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Authors: Annali Jacobs, Nomusa Dlamini

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1 Introduction:

The report discusses the identification of the most promising technologies, based on the information from literature reviews and survey reports submitted by the product champions of each of the traditional products.

The products were evaluated on the basis of potential or promise for development, taking into account the status of current products as well as the impact of possible improvements to these products/technologies. Products/technologies were considered for suitability for improved local production and trading as well as for improved export and commercialisation potential. Product champions will use the criteria to select specific products/technologies for re-engineering of existing products or for the development of new products (e.g. dried extracts with longer shelf-life).

Completely new products or technologies were not included in this ranking evaluation. This evaluation will be revisited when specific products for re-engineering/new products have been selected by each product champion and when more information becomes available from market assessments, nutritional and other analyses, value chain analyses, regulatory barriers identification and compliance with safety standards/HACCP.

2 Selection criteria used to identify the most promising technologies:

All products were evaluated and scored according to the following criteria:

2.1 Technologies to be developed for African/local market

Socio-economical impact

Volumes of current local production

Number of actors to benefit from technology development (% of population)

Percentage of female actors in the industry

Number of villages currently producing/trading to be affected by improved technology

Popularity/use in other African countries/local market potential

Profitability increase with re-engineering

Technological impact

Current shelf-life of product

Improved shelf-life of re-engineered product

Extent/size of problem (safety, stability, customer attractiveness) addressed

Risk/suitability of improvement to address problem

Environmental impact

Type and volumes of raw materials used

Availability of raw material (cultivated/ wild/ open access, destructive harvesting)

Current water use (washing, wet-milling, fermentation, cooking)

Current energy use (heating ovens, smoking)

Increase/decrease in energy use (heating ovens, smoking) with re-engineering

Current pollution level of air, water

Increase/decrease in pollution of air, water with re-engineering

Health impact

Current and improved therapeutic and dietary benefits

2.2 Technologies to be developed for European/international market

Socio-economical impact

Current export volumes

Current product attractiveness to EU consumers

Potential industry uptake in EU of re-engineered technology

Potential profit margin after re-engineering

Technological impact

Current shelf-life of product

Improved shelf-life of re-engineered product

Potential for scale-up

Regulatory impact

Regulatory export/import barriers

Health impact

Current and improved therapeutic and dietary benefits

3 Evaluation of technologies and products, per group

The various technologies used for each of the ten products are discussed based on information presented in the literature studies and survey reports on each product.

The detailed evaluation sheets using the selection criteria for each product are then presented per product group.

3.1 Group 1 - Fermented cereal-based products:

Akpan:

Akpan is prepared from either maize, sorghum, kneaded sorghum or a mixture of maize and sorghum.

Maize and/or sorghum is either milled and kneaded into a dough which is then fermented and moulded into balls (mawe), or wet-milled and fermented to a semi-liquid mash (ogi). The ogi is then cooked, homogenised and diluted and additives such as flavouring, milk and ice are added before consumption.

The process using maize ogi is the most promising technology according to consumer preference as well as quality attributes. For this process, maize is steeped in boiled water and in some variations of the process, the maize is also pre-cooked, which facilitates wet-milling as well as improves the microbiological quality by reducing the levels of spoilage organisms. Over-cooking however leads to a burnt taste not enjoyed by consumers.

Fermentation then proceeds for one to three days, the longer period being preferable for product safety, as it allows the lactic acid bacteria to lower the pH more substantially, thereby inhibiting the growth of pathogenic bacteria. Higher acidity products may have a longer shelf life and higher degree of safety, compared to maize that is steeped in boiled water and fermented for one day only.

Consumer preference is for akpan prepared from maize ogi which is white in colour and lightly fermented and smooth.

Gowé:

Gowé is prepared from maize or sorghum by one of three processes: fermentation of malted maize or malted sorghum grains or of a mixture of malted and non-malted sorghum and maize. Malting of the grains before milling improves the subsequent fermentation by increasing the level of fermentable sugars. A higher level of acidity is therefore attained, compared to non-malted grains. The high acidity gowé may have a longer shelf life, as well as a higher level of food safety.

