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A value chain analysis of baobab (*Adansonia digitata* L.) products in Eastern and Coastal Kenya

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Appendix A

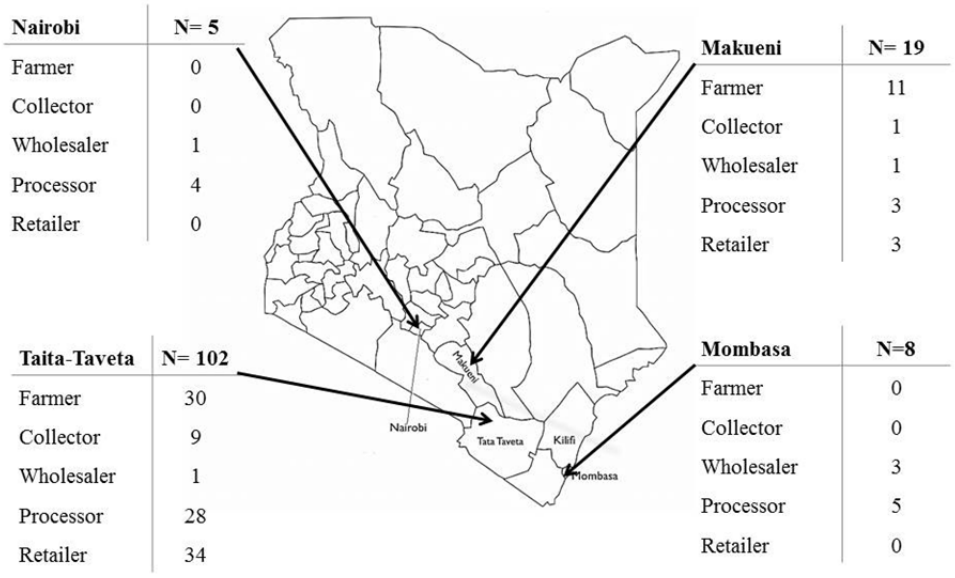


Fig. A1 Research area and number of respondents per value chain actor (total N=134) interviewed in four regions of Kenya. Source: Own data; Map adopted from GeoCurrents.

Table A1a: Measurement units for the calculation of profits for baobab seeds/pulp and fruits

Product	Sales unit	Weight per unit in kg pulp/seeds
Extracted pulp covered seeds (=pulp/seeds)	'Debe'	7 kg
	90 kg bag	70 kg
	50 kg bag	35 kg
	Tree	140 kg
Whole fruits	90 kg bag	21 kg

Note: Sales units were identified by value chain actors (N=134) and were crosschecked with own measurements taken with the help of large-scale processors and large-scale wholesalers.

Table A1b: Measurement units for the calculation of profits for mabuyu

	Mabuyu (in packets)	Unit
Ready made mabuyu sweets	1 pkt	30 g
	30 pkt	1 kg
	210 pkt	7 kg

Note: Numbers are averages, based on information given by processors (n=40) and were crosschecked with own measurements taken during the observed processing process. In addition, a set of 30 mabuyu packages was weighted, leading to an average package weight of around 30 g.

Table A1c: Input prices for processing 1 kg mabuyu

	(1)	(2)
Input type	Average input use for processing 1 kg mabuyu (KES)	Cost (KES) Per input unit
1 kg sugar	38	80
Food colour (15 g container)	8	20
Other optional inputs	5	34
Spices (cardamom, chili pepper) per kg mabuyu		20
Artificial aroma (per kg mabuyu)		5
Packaging (per kg mabuyu)		9
Sum in KES	51	134

Note: Numbers in column 1 are averages, based on information given by processors (n=40) and were crosschecked with own measurements taken during the observed processing. Many processors did not use optional inputs. Therefore, the average use of optional inputs such as aromas is relatively low. Column 2 reflects unit costs.

