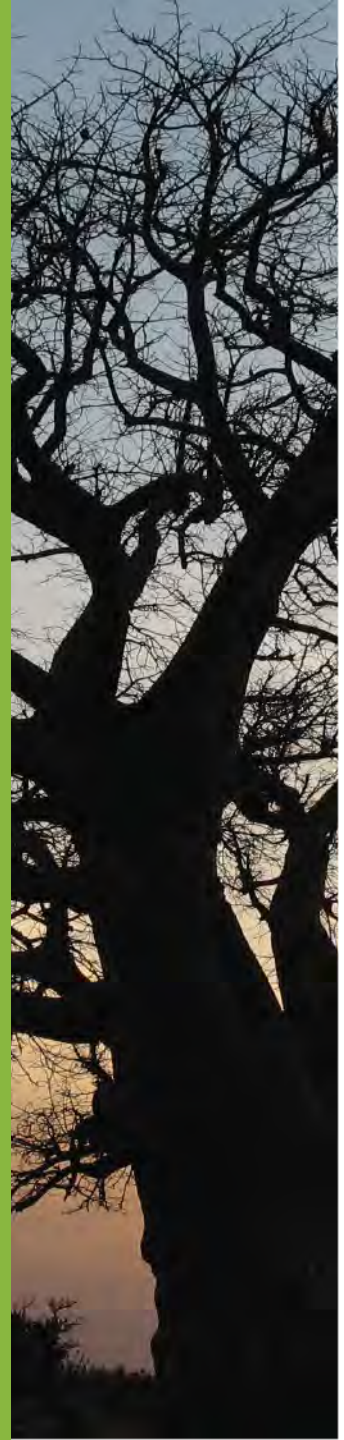

Commercialisation of Baobab (*Adansonia digitata* L.) Fruit Products as an Exemplary NTFP

Lessons Learned from Local to Global Markets

Webinar Series 'Unlocking the Bioeconomy for Nontimber Forest Products'
18th November 2021

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The baobab tree (*Adansonia digitata* L.)

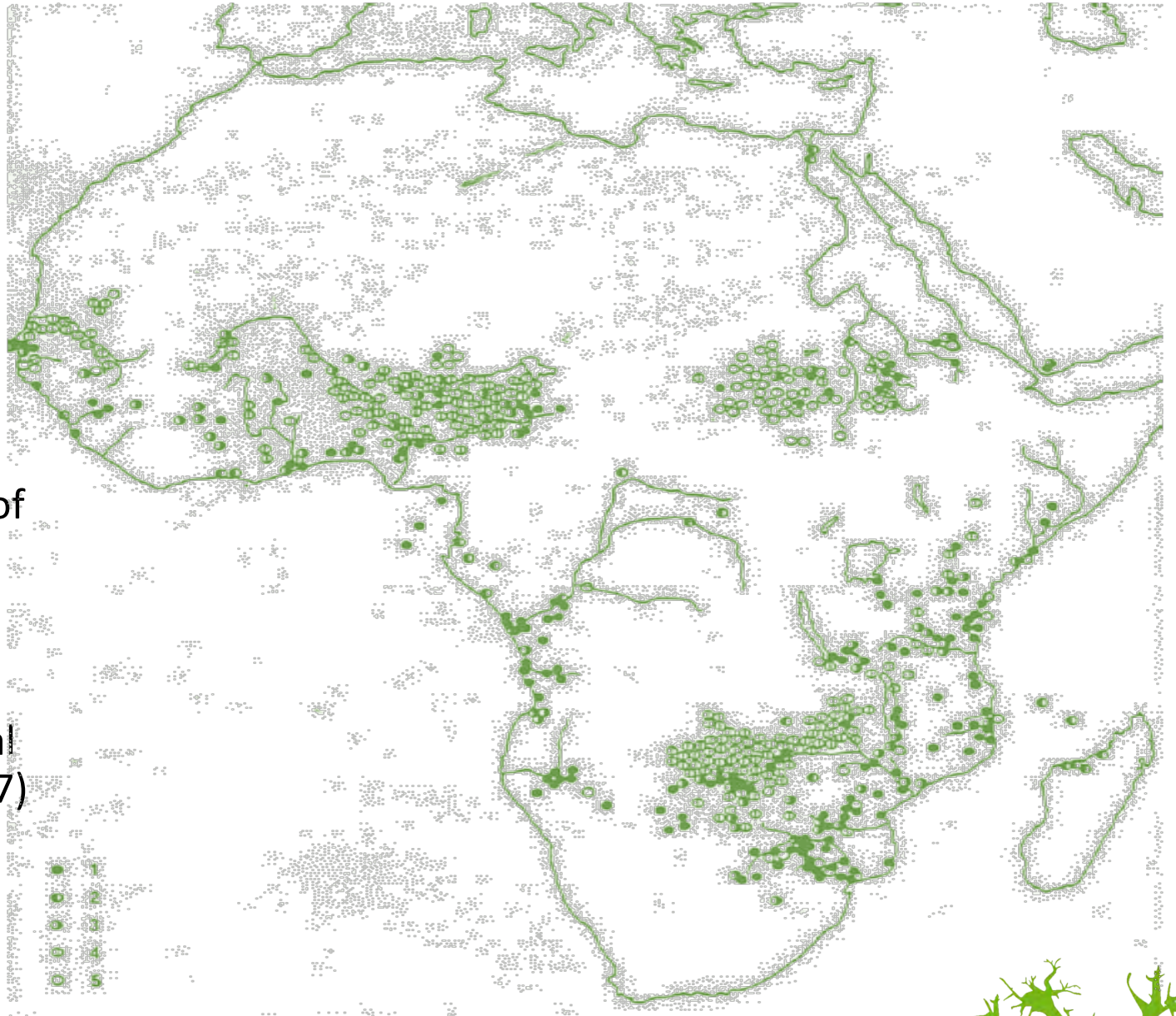
Deciduous, majestic tree up to 25 m high, thick, angular, wide spreading branches and stout trunk (Wickens 2008)

One of the most important indigenous fruit trees in SSA: direct and indirect contribution to food security / livelihoods (Franzel et al. 2008)

Distribution

Mainly in semi-arid areas of SSA, hot-spots of food and nutrition insecurity and socio-economic marginalization

Baobab trees often preserved on agricultural lands (Dhillion and Gustad 2004; Duvall 2007)



Wickens (1982) cited in Gebauer et al. 2013

Traditional uses

Type and extent of use highly variable across the tree's distribution area

Almost all parts of the tree have been reported useful, e.g. for food, fodder, fiber, medicine, shelter (Wickens 2008)

Commercialisation levels generally lower in Eastern Africa than in Southern or Western Africa (Gebauer et al. 2016)

Baobab Biomass

Baobab Use Cascades

Fruits

Leaves

Food

Medicine*

Bark

Handicrafts

Pulp-on-seed

Fruit Pulp

Fruit fibres

Beverages*

Fruit Powder

Confectionaries

Drink & beverages

Seeds

Seed oil

Cosmetics & personal care

Lubricant

Press cake

Animal feed

Fertilizer and soil conditioner*

Seedlings

Leaves

Food

Medicine*

Fruit shell

Briquettes & pellets*

Soil conditioner

Tubers

Food*

Medicine*

Legend

- High value product
- Intermediate or by-product
- Waste product
- Energy product
- Use cascade

TABLE 2 Medicinal Use of Baobab Fruits, Seeds, and Leaves Documented in Literature

Part of tree	Symptoms/illness treated	References
Fruit pulp	Constipation[1] Diarrhoea, dysentery Fever Intestinal inflammations Low iron content in blood Smallpox	(Assogbadjo 2006; Berhaut 1974; Burkill 1985; Codjia et al. 2001; Dalziel 1937; Dweck 1997; Gerber 1895; Hines and Eckman 1993; Kerharo 1974; Kerharo and Adam 1974; Maundu, Ngugi, and Kabuye 1999; Szolnoki 1985; Wickens and Lowe 2008)
Seeds	Diarrhoea, dysentery Diseased teeth and gum Fever Inflammations Intestinal inflammations Wounds	(Arbonnier 2004; Assogbadjo 2006; Berhaut 1974; Booth and Wickens 1988; Burkill 1985; Codjia et al. 2001; Dalziel 1937; Dweck 1997; El-Kamali and El-Khalifa 1999; Hines and Eckman 1993; Kerharo 1974; Kerharo and Adam 1974; Owen 1970; Sidibé and Williams 2002; Szolnoki 1985; Wickens and Lowe 2008)
Leaves	Coughs, asthma and respiratory problems Diarrhoea, dysentery Eye complaints Inflammations of the digestive tract Inflammations Lower blood pressure Malaria Tumors Wounds	(Arbonnier 2004; Assogbadjo 2006; Berhaut 1974; Booth and Wickens 1988; Burkill 1985; Dalziel 1937; Diallo et al. 1999; Dweck 1997; Gerber 1895; Gustad, Dhillion, and Sidibe 2004; Hines and Eckman 1993; Joshi et al. 2004; Kerharo 1974; Kerharo and Adam 1974; Kerharo and Bouquet 1950; Owen 1970; Sidibé and Williams 2002; Wickens and Lowe 2008)

Note. [1]Although baobab fruit pulp is widely used to treat diarrhea and dysentery, in several countries the pulp is also used to treat constipation (Gustad, Dhillion, and Sidibe 2004; Wickens and Lowe 2008).

