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Cassava Value Chain Assessment: Bas-Congo, Kinshasa, and Bandundu Provinces

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Cassava Value Chain Assessment: Bas-Congo, Kinshasa, and Bandundu Provinces

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Acronyms & Abbreviations

ADER	Average Daily Energy Requirement
Allonge	Long shipping sack for cassava; holds about 70 kg. of cossettes
APTM	Association des Producteurs et Transformateurs de Manioc
Bimpuka	Raw cassava paste
CARG	Conseil Agricole Rural de Gestion (Rural Management Council for Agriculture)
CBSD	Cassava Brown Streak Disease
CF	Congolese Franc (valued at 600 CF per USD in this report)
Chikwangue	Steamed cassava (usually prepared and marketed in roll of leaves)
CMV	Cassava Mosaic Virus
Cossette	Dried chip of peeled and leached cassava tuber
DRC	Democratic Republic of the Congo
Fufu	Fermented cassava flour (often mixed with maize flour)
FPPM	Food Production, Processing, & Marketing Project
IITA	International Institute of Tropical Agriculture
INERA	Institut National pour l'Etude et la Récherche Agronomique
INS	Institut National de la Statistique
IPM	Integrated Pest Management
Matchem	Kinshasa-Based SME (involved in processing/marketing of cassava)
MDER	Minimum Daily Energy Requirement
NGO	Non-Governmental/Non-Profit Organization
ONGD	Non-Governmental Development Organization
SENASEM	Service National de Semences
SNV	Service National de Vulgarisation
USAID	United States Agency for International Development
USG	United States Government
WFP	World Food Program

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0.0 Executive Summary

This assessment analyzes opportunities and constraints in the Cassava Value Chain that are important to the implementation of the Food Production, Processing, and Marketing Project (FPPM). The assessment provides information and insights into the operations and performance of the Cassava Value Chain in the Provinces of Bas-Congo, Kinshasa and Bandundu that supply the cassava consumed in Kinshasa.

Cassava is the one staple food in the DRC that is not imported in significant quantities, reflecting the fact that nearly every rural and peri-urban household in the DRC grows cassava. Cassava is produced primarily for on-farm consumption and sales to the food market with very little going to animal feed or industrial uses. Cassava consumption in the DRC accounts on average for about 55% of per-capita caloric consumption, although rural consumption rates are higher.

The average yields of cassava in DRC are low compared with other producing countries, due to the low-input nature of production in DRC, where generally poor soils make it difficult to obtain higher yields. Cassava pests and diseases, e.g. Cassava Mosaic Virus Strain 2 (CMV2) in the late 1990s through 2000, and currently the Cassava Brown Streak Disease (CBSD), continue to take a heavy toll.

Constraints affecting the performance of the cassava value chain include:

- Cultivation of low-fertility soils without improved inputs or technologies;
- Lack of improved post-harvest technologies;
- High cost of existing market mechanisms;
- Lack of access to capital and financing;
- Long-term degradation of transport infrastructures.

Ongoing activities addressing major constraints:

- Widespread distribution of improved planting materials and emergence of seed multiplication businesses;
- Emergence of SMEs investing in value chain improvements, particularly the processing or selling of branded, specialized food products;
- Large-scale investments by donor community and GODRC in rehabilitation of primary, secondary, and farm-to-market roads, river dredging and channel marking;

0.1 CASSAVA PRODUCTION

In the last half of the 1990's, cassava production in the DRC nose-dived. Producers were cut off from markets and sources of new planting materials; transport of goods slowed as road, river, and rail transport crashed; and rural areas were demonetized, large areas reverting to barter trade. Despite a drop in production, cassava never lost its dominance in the DRC market and diet and major national and international efforts have since helped to re-establish production. Productivity increases required the identification of cassava varieties tolerant to aggressive new stains of CMV, new rapid bulking techniques, and substantial investments to multiply and distribute CMV tolerant varieties to agricultural associations for further distribution and propagation by smallholders. IITA and INERA researchers rapidly screened

and introduced new CMV resistant varieties, building from their disease and pest-tolerant cassava breeding programs; building also on three decades of work at the major INERA cassava research station in Mvuazi, Bas-Congo, as well as the important regional facility at Kiyaka, Bandundu. USAID and other international donors and organizations lent their support to the task of bulking-up and distributing improved CMV-tolerant varieties. Adoption, especially along the all-weather roads, took time because of the need to bulk materials, distribute them for multiplication by farmers, and have producers evaluate production and quality.

Extensive areas of production in Bandundu and most of Kinshasa Provinces are covered with open-wooded savannas and grasslands on Kalahari sands of low overall fertility. “Forest” areas, essentially all secondary forest, are sought out for their higher fertility. These forest areas, scattered throughout Bandundu and Bas-Congo Provinces, include high-fertility sites that may yield up to 20 mt/ha of fresh root production if cassava is planted early in a rotation. Yields of cassava in the RDC are likely to be limited first by soil fertility; second by rainfall distribution within the season and soil moisture; third by the early season weed challenge; fourth by diseases and pests; and fifth by the seasonal differences in sunlight - lower in the longer and wetter growing season A and higher in the shorter and drier growing season B.

Recovery of cassava production also required advances in Integrated Pest Management (IPM) leading to the development of mass release and naturalization programs of parasitic wasps to control scale insects.

0.2 MARKET ANALYSIS

The major reasons for the dominance of cassava among Congolese foods:

- It fits most regional variations in dietary preferences and is appreciated for its taste;
- It is a broadly-adapted and drought-hardy crop, once established;
- In rural areas it is a major hedge against economic, weather, and political risks;
- Fields can be harvested fractionally over a few months;
- In urban areas, it is an important part of household food security coping strategies;
- It is a dual purpose crop; leaves are harvested to provide the principle ingredient of pondu, the Congo’s principal vegetable dish.

Consumption patterns in Kinshasa reveal a rapid reduction recently in fresh root consumption and a steady increase in the longer “shelf-life” dried cossettes. While the Congolese diet is built on cassava as the fundamental food product, there are some household consumption trends to bread, rice, plantains, and maize. Data on the consumption rates of different cassava products that are regularly traded on the Kinshasa market are weak; FPPM will undertake a household consumption/market survey to better understand shifts in preferences.

When food shortages occur, price spikes of great amplitude develop rapidly, especially in Kinshasa. As long as global prices for substitutable food staples, such as maize, rice, and wheat, remain high and volatile, and as long as the DRC’s road, river, and rail transport network remains in its current degraded and de-linked state, price swings will be amplified. The poor condition of transport infrastructure - and the failure of policy makers to identify a source of recurrent income to finance annual maintenance of all transport infrastructure - road, river, and rail - lies at the heart of a deeply-fractured national market place.

0.3 VALUE CHAIN MAP

The cassava value chain map describes the following core activities and actors:

- **Cultivar R&D:** A core process to maintain and improve average crop productivity.

- **Planting Material Propagation:** Farmer self-propagation and exchange of cuttings is the primary form of cassava propagation by smallholders and commercial farmers.

- **Smallholder Production and On-Farm Processing:** Once harvested, cassava roots break down quickly. Initial processing usually must be done within 24 - 48 hours of harvest to maintain dry matter content and quality and avoid rot. The value chain map does not show the movement of cassava leaves that are sold as a vegetable. Bundles of fresh leaves make short movements with smallholder-traders or collectors who transport by foot, bicycle, taxi, and taxi-bus with passengers that are part of the fresh vegetable value chain. This value chain generally operates within 12-24 hours travel time of the consuming market.

- **Smallholder-Traders:** Some smallholders act as local aggregators of sacks of cossettes or cassava paste, bimpuka.

- **Off-Farm Rural Processors:** Small-scale processing units, such as those developed by IITA, help to reduce hand labor, speed processing and drying, and standardize the finished cassava products (micro-flakes, fermented fufu flour, and unfermented flour);

- **Collectors:** Small independent traders who play the key role of assembling product in the production zones, usually by the sack (allonge).

- **Agents:** Trader financed by actors higher up in the value chain (usually wholesalers). They fulfill a market function similar to collectors, but operate not on their own behalf but for their financier/buyer.

- **Transporter/Agents:** Actors who do not buy and sell product on their own account; often truck owners/operators who will take product signed over to them from farmer-traders and transport it to Kinshasa where a buyer (most often pre-arranged or known to the seller) will take possession after paying the negotiated percentage price of the Kinshasa market value.

- **Urban Wholesalers and Semi-Wholesalers:** Present in very small numbers in the larger Kinshasa markets and in urban centers such as Kikwit and Matadi; they buy from smallholder-traders, collectors, and agents.

- **Mamans Manœuvres:** Small traders who play a role as intermediaries in Kinshasa and other urban markets by buying product in one location and selling it in another nearby market - often moving from larger markets or ports to smaller neighborhood markets; there are a range of categories of mamans manœuvres.

- **Mamans Bimpuka:** Small traders who sort cassava products, often by the sack or half sack, at storage depots near the markets, into different quality products for direct retail sale to consumers or, in the case of highly degraded cassava products, sale to alcohol fermenters and distillers. They produce a range of qualities of cassava flour and paste for sale to the retail market across a range of quality and price points. Some also extract starch to prepare chikwangue for retail sale.

- **Urban Processors:** There are two groups - one comprises semi-wholesale millers who mill cassava and maize for their own account and for customers, generally at a minimum

level of a single sack; the second comprises processors/semi-wholesalers who buy fresh roots for processing from small and medium-scale farmers within a day's transport distance from Kinshasa.

- **Commercial Farmers:** Growers who incorporate on-farm processing of cassava into dried cossettes for their own depots and flour mills in Kinshasa or for sale to traders or agents for urban semi-wholesalers.

- **Commercial Vertically-Integrated Grower/Processors:** A subset of the Cassava Producer and Processors Association (APTM) members clustered on the Plateau de Bateke. This category grew out of the urban processor category, some of whom found that organizing raw material from smallholders was problematic in terms of establishing a consistent supply chain, and that expanding wet processing operations in Kinshasa posed a number of physical, environmental, and logistic challenges.

- **Retailers:**

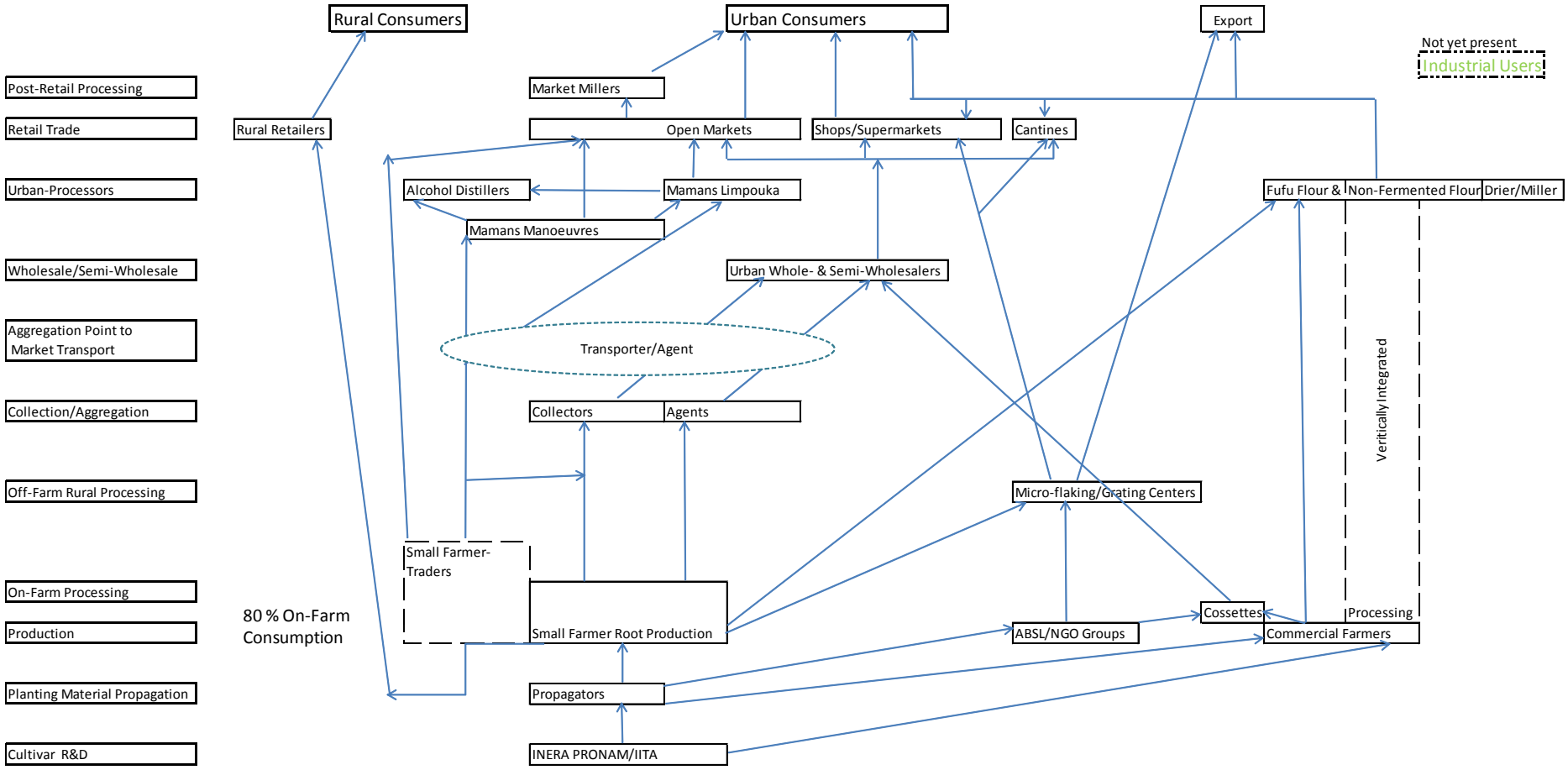
Open Markets: The dominant force in the retail trade are the small traders with regular spots in the cassava sections of open markets who generally buy sacks or half sacks of cossettes that they will sort and sell in basins to household buyers or mill into flour for direct sale; or purchase small lots of chikwangue for direct resale. They purchase their stocks from smallholder-traders, collectors, semi-wholesalers, and maman-mainoeuvres.

Shops/Supermarkets: Many Kinshasa households purchase some cassava products, especially unfermented cassava flour, gari, tapioca, and blended cassava-soy flour products from small shops; middle and upper income consumers purchase at larger supermarkets.

Cantines: Larger companies in Kinshasa have traditionally had cantines and employee consumer cooperatives that supply basic household necessities in bulk quantities. They buy cassava flour in 15, 30, and 60kg sacs from off-farm rural processors, urban processors, and the vertically-integrated commercial farmer/processors

- **Post-Retail Processing:** Millers are present in most of the larger open markets in Kinshasa to convert cossettes into flour using low capacity grinders and mills, both electric and diesel.

Fig. 24 Cassava Value Chain Map



0.4 MARKETING MARGINS

Because cassava cossettes are not uniform and standardized in kind or in quality, prices are negotiated on a transaction-by-transaction basis to permit market participants to establish a profit margin. There are also market preferences. Plateau de Bateke cossettes, for example, which are usually very white in color and have travelled the shortest distances from the field to Kinshasa, receive a premium price. Cossettes with a yellower color, such as those from Tshela in Bas-Congo, or cossettes arriving with high degrees of insect damage and discoloration, such as those arriving by boat from Bulungu in Bandundu Province, command a lower price. The cost of transport and handling from southern Bandundu has decreased with the completion of the Kinshsasa-Kikwit-Batshamba Bridge and rehabilitation of the paved highway, making the supply chain more efficient.

0.5 WESTERN CONGO CASSAVA MARKETS

The demand of the huge Kinshasa consumer market attracts a correspondingly huge supply of food staples from the entire country. Local production is insufficient, however, to meet demand; imports come in from neighboring countries and international markets to fill the gaps. But, cassava products are drawn only from national supply. The main cassava products marketed in Kinshasa are the cossettes, or chips, for which the two largest sources of supply are Bandundu and Bas Congo, with the supply from Kinshasa Province dominated by chikwangue and fresh cassava roots. Bandundu chips are of a fundamentally different quality than those from either Bas-Congo or the Plateau de Bateke. Bandundu chips are usually sold at the farm gate or village collection point as whole, partially dried root pieces, which are broken up and “dried” as they transit in sacks from collection points to trucks and boats. These chips arrive with higher average moisture content and often show higher levels of molds and insect damage than those from the Bas Congo and the Plateau de Bateke in Kinshasa Province. At the retail consumer level, most cassava products are purchased on public markets from small scale vendors, or from individual vendors’ homes, or attached small shops.

0.6 PROCESSING

Most cassava is processed manually in rural areas in small batches, equivalent to a few head loads of cassava root, that are intended to feed individual households. The labor needed to transport cassava roots to a spring, stream, pond, swamp, or river for leaching is a major constraint to the amount of cassava that can be processed using traditional methods. Water availability is the other major constraint.

Grating and chipping can be done by hand in small lots, but production is limited by the lot-size constraint that a woman can handle in a daily work-schedule. The intermediate wet products are either broken up into fragments and paste that can be stored for up to two months to produce chikwangue, or they are dried to produce cossettes, whole or halved roots of various lengths, chips or flakes, i.e. micro-chips. The rate at which cossettes, grits, and flakes dry also determines how much mold development and discoloration occurs. Sun drying dominates and local cloudiness, temperature, wind, and rainfall lead to wide variations in drying times for the same type of product in different locations and at different times of the year in the same location. Village level processing is done in small lots on roof lines, racks, drying floors, or the ground. Protecting the drying product from wind, rain, animals, and theft

occupies substantial time. The drying space that a single family can manage is generally small. If harvests for marketing are done, small lots are accumulated to reach a minimum sale volume, or rotating work groups, *tontines,* are formed to harvest, process, and dry cassava across a number of households, often on a 50:50 end-product sharing basis.

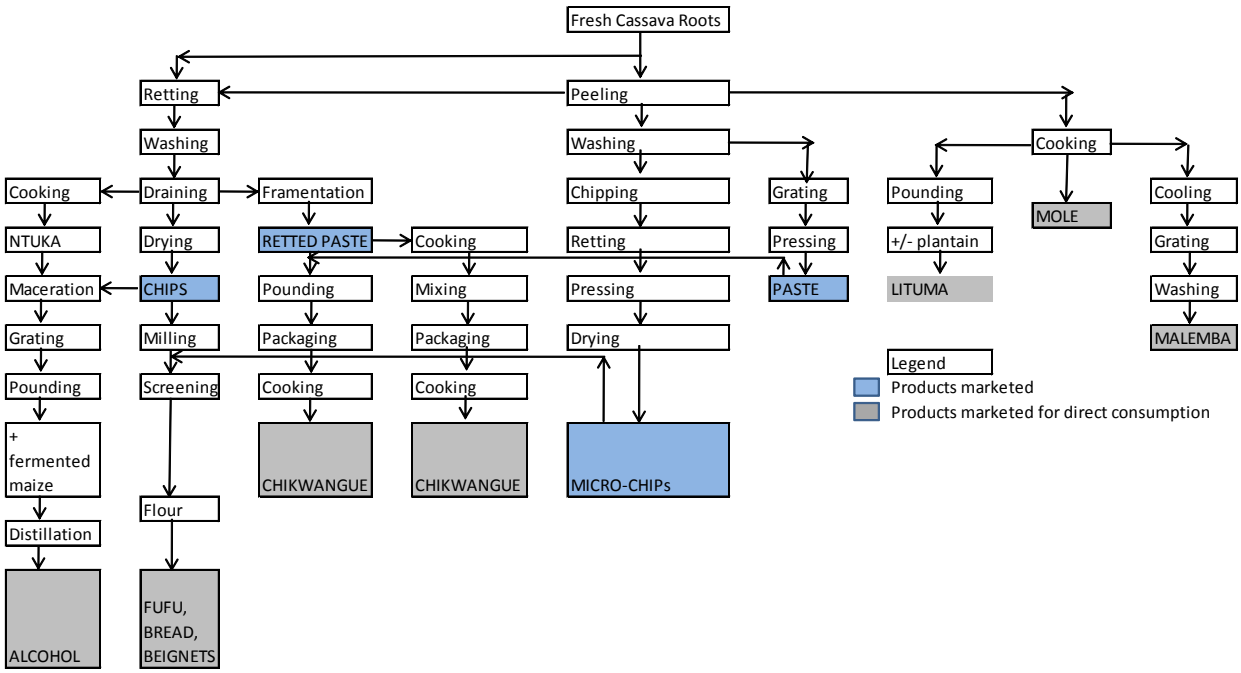
There is now increased artisanal production for local shops, canteens, and street snack vendors in Kinshasa and secondary cities. Hand graters are manufactured for household and small vendor use at a tiny fraction of the cost needed to buy an engine-powered chipper/grater, but it is not known how many are in use. While a few hundred chippers and grating machines have been distributed, it is not known how many are used for unfermented flour, or even how many are in operation. FPPM is gathering information on chipping and grating machines to determine whether they are operational, and if not, what the problems are.

Some of the major problems affecting quality processing of cassava include

- Staggering harvest over 18-24 months increases fiber/reduces starch yield
- Poor retting water quality (swamps) affects product quality
- Insufficient drying on racks with/without smoking
- Sack to sack transfer breaking up chips
- Humidity and long transit time on rivers
- Poor storage conditions and handling
- Slow sales at markets from atomized transactions and monthly dip in sales after 10th-15th of the month.

The chart below shows what processes are required for different end-products

Fig. 6: Cassava End Product Flow Chart



0.7 TRANSPORT

The cassava value chain is constrained by poor access to transportation infrastructure, especially the very poor condition of farm to market roads. All agricultural commodities transported in the Kinshasa marketshed suffer from the problems of high transport costs, difficult or zero access during the rainy seasons to many producing areas, and loss of product quality associated with the mode of transport and long duration of transport by road, river, or rail. These problems are magnified with the DRC's main staple food crop, because fresh cassava roots are highly perishable. Cassava paste and dried cassava cossettes are more stable than fresh roots, but they are still inherently much more perishable than the grains of cereals or pulses.

