

Feasibility Study

Production of Fruit Juice Concentrate at Magomero Vocational College – Malawi

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Executive summary

This feasibility study was conducted to determine the viability of a fruit juice concentrate processing enterprise located at Magomero, Malawi. The feasibility of the proposed enterprise was assessed in four core areas namely market and financial feasibility, technical feasibility, resource and environmental feasibility and social and institutional feasibility.

A market opportunity was identified for the domestic production of good quality fruit juice concentrates in Malawi to be sold to manufacturers in the growing fruit juice nectar producing sector in Malawi. The analysis of the financial feasibility of the proposed enterprise revealed that (based on the assumptions that were made) the enterprise is potentially profitable, is projected to have a healthy cash flow and is viable over the longer term.

As a result of a lack in a comprehensive analysis of the current natural resources that are available in Malawi this feasibility study has made a number of assumptions regarding the environmental and/or natural resource feasibility of the enterprise. Based on the limited information it was concluded that the proposed enterprise could be environmentally feasible.

Processing technology that is ideally suited to the specific technical requirements of the proposed processing enterprise at Magomero, Malawi is available. The location at Magomero is ideally suited to the establishment of a processing enterprise of this nature since it is reasonably well located with regards to resources, input supplies and access to distribution channels.

Taking the net social benefit of the proposed processing enterprise into consideration it can be concluded that the processing enterprise is anticipated to be socially and institutionally feasible. Surrounding communities would benefit in

a number of direct and indirect ways from the establishment of the proposed enterprise.

Based on the framework set out in this feasibility study it can be concluded that the proposed processing enterprise at Magomero is feasible. This positive result of the feasibility analysis is, however, heavily dependant upon the assumptions made during the study and on conditions (political, environmental, economical etc.) remaining relatively stable within the enterprise's operating environment. If either the assumptions or the operating environment were to differ substantially from actual circumstances the actual feasibility of the processing enterprise at Magomero could differ from the current result.

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1 Project summary and terms of reference

The Commercial Products from the Wild Group (CPWild Group) and the World Agroforestry Centre are jointly investigating the feasibility of possible enterprises based on indigenous forests and woodlands products in Tanzania, Zambia, Malawi and Zimbabwe. A critical element of these studies is a series of feasibility studies based on selected potential products for each target country.

Based on a general scoping study it was decided to investigate the feasibility of fruit juice concentrate production in Malawi.

The feasibility study is based on the production of 12-ton fruit juice concentrate per month by a small-scale processing plant at the Magomero Vocational College outside Zomba (Figure 1). Concentrates of Mango, Citrus, *Uapaca*, *Ziziphus* and *Strychnos* would be the main products. These concentrates would be sold to fruit juice manufacturers in Blantyre.

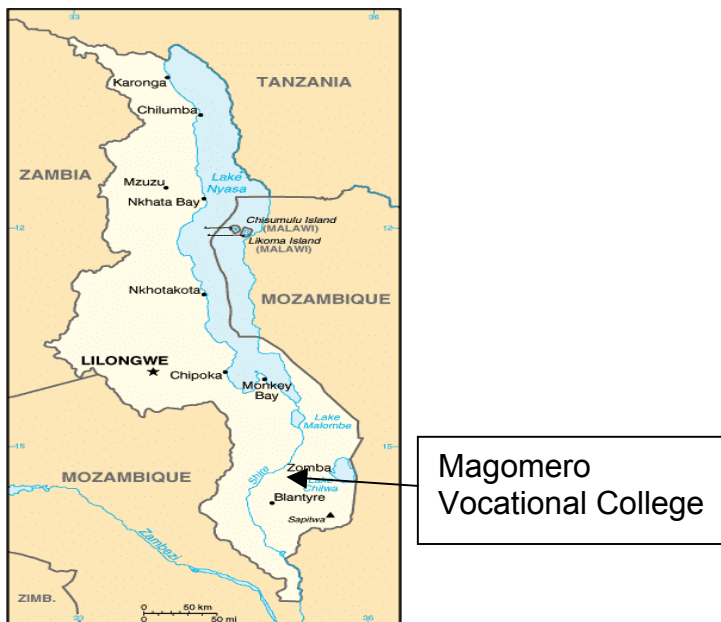


Figure - Location of Magomero Vocational College

2 Malawi country overview

2.1 General

Malawi is a landlocked independent republic with a democratic government. It lies south of Tanzania and to the west of Mozambique and forms part of the Southern African Region. The capital city is Lilongwe. The largest town in Malawi is the conurbation Blantyre-Limbe (the commercial “capital”) in the south followed by the capital city of Lilongwe in the central region. Mzuzu is the only large town in the north.

