled more than 10 000 tonnes of mango.<sup>9</sup> Two other private pack houses in Bobo Dioulasso are Fruiteq and Ranch de Kobalt. In the pack houses, the mature mangoes for export are selected, cleaned and packed, after which the largest share is transported by train to the harbour in Abidjan (Cote d'Ivoire) and shipped by sea. Small volumes of ripe mangoes are transported by air for better control of anthracnose.<sup>10</sup>

### 3.3 Ghana

#### A. Macro-economic context

Ghana is a coastal West African country bordered by Togo to the east, Cote d'Ivoire to the west and Burkina Faso to the north. Ghana has emerged as a politically stable country within Western and Central Africa. It managed to achieve a peaceful political transition in 2008-2009, and it has a strong political and policy environment for social and economic development and poverty reduction. The country is rated highly on the Doing Business ranking of the World Bank (ranked 7th for all sub-Saharan African countries). The country's economic growth and poverty reduction indicators have been among the best in SSA for the past 15 years. Poverty reduction took place mostly in urban areas, however, while in rural areas (Northern, Upper East and Upper West regions) poverty is still prevalent. About 51 percent of the poor live in rural areas, and the poorest are small scale subsistence farmers. Small scale farmers constitute 85 percent of all agricultural land holders in Ghana.

The agricultural sector is considered a major engine of economic growth and contributes an average of 35 percent to GDP. Main agricultural export commodities are cocoa, cocoa butter and sugar as well as bananas and pineapples.

#### B. Mango sector

Commercial farming of grafted mango varieties has been increasingly adopted by Ghanaian farmers since the late 1990s, mainly due to programs on food security sponsored by the United States Agency for International Development (USAID) and efforts of the Ministry of Food and Agriculture (MOFA) and other Ghanaian government programs. Over the past seven years, because of increased demand for mango on overseas markets, the mango sector has captured the attention of farmers and traders.

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<sup>9</sup> Information dated March 2010.

<sup>10</sup> Anthracnose is a disease caused by fungi.

Ghana has three main production zones, namely:

- the southern belt around the capital Accra (+/- 2400 ha of planted orchards at early stage of development)
- the Brong Ahafo region
- the Northern Zone, spearheaded by the Integrated Tamale Fruit Company's (ITFC) organic mango production program with at least 1200 outgrowers

Mangoes from Ghana have different destinations: firstly, the local urban market of Greater Accra, usually traded through a network of wholesalers and retailers; secondly, export markets for fresh fruit, primarily to Europe, including the fair trade and organic niche markets. To facilitate these exports, public and private investors have undertaken efforts to set up cool storage facilities at the harbour. Finally, a large share of mango is sold to processing firms. Fruit processing has developed into a competitive industry in Ghana. The country successfully exports fresh-cut fruit (through BlueSkies Ltd.), and produces juice and pulp for domestic, regional and international markets (e.g. through Sunripe Ltd.).

Ghana has a comparative advantage over neighbouring countries because it has two harvest seasons in the south (peak and minor season). Several producer associations have emerged over the past decade, each of which federates more than 100 farmers, for whom they sell collectively, organize farm services such as pruning and spraying, and in some cases establish a pack house. The mango associations in the south and outgrower schemes in the north have a strong focus on exports, whereas other organizations in the Brong Ahafo region aim to improve household welfare by promoting local marketing of the fruit.

### 3.4 Summary

Table 2 summarizes some key characteristics relevant to the mango sector in the three selected countries:

**Table 2. Key features of the mango sector in three countries**

	Area under mango cultivation (Ha)	Location	Level of processing	Cooperative action of producers	Public support to mango sector
<b>Benin</b>	2400 <sup>11</sup>	Sea-bordered	Low	No	Low: -No NGO programs -Not selected by Gov't as focus crop
<b>Burkina Faso</b>	13,500 <sup>12</sup>	Landlocked	Medium/High	Yes	Medium/High: -WorldBank /Gov't subsidy program PAFASP -In portfolio of national extension and research institutes -Many NGO programs with producer organizations and exporters
<b>Ghana</b>	4,208 <sup>13</sup>	Sea-bordered	High	Yes	Medium/High - USAID and gov't program to promote exports. -NGO programs to establish trade linkages, certification and Good Agricultural Practices (GAP)

<sup>11</sup> Source: FAOSTAT (2008). Estimation; reliable statistics are not available.

<sup>12</sup> COLEACP (2010) [http://www.coleacp.org/fr/system/files/file/COLEACP/LE\\_2010\\_05\\_ENG.pdf](http://www.coleacp.org/fr/system/files/file/COLEACP/LE_2010_05_ENG.pdf).

<sup>13</sup> Source: TIPCEE.

## 4. Typology of value chain models

Gereffi *et al* (2003) used the governance structure of value chains as a tool to categorize different types of global value chains. The classification of governance structures is based on 1) the complexity of transactions, 2) the ability to codify transactions and 3) the capabilities in the supply base. This results in five types of value-chain governance systems, varying from high to low in explicit coordination and power asymmetry between the chain actors.

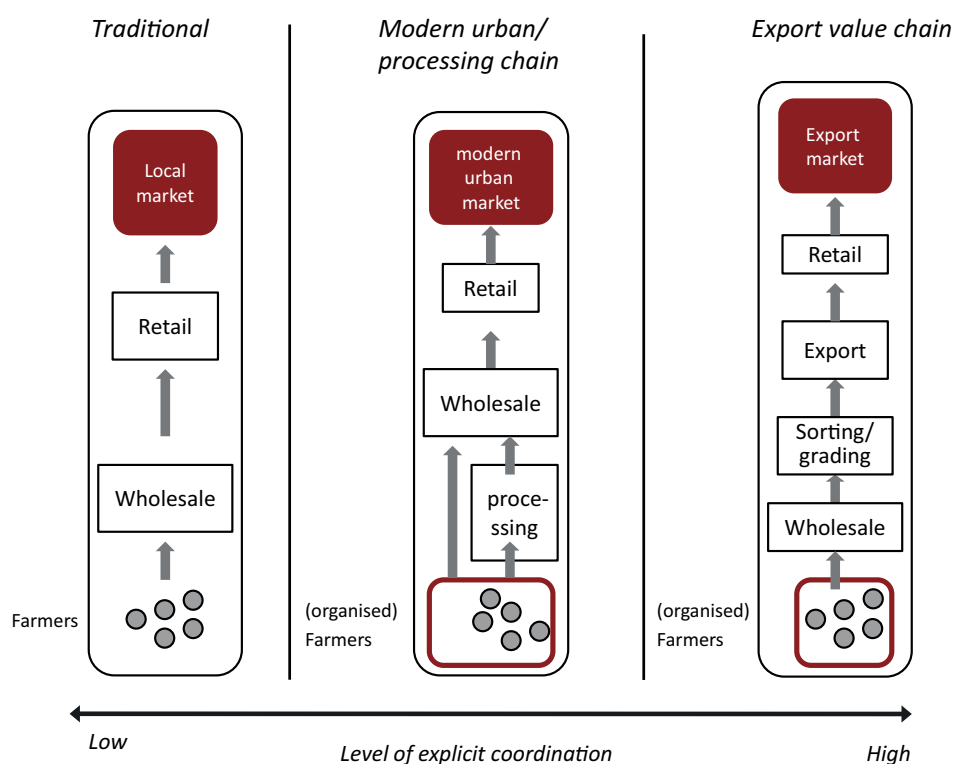
To make a classification of mango value chains in West Africa we have used this approach and have selected the targeted end-market as the main characteristic to define a typology of mango value-chain models. This characteristic encompasses an indication about the complexity of the transaction and degree of coordination needed in the chain. We can broadly distinguish three different types of end-markets, varying from a low to high level of quality requirements for the smallholder producers.