First movement of cassava from field to on-farm processing point is almost always by head-load by women. At the farm level after harvest, women have the burden of moving cassava roots to natural bodies of water to soften roots, to break down and leach the cyanogenic glucosides in bitter varieties to make the cassava safe to eat. They then transport to villages 25-35 kg headloads of wet cassava to racks, roofs, drying floors, or the ground to dry. If feeding Kinshasa takes about 4.5 million tons (wet-weight) of retted cassava roots, this represents about 180 million head loads. Counting the original trip from field to water source, about 360 million head loads are needed to feed Kinshasa.

The harvesting, transporting and on-farm processing of cassava to send to market as dried cossettes requires a concentration of female labor that rotates among fields during the marketing seasons. The farther the fields and the water source from the village the lower the lower the per ton-km value of the transport. Costs of transport from village to aggregation center vary greatly. Transporter margins for both types of bicycle pushers are dependent on the mix of products that they carry; their ability to turn their receipts at food markets into consumables that they can sell in the villages; their management of their own costs for energy (food), upkeep and repair of their cargo bicycles; and their down time to recover from the arduous trips (at least 2-3 days a week). There is a constant flow of long-distance bicycle pushers from villages to market towns and river loading points during the marketing seasons.

Motorized transporters are generally both traders and transporters in general cargo and passengers with the mix of cargo shifting on a seasonal basis and passenger loads and fares often set on the basis of how much cargo they displace. Terms of carry tend to be based on a *pari-colis* system, where one sack of cossettes pays for the transport (to be sold by the transporter) and one sack is sold by the shipper (a trader or farmer who also often accompanies the lot shipped to market). This system dominates even along now well-established routes on paved and rehabilitated roads in Bas Congo and the Plateau de Bateke, where cash payment is made for transport.

Truck transport is used for long-distance but breakdowns are frequent, as is damage to the truck body, springs, axles, and transmissions. Breakdowns cause significant delays of days of even a week or more as a crew member is sent to look for a spare part or to fetch a welder. Even when there is not a major breakdown on the road, these trucks frequently spend a day or more in repair when they arrive at a major market, adding significant costs each truck's rotation. Truckers contribute to their overload by carrying fuel and major spare parts for both long and medium-haul trips.

Kinshasa is served by water from the Congo, Kwa, Kasai, Kwango, Kwilu, and Lukenie Rivers and their navigable tributaries, along with Lake Mai-Ndombe. These river routes, plus the main Congo River route to Mbandaka. There are three main types of cargo vessel. Pusher boats that maneuver barges that carry loads of a few hundred tons each, wooden baleineires that carry from 10 to 70 mt, and dugout canoes that carry from 700 kg to 3-5 metric tons. All river transport also requires trail or road transport of some kind: it all starts with head-load, bicycles, hand carts, a very few ox- and tractor-carts, and trucks to ports and embarkation points. Rural access roads are oriented to connect to river ports as well as major primary and secondary road ways in Bandundu Province.

After rehabilitation, the financing of regular maintenance of national secondary roads and market access routes remains the Gordian knot to be solved before the high cost of food transport to Kinshasa and the reflow of basic manufactured goods to rural areas can be brought down. In a very few cases, the rain barriers are being used as toll gates to collect funds for local hand maintenance committees (CLERs), but this is an ad hoc solution subject

1.0 Introduction

The objective of the assessment is to use the value chain approach to identify opportunities and constraints that will affect the implementation of the Food Production, Processing, and Marketing Project (FPPM), and to suggest strategies to leverage the opportunities and reduce the constraints to improving smallholder productivity and income from the production, processing, and marketing of cassava and cassava products in the three provinces of Bas-Congo, Kinshasa, and Bandundu that supply most of the cassava consumed in the capital city of Kinshasa.

Cassava markets around the world generally consist of food, feed, and industrial segments. In the DRC, almost all cassava production is oriented to the food market, with tiny amounts of byproducts used close to production zones for animal feed. There are almost no current industrial uses of cassava starch as former industrial uses, such as cotton fabric sizing, have disappeared with the collapse of the DRC's domestic textile industry, and other industrial starch users find it cheaper and more convenient to use imported substitutes, such as glue extender for plywood manufacture.

Cassava's importance to the average diet and economy of individual households in the DRC has remained more or less constant over the past decade, representing about 55% of the caloric consumption of each person. The average Congolese consumer takes in about 1590 kcal/person-day or only 89% of the FAO's Minimum Daily Energy Requirement (MDER) of 1750 kcal/person-day and only 74% of the Average Daily Energy Requirement of 2170 kcal/person-day (the higher level is a better reflection of the energy requirement of a working person). Rural consumption rates for cassava are probably higher across all income levels. Rural per capita consumption of cassava is reported to be substantially higher than urban consumption. Past studies (Goossens,1996) suggest that most Congolese smallholders consume from 70 to 80% of their own cassava production. Maize and cassava flours, plantain and cassava- where plantain is available, and plantain, maize, and cassava, are mixed to produce fufu throughout Western Congo, with proportions varying with the local availability, and market prices of each crop seasonally.

DRC is the fifth largest cassava producer in the world. While cassava production has long been dominated by smallholders, larger scale producers are now emerging, especially from the Plateau de Bateke and some parts of the Bandundu and Bas Congo Provinces.

The average yields of cassava in DRC range between 7 and 10 mt/ha, low in comparison with other major producing countries. The low yields are a result of the low-input nature of production in DRC, where generally poor soils make it difficult to obtain higher yields. Cassava is usually a "field closer" planted in many subsistence areas at the end of the rotation period. Some of the major issues facing improved yields are: weed control early in the plant establishment period, rising costs of field labor, widespread retention of lower-productivity and disease-susceptible varieties due to consumer preferences and better in-field storage fiber profiles, and low rates of renewal of disease-free planting materials. Cassava pests and diseases evolve constantly in an environment where cassava is found in the same environments at essentially all growth stages of the plant. Overall production seems to be recovering from the negative effects of civil conflict and the emergence of Cassava Mosaic Virus strain 2 (CMV2) in the late 1990s that persisted throughout the first decade of this century. A more recent threat to cassava production is Cassava Brown Streak Disease (CBSD) which appears to be moving in from east Africa.

DRC's production of food since independence, and even more so since the Army uprising and looting of Kinshasa in 1991, has not kept pace with demand in Greater Kinshasa. Imports of food staples have filled the gap. Cassava is the one staple food crop in the DRC that is not imported in significant quantities, reflecting the fact that nearly every rural and peri-urban household in the DRC grows cassava. Past surveys (ref) suggest that while 70% of smallholder production is consumed on the farm, they sell a significant portion of their production.

The food commodity price spikes in 2007-2008 did shift public thinking towards the need for greater local production to hedge the risk of future supply and price disruption. However, domestic supply response has been slow to respond for a number of critical constraints:

- Farmers work on low-fertility soils without improved inputs or technologies. The low to moderate quality soils of the Kinshasa marketshed have been depleted by farming without inputs and by the shortening of bush fallow/farm cycles. Poor access roads and unreliable transport services of many rural areas cut smallholders off from sources of inputs as well as markets for sales, thereby providing little incentive to invest in farming.

- Market actors have little access to improved post-harvest technologies. High losses at all stages of the chain result from the lack of post-harvest storage, conditioning, and processing technologies. These also contribute to health problems for consumers.[1] With an atomized production and consumption market where actors generally are unable to deal in truckload transactions (much less river barges), leverage points for introducing new technologies downstream from the farm are not easy to identify, as most traders and depot owners have little physical capital and may lack business skills. Producer organizations are also weak institutions suffering from their members' poor literacy and numeracy—which hinders their ability to serve as focal points for the introduction of new technologies.

- Existing market mechanisms work, but at a high cost. Transactions in staple food value chains are heavily layered with intermediaries who negotiate the long transport delays, calculated in months for river transport and weeks for road transport, and unpredictable market clearing times with frequent and substantial product losses. Often supply chain participants are not paid until the product is sold in the final market, which has little wholesale capacity, adding again to market clearing delays. Trust in the whole system is low, with upstream sellers often traveling with product to ensure payment. Informal payments at road barriers, truck parks, and ports and *plages* also contribute to delays and add to costs of trading. For these reasons, gross trading margins and transport costs tend to be quite high - which in turn discourage farmers from viewing food crops as a major source of revenue

- Actors lack capital and financing options. Almost all market actors suffer from weak capitalization. This is particularly true of farmers who are in many zones are "asset poor" in that they lack physical assets necessary to maintaining basic minimum living standards. With the accompanying lack of financial services, particularly for long- or even medium-term lending and a bank account penetration rate that is one of the lowest on the planet, the lack of financing for investments in enhancing farm productivity and new post-harvest technologies poses a critical challenge.

[1] Alfatoxins in maize are a real problem, as is *konzo* from insufficiently leached cassava that is particularly prevalent in the parts of Bandundu south of the R,N.1.

The situation is far from static, though. In the past five or six years, greater stability in Kinshasa marketshed has prompted perceptible changes of relevance to the staple food economy. First and most important among them are large-scale donor investments in road improvements and river dredging and marking. CTB and UNOPS have not only rehabilitated the Kinshasa to Kikwit portion of R.N. 1, but also improved feeder roads over portions of Bandundu and the Bas Congo. It is now feasible for large trucks to travel to Kinshasa in one day (as opposed to three weeks or more) from areas in Bulungu, Idiofa, Masimanimba and Gungu with rehabilitated feeder roads feeding into R.N.1. Similar improvements in Bas Congo have reduced access times and costs to areas in the Bas Fleuve.. These changes are helping to open up wide areas of previously isolated territories to new market incentives.

A second trend is the growing numbers of rural entities (farms and NGOs) engaged in the generation of quality planting materials and emerging as capable seed multiplication businesses with established networks and delivery systems. Though still largely donor dependent, these centers provide possible relay points for other production-related services, including other inputs, extension services and possibly processing and aggregation services.

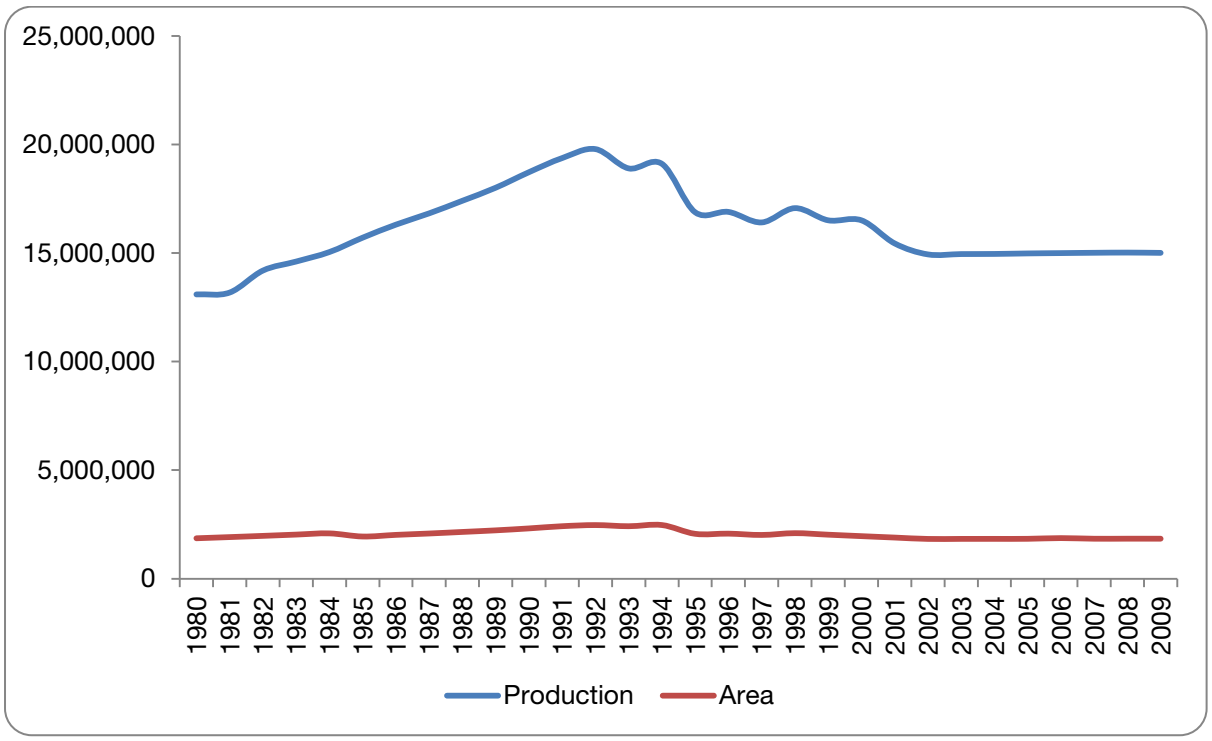
A final trend is the emergence of SMEs who invest in value chain improvements by focusing on the processing or selling of branded, specialized food products. With their business decisions affecting both input suppliers and end-product buyers, these SMEs are becoming anchor firms that will help organize value chains and spur rapid growth in a given market segment.

2.0. Cassava Production

2.1 LONG-TERM PRODUCTION TREND

As reported in the FAO Stat database, cassava in the DRC suffered a severe drop in production in the 1990s from a one-two punch: the outbreak of new Cassava Mosaic Virus (CMV) strains in the early part of the decade; and, the civil war and "pillage" that destroyed infrastructure, communications, and basic services. Production declines were led by reduction in the area planted and harvested as shown in Figure 1. Producers were cut off from markets and sources of new planting materials, transport slowed as road, river and rail transport crashed, and rural areas were demonetized, with large areas reverting to barter trade. Average reported cassava yields, however, rose from about 7 MT/ha in the early 1980s then remained close to 8 MT/hectare from 1985 to 2009. However, it seems very unlikely that production was as flat as that shown over the 2001 to 2009 period.

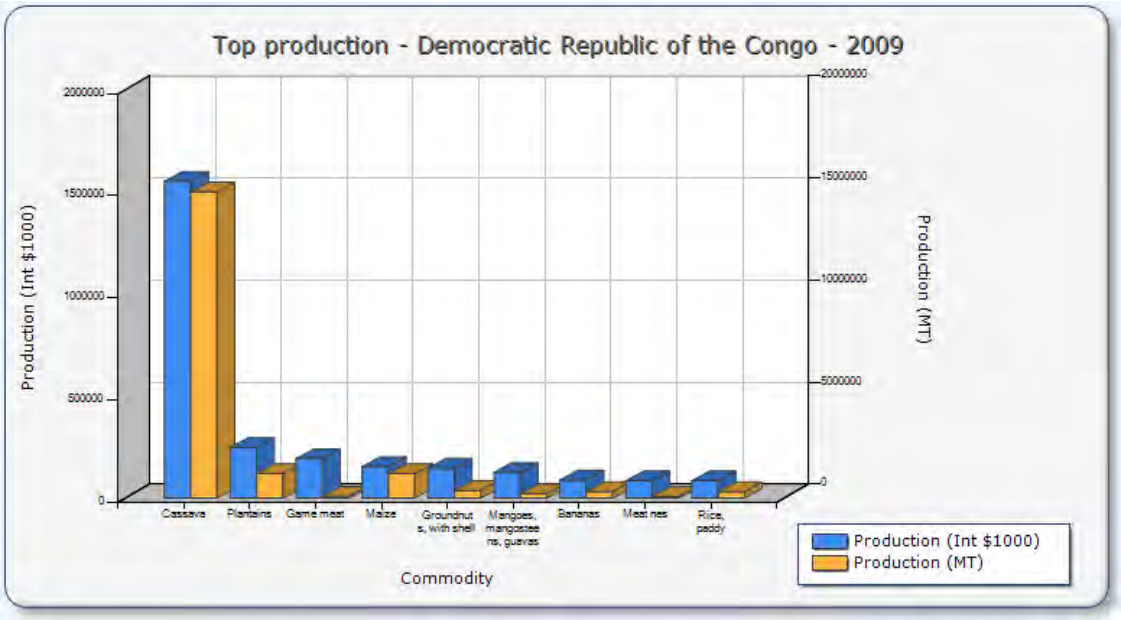
Fig. 1: DRC Cassava Production 1980-2009



2.2 CASSAVA DOMINATES CROP PRODUCTION

Despite the production shock, cassava never lost its dominance in DRC crop production as shown in FAO Stat 2009 statistics in Figure 2 below. Note that cassava production is reported as fresh, wet root weight. It would still be dominant when adjusted to 24-26 percent dry matter basis. It should be noted that the agricultural statistics database for the DRC is weak and the numbers should be taken as indicative figures showing order of magnitude changes.

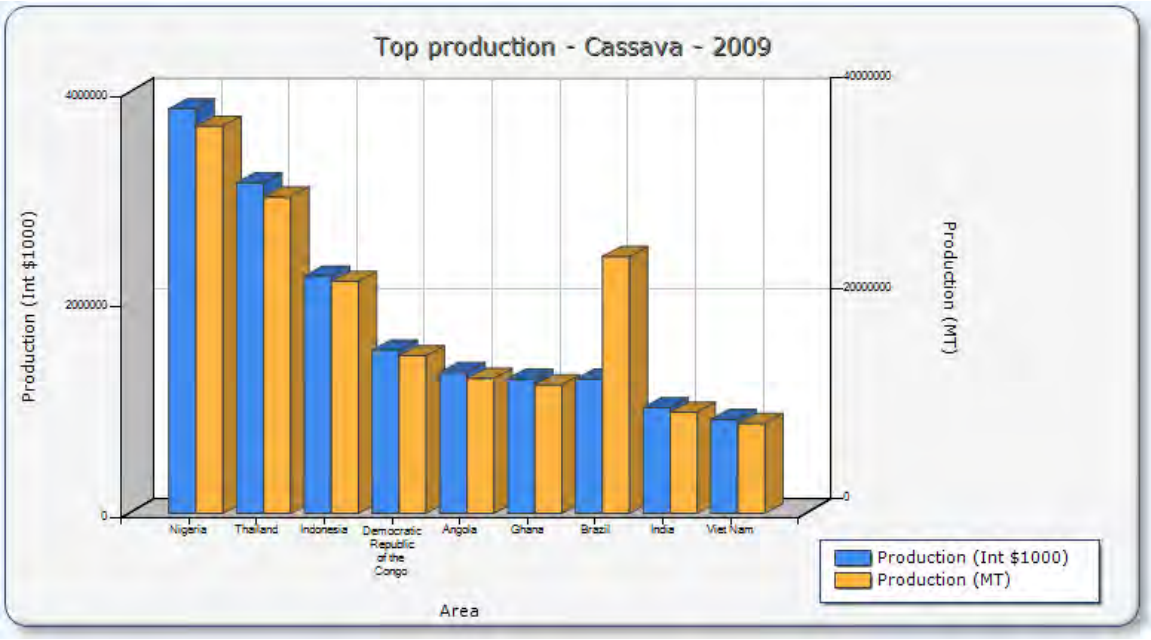
Fig. 2: DRC Food Crop Production 2009



2.3 THE DRC'S POSITION IN WORLD PRODUCTION

The DRC is the fifth largest cassava producer in the world and the second largest producer of cassava in Africa after Nigeria, the world's largest producer, as shown in Figure 3 below. FAO reports crop value based upon international commodity prices to even out currency differences. Note that most producing countries have about the same international price applied of about $102/metric ton of cassava as fresh root or slightly over $0.1 per kilogram. Brazil stands out with a per ton price of about half that of other producing nations, suggesting that it has much lower costs of production and marketing, because its average yield levels do not account for the size of the price difference.

Fig. 3: World Cassava Production – 2009



2.4 GEOGRAPHIC DISTRIBUTION OF CASSAVA PRODUCTION

In the DRC the provinces of Bas-Congo, Bandundu, and Kinshasa that form the Kinshasa marketshed represented about 31 percent of national production in 2006 as shown in Figure 4 below. Kinshasa Province contributes less than one-tenth percent (0.1%) of national cassava root production according to these numbers, although the province produces some of the highest quality intermediate and finished project among the three provinces that form the Kinshasa marketshed.

Fig. 4: DRC Cassava Production by Province

Province	2000	2001	2002	2003	2004	2005	2006	2006
Kinshasa	11,171	10,805	10,451	10,461	10,465	10,486	10,458	0.1%
Bas Congo	1,456,269	1,404,652	1,358,206	1,359,961	1,360,497	1,363,132	1,359,490	9%
Bandundu	3,530,131	4,052,325	3,302,434	3,305,739	3,308,142	3,313,451	3,304,604	22%
Equateur	1,856,032	1,452,634	1,736,861	1,738,013	1,738,748	1,742,112	1,737,411	11%
Orientale	2,097,013	2,027,656	1,961,755	1,963,716	1,964,569	1,968,302	1,963,042	13%
Maniema	775,607	750,177	725,580	726,292	726,592	728,006	726,057	5%
Nord-Kivu	335,139	324,150	313,522	313,836	313,961	314,569	313,622	2%
Sud-Kivu	617,613	597,363	577,777	578,357	578,585	579,705	578,156	4%
Katanga	2,979,546	2,881,852	2,787,364	2,790,151	2,791,262	2,796,667	2,789,123	18%
Kasai Occ	1,050,102	1,015,672	968,370	1,174,643	1,175,111	1,177,386	1,174,240	8%
Kasai Or	1,254,377	1,213,249	1,173,470	1,174,643	1,175,111	1,177,386	1,174,240	8%
DRC	15,963,000	15,730,535	14,915,790	15,315,812	15,143,043	15,171,202	15,130,443	100%
Kin Marketshed	4,997,571	5,467,782	4,671,091	4,676,161	4,679,104	4,687,069	4,674,552	31%

Source: WB Figures

Besides direct food distribution, major national and international efforts were raised to re-establish agricultural production., IITA and INERA researchers rapidly screened and introduced new CMV resistant varieties building from their disease- and pest-tolerant cassava breeding programs, building on three decades of work with INERA at the major cassava research station in Mvuazi, Bas-Congo Province, and important regional facilities at Kiyaka, Bandundu Province, USAID, international donors and organizations leapt to the task of bulking-up and distributing improved CMV-tolerant varieties. Adoption, especially along the all-weather roads, took time because of the need to bulk materials, distribute them for multiplication by farmers, and for producers to evaluate production and quality.