The most promising technology therefore appears to be the use of malted grains, but scientific based evidence is needed to verify the advantage of one process over the other. Consumers prefer slightly acidic, sweet, white (from maize) gowé.

Kenkey:

Kenkey can be produced by at least three different processes of production all using maize as the raw material. The treatment of the maize results in products with different shelf life, and probably different levels of food safety. Ga kenkey which is produced from whole maize, and fermented for a shorter time (2-3 days) has a shorter shelf life (4 to 5 days) than Fanti kenkey, which is fermented for a longer period (3 to 4 days) and has a longer shelf life of 1 week. The differences are probably due to higher acidity in Fanti kenkey, which extends its shelf life, and the high acidity also renders the product microbiologically safer than the Ga kenkey.

Two other varieties of the production technologies are Nsiho and Fom Fom kenkey which are produced from dehulled maize. At present, there is not much information on the shelf life and comparative safety of these products. The technology for the production of Nsiho kenkey is however promising in terms of cost and time saving. The dehulled maize is steeped and milled and then fermented for only 24 hours. Fermentation time for the production of these white smooth-textured kenkey balls could be further shortened by "back-slopping" or the re-use of inoculums from previous batches.

Kishk Sa'eedi:

Essentially kishk Sa'eedi is prepared from a mixture of parboiled wheat and fermented milk (zeer) which is fermented and kneaded to a dough and then sun-dried. This product only has one main process, which, although it varies slightly from area to area and between home-based and commercial operations, will be scientifically evaluated and improved, where required**. T**he use of full fat home-made zeer milk produces a more highly valued product which is preferred by consumers. The dried dough could have several uses and applications, one of the most promising being the production of a soft chewable school snack/convenience food.

GROUP 1: Evaluation according to selection criteria to identify promising technologies

(5 = high potential 3 = medium potential 1 = low potential)

AKPAN		Score
AFRICAN MARKET		
Socio-economical impact		
Volumes of current local production	popular drink, uses 7% of maize crop	5
Profitability increase	currently 43% profit to producers to 50%?	3
Number of actors to benefit from technology development (% of population)		
Percentage of female actors (>80% = 5, 50-80% = 3, <50% = 1)	100% producers/sellers are female	5
Number of villages currently producing/trading to be affected by improved techno	18 municipalities	5
Popularity in other African countries/local market potential	similar products West Africa, Kenya, Zimbabwe, South A	5
Technological impact		
Current shelf-life of product	2-5 days	1
Improved shelf-life	8 days?	3
Extent/size of problem (safety, stability, attractiveness to clients) addressed	sensory (souring), time-consuming production, shelf-lif	3
Risk/suitability of improvement to address problem	re-engineered (Mestres publication), commercial starte	5
Environmental impact		
Type and volumes of raw materials required	maize/sorghum abundant	5
Availability of raw material (cultivated/ wild, destructive harvesting)	cultivated	5
Current water use (washing, wet-milling, fermentation, cooking)	wet-milling, steeping, fermentation, cooking	3
Current energy use (heating ovens, smoking)	cooking, produce ice	1
Increase/decrease in energy use (heating ovens, smoking)	none	3
Current pollution level of air, water	no effluent, but smoke from cooking?	3
Increase/decrease in pollution of air, water	none	3
Health impact		
Current and improved therapeutic/nutritional benefits	5 log LAB possible probiotic effect	5
EXPORT MARKET		
Socio-economical impact		
Current export volumes	South Africa mageu not exported but commercial	3
Potential industry uptake in EU		1
Potential profit margin		
Attractiveness to EU consumers	If flavoured, marketed as health/energy drink	3
Technological impact		
Current shelf-life	2-5 days	1
Improved shelf-life	8 days (at 4 degrees)	3
Potential for scale-up	time-consuming process but scalable	5
Regulatory impact		
Export/import barriers		
Health impact		
Current and improved therapeutic/nutritional benefits	5 log LAB possible probiotic effect	5
		84
	Average score	3.50