Buchmann et al. (2010)

Renowned interest concerning the baobab fruit

Interest and demand for baobab fruit products increasing on both a global as well as local level

International markets open since acceptance as novel food in EU and US since 2008

More than 300 products containing baobab have been identified on the European market (Gebauer et al. 2014)


innocent
Green Smoothie
Apfel, Birne, Spinat, Grünkohl & Baobab
SANATURA
Baobab44
FRUCHTPULVER
CLARINS
50+
BAOBAB
TERRA SANA
BAOBAB
BAOBAB
BAOLA
BAOLA
BAOBAB
BAOBAB REZEPT IDEEN
BAOJAM
Bauer
DER GROSSE BAUER
chocolate
Baobab-Extrakt
Balea
VITAL
Baobab-Extrakt
Balea
VITAL
Balea

Nutrient content of baobab fruit pulp

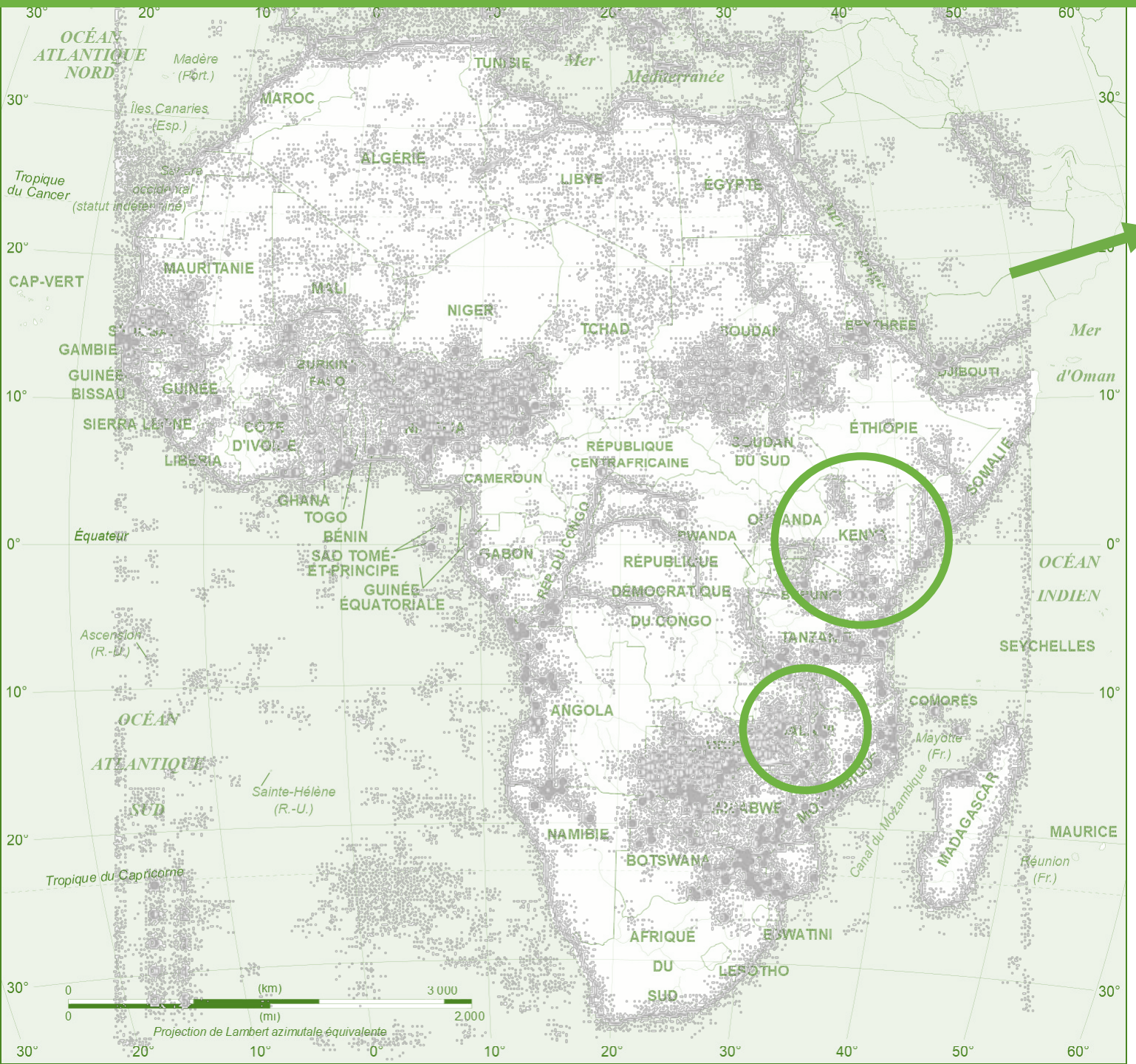
	Average	min	max
Water [%]	11.6	2.0	27.5
Energy [kj/100g dw]	1274	849	1495
Carbohydrates [g/100g dw]	74.9	46.6	87.7
Lipids [g/100g dw]	3.6	0.2	15.5
Protein [g/100g dw]	5.3	2.5	17
Fibre [g/100g dw]	13.7	6.0	45.1
Ca [mg/100 g dw]	302	3.0	701
Fe [mg/100 g dw]	4.3	1.1	10.4
K [mg/100 g dw]	1794	726	3272
Mg [mg/100 g dw]	195	100	300
Vitamin C [mg/100 g dw]	290	209	360

Adapted from Chadare et al. (2009)

Renowned interest concerning the baobab fruit

Opportunities for income generation for vulnerable and poor local communities in SSA

Unintended consequences such as risk of overexploitation of resource, threat of subsistence use



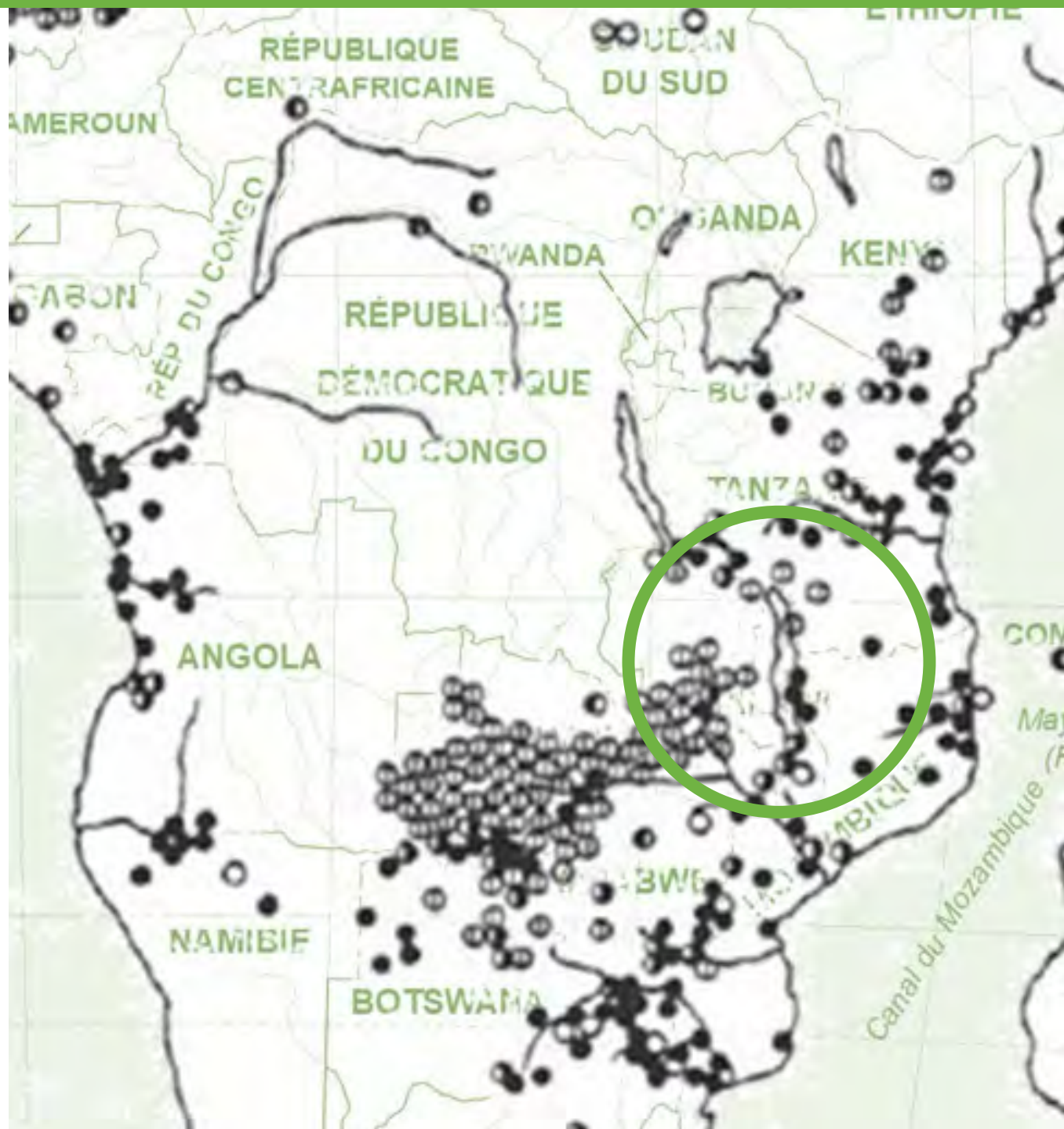
Export: baobab food products increasingly available on international markets