Marketshed-wide adoption rates are reported by project staff and rural development NGOs to be about 15%, a figure that probably reflects the following factors:

Infrastructure and transport limitations impede the demonstration and distribution of new varieties. National secondary roads are in poor shape providing only seasonal access. And, the farm access roads that are 1 to 4 kilometers away from most villages and link to the secondary roads are highly degraded and primarily traveled by foot or bicycle most of the year. Cassava cuttings are bulky and much lower value for transporters than other goods, limiting their appeal as freight to truck, boat, or bicycle transporters.

Rural and urban consumer preference for white cassava flour and white/light colored chikwangue increases demand and leads to higher semi-wholesale and retail prices. Many of these varieties are susceptible to cassava mosaic virus. They include varieties from the first and second waves of cassava varietal releases from the IITA/INERA collaboration and older cultivars that pre-date the collaboration. Many released varieties have been re-baptized with local names.

The third wave of CMV-resistant improved varieties have roots that bulk up in size and maturity in 12-14 months. The roots of these varieties then rapidly increase in fiber density and thickness reducing edible dry matter, which makes them less desirable for smallholders who must spread their harvests on each field over several months. Smallholders retain older varieties that are later bulking and maturing to even out the supply of edible dry matter, since the best planting times are the same for almost all varieties.

The smallholder farm family need to "store" cassava in the ground , progressively harvesting small portions for weekly consumption, spreading harvest and processing labor requirements and human transport burden, and spreading market risk. Smallholders therefore select a range of varieties of different maturities and fiber characteristics to fit their production environments, meet their subsistence needs, and generate cash.

A producer and market preference for branching varieties of cassava that are susceptible to CMV for the production of cassava leaves for the fresh leaf (pondu) market.

2.5 MAINTENANCE OF FERTILITY OF SAVANNA SOILS

2.5.1 WEED CONTROL AS FIELD SIZE INCREASES

Average field sizes for cassava, without mechanization, average about 0.5 – 0.75 ha. Cassava cuttings are hand planted. Young cassava plants do not out-compete weeds. They require substantial weeding efforts before even the more vigorous stands suppress the weed challenge. Late first weeding has a substantial impact on early cassava growth, with the weeds tending to shade the cassava plant, promoting the growth of tall, sometimes etiolated cassava. Crop yields are reduced if weeding because of competition for water and nutrients. As individual field size increases, weeding labor demand and cost becomes higher per farm and, according to commercial growers, less reliable.

The primary recommendations for weed control in cassava are:

- Crop rotations to suppress weed seed bank growth from cassava following cassava;
- Timely hand weeding;
- Pre-emergence herbicides to favor early cassava growth and reduce early season labor demand;
- Mechanical weeding;
- Post-emergence herbicides;
- Intercrops and undersown cover crops to suppress weed growth.

Mechanical cultivation is possible with a tractor or pair of animals when cassava plants are short and canopies are small in diameter, but quickly becomes difficult unless the cassava is planted on ridges and weeded with a hand rotary weeder or single-row, animal drawn cultivators. Very few farmers have any motive power beyond their hands in the Kinshasa watershed, and weeding labor costs were reported to be about $1.50 per person-day. Hand hoe weeding of cassava is done mainly by women. While commercial growers report that deep tillage suppresses early weed growth, reducing some of the weeding labor required, they are turning increasing to herbicide use, primarily glyphosate, to reduce weed competition and the cost of manual or mechanical weed control. This total knock-down herbicide is relatively safe to use, but consistent use will lead to over time to glyphosate tolerance in weed species. Rotations of herbicides and cultural practices will help slow the development of glyphosate tolerance/resistance in weeds, which is already occurring in the USA, Europe, and Latin America. According to IITA and CIAT research in Nigeria and Colombia, the most effective

control of weeds in cassava is achieved with pre-emergence herbicides to reduce the need for post-emergence mechanical or chemical weed control, combined with crop rotations to suppress weed growth and to help maintain soil fertility. Pre-emergence herbicides may be very beneficial for smallholders in the DRC, but we were unable to find trials of this technology.

2.5.2 Coping with Low Fertility Soils

The photograph below shows a 1.5 meter deep section of a Kalahari sand profile on the Plateau de Bateke in a road cut. The Kalahari yellow-brown sandy loams (hydro-xero-arenoferrals in the world soil classification system) are derived from Tertiary period, very deep Kalahari sand materials. These soils are nearly 90 percent sand, 50-60% fine sand, with low clay contents ranging from 10% to 20%. These soils are fragile and very susceptible to erosion on the landscapes that are deeply incised by the Kwango and Kwilu river systems. The erosion challenge is high on slopes because this area receives 1100 to 1200 mm of rainfall each year. The soils have a low (0.3-0.7 meq per 100 mg) mineral content in their upper soil horizons. Cation exchange capacity is low: ranging from 2 to 5 meq per 100 g from mineral sources. Carbon levels are from 0.5 to 2.0 % and nitrogen levels are from 0.04 to 0.08 %. Their pH ranges from 4.5 to 5.8. They have a low water holding capacity. Their organic matter content varies considerably from 1% to 5% depending on how vigorous the wooded grass savannah is at a particular site. The photograph shows a relatively good organic matter accumulation in the A and B soil horizons to a combined depth of 70 cm in a soil formed in a Hyparrhenia spp grass-dominated landscape. Nearby commercial cassava farms yield about 10-12 MT/ha with very large root sizes up to 35 kg per root in newly opened, mechanically plowed fields.

Kalahari Sandy Loam Soil Profile on the Plateau de Bateke

Management of these generally low fertility soils depends on maintaining organic matter in the soil profile. Both commercial farms and smallholders use “ecobuage”, which is early hoeing or plowing of the land one to two months in advance of the growing season to permit “composting” the crop residue under the shallowly- (hoe-) or more deeply- (tractor-) tilled soil. This process provides time for microbial breakdown of the crop residue to make plant nutrients available for the planted crops.

Farmers seek out the more fertile sites and those that have access to water to produce cassava. These tend to be areas where there are perched water tables in upland settings or where there is proximity to a swamp or stream in lowland settings. While water availability and soil fertility is higher, these zones do pose risks from flooding in the rainy season, competition for space with fruits and vegetables during the dry season, and are also more susceptible to animal damage because they are water sources for wildlife.

2.6 CASSAVA VARIETAL IMPROVEMENT

2.6.1 PRODUCTIVITY PERSPECTIVE

Cassava production, planted area, and average yield data for the DRC are mostly educated estimates with very large confidence intervals. Our discussion will be primarily qualitative and order of magnitude in nature. Cotton cushiony scale insect in the 1980s in humid areas and CMV from the early 1990s caused major yield losses. Recovery of cassava production required the discovery and development of mass release and naturalization programs of parasitic wasps to control scale insects in the first case. Productivity increases require the identification of cassava varieties tolerant to aggressive new stains of CMV, new rapid bulking techniques, and large amounts of investment in the DRC to multiply and spread CMV tolerant varieties for distribution and propagation by smallholders.

INERA and IITA speak in terms of three major waves of cassava varietal change in the DRC. Wave III was an emergency push to provide short-cycle (12 month maturity), CMV-tolerant varieties that could rebuild the base of the Congolese diet from its crash during the civil war. From the initial releases of the first improved varieties in the 1980s until today, the average cassava yields have never exceeded about one-third of their potential yields with good management practice. Currently cassava yields are reported by smallholders, officials, and project workers alike at about an average of 7 MT/ha in savanna settings and about 10 MT/ha in “forest” settings in Bandundu, Bas-Congo, and Kinshasa provinces.

Extensive areas of production in Bandundu, and most of Kinshasa province, are covered with open-wooded savannas and grasslands on Kalahari sands of low overall fertility. “Forest” areas, essentially all secondary forest, are sought out for their higher fertility. These areas are present in zones in Bandundu and Bas-Congo provinces. High fertility sites in these zones may yield up to 20 MT/ha of fresh root production if cassava is planted early in a rotation. However, cassava often follows 2 to 3 years of maize production without fertilization and only small amounts of legume intercropping. The extraction of major and minor plant nutrients through cropping quickly reduces soil fertility on the lighter soils, leading to lower yields and long-periods of grass, bush, and tree regrowth needed to re-establish organic matter and nutrient status. Population levels in many rural zones have risen to the point that long-cycle land rotations are no longer feasible. This means that intensified management of land is essential to sustained use and sustainable productivity.

Yields of cassava in the RDC are likely to be limited first by soil fertility, second by rainfall distribution within the season and soil moisture, third by early season weed challenge, fourth by diseases and pests, and fifth by the seasonal differences in sunlight (lower in the longer and wetter growing season A and higher in the shorter and drier growing season B).

2.6.2 Pest and Disease Tolerance Perspective

Pest and disease complexes evolve constantly in the face of natural and human-made selection pressures. Over the past 30 years, the DRC has benefitted from research that has successfully introduced cassava varieties with bacterial-blight resistance (CBB), cassava mosaic virus (CMV) race 1 and race 2 resistance, cassava mealybug predators, some measure of spider-mite tolerance. However, each of these diseases and pests is evolving over time to work their way around these genetic resistances and beneficial predator insects.

In addition, new phytosanitary threats are appearing. The devastating Cassava Brown Streak Disease (CBSD) is working its way from East Africa through Eastern Congo to Western Congo. There are some reports, primarily in Bandundu Province and the Plateau de Bateké that Cassava Brown Streak Disease is present. CBSD attacks cassava after the roots reach physiological maturity. Although currently the disease prevalence is reported to be low, the "third wave" varieties from IITA/INERA all mature at 12-14 months, perhaps increasing the concentration of infection risk in the newer varieties. The incidence and spread of CBSD awaits verification by IITA and INERA. However, laboratory tests and sampling methods to detect CBSD viruses from field samples are not yet reliable enough to demonstrate infection and predict root damage. While visual symptoms on the plants are detectable in terms of leaf stress, these are subtle and also not good predictors of root damage. Farmers are not able to assess the extent of damage until the roots are harvested, when the characteristic damage is visible as shown in Figure xx. The need for sustained plant breeding and plant protection research will be constant, as long as the Kinshasa marketshed and the country is so dependent on domestic cassava production.

3.0 Processing

3.1 MANUAL PROCESSING

Most cassava is processed manually by rural in small batches that are equivalent to a few head loads of cassava root that are intended to feed individual households. The labor needed to transport cassava roots to a spring, stream, pond, swamp, or river is a major constraint to the amount of cassava that can be processed using traditional methods. Water availability is the other major constraint.

3.2 RETTING, GRATING, CHIPPING

Cassava is retted before or after peeling to soften the root and to leach out toxic cyanogenic glycosides that would otherwise cause acute or chronic cyanosis among consumers. Fermentation also takes place during the retting stage, modifying starches and producing characteristic flavors and aromas but having little effect on the breakdown of cyanogenic glycosides.

Other forms of processing, such as grating fresh cassava roots can accelerate the breakdown of these glycosides by crushing cells to release the liminarase enzyme, permitting detoxification to occur and avoiding fermentation if desired. Grating and chipping can be done by hand in small lots, but run into the lot-size constraint that a woman can handle in a daily work-schedule.

3.3 PRODUCT DIFFERENTIATION

3.3.1 FERMENTATION AND DRYING

The intermediate wet products are either broken up into fragments and paste that can be stored for up to two months to produce chikwangue or they are dried to produce dried cossettes (whole or halved roots of various lengths), chips or flakes (micro-chips). Fermented cassava paste is relatively stable at a pH of 3.5, but exposed areas tend to develop mold where condensation dilutes the acidity and provides a starch-rich environment for growth. As fermentation slows in storage, rots set in that can cause accumulation of mycotoxins. The rate at which cossettes, grits, and flakes dry also determines how much mold development and discoloration occurs. Sun drying dominates and local cloudiness, temperature, wind, and rainfall lead to wide variations in drying times for the same type of product in different locations and at different times of the year in the same location. Higher insolation during the rainy seasons may permit drying over a three-day period, compared to 5-8 days in the overcast, hazy, and low temperature regime dominant in the dry season. Village level processing is done in small lots on roof lines, racks, drying floors, or the ground. Protecting the drying product from wind, rain, animals, and theft occupies substantial time. The drying space that a single family can manage is generally small. If harvests for marketing are done, small lots are accumulated to reach a minimum sale volume, or rotating work groups (tontine) are formed to harvest, process, and dry product across a number of households, often on a 50:50 end-product sharing basis.

3.3.2 UNFERMENTED FLOUR FOR BLENDING

There is increased artisanal production of unfermented cassava flour for local shops, canteens, and street snack vendors. While a few hundred chippers and grating machines have been distributed, it is not known how many are used for unfermented flour, or even how many are in operation. Hand graters can be manufactured for household and small vendor use at a tiny fraction of the cost needed to buy an engine-powered chipper/grater, but again, it is not known how many are in use. Estimated cost of a hand-made grater is $7-10 when made from a used powdered milk can, and about another $5 for a mixing bowl. This contrasts with $1500-$2000 for a motorized grater/chipper. The simple technology may work at the household level, but requires about a two hour cycle to produce a baked batch. The Association des Producteurs et Transformateurs de Manioc (APTM) trains village women trainers-of-trainers each Monday on recipes. They also train trainers in recipes in Kinshasa every Friday. These sessions are video recorded, but it is not clear if they are scripted or if the recipes are broadly available. Matadi beignet makers use cassava flour to cut flour costs. This is partly due to the work of GROUPEDI and other projects over the past 5 years.

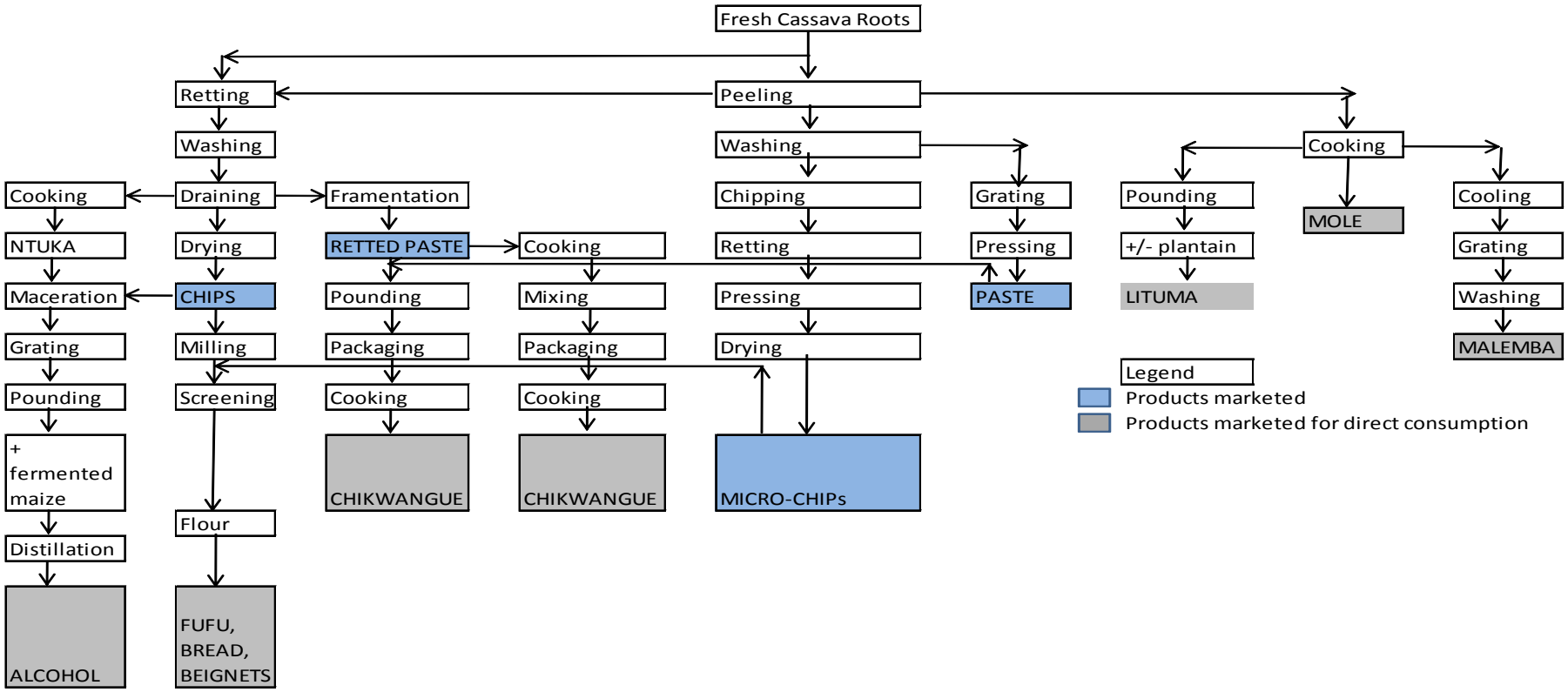
3.4 PROCESSING CONSTRAINTS

Some of the major problems affecting quality processing of cassava are illustrated in Figure 5 below.

Fig. 5: Cassava Processing Constraints

Constraint	Solution	Result	Social Gain	Economic Gain
Harvest, peeling, fermentation/leaching, has a high female labor demand (43 – 50 days/ton wet weight.	None. There is no adapted mechanical peeler for rural house-holds with low or no access to power.	None. A research topic for IITA/INERA and others.	Increased rural, non-farm employment.	Increased rural and urban incomes.
Drying of whole and halved roots and cossettes takes 7-11 days, darkening the final product, reducing value.	Move processing from swamps, ponds, streams to micro-chip stations with low power motor, leaching tanks, and drying racks	Reduce cycle time to 3-5 days; increase value by 35-40%, increase shelf-life.	Increased local demand for construction services and materials.	Greater number of services and goods available to SMEs.
Large surface areas required for air-drying racks limits scale-up of micro-cossette station.	Wood, diesel, or electric dryers at higher through-put facilities (10MT/day +)	Reduces cycle time to 2-3 days.	Increases reliability of producing quality product in wet and dry seasons, improving margin capture.	Increased income for households from more days worked per season.
Wood-fueled dryers, most likely options, would further stress urban and peri-urban fuelwood supply.	Extend *Acacia* and other woodlots and plantations inter-cropped with cassava/maize (possible carbon credit financing.)	Improved fuel-wood supply.	Increased wood and food product jobs and sales.	Increased incomes; increased demand for agroforestry support services and equipment.

Fig. 6: Cassava End-Product Flow Chart



4.0 Market Analysis

4.1 CONSUMPTION

4.1.1 INTRODUCTION

Cassava's importance to the average diet and economy of individual households in the DR Congo has remained more or less constant over the past decade, representing about 55% of the caloric consumption of each person. Cassava's importance relative to other foodstuffs has increased because of the continuing increase in population and the decline in the purchasing power of the average consumer. Reduced purchasing power is the result of the combined effects of the slow re-establishment of economic growth in the DRC, the continuation of higher prices and higher price volatility in imported cereals that substitute for cassava products as sources of carbohydrates, and the increased cost of fuel and energy for the transport, distribution, and preparation of food.

While consumers in the upper income quintiles may substitute more maize flour, rice, and bread for cassava, the higher and more volatile relative prices for these carbohydrate commodities will probably not decline substantially over the medium term, keeping cassava consumption high among all income levels of Kinshasa and Western Congo consumers. However, the lack of up-to-date and accurate statistical information on consumption levels for all food products among the different income levels in the Kinshasa marketshed poses a substantial problem for market strategy development. As part of the baseline data collection, FPPM will conduct a household consumption/market survey to provide better statistical information for developing an agricultural marketing strategy.

4.1.2 FOOD BALANCE SHEET

Food balance sheets for the DRC, while suffering from major data collection and analysis challenges, suggest that the average consumer suffers from under nutrition. He or she consumes about 1590 kcal/person-day or only 89% of the FAO's age and body-weight adjusted Minimum Daily Energy Requirement (MDER) of 1750 kcal/person-day and only 74% of the Average Daily Energy Requirement (ADER) of 2170 kcal/person-day (FAO 2011), a better reflection of the energy requirement of a working person in the urban environment. Likely daily energy requirements for farm workers in rural households are probably closer to 2400 kcal/person-day.

These estimates suggest an immediate latent demand for 25% more carbohydrate supply, if actors in the value chain can reduce their prices to levels that will stimulate effective demand.

Fig. 7: DRC Partial Food Balance Sheet, 2002 - 06

Food Balance Sheet - Averages over Six Years* Bilan Alimentaire -Moyennes sur 6 années

	Year						
Description	2002	2003	2004	2005	2006	2007	Average
Population (millions)	55	56.4	56.4	61	63.7	62.5	59.2
Total cal/ person-day	1457	1397	1458	1309	1613	1605	1473
Total protein (g)/person-day	25	24	28	30	27	24	26
Total fat (g)/person-day	17	22	21	20	20	24	21
Cassava kg/person-yr	267	260	252	228	235	288	255
Maize kg/person-yr	21	22	23	19	17	22	21
Peanut kg/ person-yr	1.9	0.5	0.4	1.8	0.4	0.3	0.9
Fermented beverages kg/person-yr **	15	15	16	13	56	16	15
Cassava % cal/p-day	55	55	52	52	42	54	52
Cassava % protein /p-day	10	10	8	7	23	20	13
Cassava % fat/p-day	9	7	2	5	7	5	6
Maize % cal/p-day	14	15	15	14	10	13	14
Maize % protein /p-day	22	24	21	17	16	22	20
Maize % fat /p-day ***	15	11	13	0	10	9	12

Notes:

* Prepared from 5 years of Ministry of Agriculture Data and 2007 from COMESA Food Balance Sheet FAMIS database

** Excludes unexplained leap in reported fermented beverage consumption in 2006

*** Excludes unexplained zero fat contribution from maize in 2005

Note that cassava root-derived products contribute an average of 13 percent of the daily intake of protein. Cassava leaves are an important leafy vegetable in the Congolese diet, primarily as a consistent source of vitamins and minerals, and secondarily as an additional minor contributor to vegetable protein, vitamin, and mineral supply.