GOWE		Score
AFRICAN MARKET		
Socio-economical impact		
Volumes of current local production	230 tons pa; 28 producers in Cotonou and Parkanou	3
Profitability increase		
Number of actors to benefit from technology development (% of population)	~30?	1
Percentage of female actors (>80% = 5, 50-80% = 3, <50% = 1)	Producers/sellers almost exclusively female	5
Number of villages currently producing/trading to be affected by improved techno	6 municipalities	3
Popularity in other African countries/local market potential		
Technological impact		
Current shelf-life of product	4-6 days ambient, sometimes non-hygienic production p	1
Improved shelf-life	8 days (at 4 degrees)	3
Extent/size of problem (safety, stability, attractiveness to clients) addressed	sensory (souring), process control, shelf-life	3
Risk/suitability of improvement to address problem	Commercial starters	5
Environmental impact		
Type and volumes of raw materials required	sorghum/maize hardy, abundant	5
Availability of raw material (cultivated/ wild, destructive harvesting)	cultivated	5
Current water use (washing, wet-milling, fermentation, cooking)	soaking, fermentation, cooking	3
Current energy use (heating ovens, smoking)	cooking, ice production	3
Increase/decrease in energy use (heating ovens, smoking)	none	1
Current pollution level of air, water	no effluent, but smoke from cooking?	3
Increase/decrease in pollution of air, water	none	3
Health impact		
Current and improved therapeutic/nutritional benefits	LAB possible probiotic effect	5
EXPORT MARKET		
Socio-economical impact		
Current export volumes	none	1
Potential industry uptake in EU		1
Potential profit margin		
Attractiveness to EU consumers		1
Technological impact		
Current shelf-life	4-6 days	1
Improved shelf-life	8 days refrigerated	3
Potential for scale-up		
Regulatory impact		
Export/import barriers		
Health impact		
Current and improved therapeutic/nutritional benefits	LAB possible probiotic effect	5
		64
	Average score	2.91

KENKEY		Score
AFRICAN MARKET		
Socio-economical impact		
Volumes of current local production	1,034,200 metric tons maize mostly for kenkey in Gh	5
Profitability increase		
Number of actors to benefit from technology development (% of population)	large section of the population in Ghana	5
Percentage of female actors (>80% = 5, 50-80% = 3, <50% = 1)	98% producers are female	5
Number of villages currently producing/trading to be affected by improved techno	23 in 9 districts	3
Popularity in other African countries/local market potential	popular in West Africa	3
Technological impact		
Current shelf-life of product	3-4 days ambient	1
Improved shelf-life	8 days (at 4 degrees)	3
Extent/size of problem (safety, stability, attractiveness to clients) addressed	shelf-life, time-consuming process, maize price	3
Risk/suitability of improvement to address problem	Commercial starters	3
Environmental impact		
Type and volumes of raw materials required	maize/sorghum hardy, abundant	5
Availability of raw material (cultivated/ wild, destructive harvesting)	cultivated	5
Current water use (washing, wet-milling, fermentation, cooking)	soaking, fermentation, cooking	3
Current energy use (heating ovens, smoking)	cooking, cooling	1
Increase/decrease in energy use (heating ovens, smoking)	faster shorter process	3
Current pollution level of air, water	no effluent, but smoke from cooking?	3
Increase/decrease in pollution of air, water	none	3
Health impact		
Current and improved therapeutic/nutritional benefits	LAB possible probiotic effect	3
EXPORT MARKET		
Socio-economical impact		
Current export volumes	local cross border trade	3
Potential industry uptake in EU		1
Potential profit margin		
Attractiveness to EU consumers		1
Technological impact		
Current shelf-life	3-4 days ambient	1
Improved shelf-life	8 days refrigerated	3
Potential for scale-up		
Regulatory impact		
Export/import barriers		
Health impact		
Current and improved therapeutic/nutritional benefits	LAB possible probiotic effect	3
		69
	Average score	3.00