- Local markets: The fruits that are sold on local markets have no stringent quality requirements and consumers on local markets do not prefer certified or highly homogeneous supplies of mangoes.
- Processing/modern urban end markets: Some smallholders predominantly produce mangoes to be sold on domestic/regional modern urban markets, or to be used for processing into juice or dried mango. The quality requirements for their mangoes are usually less rigorous than for export fruit, especially with respect to visual fruit appearance, and certification is not a prerequisite.
- Export markets: Mango is a highly perishable fruit and vulnerable to pests and diseases, such as fruit flies (a quarantined pest) and anthracnose. In order to deliver to exporters of fresh or fresh-cut mangoes (especially in the EU and the United States), farmers need to comply with stringent quality norms and standards and typically require certification of their mangoes.

**Table 3. Three categories of mango value-chain models**

	End-product/market	Chain model
<b>A</b>	Fresh mango for local markets	Traditional value chain
<b>B</b>	Fresh mango for modern urban markets or processed mango (dried/ juice) for export markets	Modern urban/Processing value chain
<b>C</b>	Export value chain (fresh/fresh cut)	Export value chain

Figure 2. Schematic representations of three mango value-chain models



The level of explicit coordination varies from low in the traditional model (no fixed buyers) to high in the export value-chain model, which usually includes formal and informal contracts between the lead firm and the producers.

Within these three broad types of value chains, there are additional explanatory factors which explain differences in the development, structure and performance of value chains. The most important factors are discussed below.<sup>14</sup>

#### 4.1 Degree of external interventions

Smallholder producers and other actors often lack the necessary resources to be included in value chains and access emerging markets, and the markets may fail to efficiently provide or allocate goods or services. Public actors such as governments, donors and NGOs can become involved by trying to remove these constraints that hamper the development of value chains. Some common constraints and related external interventions in the mango sector are listed in Table 4.

#### 4.2 Level of internal resource exchange

Besides of the interventions from outside the chain, an actor can be supported by other actors within the chain through the provision of resources such as information, skills or inputs. We call this internal resource exchange where we define resources as all capabilities, inputs assets and services which can be used by the smallholders in their farming business. Usually it is the buyer who provides these resources through

<sup>14</sup> Factors such as the production system and capabilities at the supply base (e.g. training mango production), were not included as explanatory factors of the chain model, since these often result from the value-chain model rather than creating it (intrinsic growth).

contractual agreements in order to be able to control the supply of mango at the required quality and quantity. An example of a value chain model with a high level of resource exchange is an outgrower scheme, which usually results in a high degree of risk-taking and investment by the lead firm.

**Table 4. Common constraints and external interventions in mango value chains**

Common constraints in mango sector	External interventions to remove these constraints
Poor production, harvesting and marketing skills	Capacity development, technical advice, farmer field schools, entrepreneurship education, research and development
Asymmetrical information	Set-up market information systems, knowledge of consumer preferences, access to information and communications technologies (ICT)
High transaction costs	Improved infrastructure (roads, railway, storage facilities), improved transportation, reduction of informal taxes, more efficient custom practices
Low investment capacity of chain actors	Access to (micro-) finance, subsidized access to agricultural inputs, exemption from taxes for agribusinesses
Poor quality performance	Access to (biological) control methods for pests and diseases, appropriate storage facilities, training farmers on good agricultural practices, packaging technologies

### 4.3 Level of smallholder cooperative action

The level of cooperative action of smallholders varies between value chains. Some farmers prefer to operate individually whereas in other cases they have formed strong cooperative structures. The motives for the level of smallholder cohesion are diverse, varying from socio-cultural reasons to the business orientation of the farmers. It should be noted that a high level of smallholder cooperation can be an intrinsic development resulting from the value chain to which the farmers belong (e.g. when farmers want to certify their produce, being grouped as farmers can be a pre-requisite).

## 5. Case studies in Benin, Burkina Faso and Ghana

### 5.1 Case studies selection

Our case studies were carried out in Benin, Burkina Faso and Ghana. The three countries are located within an elliptical-shaped belt across West Africa, located in the Sudano-Guinean agro-ecological zone, optimal for mango trees due to the agroclimatic conditions (Vayssières *et al*, 2008).

Based on the three types of chain models, we have looked at the models that typically occur in the mango sector in each country. In Benin only the traditional model is common, whereas in Burkina Faso most mango smallholder production has developed into types of value chains with a higher degree of coordination (see Table 5).

**Table 5. Most common chain models in Benin, Burkina Faso and Ghana**

Chain model	End product/market	Benin	Burkina Faso	Ghana
Traditional value chain	Fresh mango for local markets	✓	✓	✓
Modern urban / Processing value chain	Fresh mango for modern urban markets or processed mango (dried/juice) for export markets		✓	✓
Export value chain	Export value chain (fresh/fresh-cut)		✓	✓

For each of these models we have chosen a representative case study in one or more of the countries. For each case study we selected respondents for semi-structured interviews using a specialist sampling technique, called non-probability sampling. The most important factors have been the respondents' availability to answer the questions. Before starting the surveys, we verified whether respondents would meet the sample criteria, as presented in Section 2 above. In Table 6 the key characteristics of the value-chain models are depicted for each selected case study. Table 7 provides an overview of the sample size.