4.1.3 Dominance of Food Uses for Cassava

The major reasons for the dominance of food uses for cassava:

It fits most regional variations in dietary preferences and is the single largest source of food energy (55%) in almost all Congolese diets (see the partial food balance sheet in Table 1 above and a full version in Annex 1.);

It is a broadly adapted and a drought-hardy crop once established --relative to other staples;

In rural areas it is a major hedge against economic, weather, and political risks because of its viability as an 18-24 month crop with low care requirements (at low productivity levels);

Individual plants can be harvested over a few months, and fields can be harvested fractionally over 10-18 months to spread labor and processing requirements, operating as both a food and a cash bank from which withdrawals can be made regularly;

In urban areas, it is an important part of many households food security coping strategy, being mixed in higher proportions when relative prices of maize are higher and lower proportions when relative prices of maize are lower;

It is a dual purpose crop, with leaf harvests providing a main vegetable dish (Pondu) for many meals. Leaf harvests reduce tuberous root yields, but provide food and revenue well before root harvest is possible. Farmers select branching types of cassava to produce leaves, limit leaf harvest to the early period of crop growth (6-7 months), and retain Cassava Mosaic Disease susceptible varieties because they and other consumers find leaves infected with the virus to be “sweeter” than CMD-resistant varieties ;

Food uses also dominate because there is low current demand for feed use of cassava. Commercial livestock producers find it more convenient and cost-effective to use cereal and imported soy cake to produce feed rations.

There is also low current demand for industrial use of cassava starch. Prior industrial users such as textile mills have gone out of business and the timber industry, laundries, and pharmacies have shifted primarily to imported starch sources in finished products.

4.1.4. Geographic Variation in Cassava Consumption

Regional variation in cassava consumption is very high important, depending on the agro-ecological conditions that shape production, the food preferences and purchasing power of consumers, the mix of consumers of different origins who have moved westward into Bandundu, Kinshasa and Bas Congo over the last two decades, and the influence of emergency food aid on urban diets. Differences in climate and crop adaptability influence regional cuisines. For example, in the cool highlands of the Eastern Congo where cassava grows slowly and cereals, beans, bananas, and other roots and tubers are important; in the Kasais and Katanga, where maize is of central importance to the diet; and in parts of the Bas Fleuve in Western Congo where plantain consumption is high. The Kinshasa market draws nationally grown food products primarily from Bandundu, Bas-Congo, Kinshasa, and Equateur Provinces, but pulls on food supply from all of the country -- and from around the world.

4.1.5 Historic Variation in Cassava Consumption in Kinshasa

Goossens (1996) synthesized studies of the changes in food consumption in Kinshasa from 1969, 1975, and 1986, based upon studies done by Houyoux (1986). Figures 8 to 11 below present the information on per capita starchy staple consumption on a monthly basis in both total quantity and percent of starch consumed. They show both substantial changes in overall starch consumption and relative changes in the amounts consumed over time. Goossens attributed the changes in consumption to relative price changes for products that are substitutable.

During this period of rapid growth of the city of Kinshasa, from about 600,000 to 2.6 million, there was a rapid reduction in fresh root consumption per person, a swing back and forth in chikwangue consumption, and a steady increase in the longer “shelf-life” cossettes.

Fig. 8: Historical Consumption of Starchy Staples (Kg/Person) in Kinshasa, 1968 - 86

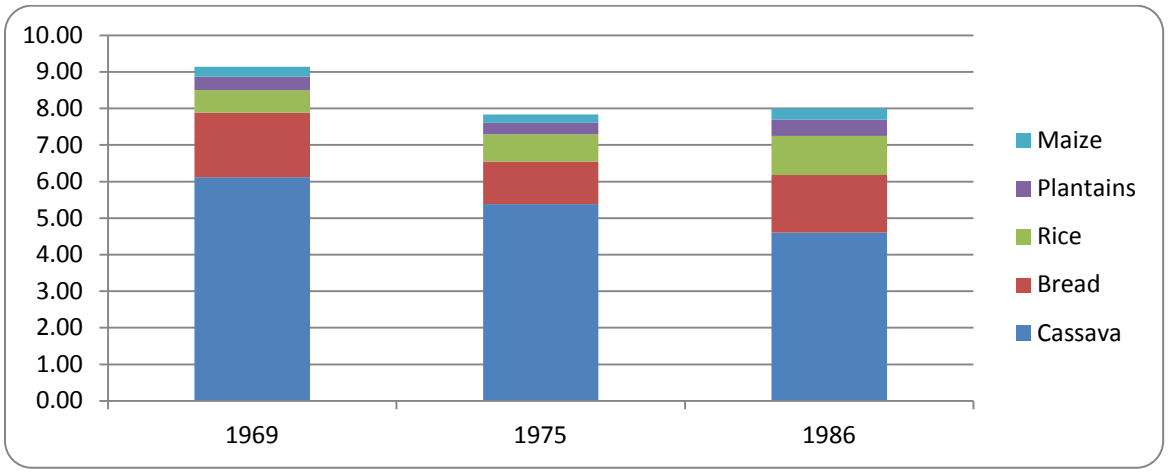


Fig. 9: Historical Consumption of Starchy Staples (%) in Kinshasa, 1968 - 86

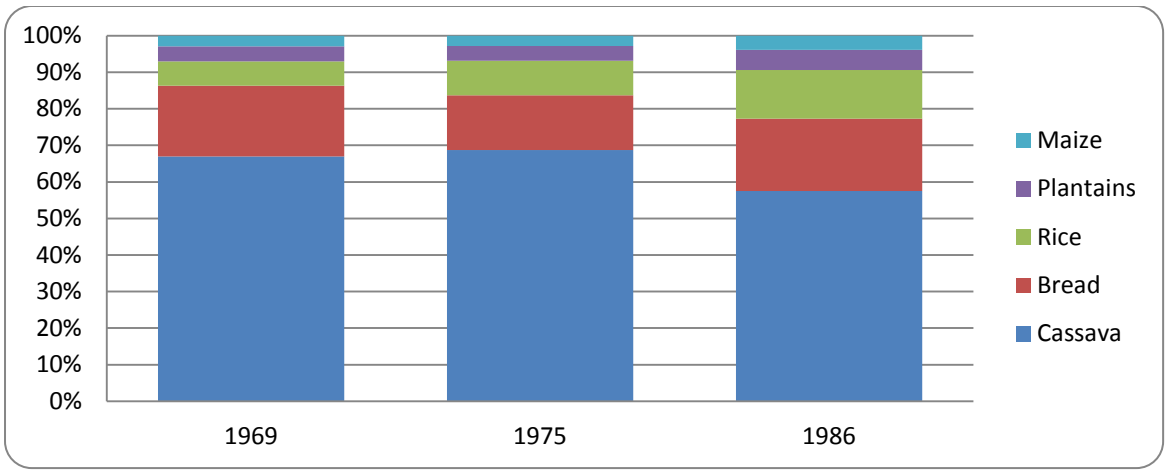


Fig. 10: Historical Consumption of Cassava (Kg/Person-Mo) in Kinshasa, 1968-86

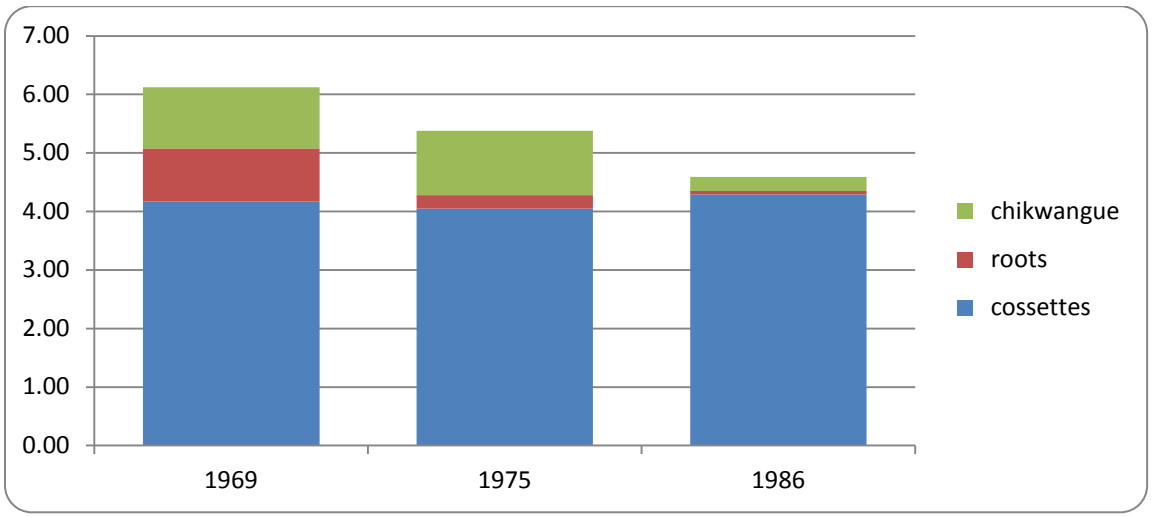
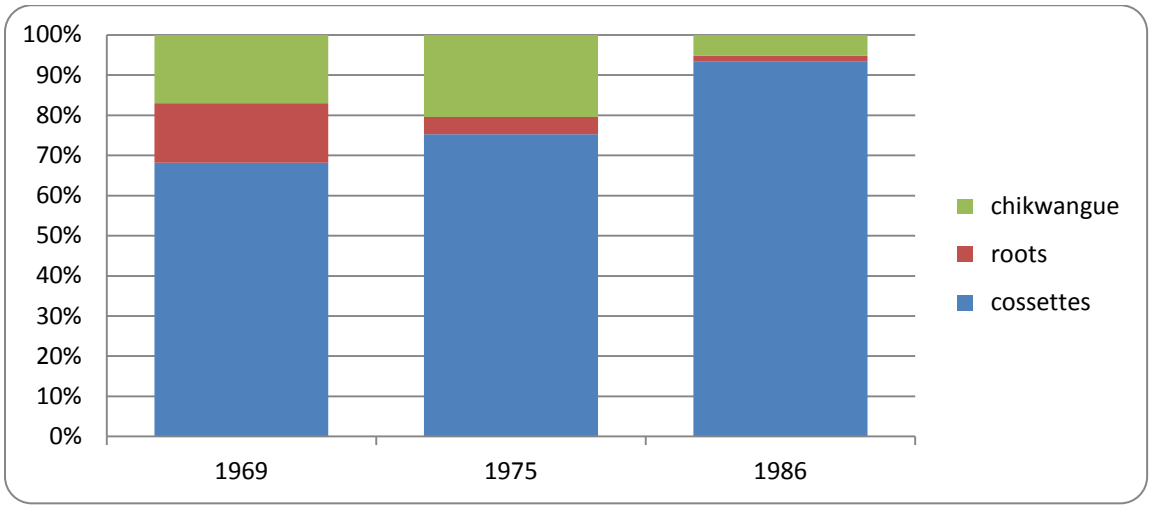


Fig. 11: Historical Consumption of Cassava (%) in Kinshasa, 1968 - 86



Goossens attributed these changes to the rapid increase in costs to deliver highly perishable fresh roots to market, the relative prices swings for substitutable foods, e.g., rice substituting for cossettes, where both require further preparation and cooking to be eaten. The overall decline in starchy food consumption parallels an overall reduction in per capita food consumption over the 17 year period from 1969 to 1986.

The DRC's recent food balance sheets per capita also suggest continued reduction in per capita food availability on a national level, although there are substantial problems with the data supplied in the balance sheet estimates. Figures 12 and 13 below from Eric Tollens' (2003) data provide a look at monthly consumption from 1975 to 2000. While Tollens' figures use definitions for the foods consumed that are slightly different from those of Goossens, they still show a continuing slide in cassava consumption, a relatively stable share for bread, a substantial increase in the total amounts and relative share of rice (primarily imported), and a more modest increase in the total amounts and relative shares of plantains and maize.

Fig. 12: Monthly Consumption Per Capita (Kg) of Starchy Staples in Kinshasa, 1975 - 2000

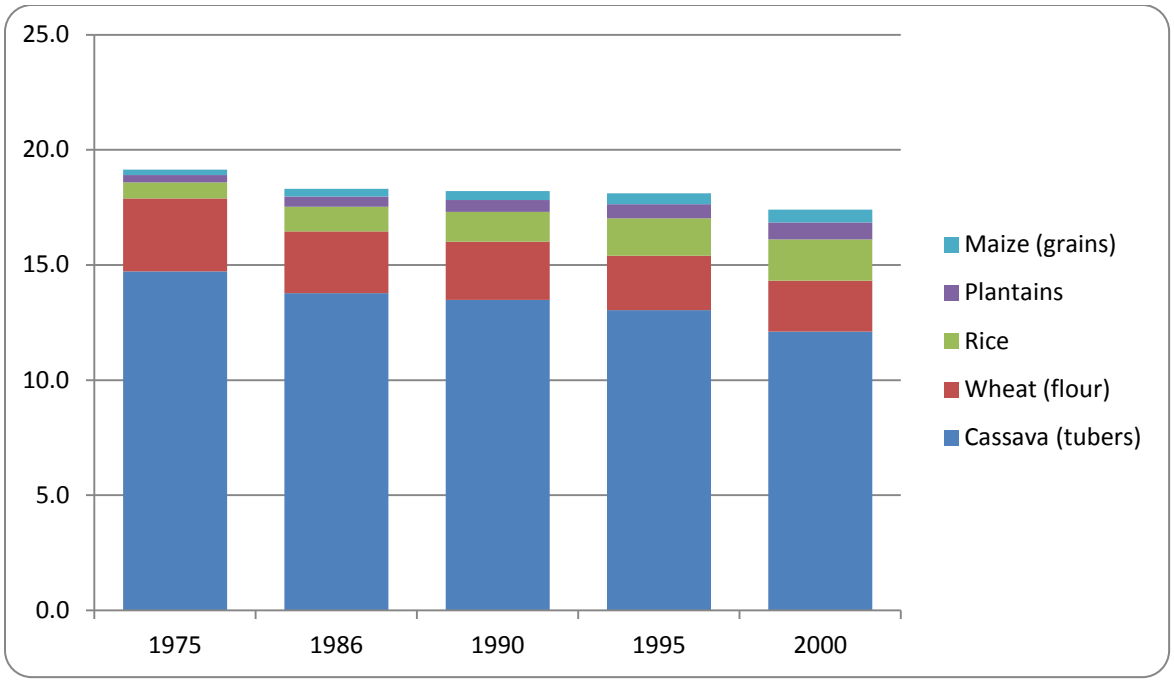
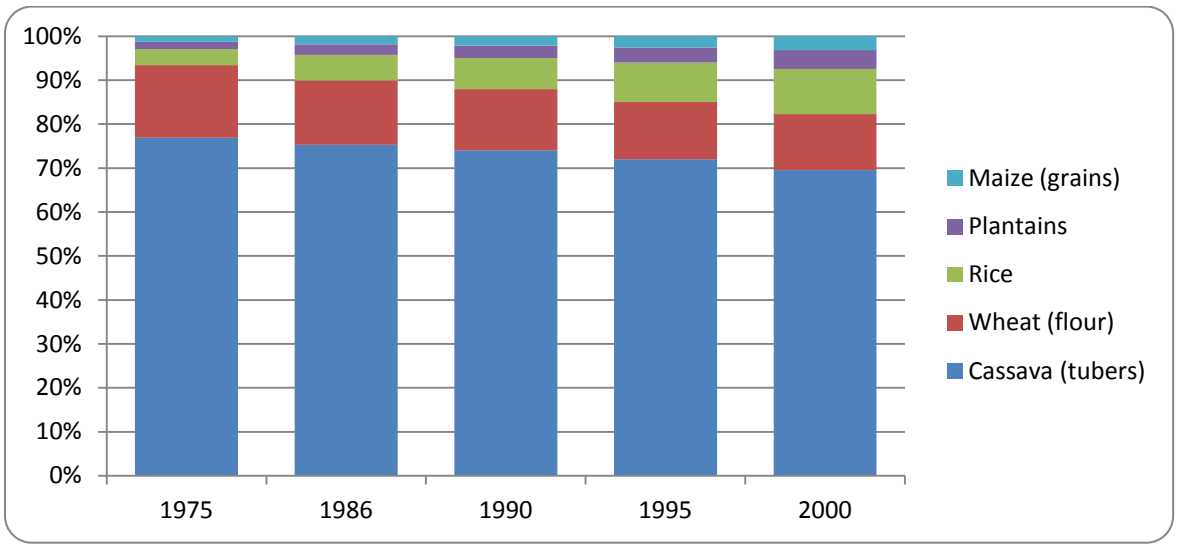


Fig. 13: Monthly Consumption Per Capita (%) of Starchy Staples in Kinshasa, 1975 - 2000



4.1.6 Current trends in Kinshasa Consumption

This study attempted to use roughly comparable definitions of foods to those of Goossens, adding the national consumption data for the 2002 and 2009 periods to estimate crudely the Kinshasa consumption that preceded and followed the 2007/8 global food price spike. The relative changes in diet support the growth in importance of maize in both the pre-and post-food price spike periods, while bread and rice contributions to diet have diminished on a per capita basis.

This conclusion may be controversial because it contradicts the view that rice has steadily become a greater component of the individual Kinois diet because of its ease of storage and its convenience in preparation. People in the lower income quartiles eating one or two meals a day are likely to respond more quickly to relative price changes, buying lower cost products. Note that this statement does not imply that total demand for rice or bread has declined. Total demand for all foods has grown with the rapid rate of growth of the Kinshasa population to approximately 9 million people.

The Congolese diet is built on cassava as the fundamental food product. The key question is whether the relative prices for wheat and rice have shifted since the 2007-2008 rice spike to the extent that per capita cassava consumption is increasing along with per capita increases in maize relative to imported rice and wheat. Knowing which ways the trend arrows point and how frequently they reverse is pretty important to orienting production and marketing strategy. The 2009 balance sheet figures and the price differentials and range of qualities of cassava observed on the Kinshasa marketplaces in June and July 2011 suggest that per capita cassava supply has increased.

The steady decline of per capita consumption of all foods shown in the official food balance sheets becomes less and less credible as consumption figures sink below the minimum needed to sustain metabolic functions at rest, never mind the physical activity required to walk the distances that most Congolese do every day. Data on the consumption rates of different cassava products that are regularly traded on the Kinshasa market is weak. APTM is planning to undertake a cassava consumption survey to better orient its producer and processor member strategy.

Fig. 14: Kinshasa Historical and Estimated Per Capita Monthly Consumption (kg) of Starchy Staples, 1969-2009

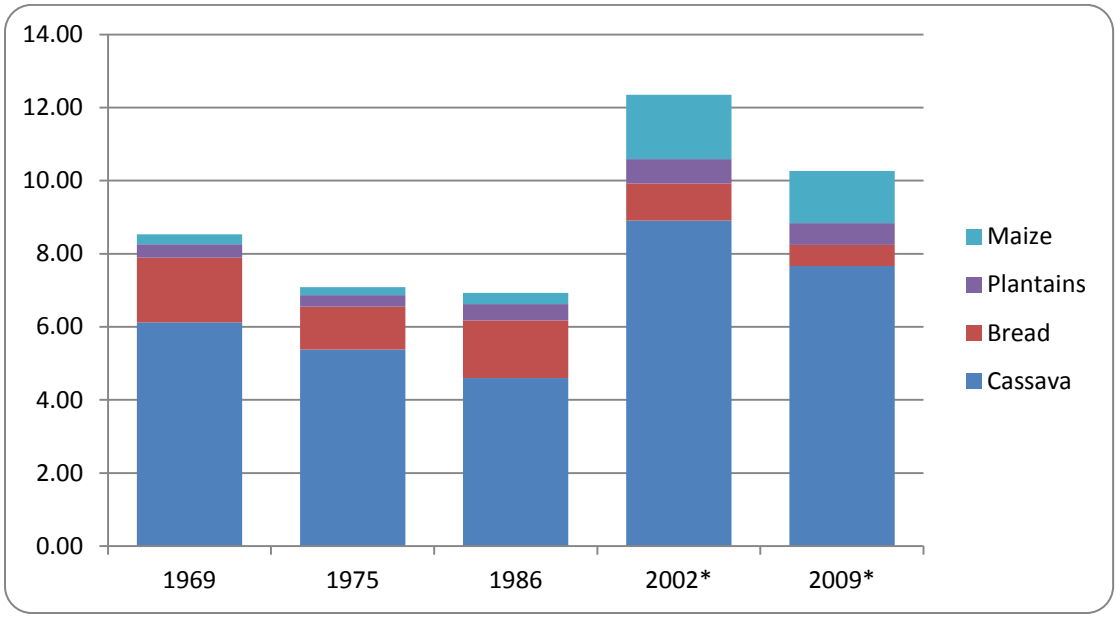
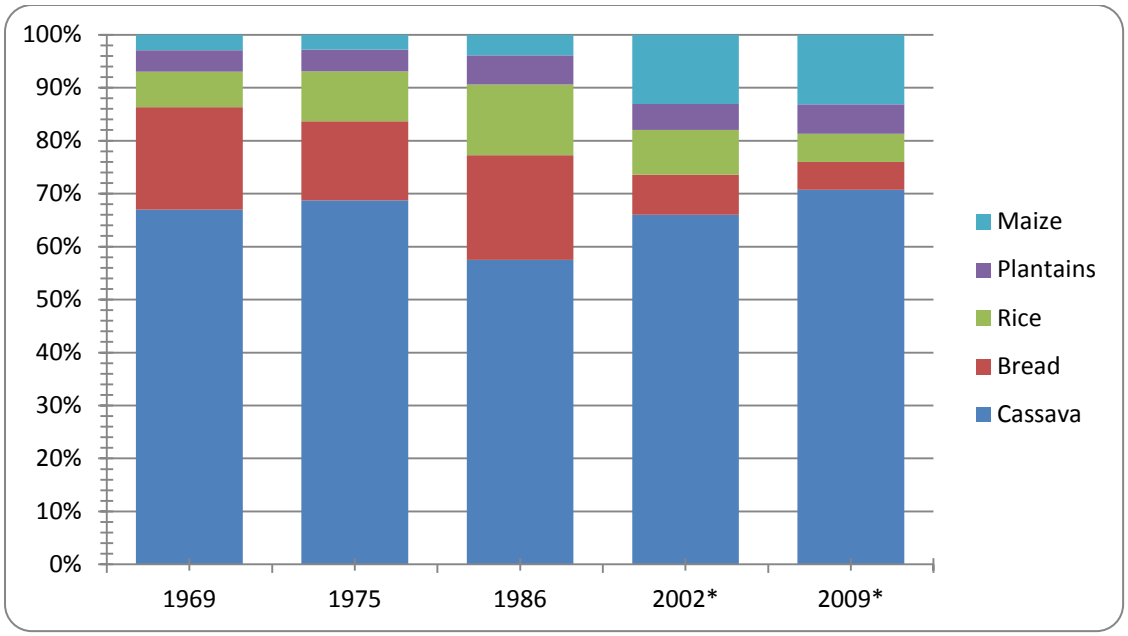


Fig. 15: Kinshasa Historical and Estimated Per Capita Monthly Consumption (percent) of Starchy Staples 1969-2009



4.1.7 CONSUMPTION AT DIFFERENT HOUSEHOLD INCOME LEVELS

The Kinshasa 1-2-3 survey on employment, the informal employment sector, and household status (Institut National de la Statistique, 2005) provided a rarely done look at household consumption across a range of households from poor to relatively well-off. Figure 16 below shows the increase in yearly per capita cassava and maize flour consumption as household income levels increase; Figure 17 provides details across a range of food groups.