KISHK SA'EEDI (KS)		Score
AFRICAN MARKET		
Socio-economical impact		
Volumes of current local production	8-30 kg consumed per cap pa	5
Profitability increase	Predicted high potential	
Number of actors to benefit from technology development (% of population)	More than 50% of the population (about 45 million)	5
Percentage of female actors (>80% = 5, 50-80% = 3, <50% = 1)	mostly female actors	5
Number of villages currently producing/trading to be affected by improved techno	Approximately 4000 villages out of 7500 mother villages	5
Popularity in other African countries/local market potential	Comparable products popular in North Africa, Arab coun	3
Technological impact		
Current shelf-life of product	1 year	5
Improved shelf-life	1 year	5
Extent/size of problem (safety, stability, attractiveness to clients) addressed	time-consuming process, variation in hygiene standard,	1
Risk/suitability of improvement to address problem	Highly suited to proposed technological development e	5
Environmental impact		
Type and volumes of raw materials required	Wheat, zeer milk, salt and condiments (cumin)	5
Availability of raw material (cultivated/ wild, destructive harvesting)	Regular supply of raw materials from sustainable source	5
Current water use (washing, wet-milling, fermentation, cooking)	Washing, parboiling, fermentation	3
Current energy use (heating ovens, smoking)	Parboiling wheat on open wood fire/gas cylinders	3
Increase/decrease in energy use (heating ovens, smoking)	Mechanised milling, mixing, drying etc	3
Current pollution level of air, water	Biodegradable waste water	5
Increase/decrease in pollution of air, water	none	3
Health impact		
Current and improved therapeutic/nutritional benefits	High fibre, low fat, balanced protein profile	3
	easily digestible, pre- and probiotic action	
EXPORT MARKET		
Socio-economical impact		
Current export volumes	None	1
Potential industry uptake in EU	Unknown	3
Potential profit margin	Unknown, could be high	3
Attractiveness to EU consumers	Unknown	3
Technological impact		
Current shelf-life	1 year	5
Improved shelf-life	1 year	5
Potential for scale-up	High	5
Regulatory impact		
Export/import barriers	Unknown	1
Health impact		
Current and improved therapeutic/nutritional benefits	High fibre, low fat, balanced protein profile	3
	easily digestible, pre- and probiotic action	98
	Average score	3.77

3.2 Group 2 – Meat and fish products:

Lanhouin:

Lanhouin is spontaneously fermented fish which is prepared by either using the whole fish or by first gutting and salting the fish and then allowing fermentation for three to eight days. After fermentation the fish is washed and sun-dried.

The technologies are very similar, but using the whole fish in seawater is probably more cost-effective and less labour intensive. From a process control and safety point of view, evisceration and use of portable water containing salt would improve the quality of the fish product and would be the more promising technology.

Kitoza:

Two types of kitoza are most commonly produced namely, kitoza from beef or from pork. The process involves drying thin slices of marinated meat and then exposing it to heat and smoke for 45 minutes to two hours. Drying the meat to below 9% moisture will increase the shelf life and this could be achieved by hanging the drying strips individually.

Dried smoked pork kitoza appears to be the more promising product as it enjoys greater consumer popularity than kitoza from beef.

Kong:

Kong is prepared from fresh fish, mainly catfish, which is eviscerated, salted and smoked. The salting step is performed either with seawater or salted fresh water. Two different technologies are used, one producing wet, softer smoked kong, while the other produces a drier smoked kong product. The former has a shelf life of only one to two days and can only be sold in close proximity to production areas, while the latter has a lower moisture content and has a shelf life of 39 to 87 days. The moisture content is the crucial factor in controlling microbiological risk in this product.

The dried smoked kong therefore represents the most promising technology in terms of safety and distribution as it can reach a larger market.

GROUP 2: Evaluation according to selection criteria to identify promising technologies

(5 = high potential 3 = medium potential 1 = low potential)