**Table 6. Overview of five mango chain models**

Selected Case	Model	Country	Degree of external interventions	Degree of internal resource exchange	Level of small-holder cooperative action
<i>Traditional</i> Individual mango farmers around Parakou	Traditional value chain	Benin	-	-	-
<i>Intensive contract farming</i> Integrated Tamale Fruit Company (ITFC) outgrower scheme	Export value chain	Ghana	++	++	+/-
<i>Dangwe West Producers Association</i>	Export value chain	Ghana	+	+	++
Cooperative Agricole de Kenedougou (COOPAKE) Association	Modern urban/ Processing value chain	Burkina Faso	+	+	++
Semi-intensive contract farming Smallholders selling to Dafani SA	Modern urban / Processing value chain	Burkina Faso	+	+	+

Our final research sample is as follows:

**Table 7. Sample selection of mango producers for the five case studies**

Cases	Number of structured interviews with smallholders	Number of focus group meetings with smallholders	Participants in focus group meetings
Individual mango farmers around Parakou	26	4	10,10,12,12
<i>Integrated Tamale Fruit Company outgrowers</i>	4	2	15,10
Dangwe West Producers Association	15	1	8
Cooperative Agricole de Kenedougou (COOPAKE)	42	1	6
Smallholders selling to DAFANI	16	1	22
<b>Total</b>	<b>103</b>	<b>9</b>	<b>93</b>

## 5.2 Description of the case studies

In the following section we will briefly describe the five case studies by summarizing the main characteristics of the producers and the value chains. A short description of the main distinctive features of the value chain organization and the relationship between the chain actors will provide insight into the differences between the five value chain model cases.

### A. Case study 1: Traditional market chain model – Benin

As an example of a traditional chain model, we visited the mango producers in the commune of Tchaourou in Benin. This commune is located in the south of the mango production zone in Benin, 200 km north of the capital, Cotonou. The selected smallholders have their orchards in and around one of the main towns in the commune, which is located along the main road that connects North and South Benin. A total of 26 producers were interviewed, and four focus group meetings were held in the villages of Boukoussera (10 producers), Koro (12 producers) Tchatchou (10 producers) and Goro (12 producers).

#### **Characteristics of the producers**

The majority of the interviewed producers (all male) have agriculture as their main source of income (70 percent); however the contribution of mango production to the total revenue from agricultural activities is less than 20 percent. The main other crops produced in this region are cashew nuts, maize and yams. None of the farmers has received formal training in mango production; however, they have received technical advice from other producers or retired extension agents in the area. The orchard size ranges from 0.25 to 7 ha and averages 1.9 ha. The majority of the producers have trees between 9 and 20 years old. All producers perform basic maintenance activities on their fields (fire belt, weeding, pruning), but none of them applies pesticides or has a certification for their mangoes.



### **Characteristics of the value chain**

The farmers are not organized into producer organizations, and they market their mangoes individually. The mangoes are bought by tradeswomen in their fields or along the roadside and transported to urban centres, mostly in the south.

In general, public sector intervention and support is slow and unobserved along the chain, since mango is not one of the country's focus crops. The national extension service, Centre Régional pour la Promotion Agricole (CeRPA) does not have mango in its portfolio. Generally, the public and private institutions in Benin have not developed the necessary competences and equipment to facilitate accreditation and certification procedures, which further supports the notion that Benin has no comparative advantage in mango production over Burkina Faso or Ghana.

Both from the interviews and the focus group meetings it became obvious that producers are not satisfied with their revenues from mango production. The main reason for this is quality constraints (especially fruit flies) lowering the value of the fruits, as well as the poor negotiation position with the tradeswomen coming from urban areas or bordering countries. Because of the fruit quality issues and the lack of a guaranteed market or contract, producers often have to accept the low price imposed by the buyers coming to their orchards. The producers suspect that traders exaggerate the quality problems to lower the price, or to refuse payment for fruit sold on credit.

Despite these constraints, about 80 percent of the producers plan to continue mango production. Mango-growing has become a part of their lifestyle, the orchards required high initial investments and farmers consider the orchards to be a part of their retirement plan. The hope is that one day the mango value chain will be developed in Benin, and revenue will be comparable to current initiatives for cashew and pineapple.

Around 20 percent of the mango producers are convinced that if quality issues continue to be a problem, they will cut their trees and use the land to grow other tree crops. Some farmers are also considering replacing their improved varieties with local mango trees, since these seem to be less susceptible to fruit flies (even though this variety is in less demand on the market).

During the focus group meetings, transportation to the urban south of Benin emerged as a major constraint; for several years the railway has not been operational, although recently investment in the rehabilitation for the rehabilitation of the infrastructure have been initiated. Currently all mangoes are transported by trucks, vans and cars. The poor packaging materials and road quality result in high losses during transport.

## **B. Case study 2: Intensive contract-farming model – (ITFC) Ghana**

The Integrated Tamale Fruit Company (ITFC) is located in the northern region of Ghana, 45 km north of Tamale. The company was incorporated in 1999, its main activities being the cultivation of organic grafted mango, nursing of seedlings and promotion of indigenous tree species. At the nucleus farm (155 ha of certified organic mango), a micro-irrigation system has been set up (one sprinkler per plant). The company has received high amounts of financial support (loans and grants) from donors to set up an outgrower scheme, in order to contribute to household food security in the region.

### **Characteristics of the producers**

Since 2000, ITFC has been working with 1300 outgrowers in villages surrounding the nucleus farm. ITFC supports the farmers with long-term loans, paid out in the form of inputs that are needed to farm one acre of organic mango, holding 100 trees. The farmers produce exclusively for ITFC as set out in a contractual

agreement. The costs of all inputs are paid back once harvesting and selling of fruit commences (after approximately five years), by repaying a maximum of 30 percent of the farm's income until all debts are paid.

ITFC also provides training and technical advice, establishes irrigation systems or provision of water, and assists with record-keeping for compliance with the organic certification requirements (98 percent of the farmers are illiterate). ITFC has maintained constant intensive monitoring and training of farmers for ten years. In the view of the company, short-term projects cannot teach skills and change mentality. The farmers themselves are responsible for the maintenance of the fields. ITFC markets the mangoes for farmers, using its bulk-marketing advantage. The farmer groups are all united in the Organic Mango Outgrowers Association (OMOA), although the independence of this organization from ITFC can be questioned. The farmers are obliged to sell 100 percent of their quality fruit to ITFC until all debts are cleared. At the start of every season, OMOA and ITFC negotiate the price, which is then communicated to the farmers.