Kenya: local markets developing; baobab considered underutilised

Malawi: thriving local market, major player in formation of the export market; signs of overexploitation

Wikimedia Commons; Eric Gaba

Malawi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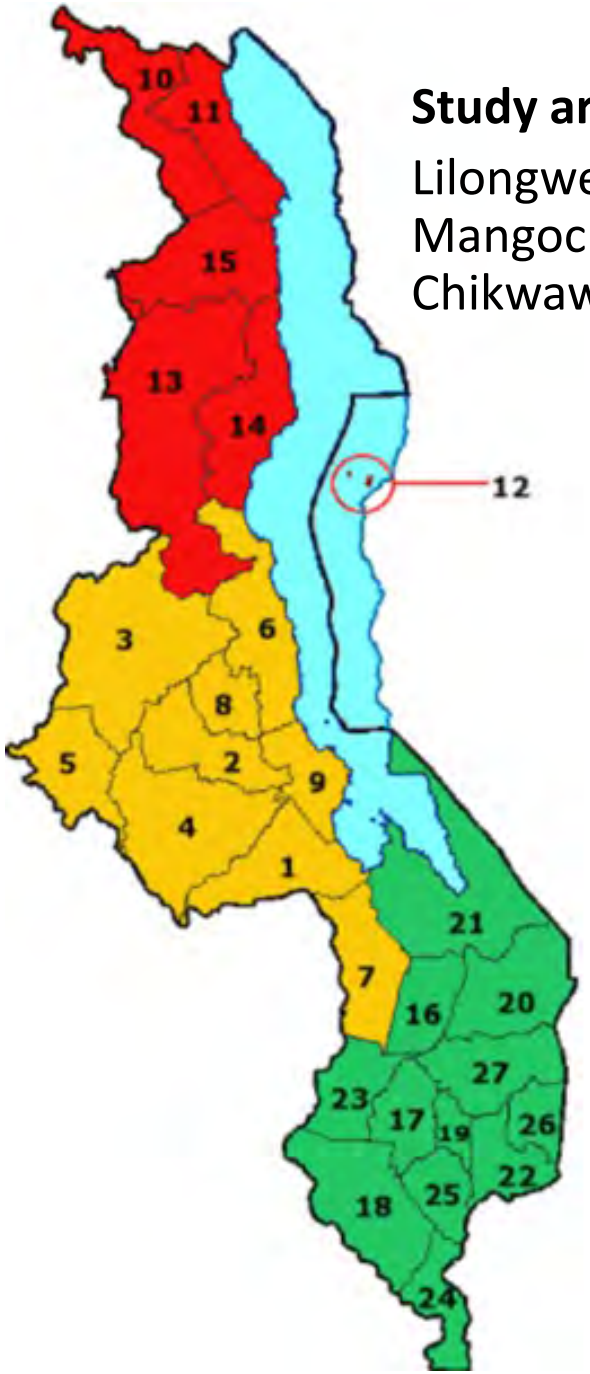
RÉPUBLIQUE
DÉMOCRATIQUE
DU CONGO
ANGOLA
NAMIBIE
BOTSWANA
Canal du Mozambique

Baobab use and commercialisation in Malawi

High levels of local commercialization; transition from solely informal baobab use to higher-value market segments has been observed (Darr et al. 2020)

Investigation of implications such a transformation may have, particularly on food safety issues and possible supply chain implications

Mixed-methods approach, semi-structured interviews with value chain actors, key-informants; concurrent collection of baobab product samples



Study area

Lilongwe, Blantyre, Mangochi, Salima, Chikwawa

Historic development of the baobab processing sector in Malawi

Initially: solely household level use, small-scale trade; baobab mainly used in porridge, or as snack; traditional processing

Development project (1996 – 2006): professionalising baobab juice production to improve livelihoods and preserve forests → supply of bottled baobab juice to major retail markets

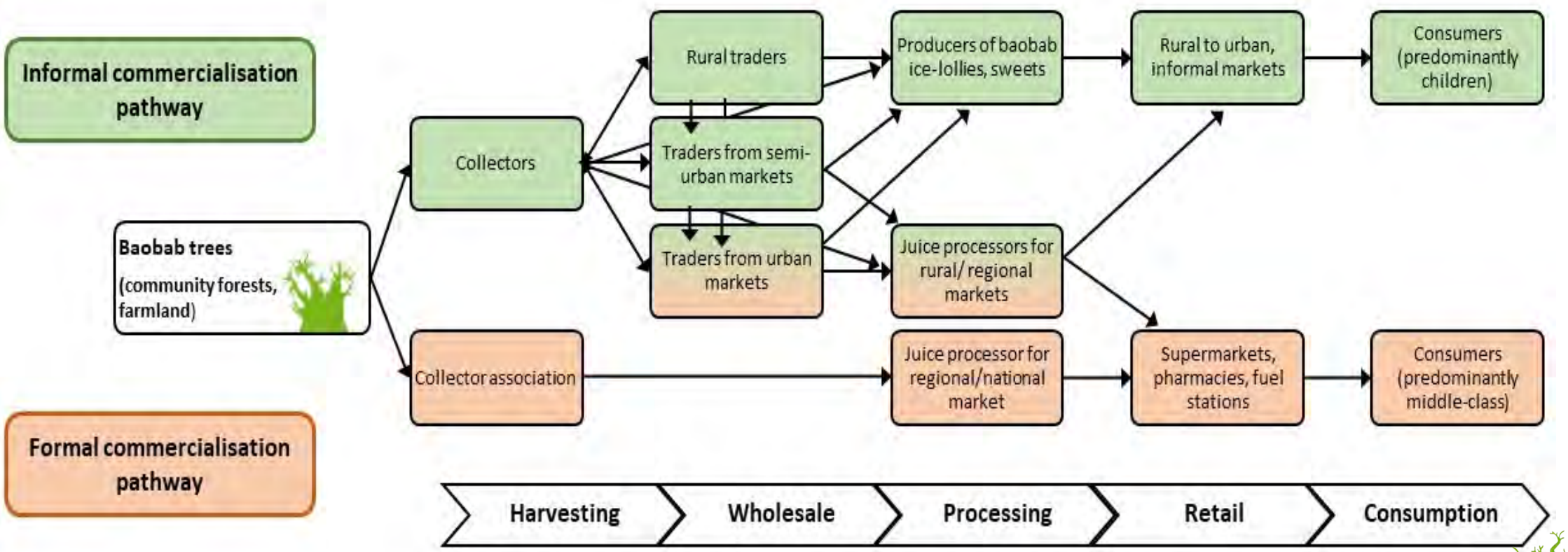
From approx. 2006 onwards: increase in informal trade in baobab juice and ice-lollies in Malawi's urban centres, leading to a rapid increase in demand for the fruit

Concurrently: Malawi became one of the pioneers in exporting organically certified baobab fruit powder, supported by trade association PhytoTrade Africa

Mushrooming off baobab processing businesses in Malawi; manufacture of baobab products such as fruit juices, ice-lollies, sweets or cosmetics became common business

Demise of baobab exporting sector in 2016/7 (unmet quality parameters, premature fruit harvesting, season of drought)

Baobab value chain in Malawi



Harvesting, trade, and storage

Storage (collector's association)

Processing (informal)

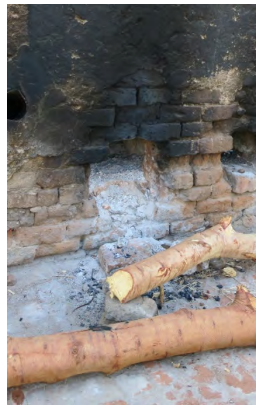





Typically conducted at home, then sold in markets, at home, schools, etc.