LANHOUIN		Score
AFRICAN MARKET		
Socio-economical impact		
Volumes of current local production	25-200 kg pm per producer/3000 ton pa in Benin	5
Profitability increase	500 000 F CFA net profit/ large producer pa currently ~25	3
Number of actors to benefit from technology development (% of population)		
Percentage of female actors (>80% = 5, 50-80% = 3, <50% = 1)	100% of processors female	5
Number of villages currently producing/trading to be affected by improved techno	several along Benin coast (6 interviewed for survey)	3
Popularity in other African countries/local market potential	West Africa: Benin, Togo, Ghana, Senegal, Ivory Coast	5
Technological impact		
Current shelf-life of product	3-6 months ambient but quality problems	3
Improved shelf-life	3-6 months ambient with improved quality	3
Extent/size of problem (safety, stability, attractiveness to clients) addressed	Quality (microbiological, histamine, insects), packaging	1
Risk/suitability of improvement to address problem		
Environmental impact		
Type and volumes of raw materials required	fish (croaker, threadfin, mackerel) and salt	3
Availability of raw material (cultivated/ wild, destructive harvesting)	fish could be farmed	3
Current water use (washing, wet-milling, fermentation, cooking)	salting, washing,	3
Current energy use (heating ovens, smoking)	low (fermented, sun-dried)	5
Increase/decrease in energy use (heating ovens, smoking)		
Current pollution level of air, water	effluent, fish waste	1
Increase/decrease in pollution of air, water	larger volumes, more waste	3
Health impact		
Current and improved therapeutic/nutritional benefits	protein source	3
EXPORT MARKET		
Socio-economical impact		
Current export volumes	local cross border trade (Togo, Ghana) -50%	3
Potential industry uptake in EU		1
Potential profit margin		
Attractiveness to EU consumers		1
Technological impact		
Current shelf-life	3-6 months ambient but quality problems	1
Improved shelf-life	3-6 months ambient with improved quality	3
Potential for scale-up		3
Regulatory impact		
Export/import barriers		
Health impact		
Current and improved therapeutic/nutritional benefits	protein source	3
		64
	Average score	2.91

KITOZA		Score
AFRICAN MARKET		
Socio-economical impact		
Volumes of current local production	34-270 kg pm - small niche market	3
Profitability increase	Employment creation	3
Number of actors to benefit from technology development (% of population)	mainly household production	3
Percentage of female actors (>80% = 5, 50-80% = 3, <50% = 1)	On average: female actors ~50%	3
Number of villages currently producing/trading to be affected by improved techno	13	3
Popularity in other African countries/local market potential	variety popular in South Africa (biltong)	5
Technological impact		
Current shelf-life of product	1-7 days	1
Improved shelf-life	several weeks - dry variety (at 4 degrees)	5
Extent/size of problem (safety, stability, attractiveness to clients) addressed	meat price, oven design to optimise energy, HAP	3
Risk/suitability of improvement to address problem	improved oven, safe smoking method/materials	3
Environmental impact		
Type and volumes of raw materials required	meat (beef/pork), salt, garlic, ginger	3
Availability of raw material (cultivated/ wild, destructive harvesting)	farmed animals	3
Current water use (washing, wet-milling, fermentation, cooking)	washing	3
Current energy use (heating ovens, smoking)	smoking, refrigeration of semi-dry variety	3
Increase/decrease in energy use (heating ovens, smoking)	faster shorter process with imroved oven design	3
Current pollution level of air, water	wash effluent, smoke from oven	1
Increase/decrease in pollution of air, water	less smoke from better design	3
Health impact		
Current and improved therapeutic/nutritional benefits	protein source but HAP risk	3
EXPORT MARKET		
Socio-economical impact		
Current export volumes	South Africa and Britain producing similar biltong	3
Potential industry uptake in EU		
Potential profit margin		
Attractiveness to EU consumers		3
Technological impact		
Current shelf-life	1-7 days	1
Improved shelf-life	several weeks - dry variety (at 4 degrees)	5
Potential for scale-up		
Regulatory impact		
Export/import barriers	Importer country norms	1
Health impact		
Current and improved therapeutic/nutritional use		
		67
	Average score	2.91