Established in 1891, the British protectorate of Nyasaland became the independent nation of Malawi in 1964. After three decades of one-party rule, the country held multiparty elections in 1994 under a provisional constitution, which took full effect the following year (www.cia.gov/publications/factbook).

Malawi is one of Africa’s smaller countries, a little over 118 400 square kilometres, of which about 20 per cent is occupied by Lake Malawi – Africa’s third biggest lake. Much of the country lies within the Great Rift Valley of eastern Africa, with Tanzania to the north, Zambia to the west and Mozambique to the east and south. Malawi’s northern boundary comes within 9°S of the equator. The country stretches southwards to 17°S (www.cia.gov/publications/factbook).

With a population of approximately 12 million, Malawi is one of the more densely populated countries of this part of Africa. Most of the population is rural (85 per cent), living largely in traditional villages (www.cia.gov/publications/factbook).

2.2 Economy

Landlocked Malawi ranks amongst the world's least developed countries. The Malawian economy is heavily dependent on agriculture, which accounts for 40% of GDP, provides 88% of exports, and employs 86% of the total work force. Topography and dependence on climatic conditions, however, limit the arable land to 19.93% and permanent crops to 1.33% of the land area. Cotton, sugar, tobacco and sugar dominate the country's exports. The country is also very dependent upon financial assistance from the IMF, the World Bank and individual donor nations. Malawi has also been approved for relief under the Heavily Indebted Poor Countries (HIPC) program (www.cia.gov/publications/factbook).

The Malawian government faces the challenges of developing a market economy, promoting exports, improving both educational and health facilities, dealing with the environmental issues of deforestation and erosion, dealing with the rapidly growing problem of HIV/AIDS and satisfying foreign donors that fiscal discipline is being tightened (www.cia.gov/publications/factbook).

The main export commodities in Malawi include fish, furniture, gemstones, groundnuts, rice, rubber, sugar, tea and coffee, textiles and knitwear, tobaccos and cut flowers. Main export partners are USA (17.3%), Germany (13.6%), South Africa (10.2%), Egypt (6.2%), Japan (6%), Netherlands (5.5%), Russia (4.8%), UK (4.3%) (www.cia.gov/publications/factbook).

Import commodities include automobiles, consumer goods, dairy products, equipment, footwear & footwear components, fuel, machinery, medical and pharmaceutical goods and vehicles. Main import partners are South Africa (44.4%), Zambia (12.7%), USA (5.6%), India (4.2%) (www.cia.gov/publications/factbook). Most goods may be freely imported from Commonwealth countries that are members of WTO - under an open general licence and Malawi has established Export Processing Zones (EPZ).

In mid 1999, Malawi joined neighbouring countries in creating the Mtwara development corridor. The project aims to promote trade and development in the region. Malawi is also a member of the Southern African Development Community (SADC) and a member of COMESA - Common Market for East and Southern Africa (A market of 20 countries with over 300 million people that has more than doubled its intra-regional trade to US\$ 4 billion since 1993). Apart from SADC and COMESA Malawi has economic links with:

- *The European Union (EU)* - through the Lome Convention Malawi has preferential access to the EU market for most of its agricultural commodities and virtually all of its manufactured products.
- *US Market* - Malawi qualifies for AGOA. Textile products and many others from Malawi enter the US market duty free and quota free.
- *South Africa* - Malawi has a bilateral agreement with South Africa whereby Malawi exports attract reduced tariff in South Africa.
- *Zimbabwe* - Malawi has a Trade Agreement with Zimbabwe whereby exports from Malawi to Zimbabwe are duty free and vice versa.

3 Methodology

A feasibility study is generally defined as a structured way to efficiently organize the information that is needed for confident decision-making regarding the profitability and technical/financial/social/environmental viability of a specific proposal.

The general approach used in the assessment of project feasibility assesses four main focus areas of enterprise development as proposed by Lecup and Nicholson (2000):

- The market and economic environment
- The scientific and technological environment
- Resource management and the environment

- The social and institutional environment

A feasibility study could follow the structure of the diagram in Figure 2 (Adam & Doyer, 2000). A critical output from the study would be an indication of the viability of an indigenous fruit processing industry. If viable, the results from this study can be used to compile a comprehensive business plan for such an industry.