No certification, quality checks

Processing (formal)



Typically certified (Malawi Bureau of Standards), sold via supermarkets, small shops

Implications of the rapidly developing sector

- Baobab supply chain has elongated in recent years, increased role of trading and processing

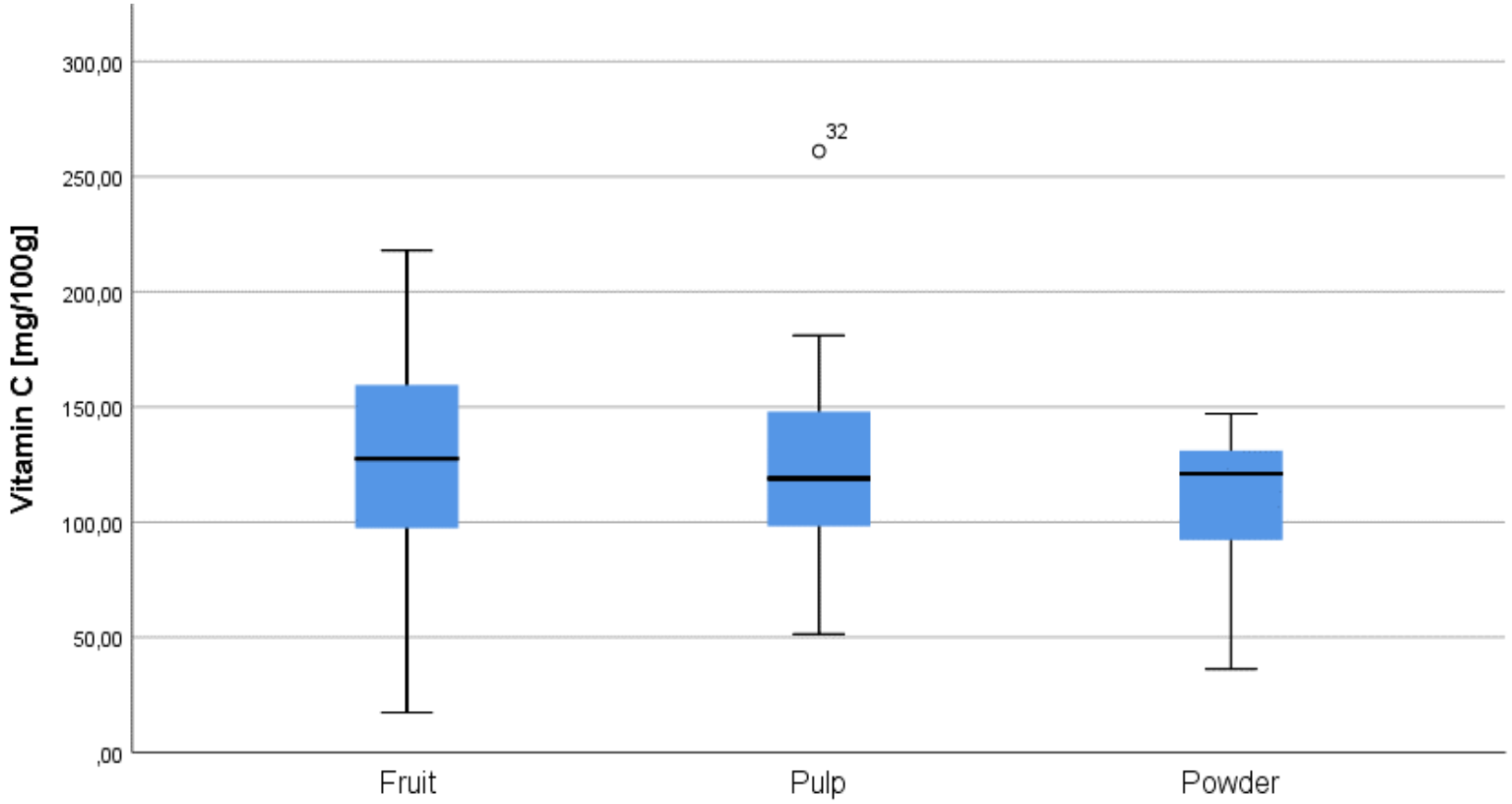
- Broad variety of handling practices concerning harvesting, storage, and processing can have implications on product quality obtained

  - Baobab storage can last several months (peak harvesting in April, sales dominating in the hot months towards the end of the year)
  - Depending on their position within the value chain and markets targeted, stakeholders perceived the importance of different quality characteristics differently
  - Dryness was commonly considered the most important quality indicator, other factors, such as cracks in the fruit shell, fruit shape or colour were more heavily disputed.
  - With most more formal processing facilities obtaining their raw material via traders and regulations on traceability lacking, the risk of low-quality baobab entering formal retail outlets remains

Occurrence of mycotoxins

	Contaminated fruit sample	Contaminated pulp sample
Sum Aflatoxins[µg/kg]	9.1	3.2
Aflatoxin B1 [µg/kg]	5.3	3.2
Aflatoxin B2 [µg/kg]	1.8	<0.2
Aflatoxin G1 [µg/kg]	1.1	<0.2
Aflatoxin G2 [µg/kg]	0.9	<0.2
Vitamin C content (mg/100g)	158	153
Estimated month of fruit harvesting	April	July
Time between fruit harvest and pulp extraction	3 months	3 months
Colour of fruit pulp (RHS Colour Chart)	Pale Yellow (158B)	Pale Yellow (18C)