Fig. 16: Kinshasa Fufu Flour Consumption per Person by Household Food Consumption Quartile -2004

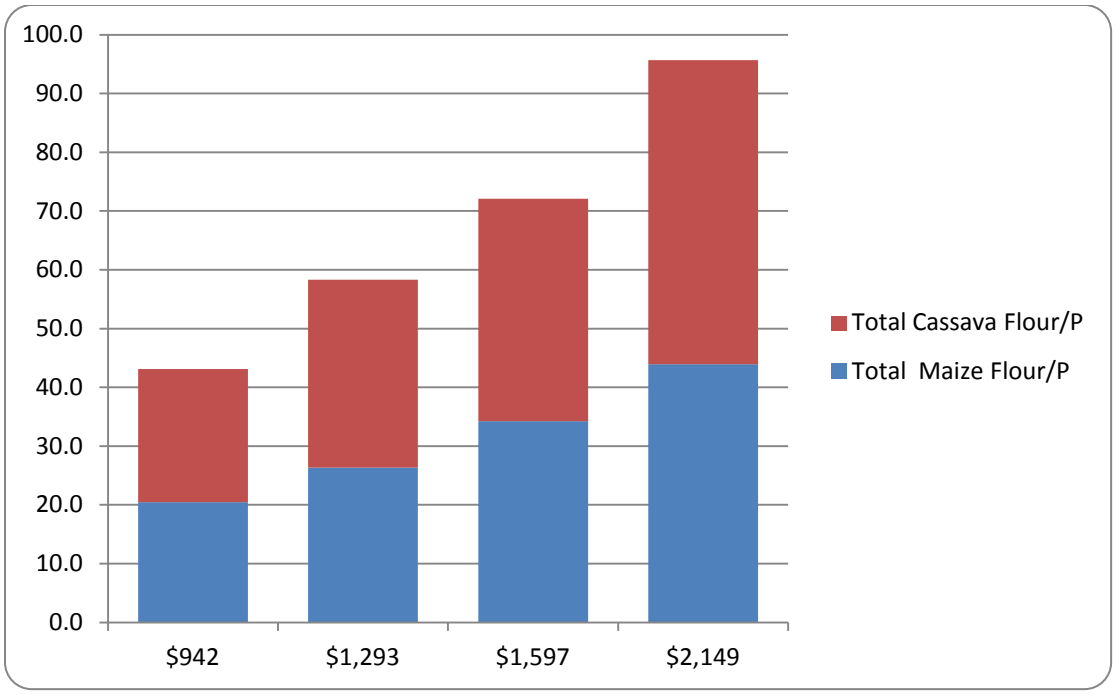


Fig. 17: Kinshasa Household Characteristics and Annual Food Consumption Ranked by Consumption Quartile

Annual amount per person of principal foods by houshhold consumption quartile
(Including own-production and gifts) in kg, liter, or other normal unit

	Household Consumption Quartile				
Household Description	1st	2nd	3rd	4th	All Quartiles
People/Household	7.35	6.23	5.52	4.45	5.91
Household Expend.	$ 1,552	$ 2,349	$ 3,187	$ 5,854	$ 3,235
Food Expend.	$ 942	$ 1,293	$ 1,597	$ 2,149	$ 1,495
Food/Total HH Expenditure	61%	55%	50%	37%	46%
Products	Annual Consumption Per Person				
Maize grain	5.7	11.2	23.2	39.7	17.6
Imported rice	16	21.4	30.5	53.5	27.8
Maize flour	16.8	19.2	19.4	18.5	18.4
Bread baguette	7.5	13.3	16.1	24.3	14.2
Mackerel	6.7	12.3	15.1	25.3	13.6
Palm Oil	13.0	16.7	21.0	22.9	17.7
Cassava Leaves	3.2	3.8	4.7	5.9	4.2
Manioc Chips	1.5	3.5	10.9	26.4	8.9
Cassava Flour	21.3	28.7	27.8	27.5	26.0
Sugar	4.9	9.3	12.4	19.1	10.5

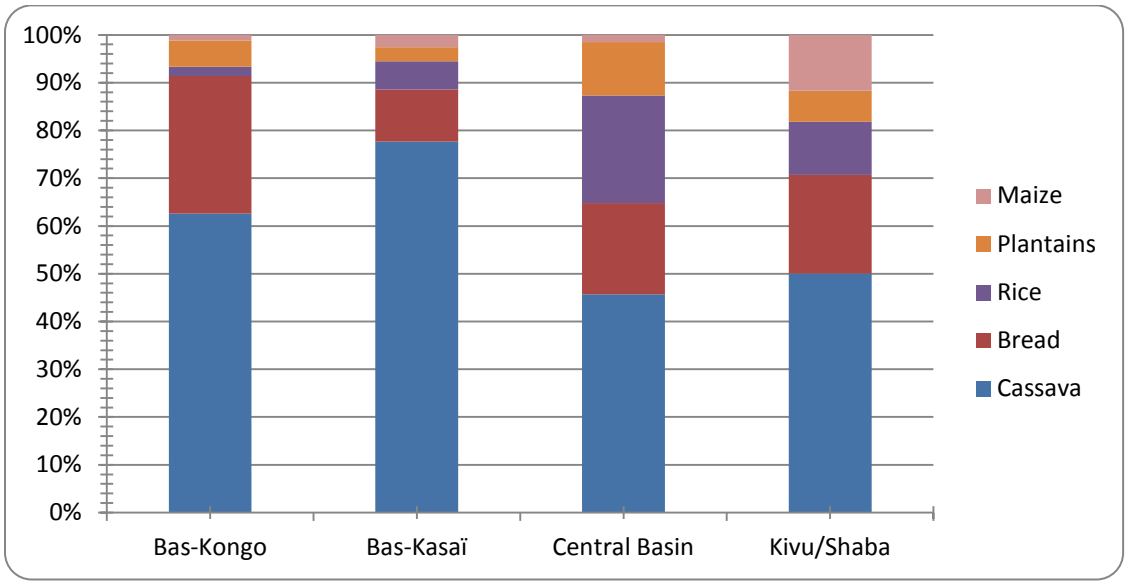
Source : Enquête 1-2-3, phase 3, 2004, Indice des prix à la consommation, INS - Kinshasa, République Démocratique du Congo.

4.1.8 GEOGRAPHIC/ETHNIC ORIGIN AND CONSUMPTION

Goossens 1996 synthesis of consumption data provided information on how geographic and ethnic origin affected per capita consumption of starchy staples in 1986 (Fig. 18). This figure

shows the substantial variation in individual diet by zone of origin that existed in that period, with those from the Bas-Congo consuming the highest proportion of bread compared to other groups; those from the Kasai/Kwilu/Kwango consuming the highest proportion of cassava; those from the Central Basin consuming the highest proportion of rice; and those from Kivu and Shaba (now Katanga) consuming the highest proportion of maize. However, cassava was the dominant single component in the diet of all Congolese in Kinshasa.

Fig. 18: Kinshasa Starchy Staple Consumption by Origin of Consumer 1986



Figures 19 and 20 give Kinshasa consumption of major cassava products on an absolute and relative basis by family origin. Cossettes made up 70% or more off all regionally-influenced diets, reaching 90% for the Kwango, Kwilu, and Lower Kasai, with surprisingly high (nearly 18%) consumption of fresh roots by those from the Central Basin/Ubangi and about equally surprising 28% consumption of chikwangue by those with origins in Kivu and Katanga.

Fig. 19: Kinshasa Cassava Consumption (Gms/Person-Month) by Origin of Consumer 1986

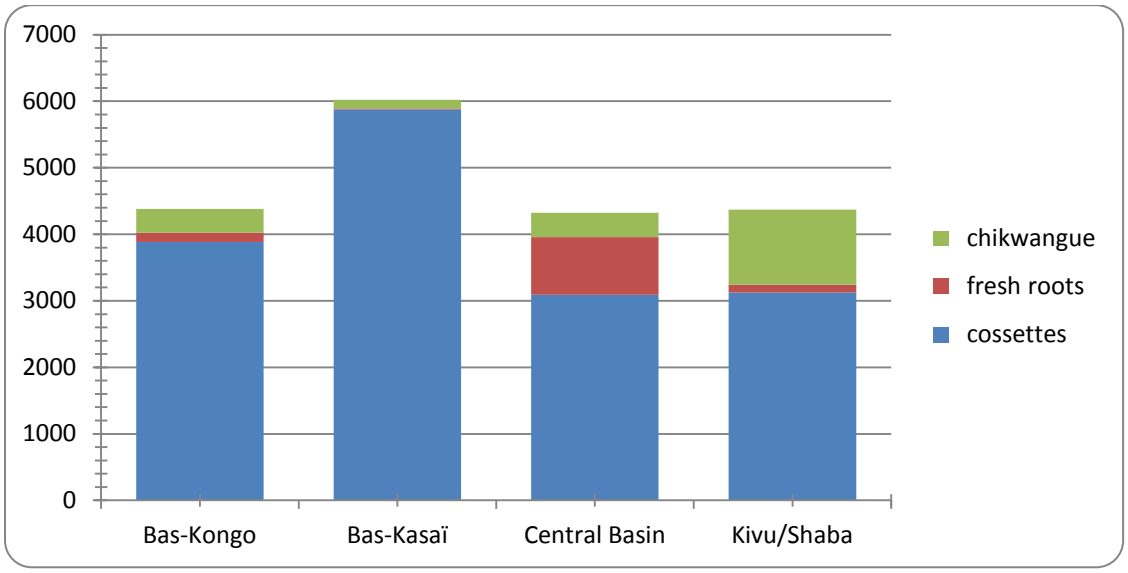
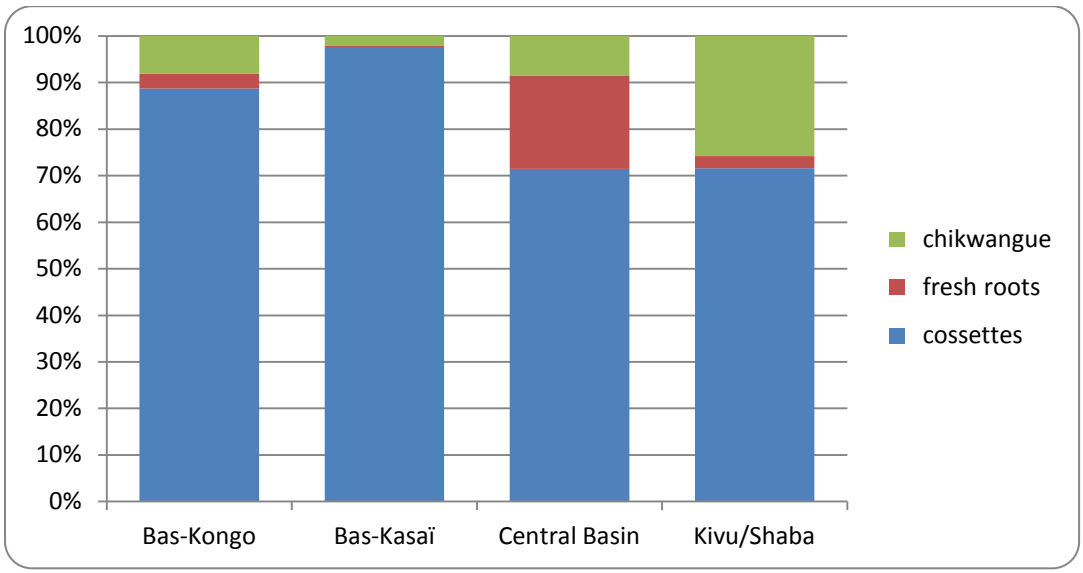


Fig. 20: Kinshasa Consumption of Cassava (%) by Origin of Consumer 1986



Today, Kinshasa and its broader marketshed has a much larger diversity of ethnic groups and more blended food consumption patterns than in the1980s. The demographic diversity and dietary patterns have been shaped by the decades long movement of Angolan refugees into and out of Bas Congo, internal displacement from East to West because of civil strife, emigration to urban areas, especially Kinshasa, for economic reasons, and the evolution of food consumption patterns through public policy to support low bread and rice prices and to use food aid monetization as a consistent strategy over the past four decades to generate counterpart funds to raise "matching" funds required by donor projects.

Noticeable overall shifts have occurred in the foods eaten in Kinshasa. For example, during the intensive food relief period after the 1991 army looting of Kinshasa, yellow maize fufu – actually almost always a blend of yellow maize with cassava - became an acceptable product on the capital city's market. Yellow maize varieties have been grown in the DR Congo for decades but had little market penetration as a main ingredient in fufu on the Kinshasa market. General acceptance of yellow maize in fufu occurred during the food emergencies of the last two decades, when imported yellow maize was often the only maize available on the capital's market. It was, and continues to be, promoted as being more nutritious than white maize. Market acceptance of the yellow color also permits the use of yellow cassava varieties in the maize/cassava blend, which in turn improves the market acceptance of the yellow cassava varieties in a market place that has a strong preference for white cassava products.

The imprint of geographic point of origin on consumers is, nevertheless, still an important feature of Kinshasa markets. Kinshasa truck parking places and semi-wholesale markets for domestically produced food stuff are structured primarily by the geographic origin of the original residents of those areas, with Bas Congo and Bandundu origins dominating. Truck transporters tend to work primarily either the Kinshasa-Bas Congo/Angola or the Kinshasa-Kikwit transport routes. River transport arrives at the same ports and plages, but with a high concentration from single sub-provincial zones of production that help preserve the broad regional identity of arriving food products. This form of market organization helps to maintain some level of origin specific consumption patterns, within the bounds set by seasonal availability, relative prices, and shifts in consumer acceptance of new and different foods and food ingredients.

4.1.9 Weaknesses in the Kinshasa Marketshed Consumption Data

Identifying opportunities and leverage points for pro-poor value chain projects starts with analysis of end-markets. Consumption across households with different income levels and sources (livelihoods) creates the end market and end-market segments. When the consumption data is weak and unreliable over time, their analysis leads to weak and unreliable conclusions about end markets, trends, and drivers behind the trends.

Our review of available information indicates that there is a great need for better market and consumption data especially for Kinshasa, despite the political sensitivities associated with the reporting on income, consumption, and poverty data within the capital. Many national surveys do not include or publicly report on Kinshasa data, e.g. the WFP CVFSA. Also, and unfortunately, government decentralization seems to be making it more difficult for Kinshasa data to be obtained. The Provincial Minister of Agriculture for Kinshasa, for example, informed the National Ministry of Agriculture in June 2011 that they would no longer be allowed to obtain market price information directly from Kinshasa parkings and markets.

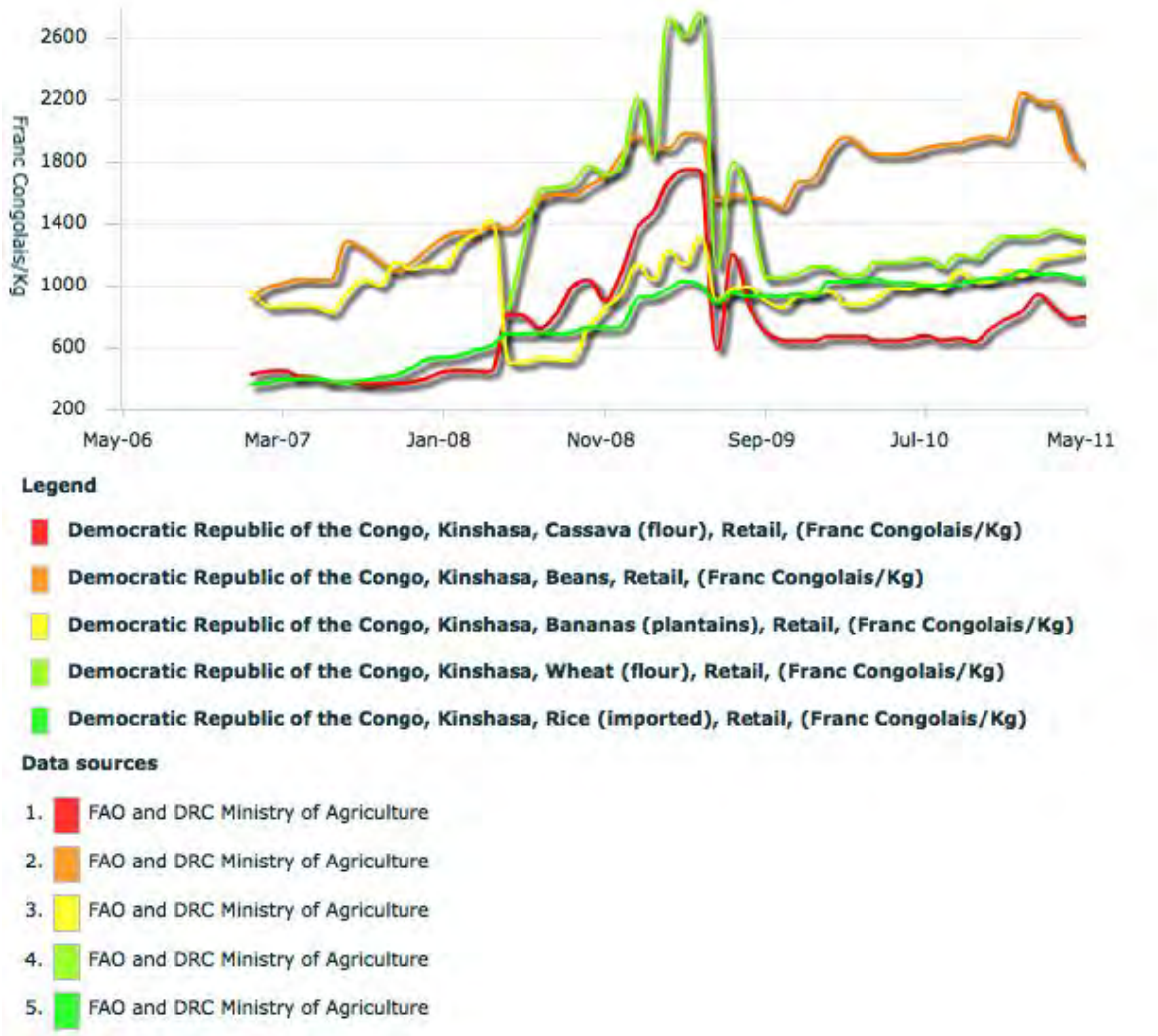
4.2 MARKET PRICE TRENDS AND SEASONALITY

4.2.1 Staple Food Prices Trends in Kinshasa

Urban centers in the Kinshasa marketshed have a broad array of calorie sources that are within the purchasing power of city and town dwellers. They are close to the food processing and logistics centers that deliver imported wheat and rice. However, imported staple food crops are likely to remain at higher price levels and be subject to more price volatility than in the pre-2007 period, providing an upward boost for substitutable domestic staple food prices

The global pressure on staple food and feed crop supply results from increased worldwide demand. The increase in worldwide demand is powered by the combined effects of population growth and increases in per capita meat and milk consumption; policy shifts that have reduced food reserves; increasing production uncertainty from climate change; the rapid growth in use of cereals, sugar, starch, and oil crops for biofuel production; and, increasing energy and transport costs to move product from surplus to deficit regions and countries. The relatively rapid shifts in the unit prices of different staple foods send a mix of signals to Congolese farmers and traders about where the greatest returns from investment of their land, time, labor, and money may be obtained. However, rural growers beyond the peri-urban zone of Kinshasa and larger secondary cities are generally locked into 12- to 18- month cycles of cassava production of the bitter varieties that store well in the ground and are more resistant to animal damage. Therefore, given the importance of cassava to the rural diet and to the stability of cash of cash flows in marketing seasons, smallholders are not likely to be able to make major production swings from year to year, especially if the change would involve replacing surface area of cassava production with shorter cycle, and potentially more profitable crops.