For this study the following organizations were consulted:

- World AgroForestry Centre (ICRAF – Malawi)
- Stanbic Bank
- Malawi Revenue Authority
- National Statistical Office of Malawi
- Dairiboard
- Golden Sun Foods
- Suncrest Creameries
- Tambala Food
- Malawi Distillers Ltd
- Magomero Vocational College
- Water Board
- Agricultural Research Council – Infruitec-Nietvoorbij (South Africa)
- Southern Bottlers Limited
- Dryers for Africa

The production process under investigation is based on a concept process developed especially for this project by Dr. Chris Hansmann of the ARC Infruitec-Nietvoorbij

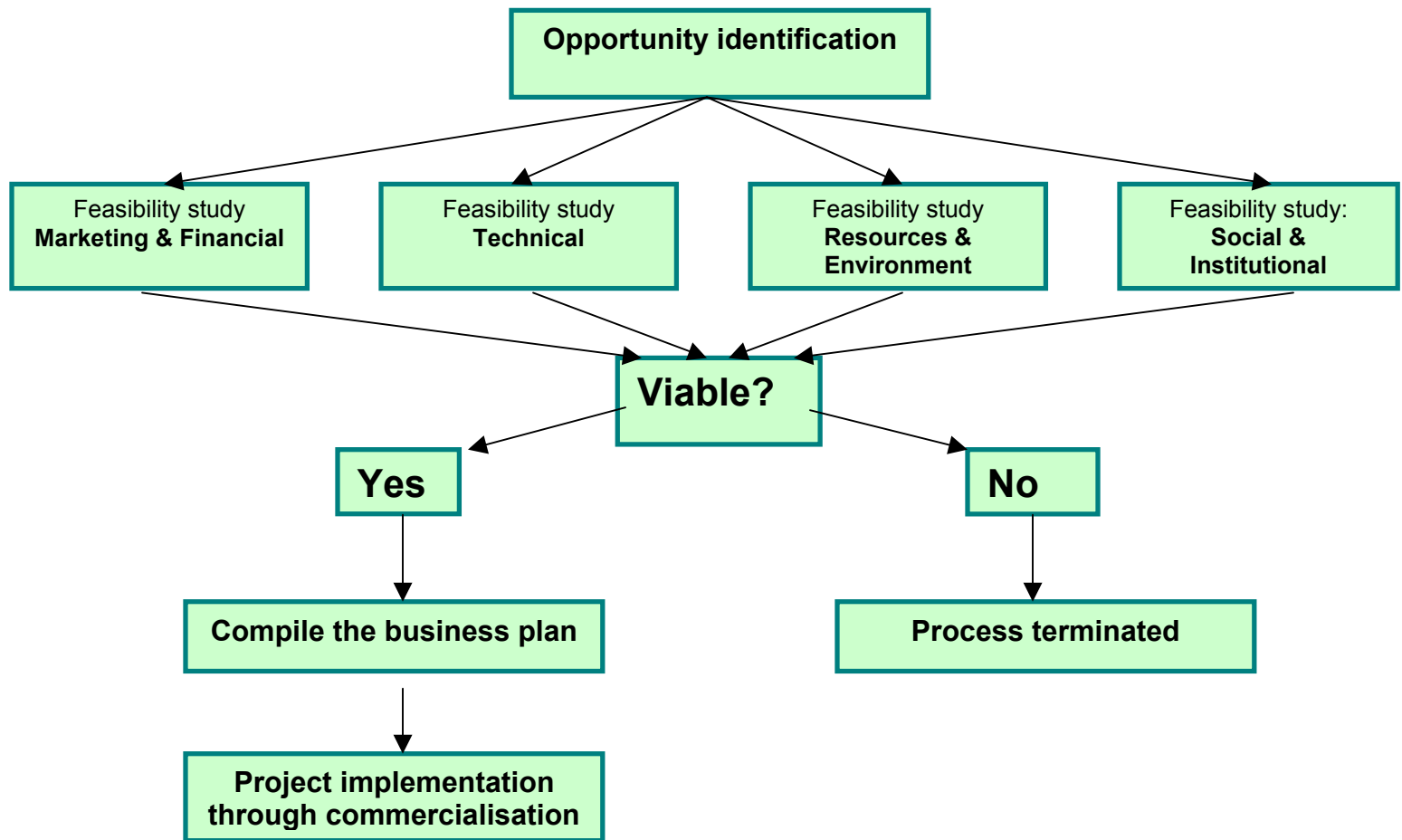


Figure 2 - Flow diagram for the exploration of new opportunities

4 Results and Discussion

4.1 Marketing and financial feasibility

The assessment of the market and the economical environment entails, amongst others, investigation into raw materials, the market potential of products, competition, constraints to business entry and margins and profitability.

Market and economic assessment is important to identify strengths, weaknesses, opportunities and threats in the marketing channels and to gather information

about the business environment. Through this exercise, obstacles to the marketing of products can be identified. The goal is to gather information from all role-players involved in the marketing of the product. According to the opportunities identified, studies of the other areas of enterprise development are then undertaken.