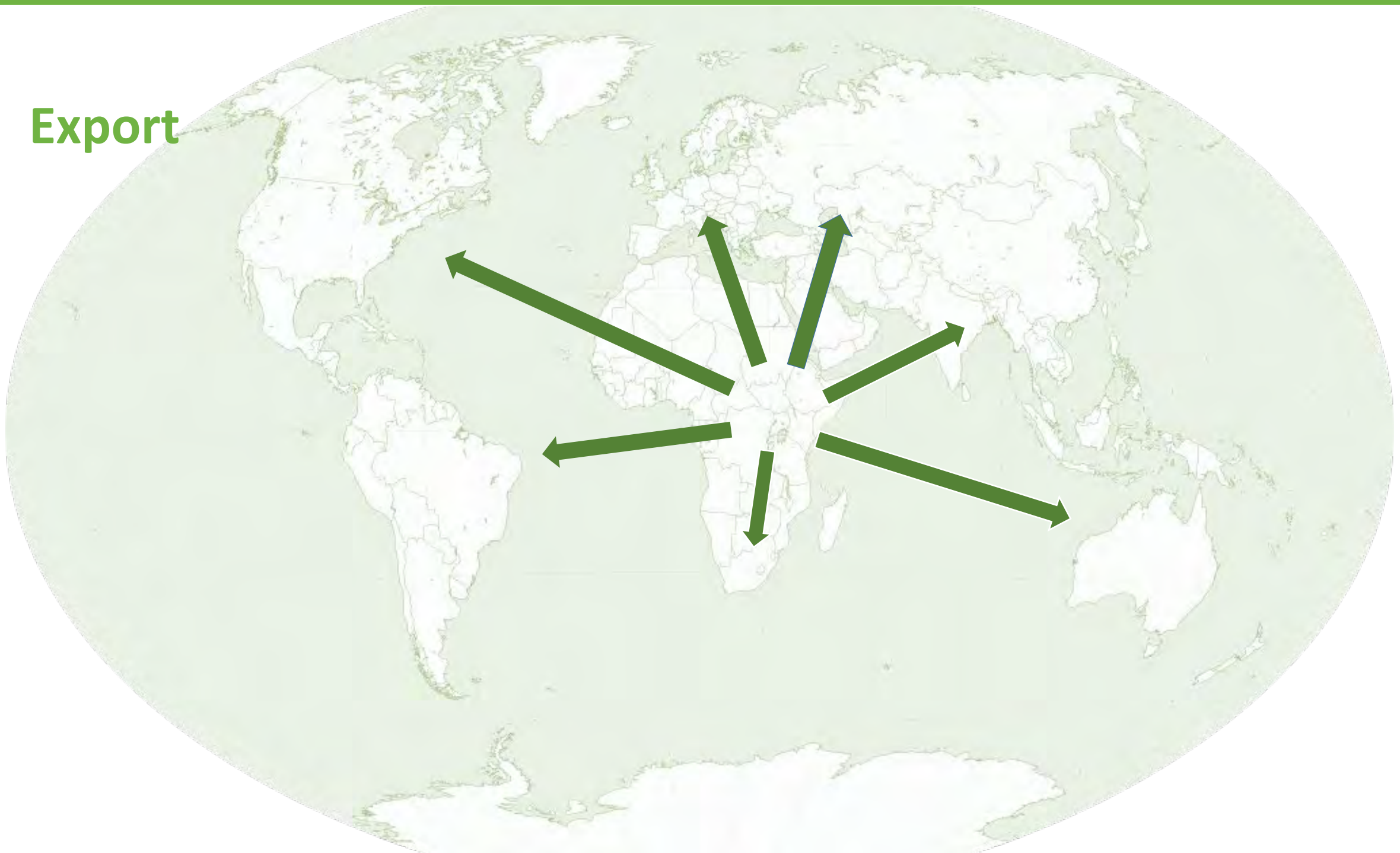
Vitamin C content



Baobab use and commercialisation in Malawi

- While historically the focus has been on establishing formal supply chains, this has fueled developments in the informal sector
- Highly variable storage durations and handling practices can lead to unreliable product qualities
- Dire need to strengthen the institutional framework and enabling environment to foster production of high-quality products, for both formal but especially also in the informal sector.

Export



Formation of the export market

Overall, despite opportunities for innovation only few NTFPs manage to enter high-end markets or are found in a wide range of products

Assessment how baobab overcame poor innovation environment for NTFP enterprises

Qualitative approach to holistically understand the framework conditions of the emerging baobab industry and corresponding markets

Historic development of the export-oriented baobab processing sector

Initially no market for baobab in the global North; solely traditional, informal use and trade in producing countries, simple processing technologies such as pounders, mortars

Late 1990s and early 2000s: identification of baobab as a priority species for pro-poor commercialisation; activities to professionalise firstly both in Senegal and Southern Africa (Malawi)

2008: EU novel food approval, followed by FDA approval for the US market

Various activities building the sector, including technology establishment and product research, resource base assessment, or market development activities (PhytoTrade Africa)

From approx. 2010: rising demand for baobab internationally, further actors in both producer and consumer countries entering; export currently estimated at several hundred tons/year

2018: Formation of the African Baobab Alliance (ABA) aimed at raising quality standards, grow global demand, and promote sustainable, reliable and ethical supply chains

Innovations in the sector

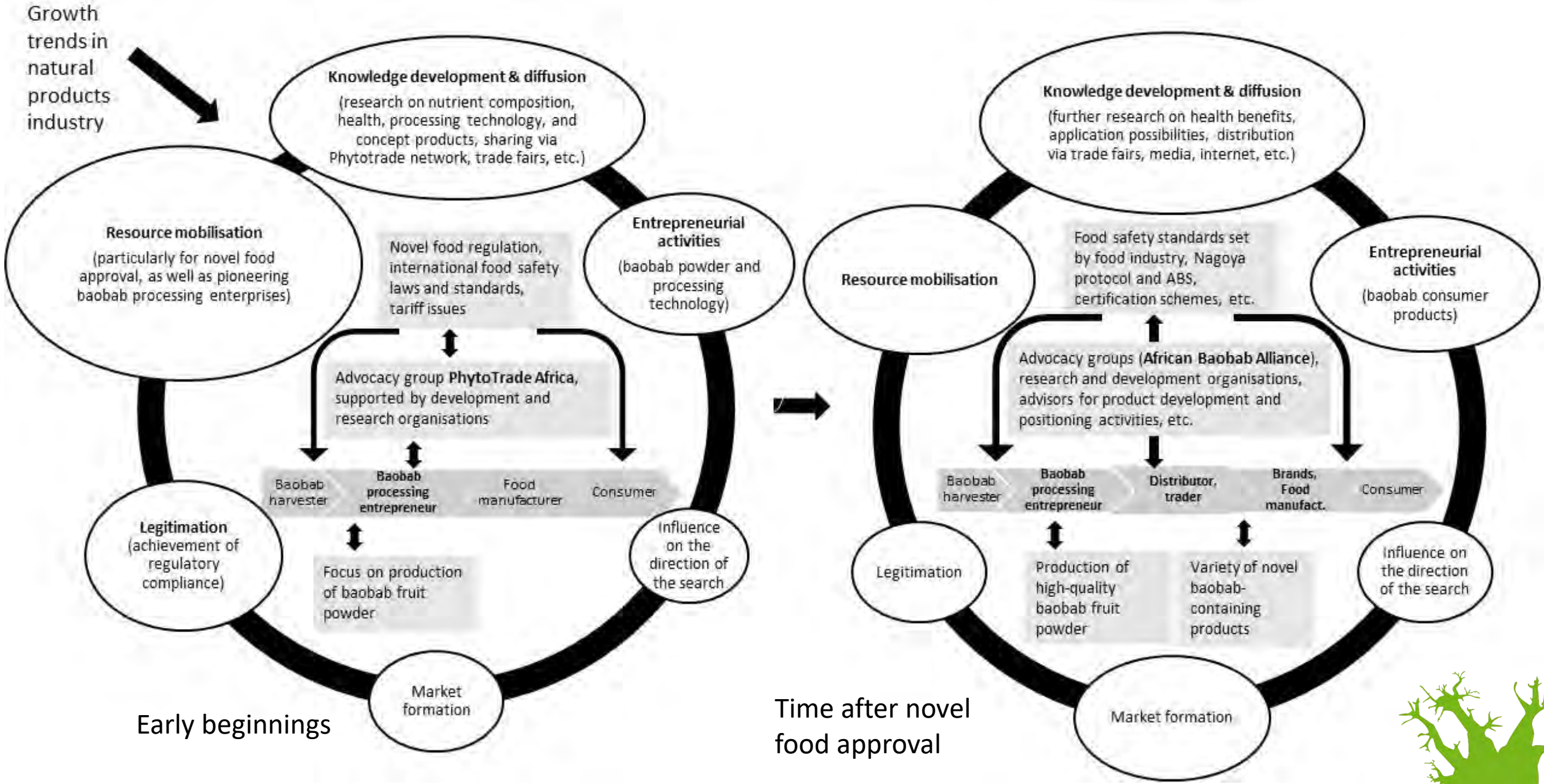
Innovation type (IT)	Frequency IT mentioned	Main examples
Product innovation	19	– Novel product formulations with baobab fruit powder as an ingredient, including e.g. sports and energy drinks, drink powders, smoothies, supplemental superfruit blends, bars, chocolates, capsules, prebiotic and symbiotic products, dairy products, etc.
Process innovation	9	– Baobab pulp processing machines, filtering/sieving systems – Storage systems
Organisational innovation	21	– Supply chain organisation in producer countries and quality control procedures – Shareholding structure to involve smallholder producers – Logistical advancements to allow bulk sales – Collaboration with (subcontracted) specialists, e.g. for NPD or positioning of products
Marketing innovation	3	– Novel B2C approaches to marketing by baobab brands to tackle low consumer awareness

Market development

Most important export markets for baobab (excluding intra-African trade) include North America and Europe, with UK and Germany dominating the European side

Early adopter market, sold primarily in health or organic stores; yet also more mainstream food manufacturers are starting to utilise baobab

Various activities conducted to raise awareness amongst both the food industry and consumers; partnerships with market participants, PR campaigns, etc.