Table A2: Currency conversion

KES/USD for the 24-hour period ending Tuesday, Sep 30, 2014 22:00 UTC

Selling 1.00000 KES	→	you get 0.01101 USD
Buying 1.00000 KES	→	you pay 0.01140 USD

Online (09.02.2015): http://www.oanda.com/currency/converter/

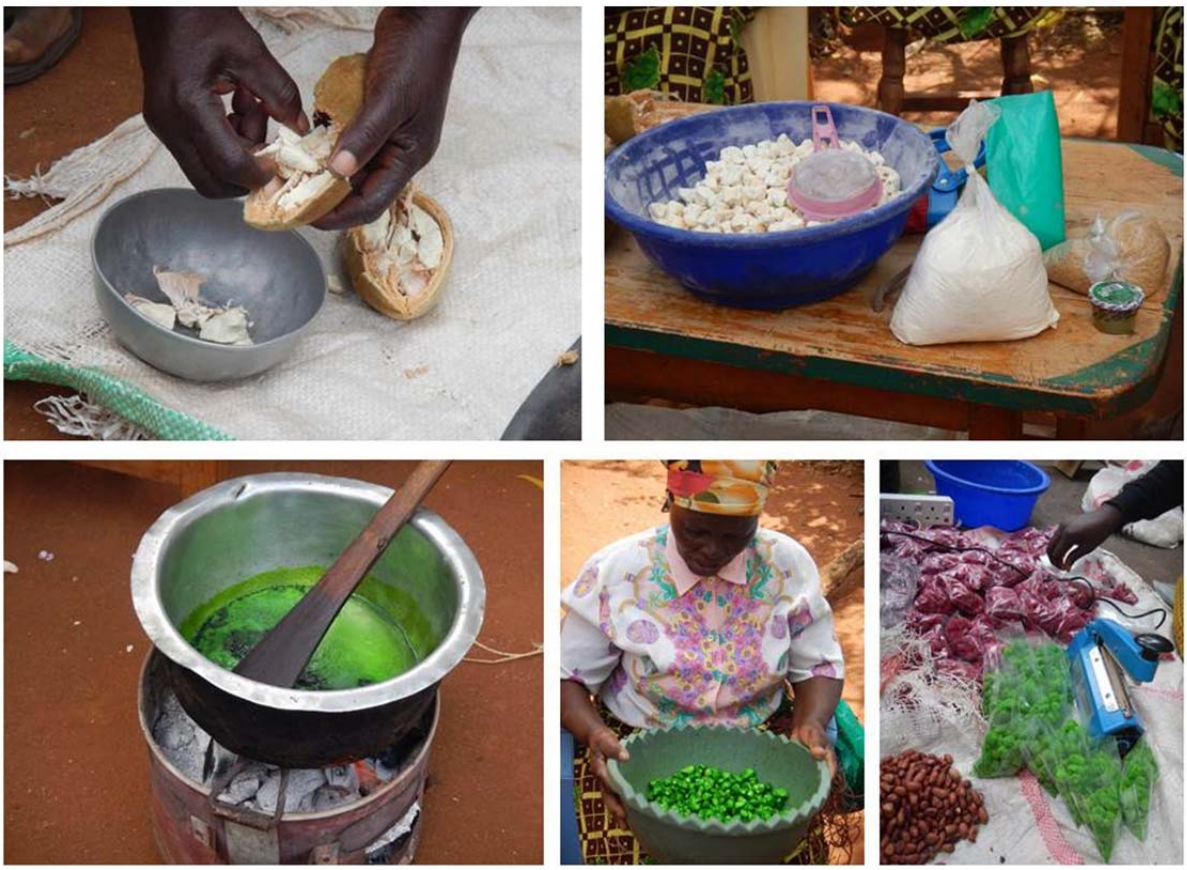
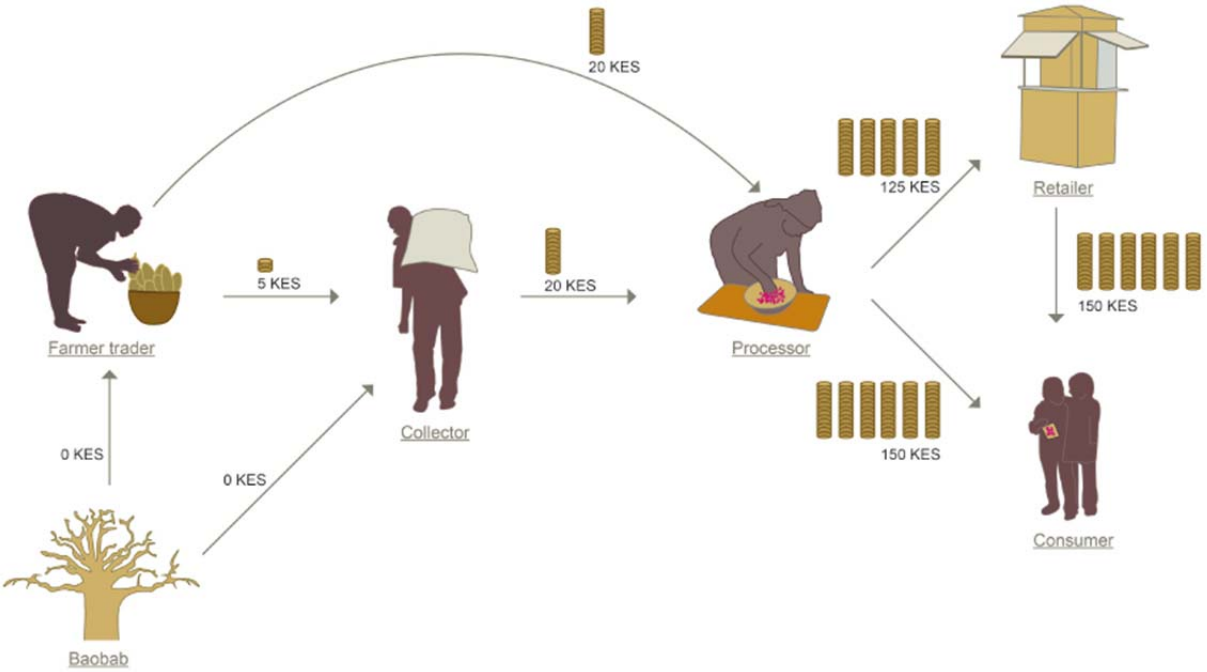