4.1.1 Fruit juice products supply chains

Following research conducted amongst fruit nectar manufacturers in Malawi their predominant supply chain for fruit juice and fruit juice nectar can be mapped as depicted by Figure 3 below. It is noticeable that currently a very large proportion of the fruit juice and fruit nectar that is available in Malawi do not have their origins in Malawi but elsewhere in Southern Africa. There is currently only one fruit juice company (Malambe Fruit Juice Company) in Malawi that produces fruit juice from indigenous fruit - predominantly baobab (*Adansonia digitata*).

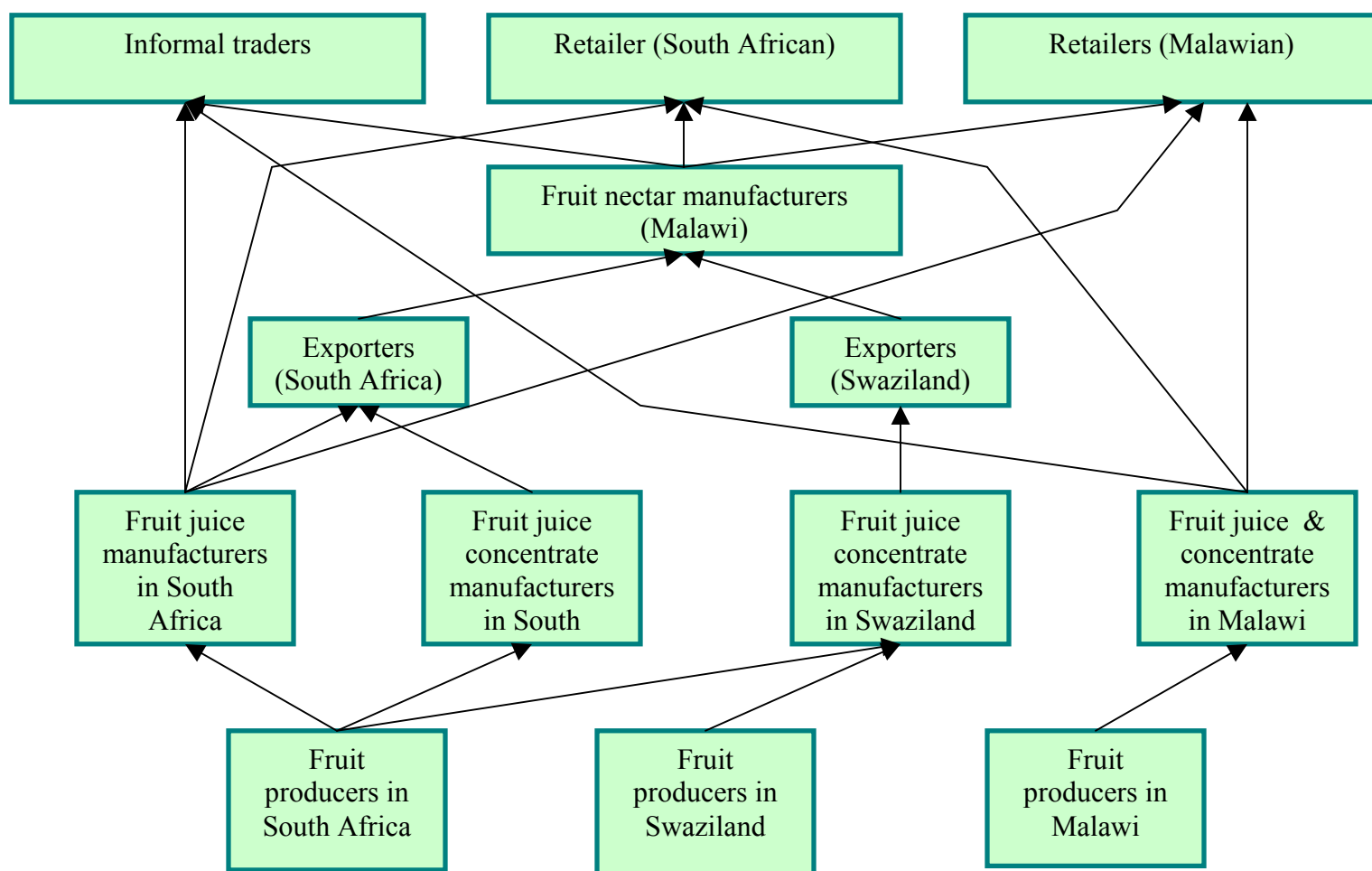


Figure 3 – Fruit juice product supply chains

4.1.2 Raw material supply

The procurement of raw material inputs must be studied before investing in a processing plant. Raw material input supply is of great importance because the transformation of inputs is one of the basic tasks performed in a processing facility. If inputs are defective, problems will occur in processing and marketing.