Meinhold et al. (2021)

System function (SF)*	Contributing factors		Hindering factors, blockages	
	Frequency SF indicated	Main phenomena	Frequency SF indicated	Main phenomena
Knowledge development and diffusion	54	– Different research activities concerning baobab, such as investigations into its nutritional value, health implications, or ecological aspects – Technology development (e.g. baobab processing machines) and NPD, leading to new (functional) food products – Sharing of knowledge e.g. via conferences and trade fairs, PhytoTrade network, awareness campaigns, etc.	19	– Limited financial/human resources amongst involved enterprises for R&D and to spread generated knowledge (e.g. on new application possibilities) – Remaining knowledge gaps, e.g. concerning health implications due to baobab consumption (particularly concerning gut health), pan-African baobab resource base assessment, or further product application possibilities – Knowledge dissemination not coordinated, particularly after demise of PhytoTrade
Entrepreneurial activities	23	– Often passionate individuals behind the increasing number of enterprises processing and utilising baobab – Steady experimentation with baobab processing technology, supply chain configuration, etc.	26	– High financial risk for entrepreneur baobab producers, e.g. high levels of pre-financing necessary, cash-flow issues since small-scale harvesters need to be paid in cash – Exacerbated by difficult business environment in Africa (e.g. SME support, general infrastructure)
Influence on the direction of the search	9	– Changing preferences in society (trend towards natural, healthy, ethically sourced food) – Growth anticipated in the sector by baobab producers – Interest rising among (mainstream) food manufacturers on using baobab as an ingredient	16	– Standards set by Western markets (e.g. concerning certification, quality standards) can yet act as trade barrier – Sector currently not differentiated sufficiently by quality/ethical standards; – Consumer awareness often still relatively low

Market formation	16	– Increased awareness and demand for baobab generated via broad mix of marketing activities (e.g. trade show participation, PR campaigns, partnerships with food industry, etc.); supported by trend for natural, healthy food	16	– No demand at onset, regulatory approval for EU/US markets coincided with global financial crisis; demand did not expand as rapidly as expected – Continuous marketing efforts required, due to remaining uncertainties among potential customers (food manufacturers) and consumers on applicability of baobab
Legitimation	18	– Advocacy activities e.g. via PhytoTrade Africa or the ABA, concerted effort to make baobab next superfood – Achievement of regulatory compliance (Novel food approval EU, GRAS approval US) – Achievement of standards demanded in Western markets, e.g. concerning organic certification or food quality standards – Rules of the game on exporting to US/EU markets now well established	19	– Resource limitation of advocacy groups such as ABA, demise of PhytoTrade – Regulatory hurdles remaining, e.g. to access novel markets such as China – Differences in regulatory framework across countries e.g. concerning Nagoya Protocol or national regulations – Attaining highest food quality and safety standards demanded by mainstream food manufacturers yet difficult to achieve
Resource mobilisation	31	– Various grant funding support, e.g. for PhytoTrade (most prominently IFAD) or baobab producer enterprises directly – Grants from trade promotion programmes (e.g. CBI or SIPPO), to participate in trade fairs	30	– Unfavourable business environment in sub-Saharan Africa for NTFP start-ups – Lack of adequately trained personnel e.g. concerning food manufacturing/hygiene – Overall infrastructure can be challenging (e.g. concerning transport, electricity or accessible laboratories for sample analysis)

Sustainability aspects

All exported baobab currently from wild resources

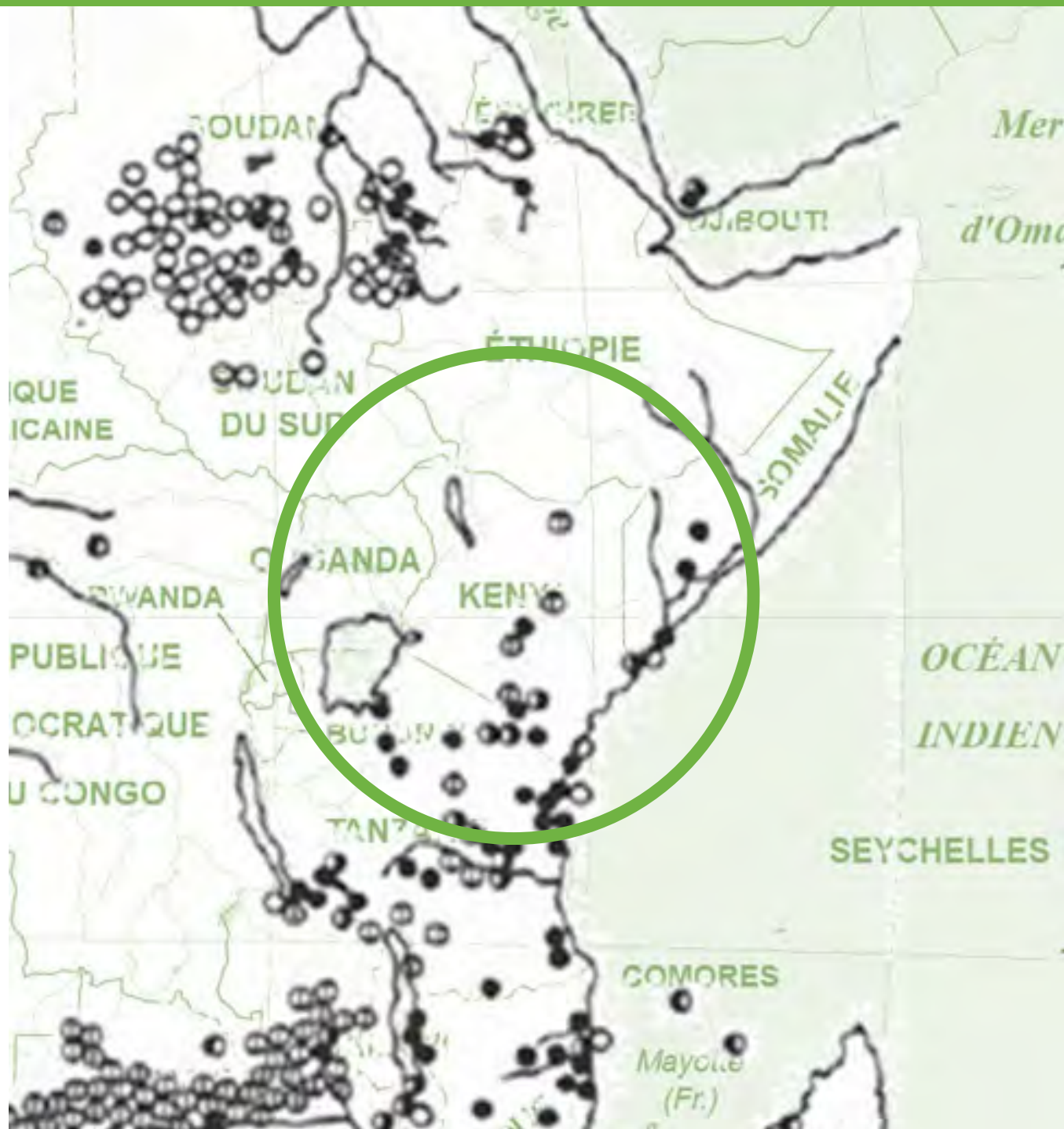
Efforts have been made in the export-oriented baobab industry aiming for an sustainable and ethical trade (e.g. certification schemes)

Perceived risk that these may become undermined in the future with increasing demand for baobab resources and more mainstream market participants entering the scene

Formation of the export market

- Overall, baobab managed to overcome many of the typical challenges associated with NTFP commercialisation
- Sector was built bottom-up using external support, via complex interactions of a variety of actors and institutions, both in the global South and the global North → inducing a variety of innovations including supply chain modifications to comply with quality standards
- In the initial phases it was particularly important to create the needed legitimacy via mobilisation of sufficient financial and human resources and generate much needed knowledge
- Moving on:
  - Continuous support for the sector as well as a close monitoring of ongoing developments and their impact on the resource base as well as associated communities needed
  - Consideration of local markets as well and synergies between different types of markets
  - With all baobab resources currently stemming from rural smallholder producers, activities focusing on increasing demand and awareness for sustainably-sourced baobab may well have higher developmental impact than direct efforts at the producer side.