A significant difference from the other cases in our study is that these smallholders were not traditionally growing mango but started from scratch under the ITFC program. Previously they were mainly growing subsistence crops; farm size in all cases is 1 acre. Farmers had to provide one bag of maize as a commitment fee, and then ITFC planted the seedlings and provided tools such as water tanks and equipment and other inputs (e.g. manure) on a loan basis. All farmers have been trained in the agronomy of mango-growing as well as in pest and disease control. In case of a problem, farmers can call a field assistant. OMOA organizes regular meetings with the producers, especially to continue encouraging the farmers and to urge producers to be patient.

### ***Characteristics of the value chain***

ITFC exports fresh fruit, but it also has a drying facility, set up in recent years, for which they are sourcing additional fruit from the south of Ghana. The drying facility has a capacity of 140 tonnes/month.

ITFC believes it is constrained on the international market because of the bad reputation of Ghanaian products. ITFC management blames the seaport in Tema as one of the main causes of quality problems because the infrastructure is not up to standard for handling perishable goods like mango.

The contract-farming scheme implies high long-term investment and risks for ITFC, and an estimated additional ten years is needed before the company will be profitable. However, ITFC indicated that it sees signs of the benefits for the smallholders who have sold their first harvests, since many of them have now, for example, made improvements to their houses. However, a risk is that ITFC has planted only one variety of mango (Kent) in the fields of the smallholders, which indicates that production risks are not widely spread.

This chain model provides a great opportunity for resource-poor farmers in the region, and can result in an improvement in incomes. However, the system is relatively young, and the sustainability of the chain model has to be demonstrated over time. One of the current challenges is that producers are dependent on the lead firm and do not upgrade into independent business-oriented producers.

### **C. Case study 3: Dangwe West mango producer association – Ghana**

The Dangwe West association has 124 members who have a total of 890 ha under mango cultivation. The association places agricultural extension agents, trained by the District Agricultural Development Unit, in the villages. The association has received support from development organizations, mainly the Dutch development organization SNV.

**Characteristics of the producers**

Members of the association reported mango losses of up to 40 percent, but a market study revealed that processing companies in Accra were looking for mango as raw material. The farmers were trained in the requirements of the processing companies so that they could deliver the right quality. In 2008, the association signed its first one-year contract with a processing company (Sunripe), one of the largest processing companies in Ghana, to sell at least 1000 tonnes of mango (from total production of 2500 tonnes).

**Characteristics of the value chain**

The association is not ready to start selling fresh fruit on the export market, since it does not have the resources to make the necessary investments for compliance with norms and standards. The association does sell to other exporters in the region, albeit at a low price. Efforts are underway to form a national mango producers association.

Through the contract, the association was able to arrange a trade finance scheme with the Dangwe West Rural Bank and Sunripe. This enabled it to purchase its own truck for mango transport, as well as its own office. Sunripe and donor organizations paid for training and local government provided human resources. The farmers themselves do not pay anything for capacity building activities. The Trade and Investment Program for Competitive Export Economy (TIPCEE)<sup>15</sup> paid for the GlobalGap certification. Given the intensive donor involvement, sustainability of this approach is questionable. So-called "market queens" (women who buy mangoes from the farm) still come to buy mangoes but at least now these buyers do not dominate the market anymore, and usually pick only the lowest quality mangoes.

The association has an internal control team, which assists the farmers with record-keeping. This year auditors will come to audit 60 farmers, an increase from 40 farmers last year. If one fails, the whole group's certification will not be renewed. If all are certified, the association will start targeting the export market as well, which may result in higher incomes.

**D. Case study 4: Strong base model - Burkina Faso (COOPAKE)**

COOPAKE is a cooperative of smallholder mango producers in the province of Kenedougou in the department Orodara, located in the western part of Burkina Faso. The cooperative was created in 1963 with the goal of improving profitability through collective sales. In 1994, the association was restructured in line with the new Law 14 regarding associations in Burkina Faso.

**Characteristics of the producers**

Currently COOPAKE has 164 members of whom 54 currently have organic certification; the majority of them are GlobalGap certified. The producers each have between 2 and 20 ha of mango trees. In this area, mango contributes up to 80 percent of total income. The varieties produced are Amelie, Kent, Keitt and Lippens. The primary constraints experienced by farmers are quality issues (mainly fruit flies) and lack of irrigation infrastructure.

**Description of the value chain**

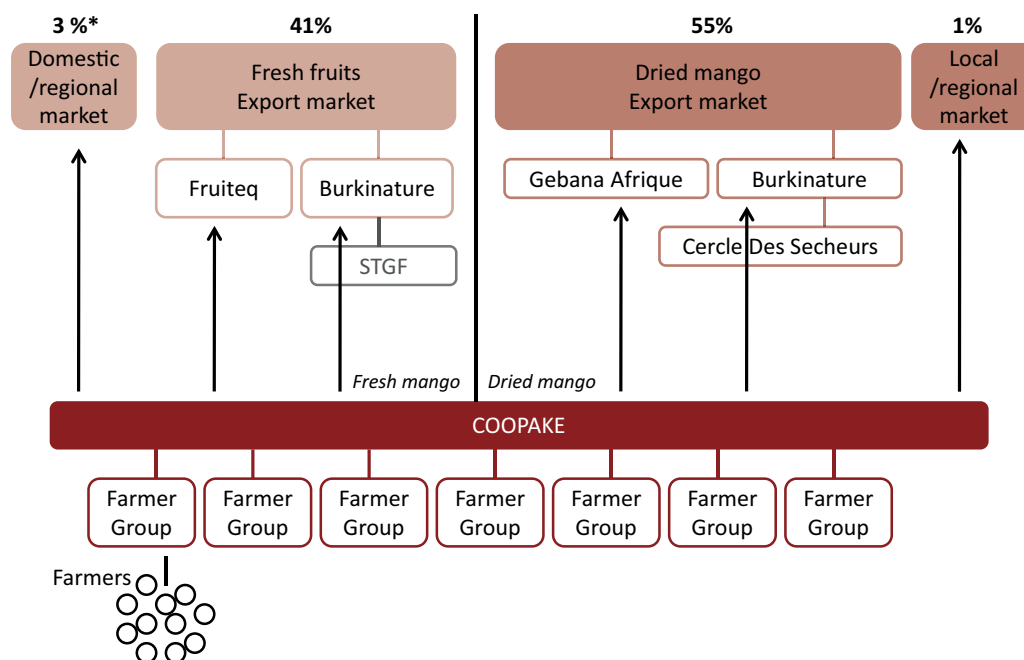
The main objective of the cooperative is to ensure effective marketing of the fruit, either in processed or fresh form. In addition, training is facilitated, using a demonstration and experimentation site. The main activity of COOPAKE is drying of mango; a drying unit with 13 gas drying ovens has been installed,

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<sup>15</sup>A recently terminated USAID project to support exports of selected crops.

which has a capacity of 40 tonnes of dried mango per season, and employs six permanent staff and 45 seasonal employees. The second business activity is to sell fresh fruit, mainly to exporters Fruiteq and Burkinature (see also Figure 3).