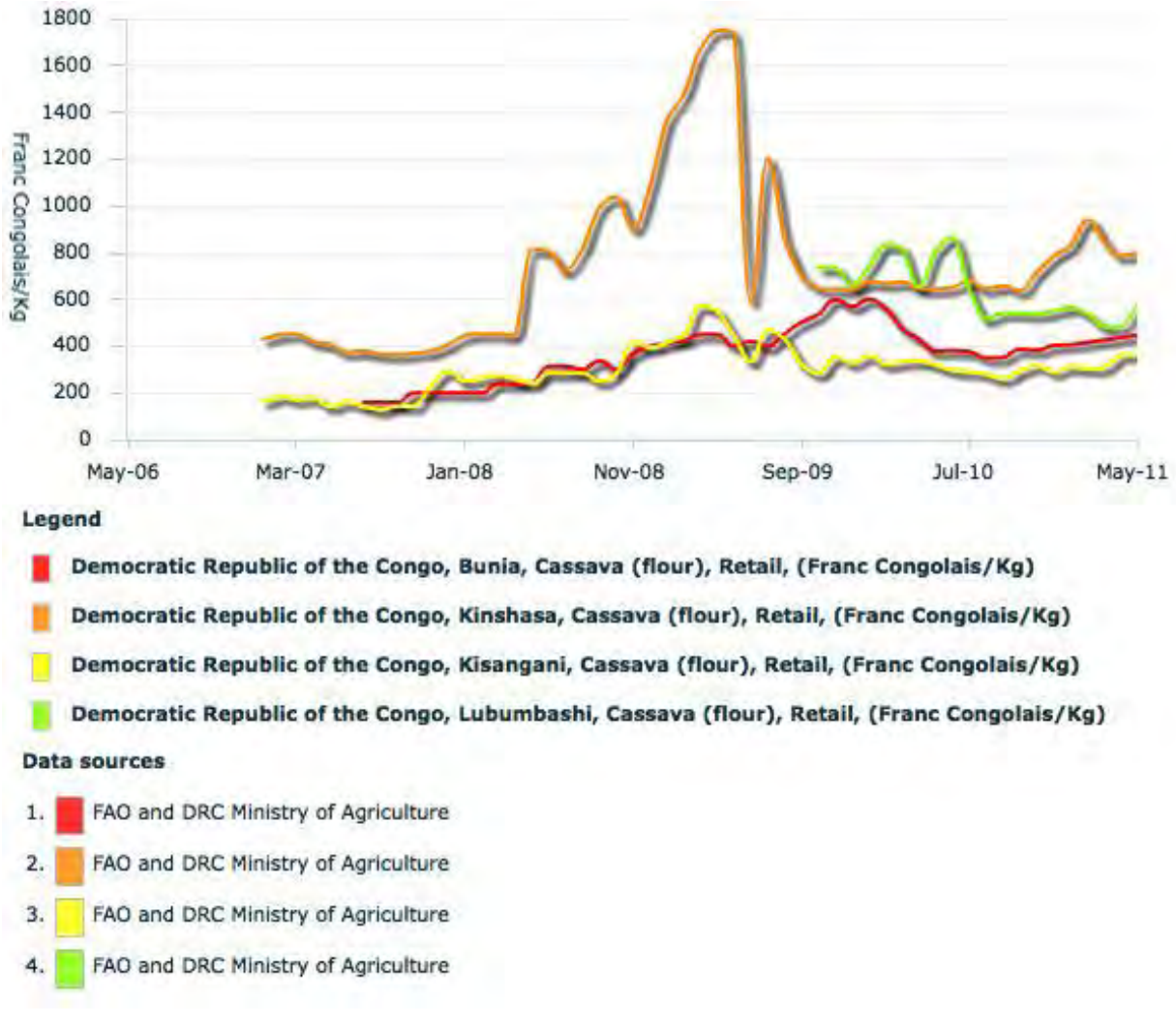
Fig. 21: Staple Food Price Trends in Kinshasa



4.2.2 The 2008 Food Price Spike and Its Aftermath

Kinshasa is home to 12 percent or more of the DRC's population. When food shortages occur, price spikes develop rapidly and are of greater amplitude, compared to other cities in the country. The post-price spike spread in cassava prices among cities is likely to continue as long as global prices for substitutable food staples (maize and maize meal, milled and paddy rice, and wheat) remain high and volatile, and as long as the DRC road, river, and rail transport network remains in its current degraded and de-linked state. For example, Lubumbashi cassava prices, almost totally delinked from Kinshasa, reflect the availability and price of maize mealie-meal from South Africa, Zambia, and other Eastern and Southern Africa states, as much as they do domestic maize or cassava supply in Katanga. The BEST study (2010) presents the lack of integration of food markets among the DRC's far-flung cities. The poor state of transport infrastructure - and the failure of the GODRC to establish a source of recurrent revenue to finance annual maintenance of all transport infrastructures – road, river, and rail - lies at the heart of a deeply dysfunctional national market place.

Fig. 22: Cassava Price Spike and Its Aftermath in DRC Cities

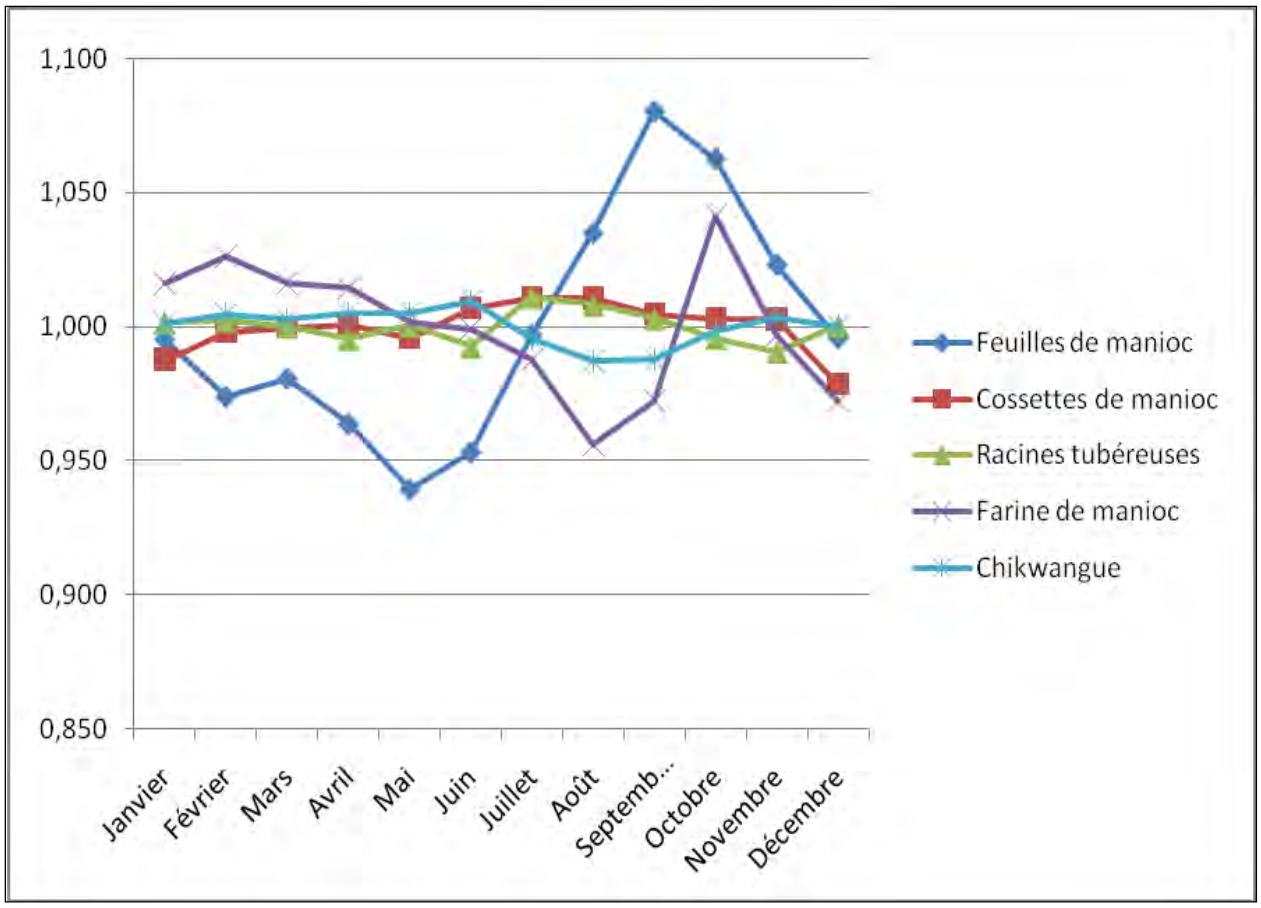


4.2.3 Seasonal Trends in Cassava Prices on the Kinshasa Market

Figure 22 below illustrates the seasonal trends in cassava prices on the Kinshasa market. The biggest price swing occurs for cassava leaves to make pondu. Cassava leaf harvest drops in the dry season because cassava leaf growth slows from lack of rainfall. Interviews showed that farmers understand that they have to sacrifice half or more of their root yield if they elect to maintain leaf harvest over the dry season on upland rain fed fields. Those farmers close to urban markets will continue to harvest leaves on a portion of their planted area, especially in the more humid valley bottom lands. The reduction in other rain fed vegetable production also increases the demand for cassava leaves in the August-November period, with leaf prices dropping as leaves from many more fields become accessible and available after the main rainy season starts in late August and September (Season A) and during the minor rainy season (Season B) in Bas Congo and on the Plateau de Bateke. Cassava flour and chikwangue prices drop over Season B and the dry season as rural access roads dry out and farm families are able to harvest and ship more paste, chikwangue, fresh roots, and dried roots and chips to market. The price seasonality has shifted a bit from that portrayed in Figure 3 (2007 data), with the completion of paving and bridge work on the RN1 highway from Kinshasa to Kikwit to Batshamba. The rehabilitation of this national primary road has increased the availability of transport for dried cossettes and greatly reduced the transit times for this core staple.

Demand for dried cossettes stays strong because it is the primary product traded with a wide variety of end uses. Cossette prices dip after the first rainy season in December and January as the crop planted 12-14 months earlier is harvested and moved to market.

Fig. 23: Cassava Price Seasonality in Kinshasa



5.0 Value Chain Map

The value chain map presented in Figure 17 is complicated, but is still a substantial simplification of the cassava value chain in Western Congo. The figure focuses on the core activities and actors observed during this assessment.

5.1 CULTIVAR R&D

Cultivar research and development is a core process to maintain and improve average crop productivity. There have been nearly 30 years of varietal releases from the National Cassava Program (PRONAM) managed by INERA with strong linkages to IITA and CIAT. PRONAM's main cassava breeding program is located at Mvuazi in the Bas-Congo with a major secondary station at Kiyaka in Bandundu. This program provides breeder level and certified clonal planting material for bulking by a range of INGOs, national NGOs, FAO, multilateral, and donor projects, certified seed multipliers, and commercial farms. The core process is the breeding and release of higher productivity clones with good pest and disease tolerance that are adapted to the domestic market. Planting material from INERA had a price of 4 US cents per meter of cutting in 2011.

5.2 PLANTING MATERIAL PROPAGATION

Farmer self-propagation and exchange of cassava cuttings is the primary form of cassava propagation by smallholders and commercial farmers. Many projects and programs have worked with farmer demonstration groups to train farmers in careful selection of vigorous, disease-free planting material. Some producer groups and NGOs have cassava multiplication fields and serve as independent or contract growers of planting material. The cost of cuttings is 4-5 US cents per meter. An important part of the formal cassava cuttings market is made up of donor-assisted projects. Certification of cassava cuttings is done by the Ministry of Agriculture's National Seed Certification Service (SENASEM).

5.3 SMALLHOLDER PRODUCTION AND ON-FARM PROCESSING

Once harvested, cassava roots break down quickly. Processing usually must be done within 24-48 hours of harvest to maintain dry matter content and quality and avoid rots. Every farm that sells more than fresh roots, i.e. almost every farm in the Kinshasa marketshed, must turn the perishable cassava root into a less perishable product. In almost all cases, on-farm processing is done manually and requires substantial amounts of water to ret the cassava roots, leaching cyanogenic glucosides out and softening the root for further preparation into a dried cossette (root segment or chip) or into a fermented paste produce chikwangue. Both the manual form of processing and the water requirement are key constraints in the amount of cassava that can be processed by the women in individual households in rural areas. Head loads of 25-35 kilograms are the norm for one woman during one day. The transport burden, itself, is large since the water points where processing is done may be several kilometers away from the cassava fields.

The value chain map does not show the movement of cassava leaves that are sold as a vegetable. These tend to make short movements with smallholder-traders or collectors on foot, by bicycle, taxis, and taxi-buses with passengers that are part of the fresh vegetable value chain. This value chain generally operates within 12-24 hours travel time of the consuming market.

5.4 SMALLHOLDER-TRADERS

Some smallholders act as local aggregators of sacks of cossettes or cassava paste, bimpuka. These traders may travel and sell at weekly markets to other traders, sell to urban markets through the market shed, e.g. Idiofa, Kikwit, Masimanimba, Bandundu Ville, Mbanza Ngungu, Matadi ,Boma, etc., or travel all the way to Kinshasa. Their costs are similar to those of other traders, with the exception that they do not have to pay cash for product at the farm-gate. Their transaction costs may be higher, because they may not have the support networks in place to reduce their cost of transport, lodging, and meals when in the urban areas. If their product has lower than average quality, they could encounter marketing delays and additional storage and handling costs that will eliminate their profits. Most long-distance round trips will take men or women away from the farm for five days to a week. Along the major paved roads with high traffic volumes, women and girls will also prepare and sell market ready/ready-to-eat chikwangue.

5.5 OFF-FARM RURAL PROCESSORS

Small-scale (1-3 MT/day fresh roots) processing units were developed by IITA to reduce hand labor, speed cassava processing and drying, and help standardize the finished cassava products, e.g. micro-flakes, fermented fufu flour, and unfermented flour. Estimates made by the two equipment manufacturers in Kinshasa are that over 200 small scale processing units made up of dewatering presses, graters and micro-chippers of IITA design, drying racks, and low capacity flour mills have been distributed to rural areas in the Kinshasa marketshed since the early 2000s. Distribution was primarily done through donor-supported programs as grants to farmer groups and ASBLs/NGOs. We were unable to verify how many of these units are functioning today. At the 5 groups visited, 3 had one or more machines that had mechanical problems with the equipment or the motors used to power them. Group leaders and workers cited water supply, equipment maintenance and repair, fuel supply, and marketing costs as four key constraints to their operation. One off-farm rural processor has higher capacity processing equipment and driers, capable of handling 30 MT lots of product, to produce unfermented cassava flour.

5.6 COLLECTORS

Collectors are small traders who play the key role of assembling product in the production zones, usually by the sack (allonge). They may often work in tandem with associates in rural areas who help them locate product (pisteurs). They then are responsible for the transport of product to urban areas. Collectors are independent traders with their own sources of working capital who actually buy product on their own account and who then travel to Kinshasa to sell it. Unlike Agents (see next paragraph) they are not linked to a specific buyer but can sell to wholesalers, mamans manoeuvres, retailers or even retail themselves.

5.7 AGENTS

Agents are financed by actors higher up in the value chain (usually wholesalers). They fulfill a market function similar to collectors, but operate not on their own behalf but for their financier/buyer. Like Collectors, they may work with pisteurs in rural areas who help them find product. They either travel back to the urban zone (usually Kinshasa) with the product after exhausting their working capital or stay in a rural zone for an extended time buying product and supervising its expedition to Kinshasa through independent transporters (boat

owners, truck, taxi-bus operators) with periodic replenishments of working capital from their buyer.

5.8 TRANSPORTER/AGENTS

These actors are service providers who do not buy and sell product on their own account. They are indicated as such by an oval, rather than rectangle, in the value chain map and the crossing of product flow arrows through the oval. Transporter/Agents are often truck owners/operators who will take product signed over to them from farmer-traders and transport it to Kinshasa where a buyer (most often pre-arranged or known to the seller) will take possession of it after paying the transporter/agent a negotiated percentage price of the Kinshasa market value. The buyer then either remits cash for the product sale to the transporter/agent, who is charged with paying the seller on a subsequent rotation, or uses independent means, e.g. money transfer agents, to pay the seller. This system permits the development of integrated sales circuits between small farmer traders in rural areas and networks of urban wholesalers/retailers in Kinshasa and lowers the transaction costs by removing the need for a physical person to travel with the merchandise. However, much of the trade still has the physical owner travelling with the merchandise, because money transfer agents operating in small rural towns in Bas Congo and Bandundu charge up to 6% monthly fees, and because they are absent from most small market towns.

5.9 URBAN WHOLESALERS AND SEMI-WHOLESALES

The wholesale category of actors is present in very small numbers in the larger Kinshasa markets and in urban centers such as Kikwit and Matadi. Wholesalers are defined by the volumes they treat—usually 30 sack to truck load lots. Cassava wholesalers trade in cassava, maize, groundnuts, and soybeans in different mixes depending on the season. They maintain depots that range in scale from storage areas with an enclosed area to take truck deliveries to warehouses that include dedicated riverside quays and milling facilities. Semi-wholesalers deal in small lots of sacks generally 10 to 30 sacs. They often hold covered depots in many markets, as well as open depots for bimpuka that cannot be stored with other products because of its strong smell and acidic nature that destroys cement floors. They buy from smallholder-traders, collectors, and agents.

5.10 MAMANS MANŒUVRES

These are small traders who play a role as intermediaries in Kinshasa and other urban markets by buying product in one location and selling it in another nearby market—often moving from larger markets or ports to smaller neighborhood markets. There are a range of categories of mamans manœuvres. At river ports and plages, the higher volume category operate both as service providers and traders, providing overnight storage space in warehouses or depots and buying 5-10 sack lots of product for their own account. In these areas and at the truck parkings, a lower volume category handle 2-5 sack lots for immediate resale or transport to other markets. They are the point which the sac allonge may be sold to two buyers in the quantity that can be sold in a single market session. They thus actually straddle the dividing line between the semi-whole trade and retail.

5.11 MAMANS BIMPUKA

These are small traders who sort cassava products, often by the single or half sack, at storage depots near the into different quality products for direct retail sale and sale of highly

degraded product to the alcohol fermenters and distillers. They produce a range of qualities of cassava flour and paste for sale to the retail market, across a range of quality and price points. Some will also extract starch to prepare chikwangue for retail sale.

5.12 URBAN PROCESSORS

These divide into two groups. One group is semi-wholesale millers who mill cassava and maize for their own account and as a service generally at a minimum level of a single sack. The second are generally processors/semi-wholesalers who buy fresh roots for processing from small and medium-scale farmers within a day's transport distance from Kinshasa. They use the IITA-designed and locally manufactured small scale processing units to produce micro-flakes that are transformed into fermented flour, unfermented flour and starch. Their products are generally branded and sold to supermarkets, shops, restaurants, and to a regular household clientele who leave standing orders.

5.13 COMMERCIAL FARMERS

Commercial farmers appear to be increasing in number in Kinshasa and Bandundu Province on the Plateau de Bateke and in areas of Southern Bandundu Province, such as Gungu. These growers incorporate on-farm processing of cassava into dried cossettes to sell to traders, to agents for urban semi-wholesalers, and their own depots and flour mills in Kinshasa. These farmers also produce maize and peanuts. Their scale appears to range from 20 hectares to 300 hectares. As a group, some appear to be considering becoming vertically integrated grower/processors with more advanced processing methods. They are still few in number, probably less than 50 in total in the Kinshasa marketshed.

5.14 COMMERCIAL VERTICALLY-INTEGRATED GROWER/PROCESSORS

These are a small group, representing a subset of the Cassava Producer and Processors Association (APTM) members clustered on the Plateau de Bateke. This category grew out of the urban processor category, some of whom found that organizing raw material from smallholders was a problem in terms of growing a consistent supply chain, and that expanding their wet processing operations in Kinshasa posed a number of physical, environmental, and logistical challenges. They have both increased their commercial farmed area, in one case to close to 700 ha, and installed a mix of IITA-design and larger scale Brazilian industrial equipment at their farms to produce intermediate (microchips) and final product. They continue to operate outgrower programs, providing mechanization services, cassava cuttings, training, and group organization to expand their raw material supply. This group is directly integrated with the retail trade, primarily shops, supermarkets, restaurants, cantines, bakeries. They invest directly in consumer and end-user education and marketing with a wide range of consumers and women's groups. One of the members of this group is completing the installation of a large-scale cassava drier and flour mill that may take the industry to a scale to supply unfermented cassava flour to the wheat flour and bread baking industry. Ibi Village on the plateau de Bateke represents a special case of an agroforestry-CMD financed carbon sink that produces cassava as an intercrop during tree establishment and incorporates village smallholder participation.

5.15 RETAILERS

A. Open Markets: The dominant force in the retail trade are the small traders with regular spots in the cassava sections of open markets who generally buy sacks or half sacks of

cossettes that they will sort and sell in basins to household buyers or mill into flour for direct sale; or purchase small lots of chikwangue for direct resale. Their stocks are purchased from smallholder-traders, collectors, semi-wholesalers, and maman mainoeuvres.