Efficient procurement is dependant on five basic characteristics:

- Sufficient quantity of inputs
- Correct quality of inputs

- Time sensitive operations
- Reasonable costs
- Efficient organization

Raw material supply is discussed in more detail under ecological feasibility.

4.1.3 Market analysis

The market analysis entails investigation into the major current players and competition in the market, the market volume and value and forecasts and trends for the Malawian processing sector as well as market opportunities in the specific sector.

4.1.3.1 Major current players and competition in the market

The fruit juice processing industry in Malawi is very young with many new entrants, resulting in severe competition.

The bulk of fruit juices available in Malawi are actually fruit nectars made from imported concentrates. A concentrate is a form of fruit juice that has had its “bulk” reduced by removing some water from the juice. Fruit nectar is generally made by adding water to fruit juice concentrate, pasteurising the nectar, bottling the nectar and then distributing the nectar to retail outlets. Such nectars have a restricted shelf-life and are sold from refrigeration in the retail outlets.

Growth in the manufacturing of fruit juice nectars has been responsible for the bulk of growth in the Malawian fruit juice sector. Companies that have been or currently are producing some form of fruit juice or fruit nectar include The Dairiboard, Golden Sun Foods, Suncrest Creameries, Tambala Foods and Malawi Distillers Ltd. These companies can be considered the major players in the fruit nectar sector in Malawi.

The commercial production of fresh fruit juices has, up to date, been very limited if not completely absent. The Wildlife and Environment Society of Malawi has, however, established Malambe Fruit Juice Company that produces Tamarind (Bwemba) and Baobab (Malambe) fresh fruit juices from these indigenous fruit. The establishment of this enterprise is a community development effort aimed at improving livelihoods and preserving indigenous forest trees. Malambe Fruit Juice Company can be considered the major player in the fresh fruit juice sector as well as the current leader in indigenous fruit processing in Malawi.

Currently there are no commercial manufacturers of fruit juice concentrate in Malawi and all concentrates are imported, primarily from South Africa. South African companies that manufacture fruit juice concentrate are therefore the current major players in the fruit juice concentrate sector in Malawi.

4.1.3.2 Market volume and value

Information regarding the volume and value of the fruit juice market in Malawi is relatively limited. This is primarily as a result of the information not being collected and available information being regarded as propriety by the individual juice companies. Following a survey of the fruit nectar producing companies the following volume information was however collected.

Table 1 – Estimated fruit juice concentrate consumption per month

Company	Estimated fruit juice concentrate consumption per month
Dairyboard	±20.0 tons
Golden Sun Foods	Guava – ±4.0 tons, Orange - ±2.5 tons, Peach – N/A, Apricot – N/A
Suncrest Creameries	N/A
Tambala Foods	±2.5 tons
Malawi Distillers Ltd	N/A
TOTAL	±30.0 tons at the very least per month

4.1.3.3 Constraints to business entry

The National Statistical Office of Malawi, following their Medium Business Economic Survey conducted in 1998, identified the two major difficulties in setting-up enterprises in Malawi as: a lack of capital (67% of respondents), followed by a lack of technical knowledge (13% of respondents). Significantly smaller problems in setting-up enterprises are transport (4% of respondents), and government regulations (3% of respondents). (www.nso.malawi.net).

The difficulties experienced in setting-up new enterprises in Malawi are manifested through the current ages of the enterprises in Malawi. The Medium Business Economic Survey conducted in 1998 found that the majority of enterprises (48.2 percent) in Malawi were in operation for over 60 months (5 years), followed by those with 13 –24 months of operation, while only 7.9 percent were infant enterprises in their first 12 months of operation (www.nso.malawi.net).

4.1.3.4 Forecasts and trends for the Malawian processing sector

The following excerpt from an article by the Economist Intelligence Unit provides a good summary of the prospects faced by the Malawian processing industry:

“Malawian industry faces constraints”

“Malawian industry is based around agri-processing and support for the agricultural sector, and is thus hit badly in drought years. The sector is heavily dependent on imported inputs, which means that successive depreciations of the currency have eroded gains in industrial competitiveness conversely. Continued bouts of kwacha depreciation, high real interest rates and macroeconomic instability create poor conditions for private-sector borrowing and therefore for new domestic start-ups. Despite low labour costs, labour productivity is poor. Malawi's workforce does not have the necessary skills and expertise, and the

HIV/AIDS epidemic is greatly affecting the industrial workforce. Other constraints on the development of a vigorous industrial sector include high transport costs, poor infrastructural support, dated production techniques and the small size of the domestic market. In addition, regional trade agreements are increasingly forcing Malawi's producers to compete with neighbouring countries, which have more sophisticated and competitive industrial bases. These limitations generally outweigh the value of the range of investment incentives available from the Malawi Investment Promotion Agency.”