**Figure 3. Schematic overview of COOPAKE sales structure**



\* = % of total fresh fruit yield

COOPAKE does not have long-term formal contracts; however long-term relationships with their buyers do exist. Prices for the certified products are mostly fixed; for conventional products conditions are negotiated before the season.

The association has its own team of mango harvesters. One of the agents is responsible for taking stock of the expected production and quality before the season. When harvesters pick the fruit (together with the producer), COOPAKE agents present a voucher to the producer. Two weeks later the producer comes to the COOPAKE office to receive payment. At times COOPAKE faces difficulties in paying the farmers, since pre-financing from their buyers can be small or absent (depending on the negotiations it can go up to 50 percent).

COOPAKE has received substantial external support from development organizations, World Bank (subsidies through PAFASP), governmental structures (e.g. research and trainings by Institut National pour l'Etude et la Recherche Agronomique (INERA), FAO (training on production practices), buyers (e.g. hygiene during processing by Gebana) and certification bodies (ECOCERT for organic certification requirements).

### **E. Case study 5: Semi-intensive contract farming – Burkina Faso**

DAFANI SA was established in June 2007 by a group of Burkinabe investors in Orodara, for processing mango and other tropical fruit into juice. The production in 2008 was 3000 litres of juice per hour, employing 73 permanent staff as well as 149 seasonal workers. The pulp is exported in 200 litre barrels to France and Germany. The juice, which is the main product, is mostly sold on the domestic market, with a small part sold in Côte d'Ivoire and Togo. The factory has made a good start and the product has become appreciated and well-known and is now in demand in the domestic market. The juice for direct consumption is packaged in cartons, and is a price competitive with other soft drinks and sodas. Unfortunately, however, at the beginning of 2010 the factory had to stop operating because of necessary equipment repairs and lack of inputs (packaging material). In May 2010 the government of Burkina Faso announced its willingness to assist the management of DAFANI to re-start activities. At least for the 2010 mango season, many farmers who used to sell to DAFANI were obliged to search for other buyers.

#### ***Characteristics of the producers***

The interviewed smallholder producers (all male) are selling non-certified mangoes, and their orchards are located in proximity to the DAFANI factory. DAFANI has begun to build relationships of trust: the company currently signs one-year contracts with around 300 producers per year, buying 4.5 tonnes/ha. The contract includes an agreement that both the producer and DAFANI have a two-week notice period (before fruits are ripe) to cancel the transaction.

The producers indicated that the two main problems are:

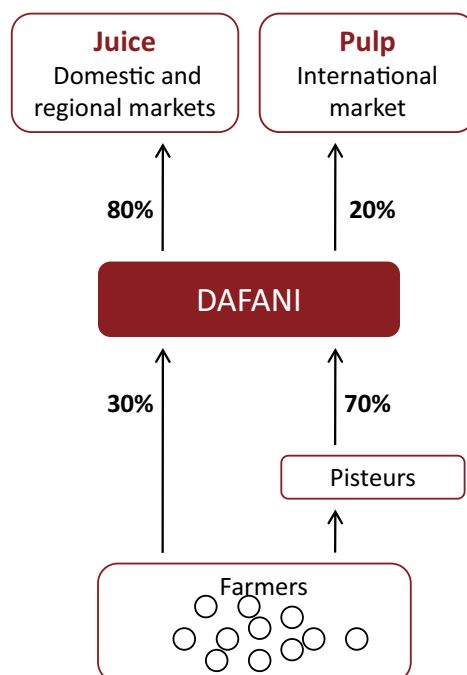
- water management (there is not enough water to properly irrigate the fields);
- quality issues (fruit fly infestations, as well as anthracnose).

#### ***Characteristics of the value chain***

The volume of mango provided by contracted producers provides 30 percent of the volume required by DAFANI; the remaining 70 percent is bought through mango wholesalers. An agent is appointed in every village to coordinate the harvest of the contracted producers and traders.

DAFANI has offered training to a selection of producers in field and nursery maintenance, as well as training and inputs for treatment of their fields against fruit flies using organic pesticides. Most producers are illiterate and from the interviews and focus group meetings it appeared that most of the producers selling to DAFANI are members of a farmer group. The volume of mango which they cannot sell to DAFANI is sold to other processors and local traders.

Figure 4. Schematic picture of DAFANI input and output markets



## 6. Assessment of the chain models

In this section we present results from the assessment of the socio-economic position of the smallholder in the five case studies. The outcomes of the proxies of market efficiency and business performance of the smallholders, as described in section 2.3, will be presented and discussed.

### 6.1 Market efficiency

The results on fruit losses (see Table 8 below), show that practically all farmers in the case study samples have reported losses of mango fruit. Based on these figures we can see that the producers in Benin estimate the losses to be more than 65 percent of their total production, whereas most other farmers indicated losses of around 30 percent of their production. The farmers in the case of intensive contract farming in Ghana reported losses of only 1 percent (confirmed by focus group meetings). Some of these losses can be attributed to natural circumstances, since it is normal that some of the young fruits drop.

When we asked the farmers about the reasons for loss, we could see that fruit quality issues are ranked as the main cause, except by the Dangwe West Association in Ghana. We have two comments regarding the interrelation between absence of buyers and quality issues.

Firstly, from our observations in Benin we have learned that in the absence of buyers, the fruit will remain on the trees until fully ripe. At this stage the fruit is much more vulnerable to pests such as fruit flies. If market efficiency were high enough, fruit would be harvested before it is ripe and at the point where it is not yet attracting insects. Therefore, the actual extent to which quality issues affect marketing efficiency might seem higher because of the lack of marketing opportunities.