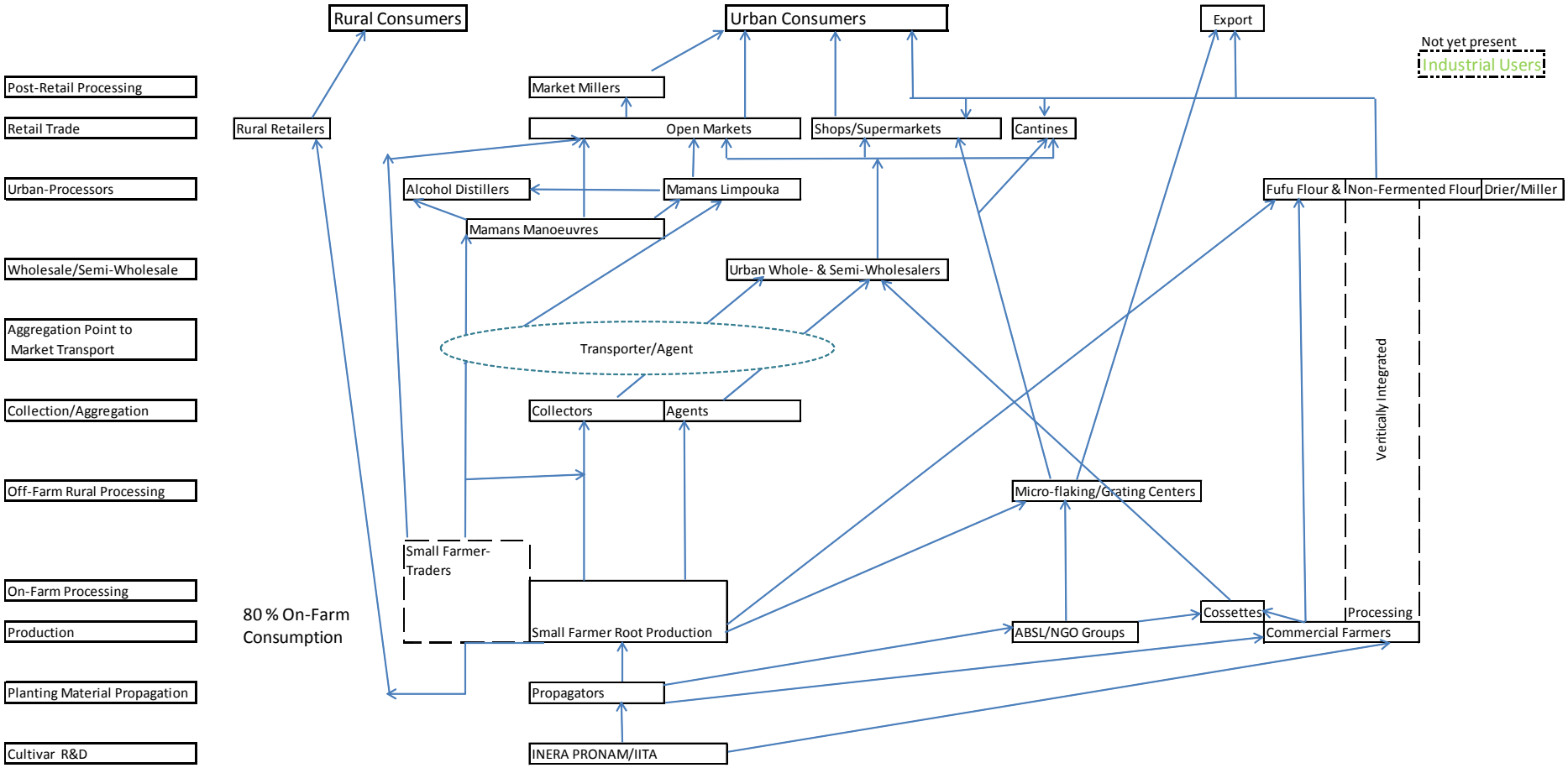
B. Shops/Supermarkets: Upper income households purchase some cassava products, especially unfermented cassava flour, gari, tapioca, and blended cassava-soy flour products from shops and supermarkets. They buy these products from off-farm rural processors, urban processors, and the vertically integrated commercial farmer/processors. The shops and supermarkets may sell branded products from their suppliers or repackage these products into store brands.

C. Cantines: Larger companies in Kinshasa have traditionally had cantines and employee consumer cooperatives that supply basic household necessities in bulk quantities. They buy cassava flour in 15, 30, and 60kg sacs from off-farm rural processors, urban processors, and the vertically-integrated commercial farmer/processors.

5.16 POST-RETAIL PROCESSING

This is a service activity, but one that is tightly linked to retail sale of cassava chips to reduce household labor in food preparation. Market millers are present in most of the larger open markets in Kinshasa to convert chips into flour using low capacity grinders and mills, both electric and fuel-powered. Many consumers prefer to select the chips before they are milled into flour to ensure that they get the final product quality that they seek. Outside Kinshasa, in major market towns, diesel-powered, belt driven hammer mills dominate the processing of maize and cassava, and more flour is milled before sale to household buyers.

Fig. 24: Cassava Value Chain Map – Western DRC, 2011



6.0 Western Congo Cassava Markets

Kinshasa's huge demand draws agricultural products from the entire country, neighboring countries, and the global food trade. However, its cassava products are drawn from national supply. Official statistics show no imports of cassava. While published sources show no formal exports, Western Congo does export small quantities of cassava products, but these do not appear in official statistics.

6.1 CASSAVA EXPORTS

FAO TradeStat figures show no significant exports of cassava in any form from the DRC since the 1970s. However, there are evidently small-scale exports to Angola and the Republic of Congo (Brazzaville), while tiny quantities are exported to the EU by air.

Our discussions with road transporters and traders in the Bas-Congo indicated that there are weekly flows of cassava products to Angola and the Republic of Congo. Despite the closing of official border crossings to organized commercial trade, small-scale trading on mixed passenger/cargo "taxi-bus" occurs at traditional weekly markets that alternate location in the DRC and Angola or the Republic of Congo. No information or estimates were available for the scale of this trade. Assuming that each week about 10 border markets are open with 10 vehicles of the "taxi-bus" type carrying about 40 allonge bags of cossettes of 50kg apiece, about 20 tons a week or 520 MT would be exported in the 26 weeks of local market opening in Angola and Congo-Brazzaville. SME producers of unfermented cassava flour who sold to Angola and Congo-Brazzaville in 2009 have not been able to make commercial shipments to these markets in 2010 and 2011 because of formal sector border closures.

Our discussions with traders indicate that there is a substantial informal trade of river-transported cassava and other food products from the DR Congo to Congo-Brazzaville. Brazzaville's 1.3 million people share many of the dietary preferences of Kinshasa. The twin city's proximity adds to the pooled market demand for DRC staple food products. Our discussions with traders suggest that little of this informal trade can afford to transit Kinshasa. A recent World Bank study points to the excessive costs of transit of goods in both directions (Brülhart and Hoppe, 2011). These costs were attributed to the DRC and RC monopolies on cross-river transport, the narrow daily operating window for river transport, the multiplication of fee-assessing agencies that provided no services or value to transport, and informal fees and bribes needed for entry, paperwork, embarkation, and debarkation. The study concluded that formal trade volume between the two cities would grow by about 40 percent if these miscellaneous fees were reduced by half. This would probably not shift the informal food trade to official channels unless costs were lower than those of the current system.

Observation of international flight check-in points in Kinshasa indicates that there are daily flows of cassava leaves and chikwangue as accompanied baggage to EU destinations. A rough guess based on passenger airline capacities is that these shipments may account for 150-250 MT a year of exports to the expatriate Congolese community in the EU.

6.2 PRODUCT MAKE-UP OF THE KINSHASA MARKET FOR CASSAVA

Table xx provides estimates made in 2007 of the main types of cassava products that are marketed in Kinshasa along with their province of origin. It shows the dominance of cossettes/chips from the two largest sources of supply from Bandundu and Bas Congo, with

the supply from Kinshasa Province apparently dominated by chikwangue and fresh cassava roots. From our observations and discussions in June and July 2011 with marketers and transporters, we suspect that these 2007 figures from Bandundu probably underestimate the amount of paste/bimpuka that is moved from Bandundu to Kinshasa primarily by river traffic, and may overestimate the amount of chikwangue that moves in finished form rather than paste/bimpuka from Bas Congo.

Bandundu cossettes are of a fundamentally different quality than those from either Bas-Congo or the Plateau de Bateke. Bandundu cossettes are usually sold at the farm gate or village collection point as whole, partially dried root pieces, which are broken up and "dried" as they transit in sacks from collection points to trucks and boats. These cossettes arrive with higher average moisture content and often show higher levels of molds and insect damage than those from the Bas Congo and the Plateau de Bateke in Kinshasa Province.

The Association of Producers and Processors of Cassava (in French Association des Producteurs et des Transformateurs du Manioc or APTM) of the DR Congo, believe that the current Kinshasa consumption of microchips or flakes is now much closer to 5% of the movement to the Kinshasa market, and that the proportion of cassava cossettes or chips arriving on the market from Kinshasa Province is easily double the 2007 estimate. APTM indicated in July 2011 that it intended to undertake a survey to update the market share held by different cassava products at the wholesale/semi-wholesale level.

Fig. 25: Cassava Products Marketed at the Wholesale/Semi-Wholesale Level in Kinshasa by Province of Origin

Provinces	Cossettes/Chips (%)	Chikwangues (%)	Fresh Roots (%)	Flour (%)	Paste/Kimpuka (%)	Microchips Or Flakes (%)	Other (%)
Bas-Congo	43,1	36, 3	8,8	7,8	2,0	2,0	-
Bandundu	83,5	8,3	5,0	-	-	1,5	1,7
Kinshasa	15,4	27,7	24,6	12,3	18,5	1,5	-

Source : USDA/LOL/SECID Enquete Avril 2007

6.3 STRUCTURE OF RETAIL SALES

At the retail consumer level most food products are purchased on public markets from small scale vendors or from individual vendors' homes or attached small shops (boutiques) as shown in Table 25. Informal outlets made over 95 percent of food and beverage sales to the Kinshasa market in 2004, a level that probably holds true today for the capital city and the other major market centers in the Kinshasa marketshed. Informal does not mean wholly unregulated, however, because the public markets are all subject to taxes and fees from local and provincial authorities.

Fig. 26: Distribution of Consumer Purchases in Kinshasa

Distribution of consumer purchases in Kinshasa by product category and place of sale (% of household purchases) at different types of sales outlets

Product Category	Traveling vendor or roadside stand	Vendor's home, small shop	Public Market	Other informal markets	Total Informal Outlets	Super-markets, stores, and registered workshops	Public or parastatal outlets	Other formal outlets	Total Formal Outlets	Overall Total
Food and non-aloholic beverages	7.7	20.4	**63.3**	3.8	95.3	3.3	1.3	0	4.7	100
Alcoholic beverages and tabacco	11.4	**61.9**	4.4	18.6	96.3	2	1.7	0	3.7	100

Source : Enquête 1-2-3, phase 3, 2004, INS - Kinshasa, République Démocratique du Congo.

6.3.1 KINSHASA MARKET NOTES

Kinshasa: Population: 7 million – 9 million growing at 5 % annually

Individual Consumption of Retail Market Product: 150 kg/person/year (~30 kg chikwangue and ~120 kg Fufu)

Total Consumption: 1,350,000 MT/year split between: 270,000 MT/ year and Fufu: 1,080.000 MT/year

"Trips" by women producers/processors per 25 kg unit of peeled and retted root (4.500.000 tons): 180.000.000 trips per year to feed Kinshasa

Ten-ton truck loads per year: 135.000

Daily truck deliveries required to supply Kinshasa markets 6 days a week (313 days): 431

Total cassava fresh weight production needed: 5.000.000 MT/year covering 714,000 ha (7 t/ha yield)

Kinshasa truckload and many retail markets are organized by origin of the product

Cassava product markets segmented by quality with two broad divisions 1)Bas Congo & Plateau de Bateke and 2) Bandundu each delivering a range of qualities (color, insect attack, molds) with different prices paid for product delivered by truck (higher) and boat (lower) . Additional cassava products are delivered from Equateur

Kinshasa is a major consumer of natural packaging (Marantaceae wrapper leaves for chikwangue) and a major market for the purchase and sale of new and used woven polyethylene sacs.

Kinshasa is the largest single market for cassava leaves (pondu): 30 kg/person/yr or about 210.000 MT of leaves annually.

Cassava plants required to produce leaves for pondu: 52.5 million/year at 4kgs per plant or about 4,200 ha (12,500 plants per ha)

6.3.2 Other Major Poles of Consumption in Western Congo

Matadi/Boma (459,000 2010 Estimates) – Consumers with the less cassava dependent Bas-Congo/Angola consumption profile, but with increasing numbers of migrants from Bandundu

Local transport 30-100 km transport to the two port towns is costly (4,500 CF/sack) compared with the illegal (but almost universal) side loads carried by long-distance truckers moving from either port to Kinshasa (3,000 CF/sack).

Consumption patterns are broadly similar to those of Kinshasa but influenced by higher per capita consumption of plantain and bigger influences of Angola and Cabinda on the consumption of pigeon peas.

Kikwit (370,000 2010 estimates) – Food products are divided into two categories: 1) food consumed locally and 2) food products marketed in Kinshasa and in the Kasaïs.

Products are moved to Kikwit in large amounts by bicycle, dugout canoe, by head load (head load from nearby villages = 10-15 km)). Kikwit market is growing because of rural in-migration and the re-opening of National Route 1. There are initial signs of specialization in truck transport and larger merchant interest (old 4-wheel drive trucks over sandy roads, recycled reefer trucks and trailers used for the Kinshasa run, but the latter are still in the minority). Tractor trailers are still pretty rare.

Kikwit is beyond the zone of heavy consumption of chikwangue but is still a major supplier of bimpuka, fermented cassava paste that is used to produce chikwangue in Kinshasa. There is a strong local preference in the cossette/dried fermented cassava roots that are whole and only partly dried. This local preference has a strong negative effect on the quality of the cossette that is "exported" to Kinshasa and the Kasaïs for cassava flour used to produce fufu.

Idiofa (56,000-2010 estimates) – Cassava preferences are similar to those in Kikwit and growing with the population and the many schools that are located in the town. Product is moved to Idiofa by bicycle pushers from up to a 50 km radius on very sandy roads, and more rarely by truck. Beyond 50 km, the bicycle pushers deliver their load to the loading points ("plages") along the Kwilu and Loange rivers that drain into the Kasaï River. There are small-scale depots scattered among the town markets (associated with flour mills and a very few deports for the elongated sack (sacs allonges) along with transit stores in private houses that aggregate product for merchants. Six-wheeled trucks prefer to aggregate loads at villages with weekly markets and then travel directly to Kikwit or Kinshasa

7.0 Transport Constraints and Solutions

All commodity value chains in the DRC are constrained by poor access to transportation infrastructure, poor quality of transport at every level from harvest on the farm to delivery to market, very poor farm to market roads, poorly marked and maintained river channels and loading points, and predatory official and unofficial taxation of road and river transport. All agricultural commodities transported in the Kinshasa marketshed suffer from the problems of high transport costs, difficult or zero access during the rainy seasons to many producing areas, and loss of product quality associated with the mode of transport and long duration of transport by road, river, or rail. These problems are magnified in relation to the DRC's main staple food crop, because fresh cassava roots are highly perishable. Cassava paste and dried cossettes are more stable than fresh roots, but they are still inherently more perishable than cereals or pulses.

Figure 27 provides a schematic map of the main road, river, and rail routes in the DRC. The system was conceived as an intermodal network, with roads delivering products to rail and river system for long distance transport. It worked well in colonial times, degraded severely after independence, and now is in various stages of rehabilitation and reconstruction that should help move more cassava and other staple food crops to market more quickly, gradually reducing the costs of providing inputs and consumer goods, if good maintenance programs can sustain the rehabilitated transport sections.

7.1 POST-HARVEST TRANSPORT

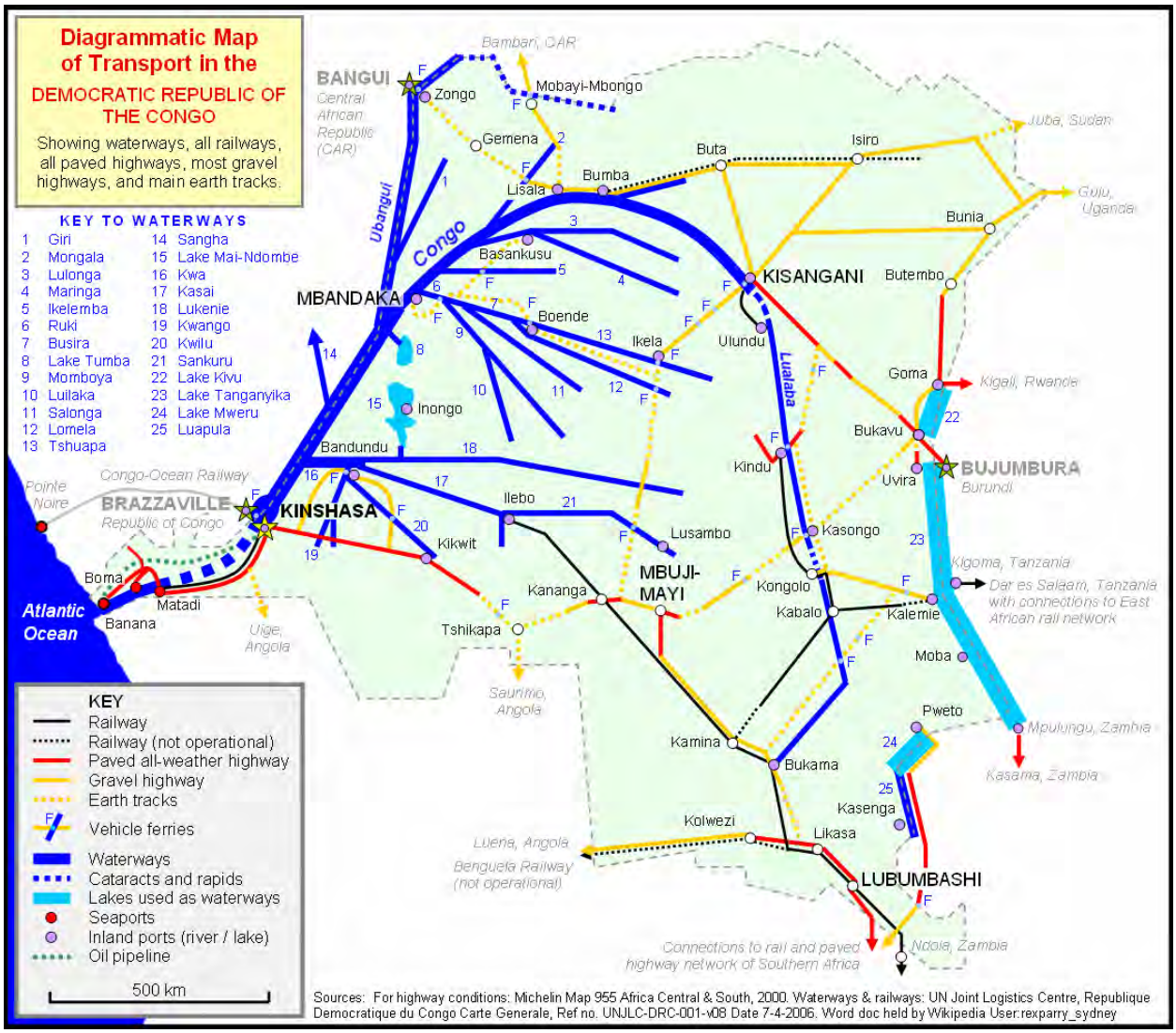
The movement of cassava from the field to an on-farm processing point is almost always by head-load by women. In peri-urban zones up to one day's travel from Kinshasa, the exceptions to this general rule are 1) fresh roots and fresh cassava leaves that may be picked up in lots daily along primary and secondary roads or at weekly village markets; 2) large scale farms where tractors are used; and 3) associations or groups that supply SME processors who buy at field side or who have access to tractors and wagons.

At the farm level after harvest, women have the burden of moving cassava roots to natural bodies of water to soften the roots, to break down and leach the cyanogenic glucosides in bitter varieties to make the cassava safe to eat. They then transport to villages 25-35 kg head loads of wet cassava to racks, roofs, drying floors, or the ground to dry. If feeding Kinshasa takes about 4.5 million tons, wet-weight, of retted cassava roots, this represents about 180 million head loads. Counting the original trip from field to water source, about 360 million head loads are needed to feed Kinshasa.

What is the monetized value of this transport? Discussions with women's groups in Bas-Congo and Bandundu indicate that harvesting, transporting, and on-farm processing of cassava to produce dried cossettes requires a concentration of female labor that rotates among fields during the marketing seasons. The labor cost of these operations is a 1:1 sharing of the quantity harvested by each woman working, with monetized cost equivalent to the value of a basket or basin head load. A 70 kg sac allonge of dried cassava varies in farm-gate weekly market price from 7,000 CF ($7.78) to 10,000 CF ($11.11) depending on quality and trader costs to access the product. At these prices, a 25 kg head load of wet retted cassava (0.24 kg of dry product per kg of wet cassava) is worth $0.67 to $0.95. Assuming that a woman can handle three heads loads over a three-day cycle of harvesting, transporting, peeling, retting, and transporting, her labor is valued at $0.67 to $0.95 a day ($0.93-$1.33 if the head loads are 35kg). If one day is involved in transport to and from the water source, the cost per wet ton is

$26.80-38.00. The distance between fields, water sources, and villages vary widely, of course, from a few hundred meters to several kilometers. The farther the fields and the water source are from the village, the lower the ton/km value of the transport. Assuming a total distance traveled of 10 km, the transport value would be $2.70-$3.80 per ton/km. Transport costs would increase with distance, because the number of head-loads that could be processed and transported in the same 3 day cycle would fall as more time was devoted to walking.

Fig. 27: Diagrammatic Map of Transport in the DRC



Costs of transport from village to aggregation center vary greatly. In Bandundu, a bicycle transporter may buy or barter for a 70 kg, 7,000 CF, bag of cossettes in a village and push it for a day or more over 40 to 50 km to sell it for 9,000 CF. This would put the value of the transport service at 2,000 CF ($2.22) to 3,000 CF ($3.33) or about $31.71 to $47.57 per ton transported. The cost per ton/km would range from $0.79 to $1.19. Long-distance bicycle pushers were observed to carry two 50kg bags of cossettes or a mix of cossettes and palm oil and to spend 2.5 to 3 days to push their loads about 160 km to the Kwilu River bridge in Kikwit, where trucks wait to pick up food to transport to Kinshasa. Assuming similar prices paid in the villages around Idiofa and a somewhat higher market price of 10,000 CF ($11.11) per 70 kg sac allonge at the Kwilu crossing (50 kg transport sacks are almost always emptied into the sack-and-one-half sac allonge for long-distance truck transport), the transporter's service is valued at about 4,300 CF ($4.78) per trip ($1.59 per day), $47.78 a ton, or

$0.30/ton-km. Transporter margins for both types of bicycle pushers are dependent on the mix of products that they carry; their ability to turn their receipts at food markets into consumables that they can sell in the villages; their management of their own costs for energy (food), upkeep and repair of their cargo bicycles; and their down time to recover from the arduous trips (at least 2-3 days a week).

There is a constant flow of long-distance bicycle pushers from villages to market towns and river loading points during the marketing seasons. On one week-end day trip from Kikwit to Idiofa in July 2011, an FPPM team counted 164 bicycle pushers heading to Kikwit. The quantity of cassava carried would fill more than three taxi-buses or two 3-axle trucks. It should be noted that when road rehabilitation projects do traffic counts they do not include cargo bicycles in the counts. This policy should be changed as it under-represents the benefits from rehabilitation and maintenance of market access roads.