(www.manufacturing.net/scm/article/NEe0130050.2iu?ticker=UPS)

4.1.3.5 Market opportunities in the fruit juice concentrate sector

Based on the market analysis it is evident that there is a market opportunity for the manufacturing and consistent supply of high quality well-priced fruit juice concentrate in Malawi. Imported concentrates currently dominate as the primary source of fruit juice concentrate. An opportunity exists for the domestic production of fruit juice concentrates in Malawi to supply the growing number of fruit juice nectar producers in Malawi.

4.1.4 Consumer analysis

The potential consumers of fruit juice concentrate in Malawi are businesses that currently use fruit juice concentrates to manufacture fruit nectar. As consumers they are characterised by organizational buying where they need to choose between the most suitable products and services available in a business market.

4.1.4.1 The buying centre

Generally the buying centre of the businesses in Malawi that are potential consumers of fruit juice concentrate from Magomero are driven by the production

managers of these firms. The production managers would typically manage the purchasing or procurement process that generally includes the following steps:

- Problem recognition
- General need description
- Product specification
- Supplier search
- Proposal solicitation
- Supplier selection
- Order-routine specification
- Performance review

4.1.4.2 Major influences on the buying decision

Based on unstructured interviews with the production managers of firms that were identified as potential consumers of fruit juice concentrate from Magomero the following major influences (in descending order of importance) were identified:

- Price
- Quality and product attributes (taste, flavour, colour, etc.)
- Consistency and reliability of supply

4.1.4.3 Consumer acceptance of locally produced fruit juice concentrate

A small sample of mango concentrate was provided to two of the fruit juice processors in Blantyre (Tambala Foods and Dairyboard). The reactions from these two processors were very positive. Both processors indicated that they would be willing to buy the product if it was offered at competitive prices.

4.1.4.4 Conclusions from the consumer profile

The conclusions that can be drawn from the consumer profile are:

- The potential consumers of fruit juice concentrate from Magomero are typically relatively large processing firms that currently are processing or intend to process fruit juice concentrate into fruit nectar.
- A relatively structured procurement process primarily driven by the production managers of these firms characterizes the buying process of these firms.
- The major factors that generally influence the buying decision of the potential consumers include the price of the product, the quality and attributes of the product and the consistency and reliability of supply of the product.

4.1.5 Financial analysis

4.1.5.1 Fruit juice concentrate recipe

The financial analysis is based on the fruit juice concentrate recipe in table 2. The recipe is formulated for 100 kg of concentrate with a dilution rate of 1:5. It is assumed that 1 kg of raw fruits would yield 0.5 kg of fruit pulp (50% conversion). The recipe was developed and tested for mango concentrate and would only need slight adjustment for other fruits.

Table 2 – Recipe to produce 100 kg fruit juice concentrate

Ingredients	Mass required for recipe (kg)
Fruit pulp	49.80
Sugar	47.80
Water	2.40

Sodium benzoate	0.26
Sodium metabisulphate	0.33
Citric acid	0.20

4.1.5.2 Key assumptions

Key assumptions had to be made for the feasibility study. Variable production costs were assumed for the production of the fruit juice concentrate based on the research conducted in this regard in South Africa and Malawi (Table 3).

Table 3 – Cost and source of variable inputs for fruit juice concentrate

Variable input	Unit	Cost (USD)	Availability
Fruit pulp	Kg	0.13	Domestically in Malawi
Sugar	Kg	0.49	Domestically in Malawi
Water	Kg	0.00	Domestically in Malawi
Sodium benzoate	Kg	1.54	Imported from South Africa
Sodium metabisulphate	Kg	0.65	Imported from South Africa
Citric acid	Kg	1.53	Imported from South Africa
Packaging & caps	Can	3.37	Imported from South Africa
Labelling	Label	0.11	Domestically in Malawi
Electricity (variable)	KWh	0.03	Domestically in Malawi
Labour (variable)	Hour	0.12	Domestically in Malawi

Miscellaneous variable costs were assumed for the production of the fruit juice concentrate based on the research conducted in this regard in South Africa and Malawi (Table 4).