KONG		Score
AFRICAN MARKET		
Socio-economical impact		
Volumes of current local production	12500 tons fish pa (wet weight)	5
Profitability increase		
Number of actors to benefit from technology development (% of population)		3
Percentage of female actors (>80% = 5, 50-80% = 3, <50% = 1)	mostly men	1
Number of villages currently producing/trading to be affected by improved techno	6	1
Popularity in other African countries/local market potential	popular in West Africa	3
Technological impact		
Current shelf-life of product	39 -87 days	5
Improved shelf-life		
Extent/size of problem (safety, stability, attractiveness to clients) addressed	quality (microbiological, benzopyrene HAP)	3
Risk/suitability of improvement to address problem	preservatives, other combustible materials	3
Environmental impact		
Type and volumes of raw materials required	catfish, salt	5
Availability of raw material (cultivated/ wild, destructive harvesting)	can be farmed	5
Current water use (washing, wet-milling, fermentation, cooking)	cleaning fish	3
Current energy use (heating ovens, smoking)	smoking oven	1
Increase/decrease in energy use (heating ovens, smoking)	faster shorter process	3
Current pollution level of air, water	wash effluent, fish waste, smoke	1
Increase/decrease in pollution of air, water	other combustible material	3
Health impact		
Current and improved therapeutic/nutritional benefits	protein source	3
EXPORT MARKET		
Socio-economical impact		
Current export volumes	export from Senegal stopped 2005	1
Potential industry uptake in EU		1
Potential profit margin		
Attractiveness to EU consumers		1
Technological impact		
Current shelf-life	39-87 days	3
Improved shelf-life		
Potential for scale-up		3
Regulatory impact		
Export/import barriers		
Health impact		
Current and improved therapeutic/nutritional benefits	protein source	3
		60
	Average score	2.73

3.3 Group 3 – Plant based extracts:

Baobab:

The fruit of the baobab tree has various uses such as drying the whole fruit, using the pulp in fresh or dried form to prepare drinks or porridge or adding the pulp to food dishes e.g. “Ngalax”. The baobab fruit is rich in polyphenols which could have therapeutic effects.

The most promising technology would be the preparation of a dried powder from the pulp, which when required can be re-constituted. The drying would contribute towards shelf stability for the export market. For the local market the juice prepared from the pulp of the baobab fruit remains popular. For both these products issues of availability of the fruit and possible cultivation of the plant should be addressed.

Bissap:

The calyx of the fruit of the *Hibiscus sabdariffa* plant is dried and then soaked to prepare a refreshing drink. The leaves of the plant are also used in the preparation of food dishes. Problems currently experienced in the use of the calyx are loss of colour and increasing moisture content.

The most promising technology would be the preparation of a concentrate or dried extract of the calyx for the export market. Re-engineering would have to address to problems of moisture re-absorption and colour retention. Alternatively, the juice can be prepared by incorporating steps to make the product commercially sterile, such as canning, tetra packaging and bottling, combined with aseptic filling.

Jaabi:

The matured dry fruit of the *Ziziphus mauritiana* tree is harvested and pound to a flour. The flour is used to prepare a dough which is moulded into balls and used for the production of yaabande cake. There are four methods of processing based on cultural traditions and practices. These methods differ mainly with regards to the method of drying of the cakes which could be roasted on a fire, vapour cooked or sun-dried.

The production of yaabande cake by the steam-cooking process is most promising. The use of hygienic practices is very important in the success of jaabi as a safe high quality product and the baking or steaming stage may reduce the level of spoilage and pathogenic microorganisms.

GROUP 3: Evaluation according to selection criteria to identify promising technologies

(5 = high potential 3 = medium potential 1 = low potential)

BAOBAB		Score
AFRICAN MARKET		
Socio-economical impact		
Volumes of current local production	widespread production, encouraged by Senegal gov	3
Profitability increase		
Number of actors to benefit from technology development (% of population)	many	5
Percentage of female actors (>80% = 5, 50-80% = 3, <50% = 1)	mostly male producers	1
Number of villages currently producing/trading to be affected by improved techno	13	3
Popularity in other African countries/local market potential	trees grown in sub-Saharan Africa, Madagascar	3
Technological impact		
Current shelf-life of product	drink 1-7 days (refrigerated),	1
Improved shelf-life	weeks e.g. Ice cream (refrigerated)	3
Extent/size of problem (safety, stability, attractiveness to clients) addressed	browning, Vit C loss, shelf stability	3
Risk/suitability of improvement to address problem	improve extraction and drying methods, pasteurisation	3
Environmental impact		
Type and volumes of raw materials required	baobab fruit pulp, sugar	5
Availability of raw material (cultivated/ wild, destructive harvesting)	cultivated	3
Current water use (washing, wet-milling, fermentation, cooking)	washing, soaking, dilution	1
Current energy use (heating ovens, smoking)	manual extraction, bottle filling but drinks refridgeratec	3
Increase/decrease in energy use (heating ovens, smoking)	mechanisation, refrigeration	1
Current pollution level of air, water	no effluent	5
Increase/decrease in pollution of air, water	none	3
Health impact		
Current and improved therapeutic/nutritional benefits	prebiotic, Vit C, anti-oxidant, anti-inflammatory	5
EXPORT MARKET		
Socio-economical impact		
Current export volumes	already exported to EU, Britain, Italy growing market	3
Potential industry uptake in EU	44 tons of fruit pulp and 83,000 € in 2004 to Baobab Fruit	5
Potential profit margin		
Attractiveness to EU consumers		3
Technological impact		
Current shelf-life	drink 1-7 days (refrigerated),	1
Improved shelf-life	weeks e.g ice-cream (refrigerated)	3
Potential for scale-up		
Regulatory impact		
Export/import barriers	currently exported to EU, England	5
Health impact		
Current and improved therapeutic/nutritional benefits	prebiotic, Vit C, anti-oxidant, anti-inflammatory	5
		76
	Average score	3.17