Secondly, if the market were operating efficiently, more resources would be available to control quality issues (e.g. by collaborative action of chain actors or investment of the lead firm in provision of control methods). Therefore, to a certain extent high loss due to quality constraints does indicate market inefficiency.

Taking all this into consideration, we have ranked market efficiency as indicated in Table 8 below.

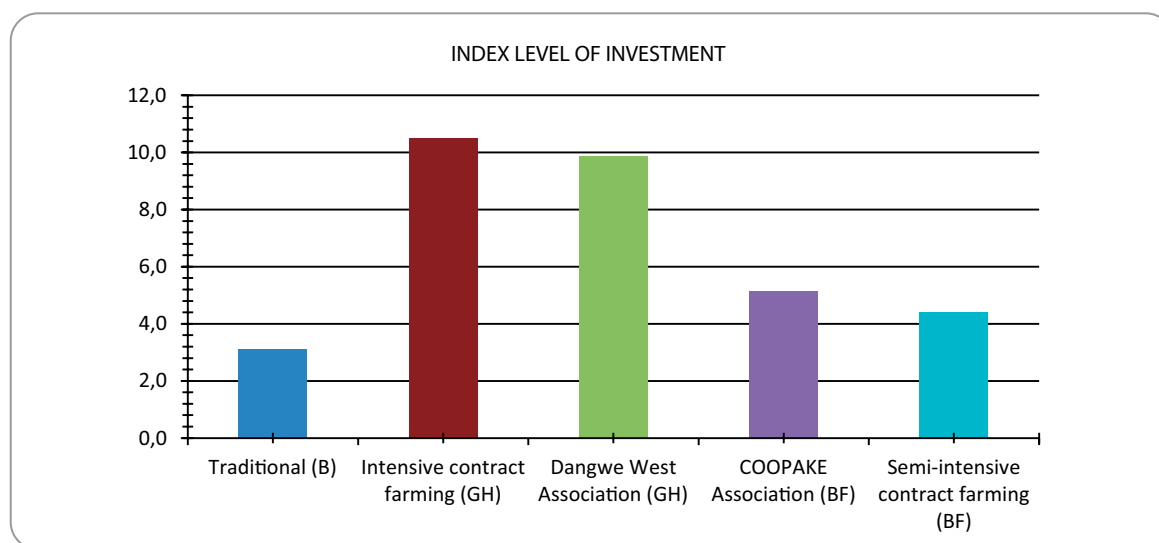
**Table 8. Market efficiency of the chain models**

Case	Farmers indicating fruit losses (% of total)	Estimated losses (% of total production)	Reasons for losses		Market efficiency
			Buyer	Quality issues	
Traditional (B)	100.0	66.9	3.7	96.3	-
Intensive contract farming (GH)	100.0	1.0	NA	0.0	+
Dangwe West Association (GH)	100.0	30.0	63.6	36.4	+/-
COOPAKE Association (BF)	97.6	30.3	30.0	70.0	+/-
Semi-intensive contract farming (BF)	93.8	26.1	20.0	80.0	+/-

## 6.2 Business performance

Figure 5 below presents the calculation of the index on level of investment as a proxy for business performance. The first figure indicates the gross index of investment and shows, as expected, a high level of investment by the smallholder farmers in intensive contract farming case<sup>16</sup> (more than 10 on a scale of 12) over the past five years. Smallholders in the Dangwe West Association in Ghana are also investing at high levels with an index of almost 10. The farmers in Benin using the traditional model have made minimal investments for maintenance of their orchards.

**Figure 5. Gross Investment Index of smallholders in different chain models**

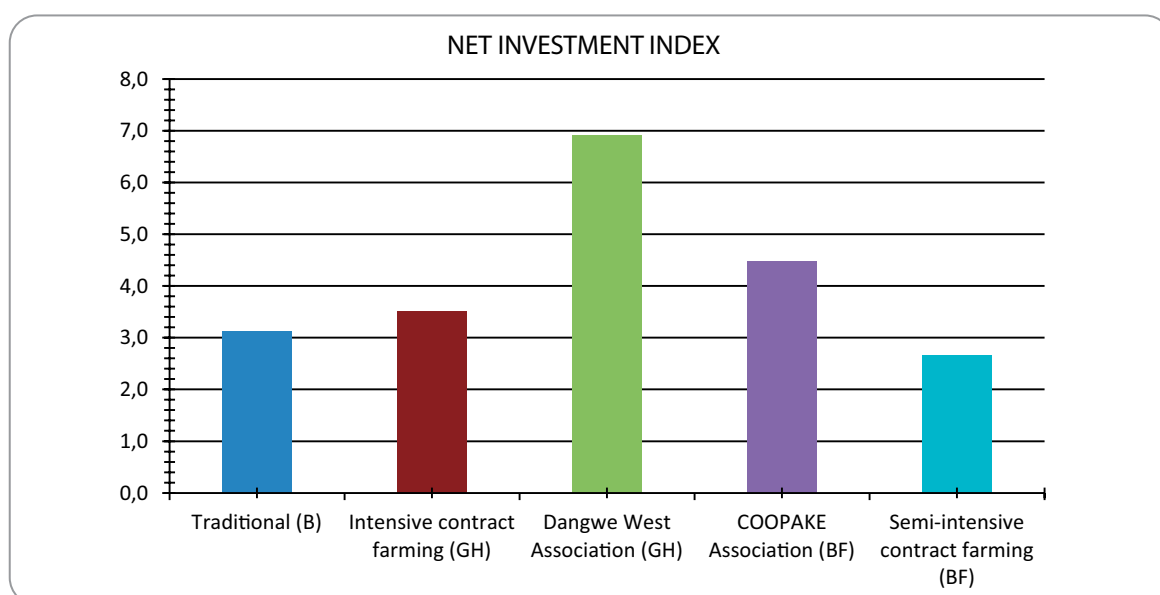


<sup>16</sup> We can use the data from the small sample of contract farmers, since they all had an identical package of investments supported by the lead firm.

By taking into account whether the farmers received financial support to make these investments (no=0, partly=0,5 and yes=1), we were able to calculate the Net Investment Index for smallholders in the different case studies. Figure 6 below displays the results. Effectively it shows that the net investments made by the farmers in the intensive contract farming case are lower since a large part is paid for by the lead firm. For the traditional model in Benin, the net investments are not different from the gross investments, which demonstrates that the farmers do not receive any support that is external or internal to the chain.