Table 4 – Cost of miscellaneous variable inputs for fruit juice concentrate

Miscellaneous variable costs	Unit	Cost (USD)
Bank fees	USD/month	± 21.50
Telephone & Fax	USD/month	± 35.50
Maintenance costs (2.5% of capital value)	USD/month	± 35.50
Licensing	USD/month	± 11.00
Insurance	USD/month	± 71.50

Fixed costs were assumed for the enterprise at Magomero to produce fruit juice concentrate. These assumptions are based on the research conducted in this regard in Malawi (Table 5).

Table 5 – Cost fixed costs for fruit juice concentrate processing facility

Fixed costs	Unit	Cost (USD)
Rent of premises (Magomero)	USD/month	± 71.50
Telephone subscription	USD/month	± 7.15
Water subscription	USD/month	± 2.15
Electricity subscription	USD/month	± 2.15
Production manager salary	USD/month	± 143.00
Depreciation (capital value over 5 years)	USD/month	± 315.00

Key assumptions were made in compiling the feasibility report for the enterprise at Magomero to produce fruit juice concentrate (Table 6). These assumptions are based on the research conducted in this regard in Malawi and information from Dr Chris Hansmann, the designer of the manufacturing process, from the ARC – Nietvorbij, Stelenbosch.

Table 6 – Key assumptions

Other key assumptions	Value
Profit taken	125%
Corporate tax rate	35%
Concentrate production per day	551 kg
Production level	7 hours per day 22 days per month 12 months per year
Profit calculation	Net profit as a percentage of total revenue
Inflation	10%
Donor financed equipment & start-up (i.e. zero financing costs for enterprise)	100%
Expected returns from investment	15%

4.1.5.3 Summary of financial analysis

Table 7 – Financial analysis estimates

Income statement	Estimate
Gross value of production	± US\$ 107 400 per annum
Total cost	± US\$ 61 700 per annum
Net income	± US\$ 45 700 per annum
Tax	± US\$ 16 000 per annum
Net profit after tax	± US\$ 29 700 per annum
Profit (Profit as % of gross value of production)	27.66%
Cash flow analysis	Estimate
Cash flow	Net positive for all months
Capital budget	Estimate
Net present value	Positive over 5 years
Breakeven analysis	Estimate
Breakeven price (@ 7 270 cans)	± US\$8.50 per 20 kg can
Breakeven quantity (US\$ 14.75/can)	± 1 150 twenty kg cans/annum
Sensitivity analysis	Estimate
Consumables (Fruit, Sugar	77.37 % of total cost
Marketing costs	8.70 % of total cost
Miscellaneous variable costs	3.41 % of total cost
Fixed costs	1.61 % of total cost
Salaries	2.78 % of total cost
Depreciation	6.12 % of total costs

4.1.5.4 Projected income statement

From the projected income statement (Appendix A) it is evident that the proposed fruit processing enterprise at Magomero is financially viable based on the key assumptions made above.

According to the projected income statement a 20-kg can of fruit juice concentrate can be sold at US\$14.75. This equates to US\$0.75/kg that compares very favourably with similar products that are currently being used by Malawian fruit nectar manufacturers. Similar imported products are procured at an estimated average cost of US\$1.00/kg.

4.1.5.5 Cash flow projections

Cash flow will be influenced by the availability of raw material. Raw material supplies based on Mango, Citrus, *Uapaca*, *Ziziphus* and *Strychnos* would experience a low period during January to March (Figure 4). During this period production could be reduced to 0.5 time normal production. During October to December fruits will be available in abundance and production can be run at 1.5 times the normal rate. During January to March management of the processing enterprise needs to exercise caution with respect to managing the cash flow.