Kenya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KENYA
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SEYCHELLES
COMORES
Mayotte
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OCÉAN
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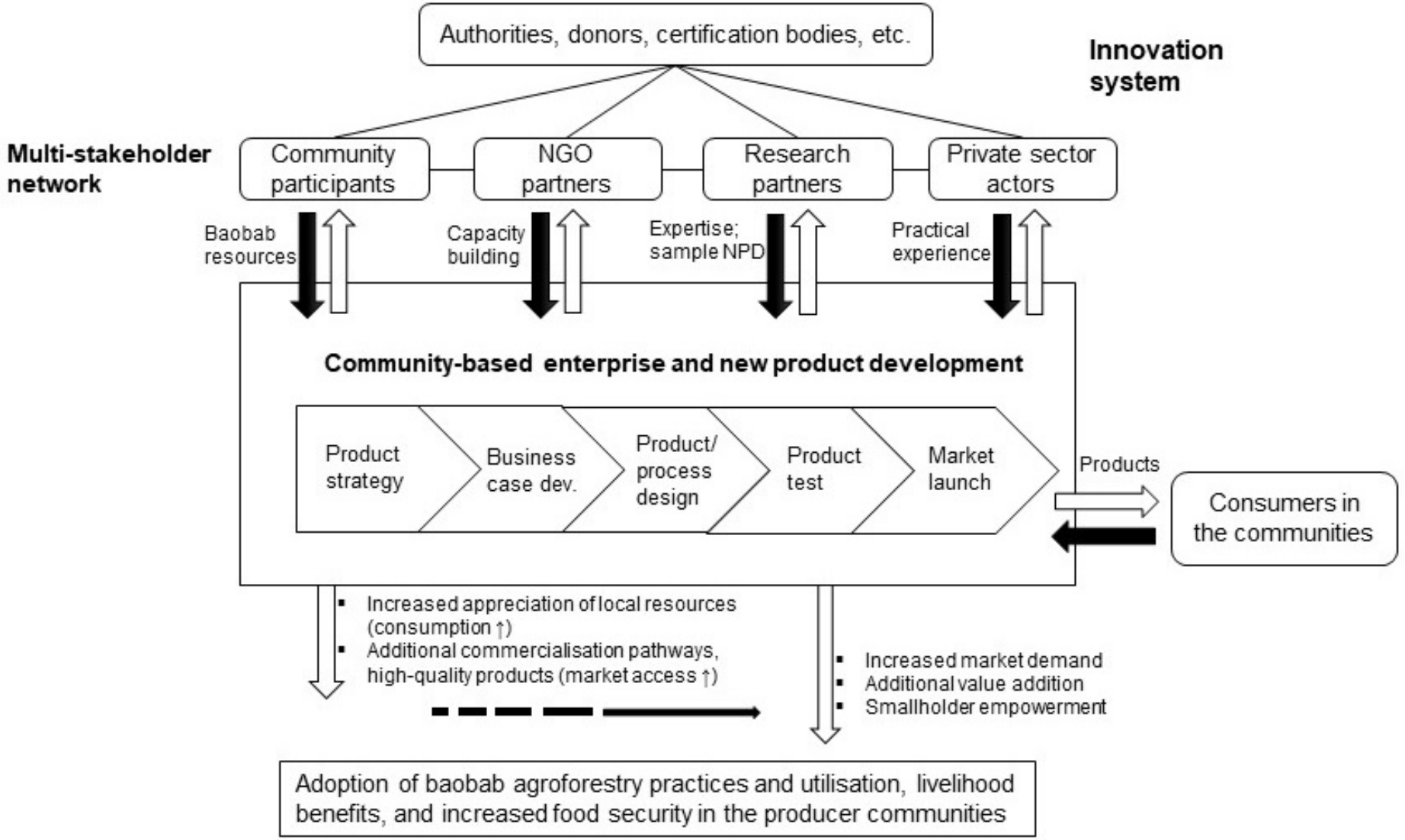
Developing local markets in Kenya

Baobab common, yet so far underutilised feature of local farming systems in (particularly coastal) Kenya

Assessment how these farming systems can by advanced by stimulating emergence of local markets for baobab products

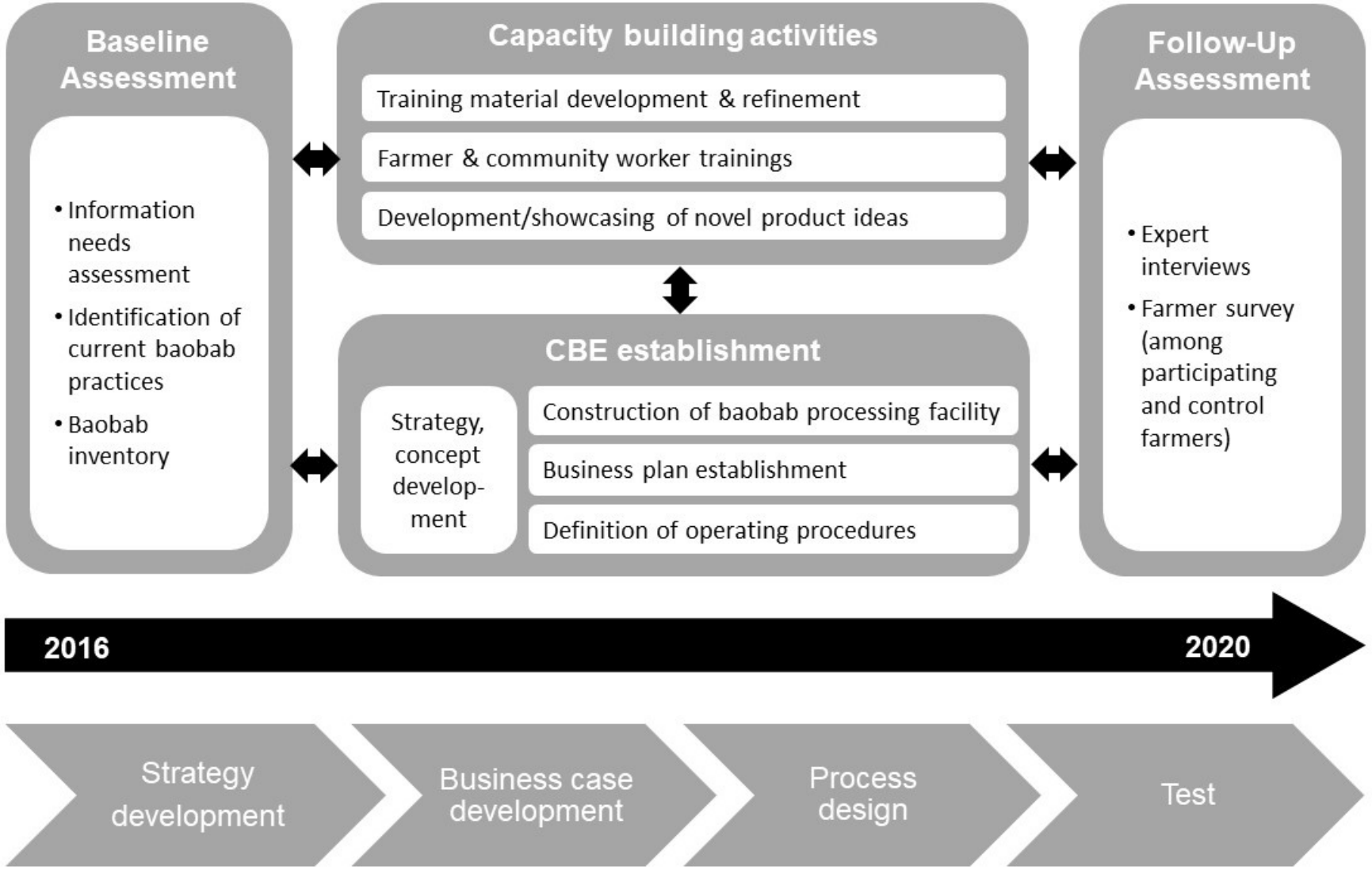
Multi-stakeholder approach initiating a community-based enterprise development producing high-quality baobab powder and oil in Kilifi, Kenya

Overall concept

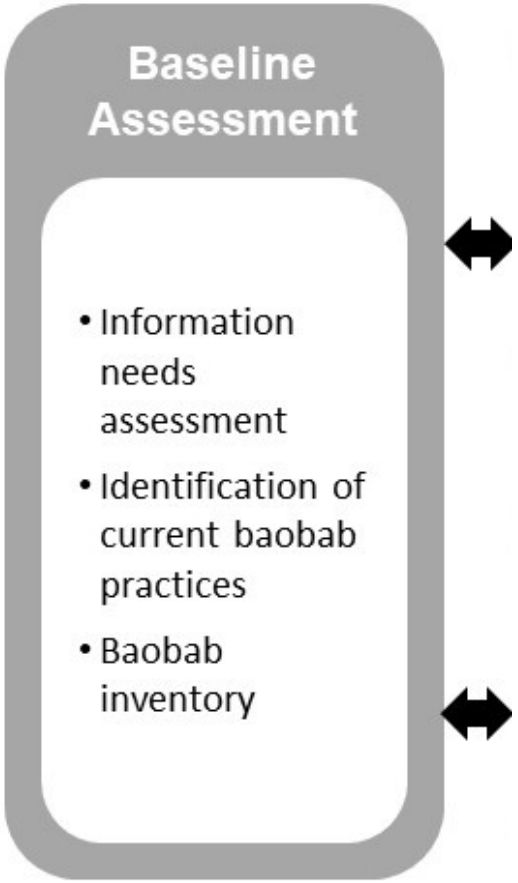


Meinhold and Darr (2020)