The producer associations in both Ghana and Burkina Faso appear to be making the highest net investments, compared to the other models. This can be explained by the positive effect of the co-operative structure on the risk assessment of the producers. Membership in the association reduces business risks, for example by more assured marketing of produce and higher access to training and new technologies, as well as economies of scale and opportunities for collective investments such as certification. In contrast to the outgrower scheme, the initiatives lie with the producers themselves. We expect that this higher level of ownership results in a higher net investment and consequently a more sustainable effect on the mango businesses.

**Figure 6. Net Investment Index of smallholders in different chain models**



The second proxy we selected to measure business performance was the contribution of mango farming to total income. We measured the contribution of mango to total income, relating this to the mean area under cultivation. Based on these data we can make an assessment of the importance of mango production relative to the income of smallholders.

As Table 9 shows, under the intensive contract farming scheme, farm income accounts for most of the total income. This is because these farmers engage essentially in subsistence farming and not much cash crop farming. The relative increase of their income is therefore higher compared to producers who are already selling their mangoes on the market.

The results also show that the producers supplying processing industries (COOPAKE Association and semi-intensive contract farming) have a slightly higher mean area under mango cultivation compared to the other cases.



**Table 9. Contribution of mango farming to total income**

Case	Income from agriculture (% of total income)	Income from mango (% of total income from agriculture)	Income from mango production (% of total income)	Mean area under mango cultivation (Ha)	Contribution of mango farming to total income
Traditional (B)	70	19	13.3	1.92	-
Intensive contract farming (GH)	100	48	48	0.4	+
Dangwe West Association (GH)	55	80	44	5.04	+/-
COOPAKE Association (BF)	67	59	39.53	5.67	+/-
Semi-intensive contract farming (BF)	83	49	40.67	5.69	+/-

Finally, the proxy we used to measure business performance is the level of satisfaction of smallholders with their current situation and their perception of the future.

Figure 7 depicts some of the answers of the different groups of smallholders to this question. It shows that, except in Benin, all producers indicate that the general situation of their families has improved over the past years because of increased income from mango farming. The smallholders in the intensive contract farming chain are the most positive, which could be a result of the income level of these farmers before entering the chain, as we have mentioned above.

Reports of farmers' subjective perceptions of security about mango sales for the next year are generally positive; however, farmers in the traditional model are relatively indifferent. Finally, all farmers agreed with the statement that they would continue mango farming for the rest of their lives. Even the producers in the traditional model answered this in a positive way, which can be explained by the fact that mango farming has been a part of their farming style, and in some cases it is an inheritance they feel obliged to take care of.

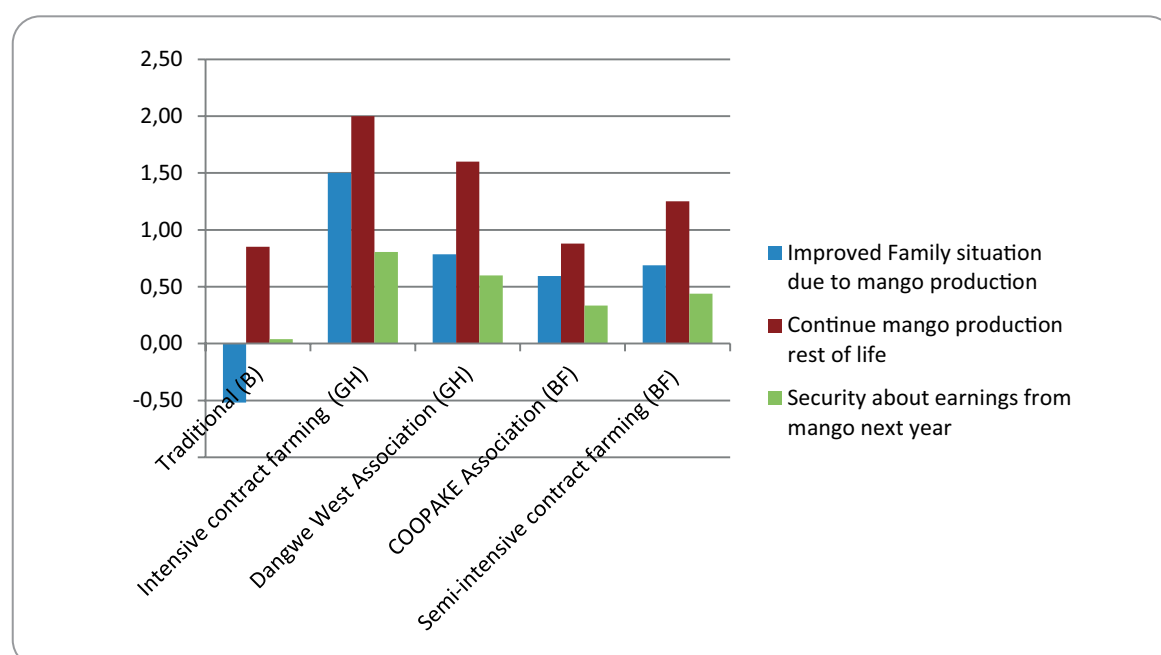
**Figure 7. Perception of smallholders on current situation and current trends**

Table 10 summarizes the comparative ranking of results from our assessment of the case studies and presents an overall ranking of the position of the smallholder in these chains based on the selected indicators. Studies of two cases with strong producer associations, in Ghana (Dangwe West) and Burkina Faso (COOPAKE), are perceived as having the best total impact on the socio-economic position of the smallholder farmers. We conclude this based on the results from our assessment and it was confirmed by information from the key informants and focus group discussions.

**Table 10. Overview of results chain model assessment**

Case	Market efficiency	Net investment index	Contribution of mango farming to total income	Smallholder satisfaction	Overall ranking
Traditional (B)	-	-	-	-	5
Intensive contract farming (GH)	+	-	+	+	2
Dangwe West Association (GH)	+/-	++	+/-	+	1
COOPAKE Association (BF)	+/-	+	+/-	+/-	3
Semi-intensive contract farming (BF)	+/-	-	+/-	+	4

## 7. Conclusions and recommendations

The objective of this study was to analyse the mango value chains in Benin, Ghana and Burkina Faso.

First, we made an overview of the value chain models that typically exist in these three countries, based on literature and interviews with key informants. Based on the main targeted end-market, we have found three different categories of value chain models that are most common for mango in West Africa. In addition, we have used the following as explanatory factors for the performance of the value chains: the degree of external interventions; the level of internal resource exchange; the level of smallholder cooperation. For each country, we have assessed the typical models for mango, and we have selected five case studies (see Table 11 below for an overview of the models and case studies).