BISSAP		Score
AFRICAN MARKET		
Socio-economical impact		
Volumes of current local production	386 kg calyx, 745L drink sold pm; cultivation increase	5
Potential profitability increase	identified as high potential crop by Senegal government	5
Number of actors to benefit from technology development (% of population)	30 000 to 40 000 producers	5
Percentage of female actors (>80% = 5, 50-80% = 3, <50% = 1)	mostly female	3
Number of villages currently producing/trading to be affected by improved techno	13	3
Popularity in other African countries/local market potential	popular in Senegal and West Africa, Sudan, Ethiopia, Egy	5
Technological impact		
Current shelf-life of product	drinks 4-10 days refridgerated; calyx 3-36 months	3
Improved shelf-life	powdered calyx 3-12 months	5
Extent/size of problem (safety, stability, attractiveness to clients) addressed	discoloration, inconsistent quality, moisture	3
Risk/suitability of improvement to address problems	standardise process, packaging, automated decortificati	3
Environmental impact		
Type and volumes of raw materials required	Hibiscus leaves, flowers, sugar	3
Availability of raw material (cultivated/ wild, destructive harvesting)	cultivated	5
Current water use (washing, wet-milling, fermentation, cooking)	extraction (x2), dilution	3
Current energy use (heating ovens, smoking)	hand-shelling, sun-drying, filtration but refrigeration ne	3
Increase/decrease in energy use (heating ovens, smoking)	possible mechanisation (e.g. drying) - increased use	3
Current pollution level of air, water	only flower waste after extraction	3
Increase/decrease in pollution of air, water	none	3
Health impact		
Current and improved therapeutic/nutritional benefits	contains anthocyanins, Vit C, medicinal properties	5
EXPORT MARKET		
Socio-economical impact		
Current export volumes	1,000 and 2,500 $US per ton to EU, USA expanding rapidly	5
Potential industry uptake in EU		3
Potential profit margin		
Attractiveness to EU consumers	American market needs 30 000 t pa	5
Technological impact		
Current shelf-life	drinks 3-4 days; calyx 3 months	3
Improved shelf-life	powdered calyx 3 months	3
Potential for scale-up		3
Regulatory impact		
Export/import barriers	currently exported in increasing volumes to EU, USA	5
Health impact		
Current and improved therapeutic/nutritional benefits	contains anthocyanins, Vit C, medicinal properties	5
		100
	Average score	3.85