Fig. A2 Processing of mabuyu in Kenya: Upper left, rural processor removes pulp-covered seeds from a baobab fruit and removes fiber; upper right: Ingredients used for mabuyu processing; lower left: liquid of boiled sugar and food color; lower middle: farmer mixing the liquid with pulp-covered seeds; lower right: large-scale urban processor packing the mabuyu. (Photos by first author).



Farmer trader (FT)

Market channel	Value addition (KES)
Tree → FT → Collector	5

Collector

Market channel	Value addition (KES)
Tree → Collector → Processor	20
FT → Collector → Processor	15

Processor

Market channel	Value addition (KES)
FT → Processor → Retailer	105
FT → Processor → Consumer	130
Collector → Processor → Retailer	105
Collector → Processor → Consumer	130

Retailer

Market channel	Value addition (KES)
Processor → Retailer → Consumer	25

Fig. A3 Mabuyu value network and its actors (top) as well as prices of 1 kg baobab pulp/seeds (or mabuyu) along the value chain Taveta (bottom). The prices are averages calculated from buying and selling prices given by each actor.

Table A3: Overview key informant interviews

Key informants	Participatory research component	Comments
Mabuyu processor		
Small-scale mabuyu processor, Tausa, Voi	X	Joined preparation of mabuyu over firewood
Small-scale mabuyu processor, Kibwezi	X	Joined preparation of mabuyu over firewood
Small-scale mabuyu processor group, Kibwezi	X	Joined preparation of mabuyu over firewood. Women group demonstrated how the bark of the baobab can be turned into robes.
Large-scale mabuyu processor, Nairobi 1		Discussion about business opportunities for baobab products
Large-scale mabuyu processor, Nairobi 2	X	Joined preparation of mabuyu. One day of joined selling of mabuyu in a store next to Jamia mosque, in the Central Business district of Nairobi. Visiting the wholesalers of pulp/seeds in Nairobi together to receive more information on quality requirements.
Other baobab products		
Baobab Start-Up, Nairobi Baobab powder processor		Three meetings to discuss the opportunities and challenges of sourcing and processing baobab powder in Nairobi.
Baobab ice-lollipops, Dandora, Nairobi		Joined preparation of baobab ice lollipops

Table A4: preliminary analysis of Vitamin C of eight mabuyu samples

Sample type	Vitamin C content (mg/100g of edible portion)
Green mabuyu powder	16.0
Green mabuyu powder	15.2
Orange mabuyu powder	15.3
Green coated mabuyu seeds	35.5
Dark green coated mabuyu seeds	25.8
Purple coated mabuyu seeds	24.2
Mixture of green, red and yellow coated mabuyu seeds	52.5

Note: source: Katja Kehlenbeck, unpublished data.

Appendix B: Labour requirements for different processing steps

Harvesting and post-harvest losses

The value chain survey revealed that the harvesting was done by either farmer traders or collectors who got assistance from their children (for free or paid in fruits). Sometimes farmer traders pay casual workers for harvesting (for one fully harvested tree they pay between 100-200 KES).

Different harvesting techniques exist. Male harvesters climb the tree (with help of sticks that are plugged into the stem or with help of a rope). Smaller children and female farmer traders normally throw stones against the fruits. Other, older female respondents wait until the fruits had fallen down to then collect them. Due to these techniques, the trees were never fully harvested. In most cases, some fruits that could not be reached were left on the trees. Participatory research in Kibwezi, where the author assisted in harvesting, shows that the harvest of an average baobab tree took from 1 hour (climbing) to a whole afternoon (throwing stones).

After climbing the tree, the harvesters started to jump and shake the branches so that the fruits fall down. Sometimes the harvesters also use a long stick to reach the fruits further away from them. The boy on the upper right picture (Figure B) climbed the tree without tools, while the farmer on the lower right used a rope to be able to enter the tree (Figure B).

Figure B1: Harvesting of baobab fruits. On the left side: Sticks plugged into the tree; right side: Baobab harvesters in Taveta and Kilifi.

Hygiene is the major problem stated by respondents with respect to harvesting of baobab fruits. The fruits fall on the ground and were likely to crack. If not properly stored, the already opened fruits are easily infected by dust and insects, which then leads to post-harvest losses. In addition, the whitish color of the pulp/seed turns orange when the seeds are exposed to light and oxygen. Often the fruits were directly opened after harvesting. Thereby dust, sand and the tiny hairs of the baobab shell could easily spoil the pulp/seeds.

Mabuyu processing

As described in Chapter 4.1. baobab pulp/seeds turn into mabuyu by adding a mix of sugar and food colour to them. Participatory research has shown that the removal of fibres and mabuyu packaging are the most time consuming tasks. It takes around half an hour to remove the fibre of 1 kg pulp/seeds. Afterwards, water is boiled, the inputs (sugar, food color and optional artificial aroma or spices) are added and the liquid is mixed with the pulp/seeds.

Next, the mabuyu has to be stirred several times so that the food color is distributed equally until every single pulp/seed is colored. This processing step takes around 15 minutes. The pulp/seed is not boiled but just doused with the hot liquid. Afterwards, some processors dry the mabuyu, others pack the mabuyu straight away. The packaging of 1 kg mabuyu takes about half an hour. The most time consuming tasks were reported to be done with help of female family members or friends. Large-scale processors in Taveta that own their own market stalls remove the fibre and seal the baobab bags while waiting for customers, lowering their opportunity costs.