**Table 11. Net investment index for the analyzed case studies**

Case study	Model	Net Investment Index
Individual mango farmers around Parakou (Benin)	Traditional value chain-Benin	3.1
Intensive contract farming: ITFC (GH)	Export value chain	3.5
Dangwe West Producers Association (GH)	Export value chain	6.9
COOPAKE Association (BF)	Modern urban/Processing value chain	4.5
Semi-intensive contract farming (BF)	Modern urban/Processing value chain	2.7

Second, through in-depth interviews with actors and informants, we identified the main characteristics and limiting factors, especially for the smallholders in the chain. The most important findings were that smallholders are constrained by the following factors:

- **Quality issues:** The main issue is increasing fruit fly infestations which are causing high losses. Farmers with a fixed buyer usually had increased access to control methods;
- **Poor negotiation power:** The case studies in Benin and Burkina Faso indicated that the smallholders feel that the price set by the traders is too low. However, farmers have little choice due to the remoteness of their orchards and the perishable nature of the fruit. To overcome this issue, the Strong Base model case in Burkina Faso has introduced its own harvesting team;
- **Transaction costs:** Remoteness and bad quality of roads and transport facilities create high post-harvest losses as well as difficulties in accessing markets;
- **Lack of irrigation infrastructure:** This is mostly a constraint in Burkina Faso, which requires high investments.

Third, the current and expected impact of these value chain models on the position of smallholders has been assessed by measuring market efficiency and business performance of smallholders.

The case studies demonstrated that the modern urban market/processing model with a high level of cooperative action proved to be most beneficial for the smallholders, because it showed a high level of Net Investments in the farming business over the past five years. This indicates that the external interventions are actually strengthening the farming business in a sustainable manner by increasing ownership, reducing risks through collective action and increasing opportunities to upgrade activities. The case in Ghana showed the highest Net Investment Index (50 percent higher than the other models), which could be related to the relatively good business environment in Ghana compared to Burkina Faso.

The intensive contract farming model was also assessed as having a positive impact on the position of smallholders in terms of market efficiency, smallholder satisfaction and contribution of mango to total incomes. However, Net Investments are lower, suggesting a high dependency on the lead firm and a weak position for the autonomous farmer. For these smallholders an increased level of cooperative action among producers could reduce this constraint.

Finally, with respect to institutional innovations and policy interventions in support of smallholder market participation we recommend the following:

- **Focus on strengthening of farmer cooperatives:** From our assessment the smallholders operating in strong cooperatives showed a high Net Investment Index. In addition, the cohesion of smallholders can lead to increased negotiating power with traders, and increased opportunities to build long-term relationships with buyers.
- **External support mechanisms:** As shown by PAFASP in Burkina Faso, when farmers can make partly subsidized investments it has a strong catalytic effect on upgrading and Net Investments of smallholders, which are expected to have an impact on sustainability.
- **Increased focus on domestic and regional markets:** These markets are growing and, as they demand less stringent quality requirements, they are easier to access for the smallholder farmer. Smallholders indicated that the investments needed to target high-end niche markets are often not in balance with the price premiums received. Although results from the assessment of market efficiency did not demonstrate a significant difference for the value chains targeting modern urban markets/processing industries, the study did reveal that quality issues are an emerging constraint. Therefore we can conclude that more feasible upgrading strategies might be to target regional and domestic markets with less stringent norms and standards.

Table 12 presents some recommendations in more detail. The explanatory factors for inclusion of the smallholders in the value chain models, will serve as a basis to suggest possible interventions.

**Table 12. Key characteristics and possible interventions by case study**

Chain model/Case	Key characteristics	Possible interventions
Traditional model –Benin	<ul style="list-style-type: none"> <li>• No government policy towards mango sector, national extension services do not have mango in their portfolios</li> <li>• Low comparative advantage over other countries because of fruit quality/variety and seasonality</li> <li>• Low level of cooperative action between smallholders</li> <li>• No government support</li> </ul>	<ul style="list-style-type: none"> <li>• Take stock of area under cultivation, varieties and volumes produced (GIS mapping), market assessment</li> <li>• Invest in small and medium-sized agro-businesses for increased processing and domestic demand</li> <li>• If potential assured, offer training on Good Agricultural Practices</li> <li>• Lobby government to include mango in agriculture policy</li> <li>• Promote model farmers who can function as drivers of change</li> </ul>
Dangwe West Association (GH)	<ul style="list-style-type: none"> <li>• Access to external support mechanisms</li> <li>• Conducive general business environment</li> <li>• High dependency on external support</li> <li>• Recent start of mango farming</li> <li>• Quality issues more difficult to manage in the south of Ghana</li> <li>• Average level of explicit coordination, although buyer assists in trainings</li> <li>• Proximity to market</li> </ul>	<ul style="list-style-type: none"> <li>• Provide continuous support of cooperative action, phasing out external support</li> <li>• Promote marketing to regional processing industry, instead of targeting high-end European market</li> <li>• Provide market information system</li> </ul>
COOPAKE Association (BF)	<ul style="list-style-type: none"> <li>• Access to external support mechanisms</li> <li>• Average level of explicit coordination between chain actors</li> <li>• High dependency on external support</li> <li>• Mango farming practiced for a long time</li> </ul>	<ul style="list-style-type: none"> <li>• Provide continuous support of cooperative action, phasing out external support</li> <li>• Focus external support primarily on capacity-building and less on assets and finance</li> <li>• Explore the possibilities for value-chain finance/trade-finance systems with fixed buyers to allow upgrading of production system.</li> </ul>
Semi-intensive contract farming (BF)	<ul style="list-style-type: none"> <li>• Targets local processing company which copes with risks in continuity</li> <li>• Average level of cooperative action</li> </ul>	<ul style="list-style-type: none"> <li>• Offer market information for increased insight into other market opportunities</li> <li>• Continue support of farmer cooperation</li> </ul>
Intensive contract farming: ITFC (Ghana)	<ul style="list-style-type: none"> <li>• Mostly subsistence farmers</li> <li>• High need for irrigated production because of erratic rainfall</li> <li>• Recent start with mango farming</li> <li>• Total dependence on contract-farming scheme and low net investment.</li> </ul>	<ul style="list-style-type: none"> <li>• Promote intensification of cooperative action between smallholders</li> <li>• Increase capacity-building in general business and skills</li> </ul>

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## Annex

### Schematic Representation of The Five Value Chain Case Studies