Motorized transporters are generally both traders and transporters in general cargo and passengers with the mix of cargo shifting on a seasonal basis and passenger loads and fares often set on the basis of how much cargo they displace. Terms of carry tend to be based on a pari-colis system, where one sack of cassava cossettes pays for the transport (to be sold by the transporter) and one sack is sold by the shipper (a trader or farmer who also often accompanies the lot shipped to market). This system dominates even along now well-established routes on paved and rehabilitated roads in Bas Congo and the Plateau de Bateke, where cash payment is made for transport. Transporters still price cassava transport at about the farm-gate or aggregation point price. This means that ton-km costs can vary significantly depending upon the route traveled. Cassava cossettes from Luozi traveling about 100 km to Kimpese in Bas Congo were charged at the pari-colis rate of 7,000 CF ($7.78) or about $110 a ton and $1.10 per ton-km. As distance increases the transport per sack price increases, rising to about 10,000 CF, $11.11 per sack or $158.7 per ton from Matadi to Kinshasa, i.e. 316 km or about $0.50 per ton/km. Sacks of cassava from Kikwit also travel at about the same cost or $158.70 a ton over a distance of about 600 km or $0.26 per ton/km. These prices may increase with the initiation of toll collection in July 2011 on the Kinshasa to Kikwit National Route.

However, transport costs can exceed this average level for shorter distance transport along bad roads, where there is a strong demand for transport, or where the quality of transport vehicle is higher. In Kinzau Mvuete Bas-Congo, for example, a 90 kg sac of bimpuka (cassava paste for chikwangue) travels about 50 km to Matadi at the 7,000 CF ($7.78) per allonge sac rate, $86.44 a ton, or a rate of $2.01 per ton-km on a taxi-bus or a 7-10 ton truck. If shippers take advantage of the passage of tractor-trailers pulling loads from Boma or Matadi ports to Kinshasa, the same sack may move from Kinzau-Mvuete, 356 km, at 3000 CF ($3.33) or $37.04 a ton and $0.10 per ton/kilometer, even though the carriage of loads on top of shipping containers, on trailer tails, or hitches is legally banned and against all commercial trucking company policy. Driver and driver team incentives are high, however, to add to individual income by adding illegal loads above truck capacity. When these overages are substantial, e.g. adding thirty 70kg sacks of cossettes to the top of a loaded container that already weighs 18 tons, the additional 2.1 tons of product adds to the wear and tear and deformation of the road surface. The tipping potential increases dramatically, as can be witnessed almost daily on the Kinshasa-Matadi toll road.

These transport rates are similar to those practiced on the short-haul runs by 4 and 6-wheel drive trucks on the sandy roads of Bandundu province that haul products from villages to marketing centers, such as Kenge. The trucks that are in reasonable condition will try to make up a full mixed load of product, e.g. cassava, maize, peanuts, palm oil, etc., to make a direct

run to Kinshasa, avoiding the costs of unloading and re-loading produce and finding a buyer or onward transporter. Most of these trucks were designed to carry, when new, a load of 7 or 9 tons, but were purchased as surplus military equipment or as used trucks, usually after being fully amortized by one, two, or three prior owners, so their safe transport capacity has appreciably declined. Still, they are almost universally overloaded with cargo and passengers riding on top of the loads.

Breakdowns are frequent, as is damage to the truck body, springs, axles, and transmissions. Breakdowns cause significant delays of days or even a week or more as a crew member is sent to look for a spare part or to fetch a welder. Even when there isn't a major breakdown on the road, these trucks frequently spend a day or more in repair when they arrive at a major market, adding significant costs each truck's rotation.

Truckers contribute to their overload by carrying fuel and major spare parts for both long and medium-haul trips. In Bandundu Province, there are very few service stations even in major market centers such as Kikwit. Kikwit has two fuel stations, but only one has a reliable supply of fuel, and both have to run generators nearly constantly to pump fuel. In addition to scarcity of supply, the cost of fuel gets higher the farther one travels from Kinshasa into Bandundu Province. The exchange rate also changes with distance from Kinshasa. In June and July 2011, the exchange rate in Kinshasa, Gombe, currency exchange offices was about 928 CF per dollar for large denomination US bills ($50 and $100). In outlying districts near Gombe the rate dropped to 920, and as one moved farther out the rate dropped further to 910 to the USD. Service stations gave a rate of between 900 and 910 CF. Along the roads to Matadi and Kikwit the exchange rate dropped to 900 CF to the USD, the same rate used by the service stations. The diesel fuel purchase cost on a dollar basis increases by 19% from Kinshasa Gombe to Kikwit. The diesel fuel needed for a round trip to Kikwit (1230 km) is about 250-280 liters. Long-distance truckers will usually carry two drums of diesel fuel, providing a substantial margin for security, unexpected side trips, and sales at destination to other transporters to take advantage of the price differential in the interior.

Fig. 28: Exchange Rates and Diesel Fuel Costs Kinshasa to Kikwit (July 2011)

Location	Exchange Rate CDF/USD	Diesel Fuel Cost CDF/Liter	Diesel Fuel Cost USD/Liter
Kinshasa-Gombe	928	1215	$1.31 (100%)
Kinshasa- Masina	910	1215	$1.34 (102%)
Masimanimba	900	1378	$1.53 (117%)
Kikwit	900	1405	$1.56 (119%)

7.2 HIDDEN COST OF BREAKDOWNS

Once cassava products reach the paved roads, truck breakdowns cause one day to one week delays in the delivery of cossettes or bimpuka to market. Fresh roots and leaves are either transferred to other vehicles or lost outright during long delays. Cossettes are a semi-perishable commodity. They are often not completely dried when bagged and loaded on trucks, and may already be infested with weevil, beetle, and grain moth eggs and larvae. When dozens of sacks are put together on a truck and transported over 2-4 days, these insects increase in numbers and migrate to grain and pulse products. Almost all cossettes seen on drying racks in villages, in local markets, in intermediate depots, on trucks, or in the Kinshasa market showed evident insect damage.

Cossettes from Bandundu pose special problems because they are usually shipped at a much higher moisture content than those from Bas-Congo or the Plateau de Bateke. Moisture content is higher because most fermented and retted roots are dried whole, rather than halved or quartered before drying. The higher moisture content means that mold and mildew grow both at the surface and along the main fiber axis of the root. These roots are also easily infested by weevil, beetle, and larger grain borers and attract swarms of ants in search of humid starch. Delays of 2-4 days en route will lead to increased insect damage and blackening of the cossettes, diminishing marketability and sales price. A UNIKIN researcher has suggested that aflatoxins from both cossettes and bimpuka from Bandundu pose a potential threat, and that this threat increases with the duration of transport because of the continued growth of Aspergillus spp mold. The danger would logically be even higher from cossettes and bimpuka paste shipped by barge or baleiniere due to the long duration of the trips and the very high prevailing humidity, but no lab analyses have been conducted to-date on cassava transported on the river.

7.3 TRANSPORT AND HANDLING COST IMPACT

The 2011 review of cassava marketing shows that the cost of transport and handling from southern Bandundu has come down with the completion of the Kinshasa-Kikwit-Batshamba bridge and paved highway rehabilitation. Travel times have been cut from more than a week to two or three days. Cargo volumes are shifting from river transport to road transport. The effect is probably very noticeable during dry Season C because the low river levels reduce the distance of navigable waterways on the Kwango and Kwilu rivers and their tributaries. The decrease in road transport costs has been substantial on the southern Bandundu to Kinshasa route, with sacks of cossettes sold in the 21,000-25,000 CF range - about the same level as river transport in 2010. Larger trucks and trailers are making the trip to Kikwit. Handling costs at the market town aggregation points also have declined somewhat but still require careful negotiation as simple loading fees per 70 kg allonge at the truck depot next to the Kwilu River Bridge in Kikwit can vary from 200 CF to 500 CF.

The other impact of paved road rehabilitation has been to sharply reduce the number of flights available to and from Kikwit from two to three flights daily by three airlines to two to three flights a week by one. There are now a range of buses, including express services, for passengers and small packages between Kikwit and Kinshasa.

7.3 RURAL ROAD REHABILITATION

Rural roads are being rehabilitated in Kinshasa, Bandundu, and Bas-Congo Provinces through a wide variety of programs funded with Belgian (CTB), EC, IFAD, UN, and other assistance. After rehabilitation, the financing of regular maintenance of national secondary roads and market access routes remains the great riddle to be solved before the high cost of food transport to Kinshasa and the reflow of basic manufactured goods to rural areas can be brought down. In a very few cases, the newly installed rain barriers on farm-to-market roads are being used as toll gates to collect funds for local manual maintenance committees (CLERs), but this is an ad hoc solution subject to reversal by provincial and national authorities. One possible solution to consider – a return to the minimum head tax to support a “territory-level” account with fixed guidelines for reflows to the sector level (40%) to support local maintenance? Centralized flows are inevitably diverted to non-road maintenance uses.

7.4 RIVER TRANSPORT

Kinshasa is served by a river network from the Congo, Kwa, Kasai, Kwango, Kwilu, and Lukenie Rivers and their navigable tributaries, along with Lake Mai-Ndombe. There are three main types of cargo vessel. Pusher boats that maneuver barges carrying loads of a few hundred tons each; wooden baleiniere that carry from 10 to 70 MT; and dugout canoes that carry from 700 kg to 3-5 metric tons.

River transport also requires trail or road links of some kind. It all starts with head-load, bicycles, hand carts, a very few ox- and tractor-carts, and trucks to ports and embarkation points. Rural access roads are oriented to connect to river ports as well as major primary and secondary road ways in Bandundu Province. Each of the rivers also has ferries that transport vehicles and goods across secondary rivers to connect to roads and to the processing centers of former industrial palm oil, rubber, and coffee concessions. During this 2011 study, however, few of the ferries upstream of Bandundu City were in operating condition.

In a 1998-99 survey, Musangu wa Mukendi and others showed that the majority of staple food products arrived in Kinshasa from Bandundu via river transport. 73% of cassava tonnage was delivered by river compared with 21% delivered by road. At that time, however, the bridges and entire sections of road between Kikwit and Kinshasa had been destroyed and river transport cost about 25% as much as road transport. Since the completion in 2010 of the road and bridge rehabilitation between Kinshasa and Kikwit, the balance appears to be swinging back toward more road traffic. There are signs in Kikwit that some transport specialization is occurring, with commercial trucking lines beginning to offer tractor-trailer service in the 12-16 MT capacity. These trucks, with closed trailers, protect products from wind, dust, and rain – protection that the older open-topped trucks cannot provide. They also reduce the physical damage to products in the top layers from passengers and livestock.

Round trip boat schedules depend upon river levels, availability of product, and organization. Travel times are generally long, sometimes taking between one to two months per trip. River levels determine the types of vessels that can be used at different times of the year, with a shift to pirogues at low water levels to aggregate product at downstream locations that can be reached by baleiniere, and, further downstream, barge-pusher vessels. The main Congo River flows in July 2011 were low enough to ground barges and even baleinieres on sand bars off Kinshasa, greatly slowing the offloading process. A lot of time can be lost just negotiating the multiple administrative controls in place on the laden legs of the upstream and downstream trips.

7.5 RAIL TRANSPORT

Within the Kinshasa marketshed the main rail line of interest is the narrow-gauge portage rail line from Matadi to Kinshasa. This rail line has fallen into disrepair with the rehabilitation of the Boma-Matadi-Kinshasa toll road that parallels the rail line. Also, the handling equipment at four quays of the Port of Matadi, along the rail siding, are not operational. Stations along the route to Kinshasa that originally pulled product from rural zones surrounding Songololo, Mbanza Ngungu, and Kimpese Districts are falling into disrepair. Rail in theory is a lower cost way to transport low value, high volume goods, but plans for the Chinese company CMIC to rehabilitate and operate the rail line are not yet being translated into action.

7.6 TRANSPORT PROBLEM SUMMARY

7.6.1 MAIN PROBLEM

After rehabilitation, the financing of regular maintenance of national secondary roads and market access routes remains the great riddle to be solved before the high cost of food transport to Kinshasa and the reflow of basic manufactured goods to rural areas can be brought down. In a very few cases, the newly installed rain barriers are being used as toll gates to collect funds for local hand maintenance committees (CLERs), but this is an ad hoc solution subject. One solution to consider – a return to the minimum head tax to support a "territory –level" account with fixed guidelines for reflows to the sector level (40%) to support local maintenance? Centralized flows are inevitably diverted to non-road maintenance uses. A similar problem, even more difficult to resolve, is the need to provide channel markers and dredging of channels. In 2011, low river flows beached many boats.

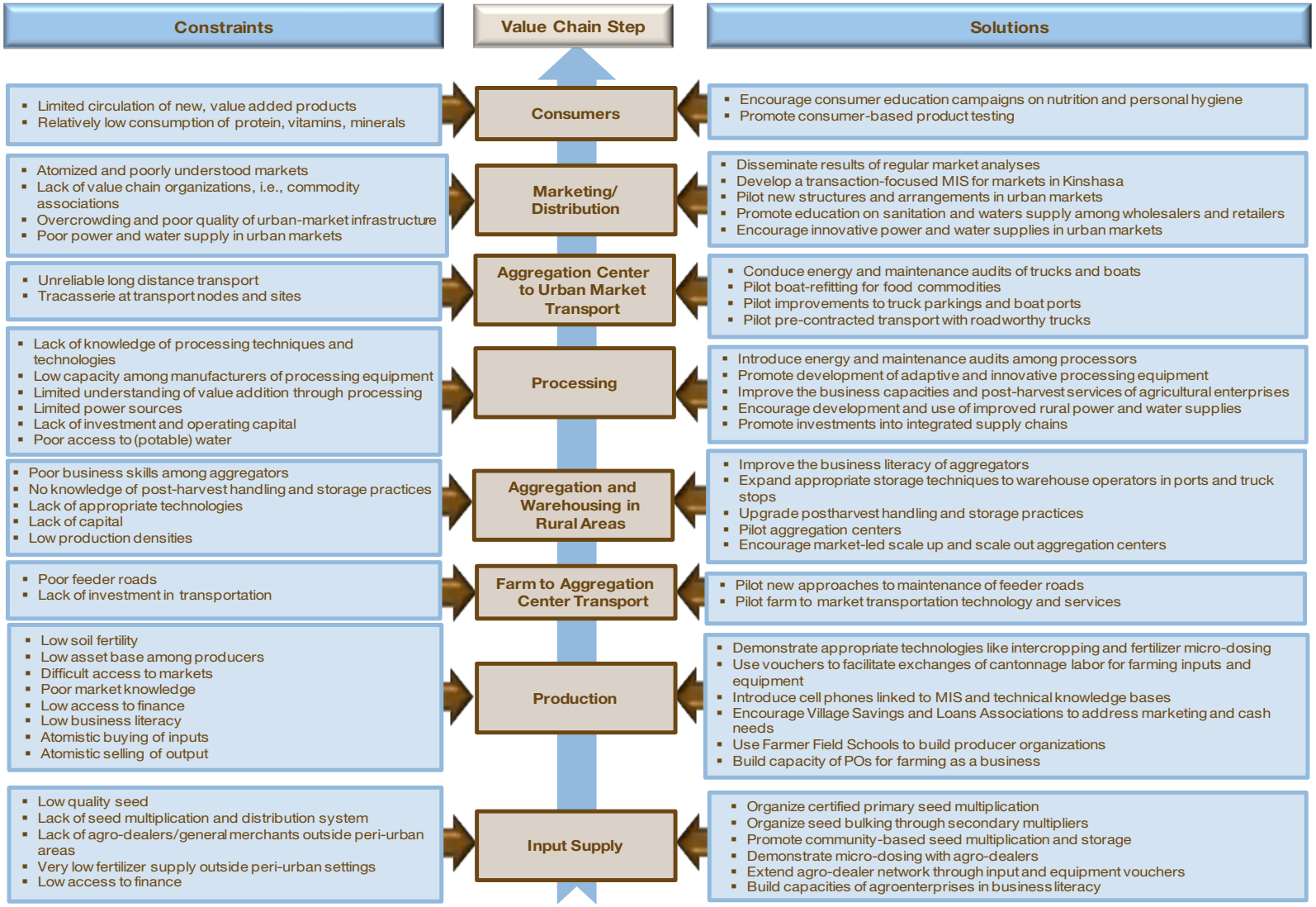
7.6.2 SYSTEM PROBLEM

Formal and informal "taxes" total up to $220 to $230 per trip between Kikwit and Kinshasa. Decentralization has led local administrative services to tax everything that moves with tax collectors piling up at each of the road barriers, sometimes levying ridiculous taxes, e.g. musician copyright fees, on commercial carriers of merchandise and passengers. Fees and taxes are about 50 % less on the Matadi-Kinshasa axis because of the shorter distance, the greater percentage of transport by large-scale transport companies, and the discipline of the toll system. Formal and informal taxes are said to be even higher at the river ports and embarkation/disembarkation points, reaching 10% of the value of transported merchandise.

7.6.3 LONGER- TERM OPPORTUNITY

Rehabilitation and operation of the Matadi-Kinshasa rail line could considerably reduce the transport costs per MT/km if the incoming loads of food and freight were to be balanced with the return freight of goods manufactured in Kinshasa and exports that are currently transported mainly by truck. Feasibility is dependent on an upswing in exports. Stable re-opening of the border with Angola to large-scale commercial operators would support this flow as well. (Note that small scale transporters still cross the border with trade goods and passengers on a daily basis.)

Fig. 29: Constraints and Solutions



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   Eleven food products on eleven semi-wholesale markets in Kinshasa. Imported rice, Cassava flour, Maize flour, Common bean colored (green from Eastern Congo mainly?), Peanut (shelled), Banana, Plantain, Palm Oil, Poisson Chincard (imported frozen macquerel), Poulet Wily P10 (Frozen chicken parts from Belgium), Viande capa

2. Ministère de l'Agriculture, 2008. Règlement Technique de la Production, du Contrôle, et de la Certification des Semences de Principales Cultures Vivrières et Maraîchères. Service National de Semences avec le Projet CTB « Semences » RD Congo

   Covers seed production, seed producer authorization, seed inspection, sampling, and labeling requirements for cereals, grain legumes, and vegetables, with a technical annex for cassava and sweet potato multiplication.

3. Goossens, Frans. 1996. Cassava Production and Marketing in Zaire. Leuven University Press. Leuven, Belgium.

   Comprehensive economic coverage especially of marketing of main cassava products. Dated because of the shifts in infrastructure, changes in population and consumer preference acceptance of products, income distribution, and the aftereffects of the "pillage" over the 1990s.

4. Ministère de l'Agriculture. 2008. Tracabilité, Contrôle, et Certification des Semences des Cultures Vivrières par le SENASEM. Projet CTP « Appui au Secteur Semencier » Kinshasa, RD Congo.

   Provides regional and SADC seed release, certification, and quarantine rules, before introducing the principles of seed traceability, organization of seed quality control and certification, inspection of seed production fields, sampling techniques, crop identification, seed sample collection, seed laboratory tests, and seed inspection in storage and packaging. In Annex are provided minimum seed certification standards of SADC, rules for lot inspection, a list of quarantine diseases for SADC states, and sample forms, labels, and sheets for seed lots.

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   Provides descriptions (fiches) for named varieties in the release Catalogue, put together by Mustapha Kouki, Guka Gangale, Tabu Sulubika, Gabriel Kapata, and Wilfried Godderis. Descriptions are not meant to replace the scientific varietal descriptions of the UPOV type that provide botanical morphology

   Cassava sweet varieties are: Antiota, Butamu, Lilayi, Mahungu, Malyoha, Mapendo, Mayombe, Nsansi, Papayi, Rav, Sawasawa, Zizila.

   Cassava bitter varieties are: Disanka, Musimwa, Mvuama, Mvuazi, and Sadisa.

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   Provides the new seed lot coding system made up of 7 letters and 7 numbers designating species, variety, province, seed production establishment, season, year, parcelle, sorted lot, and treated lot.

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   Covers Bandundu, Bas Congo, Katanga, Kinshasa. 100% of villages sampled produce cassava and maize. 2006-2007 total sweet cassava production: 185,000 tons; total bitter cassava production: 3,143,000 tons. Bandundu leads national cassava production.

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   Describes the objectives, approach, conduct, and problems encountered in doing this sample survey in Bas Congo and Bandundu. A key issue was the identification of the loading points for local food products and rural markets at the territory level, with a small subsample of field yields. Prix de gros et approvisionnement 58 points de débarquement: 15 debarcaderes, 37 points de stationnement pour véhicules (parkings), 1 gare, et 5 entrepôts. Prix au producteurs. 35 marchés ruraux dont 20 au Bas-Congo et 15 au Bandundu. The process of getting approvals to carry out the survey in Kinshasa was long and arduous.

   The most important tonnage of root and tuber crops was cossettes at 90%, followed by manioc paste (bimpuka) 2 %, chikwangue 2%, fresh roots, 0.6%,.

9. La Voix du Paysan Congolais. Editeur Baudoin Hamuli. Directeur de la Publication. Jean-Baptiste Lubama.

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    An economic regression study based on 9x9km pixels examining agro-ecological zones, FAO crop productivity potential estimates, GIS data from IFPRI using the crop allocation model SPAM, and UNEPs road infrastructure data base with estimate travel times. Ag production and travel time to urban markets are highly correlated. Total crop production to potential production is 45% for areas within 4 hours travel time from a city of 100,000. 5% for areas more than 8 hours away.

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    Stategic analysis of markets and competitors. ID key elements that affect competitiveness. Assess benefits and costs of reforms. Assess political and administrative feasibility, and develop advocacy plan. Raphael Kaplinksy and Micahel Morris, A handbook for value chain research. Sector-specific providers, Cross-cutting providers, Financial. Input suppliers, producers, buyers, wholesalers, retailers. Provides a checklist for mapping regulatory constraints to competitiveness.

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