JAABI		Score
AFRICAN MARKET		
Socio-economical impact		
Volumes of current local production	178 producers harvest 10x100kg fruit pm = 178 t pm	3
Profitability increase	10-15%	3
Number of actors to benefit from technology development (% of population)	many , mostly women	3
Percentage of female actors (>80% = 5, 50-80% = 3, <50% = 1)	mostly women	3
Number of villages currently producing/trading to be affected by improved techno	5	3
Popularity in other African countries/local market potential	tree grows wild in Africa, Asia; used for several products	3
Technological impact		
Current shelf-life of product	3-4 months for jaabi grain; >5 months for yaabande	5
Improved shelf-life	functional flour 6-12 months	5
Extent/size of problem (safety, stability, attractiveness to clients) addressed	hygiene and quality (burnt cake, dust, microbiological)	3
Risk/suitability of improvement to address problem	standardise process, introduce sun-drier to eliminate du	3
Environmental impact		
Type and volumes of raw materials required	volumes not known; seasonal, Ziziphus fruit harvested f	3
Availability of raw material (cultivated/ wild, destructive harvesting)	tree not cultivated thus fruit harvesting non-sustainable	1
Current water use (washing, wet-milling, fermentation, cooking)	pounding, sieving, cooking, roasting/sun-drying	3
Current energy use (heating ovens, smoking)	cooking/roasting with fire wood	3
Increase/decrease in energy use (heating ovens, smoking)	none	3
Current pollution level of air, water	no effluent, but smoke from cooking/roasting	3
Increase/decrease in pollution of air, water	none	3
Health impact		
Current and improved therapeutic/nutritional benefits	possible antioxidant	3
EXPORT MARKET		
Socio-economical impact		
Current export volumes	local cross border trade	3
Potential industry uptake in EU		3
Potential profit margin	Needs information	
Attractiveness to EU consumers	Needs information	
Technological impact		
Current shelf-life	3-4 months for jaabi grain; >5 months for yaabande	3
Improved shelf-life	functional flour 6-12 months	5
Potential for scale-up	not without cultivation of trees	1
Regulatory impact		
Export/import barriers		
Health impact		
Current and improved therapeutic/nutritional benefits	possible antioxidant	3
		74
	Average score	3.08

4 Results of identification of most promising technologies (as scored according to selection criteria):

The results of evaluation using the selection criteria are summarised in Table 4.

Table 4: Scores indicating the development potential for each of the products

Product	Average scores		
	Local distribution	**Export potential**	**Overall potential**
Akpan	3.71	3.00	3.50
Gowé	3.25	2.00	2.91
Kenkey	3.35	2.00	3.00
Kishk Sa'eedi	4.06	3.22	3.77
Lanhouin	3.27	2.14	2.91
Kitoza	3.00	2.60	2.91
Kong	3.00	2.00	2.73
Baobab	3.00	3.57	3.17
Bissap (Hibiscus)	3.78	4.00	3.85
Jaabi (Ziziphus)	3.11	3.00	3.08
5 = high potential	3 = medium potential	1 = low potential	

4.1 Technologies to be developed for African/local markets

For local market development, the products were ranked in the following order (most promising to less promising technologies): kishk Sa'eedi, bissap, akpan, kenkey, lanhouin, gowé, jaabi, [a]kitoza, [a]kong, [a]baobab.

[a] indicates similar scores

Higher scoring products are all produced and consumed by relatively large sections of the population and are also produced according to sustainable and scalable processes. Some other processes were found to be interesting, but with negative environmental impact such as non-sustainable sources of raw materials, pollution by smoking, high water and energy inputs (washing, cooking, refrigeration) and deforestation (firewood for cooking, roasting or smoking).

The shelf-life, safety and stability of most of the existing products studied remain a problem that should be addressed during the next phase of the project.

4.2 Technologies to be developed for the European/international market:

In order of diminishing potential, the most promising products for development for the export markets were bissap, baobab, kishk Sa'eedi, [a]akpan, [a]jaabi, kitoza, lanhouin, [b]gowé [b]kenkey and [b]kong. However, according to local food law, kitoza cannot be exported from Madagascar so should not be considered for this category.

[a] indicates similar scores

[b] indicates similar scores

The higher scoring products are either already exported or are consumed internationally in similar formats. These products appeal to health conscious consumers and innovative re-engineering could produce a range of novel functional foods. The improvement of product shelf-life and safety are of crucial importance for export purposes.

4.3 Overall most promising technologies:

The most promising products for development overall would be bissap, kishk Sa'eedi, akpan, baobab, jaabi, kenkey, [a]gowé, [a]lanhouin, [a]kitoza, and kong (in order of diminishing preference).

[a] indicates similar scores

Products with lower scores could still be important in a local context, but the ranking was performed on the basis of the available information which indicated that the products with higher scores have the most widespread application, longest potential shelf-life, least environmental impact and potential health-enhancing properties.

Product champions will identify the specific technology or format of their products which has the highest market potential for re-engineering and improvement e.g. dried extracts with longer shelf-life.