… put into practice



… put into practice



Majority (69%) of smallholder farmers owned naturally occurring baobab trees on their land; yet low awareness for baobab products and their nutritional value; only one processed food product (*mabuyu*)

Reasons cited for a not more widespread utilisation: negative perceptions associated with the baobab tree in coastal Kenya; lack of information concerning utilisation practises and benefits

… put into practice

a. Harvesting when pods are ready

YES

Picture showing Ripe, ready baobab pods on tree

- Baobab pods should be fully grown
- Baobab pods should be dry
- Mature baobab pods have a brown shell
- Baobab pods mature at different rates so harvesting should be selective
- Pods that are ready are dry inside and the seeds are hard

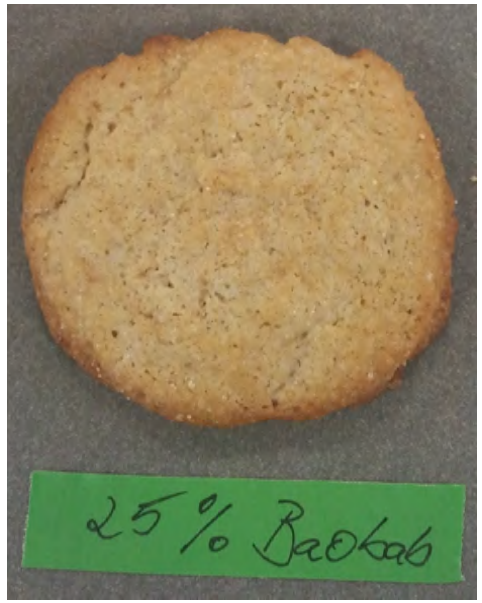
Picture showing young, immature baobab pods on tree

- Immature Baobab pods should not be harvested
- Do not harvest all the pods at the same time as some will not be ready
- Pods that are not ready may be smaller and greenish yellow in colour
- Pods that are not ready are still wet inside and the seeds are soft

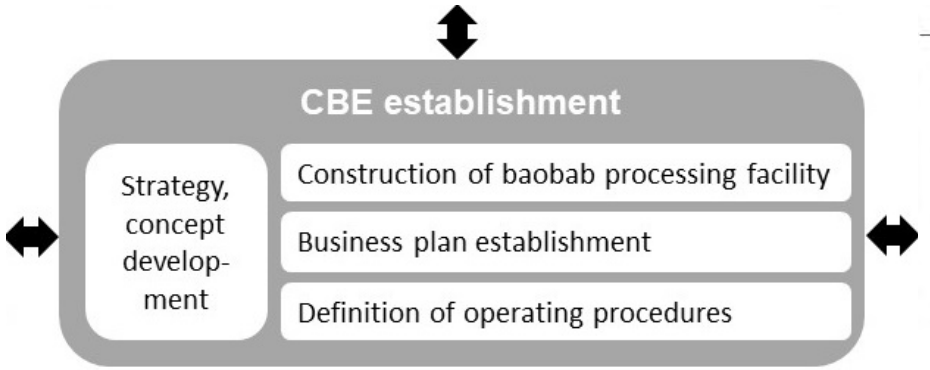
2

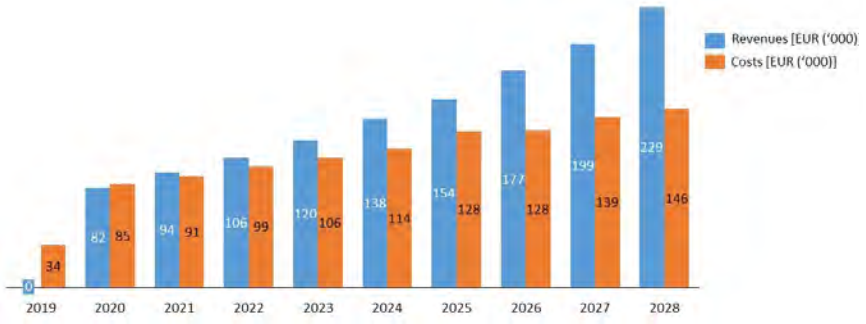
Capacity building activities

- Training material development & refinement
- Farmer & community worker trainings
- Development/showcasing of novel product ideas



… put into practice





Mabuyu Community Enterprise: Standard Operating Procedures

Document # MCE-SOP-03	Title: **SOP: Processing from whole fruit to pulp/seed**	Print Date: **30 June 2019**
Initial Release	Prepared By:	Date Prepared: 18 March 2019
Effective Date: **30 March 2019**	Reviewed By:	Date Reviewed: **[Date]**
Department **PRIMARY PROCESSING**	Approved By:	**Page 1 of 3**

Purpose: To prevent contamination of Baobab fruit during processing from whole fruit to pulp and seed

Scope: This SOP applies to all collectors of Baobab fruit

Responsibilities: Collectors, Village Agents

Definition: Contamination affects all impurities in the Baobab fruit and which can lead to loss in quality. These include physical, chemical and biological impurities.

STEP: PROCESSING FROM WHOLE FRUIT TO PULP/SEED

General:

a) Processing is undertaken by (mostly women) harvesters and is a manual activity. The collectors are responsible

b) Insects inside the fruit are a source of contamination. ALL fruit must be inspected for cracks and any obvious fruit infestation prior to commencing processing. **Any fruit showing signs of insect infestation MUST be discarded.**

c) All cracking, sorting and bagging of pulp/seed must be carried out at the collector's homestead. This process must not commence until collectors are advised to do so by Mabuyu Community Enterprise Senior Field Officer.

d) Each collector should use a clean table (preferably covered with clean new plastic) so that the fruit are kept above the floor and all processing is carried out above the floor. Children and animals should be kept away from the processing area.

e) Collectors must have a clean bill of health and should not be suffering from the following or any other communicable diseases:

- Cholera
- Typhoid

Mabuyu Community Enterprise: Standard Operating Procedures

- Dysentery
- Tuberculosis
- Skin irritations, open wounds or boils
- Colds, flus and coughs.

e) In preparing for cracking the fruit and sorting pulp/seed, Collectors are required to:

- Wash hands with non- perfumed soap
- Cover their head with a hat or headgear so that hair doesn't fall into the seed/pulp
- Keep nails short and clean
- Wear a clean kikoi or dress

f) In the course of processing, Collectors are required to:

- Refrain from smoking
- Refrain from eating – if harvesters want to take food then they must do so away from the processing area, returning having washed hands

Cracking fruit and sorting pulp and seed

- Fruit is to be cracked using either a clean steel bar, machete or a clean heavy wooden shaft.
- Fruit should be cracked individually and then sorted. Collectors should not crack large numbers of fruit and leave them open before starting to sort as this increases the risk of dust or other matter contaminating the pulp.
- Fruit pulp should be separated into small clumps or individual seeds.
- All red fibre and any fragments of shell must be removed from the fruit pulp.
- Fruit pulp is placed in clean sacks marked MCE in green (provided in advance by MCE)
- Sacks must not be over-filled – allowing for loose tying.
- Sacks should be closed using fresh, new, clean string.

Storing pulp and seed

- Closed sacks of pulp and seed must be stored in the Collectors' homestead in dry, clean conditions until MCE's representative is available to buy the pulp and seed and take it away from the homestead.

MONITORING	RESP.	DOC.
Senior Field Officer		

CORRECTIVE ACTIONS	RESP.	DOC.

Initial results

- Behavioural changes and improved practical knowhow with regard to baobab management and utilization – amongst trained, but to a lesser degree also amongst the control farmers
- Increased consumption of baobab (63.3% of trained and 37.3% of control group)
- Local farmer cooperatives have started to integrate baobab in locally produced yoghurt or cookies
- Effects on income, livelihoods, or empowerment of communities, however, will probably only be seen further down the line.

Developing local markets in Kenya

- Baobab is increasingly seen as a valuable resource as opposed to ‘food for the poor’ and a tree possessed by evil spirits
- This may lay groundwork for further value addition activities and enterprise development in the communities
- Developed CBE strategy benefited strongly from experiences of baobab-processing initiatives from other countries as well as academic and non-academic collaborators engaged in the initiative, providing scientific, local, and business knowledge and experience
- Since the baobab sector in Kenya is still in early stages, further investments into its market and value chain development will be necessary

Overall conclusion

- With interest rising in forest food resources pathways need to be found how to best integrate such resources into the bioeconomy
- Increasing demand and acceptance for wild forest products not only impacts the resource in question, but also leads to changes in market structure and supply chain organization
- Particular emphasize and more information needed on quality aspects, including the development of adequate quality control procedures

Thank you for listening!

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