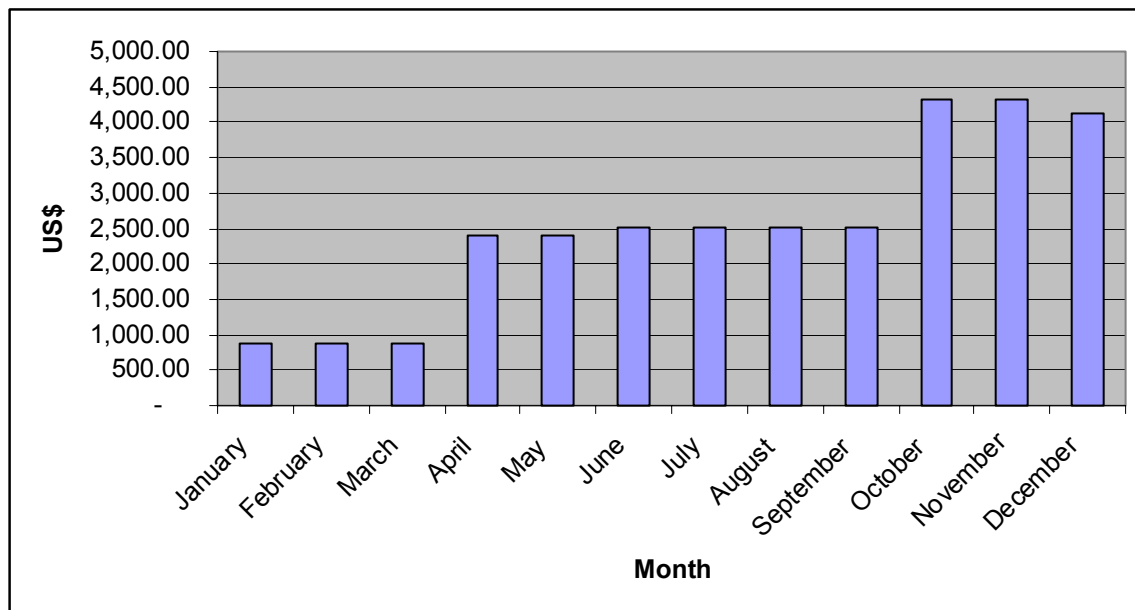


Figure 4 – Cash flow projections

4.1.5.6 Break-even analysis

The break-even analysis was conducted by:

- Determining the break-even price whilst keeping the initial level of sales constant.
- Determining the break-even quantity whilst keeping the initial price level constant.

The break-even analysis yielded the following results:

- Based on an annual production of 7,270 twenty kilogram cans of fruit juice concentrate the break-even price is **± US\$8.50 per 20 kg can. Per kg this equates to ± US\$0.43.**
- Based on a fixed price of ± US\$14.75 per 20 kg can of concentrate the break-even quantity is approximately **1,150, twenty kg cans of juice concentrate.**

4.1.5.7 Net present value

The net present value analysis was conducted by assuming the following:

- An initial investment of ± US\$17 000 is required. It is anticipated that the initial investment equates to the value of the equipment required and a small start-up contingency.
- The return that is expected on the investment is 15%
- The corporate tax rate is 35%
- Price inflation is at 10%

From the analysis of the projected net present value five years after the initial investment it is evident that the net present value for the processing enterprise is positive. According to the net present value (NPV) decision rule that specifies

that ventures with a positive NPV should be accepted it can be concluded that the fruit juice concentrate processing facility proposed for Magomero can be established knowing that the enterprise is financially viable (assuming the conditions set out in the financial analysis of the enterprise)

4.1.5.8 Sensitivity analysis

The sensitivity analysis was conducted by:

- Determining the percentage that each variable cost item contributes to the total variable cost.
- Determining the percentage that each cost item, including the variable cost, contributes to the total cost of the enterprise.

The cost of sugar is the largest cost item in terms of the variable costs of the fruit juice concentrate at just over 70% of the total variable cost. The cost of fruit, at just less than 10% of the total variable cost, is the second largest cost item of the total variable cost needed to produce fruit juice concentrate.

When considering the total costs, the variable costs constitute approximately 77% of the total cost. Marketing costs are the second largest contributors to the total cost at approximately 9% with depreciation in third at 6.5% (Appendix B).

The viability of the fruit juice concentrate enterprise envisaged for Magomero is therefore the most sensitive for changes in the price of sugar. If the price of sugar were to go up it would adversely affect the financial viability of the enterprise. Conversely a decline in the price of sugar would see the viability of the enterprise increase markedly. The cost of fruit and the cost of marketing are the other cost items to which the viability of the enterprise is sensitive and changes in the prices (i.e. costs) of these factors are also bound to have a marked impact on the viability of the enterprise.

4.2 Technical feasibility

The assessment of the science and technology environment entails investigation into the suitability of the proposed technology for members of rural target groups, the processing location and processing technology required, the status of the infrastructure and the level and availability of human resources/skills and expertise.

Further aspects of the technical feasibility analysis include:

- Processing, storage and transportation requirements;
- Identification of the gaps between the current situation and the skills to be developed and improved to meet market requirements;
- Identification of the current practices of production, processing and marketing;
- Study of the physical infrastructure and the availability of energy

4.2.1 Processing

4.2.1.1 Selection of processing technology

Upon selecting the processing technology to be used there are various factors that need to be taken into consideration. These factors are discussed at length.

The first factor is the consistency of the processing technology with qualitative requirements of the marketplace. When choosing processing technology it is of critical importance to determine whether the technology will match the quality standards of the selected target market. If the product is being positioned for export it is also important to determine whether the technology meets the consumer requirements in the export market. In the case of fruit juice concentrates in Malawi this is very relevant since the proposed marketing angle

will specifically emphasize a product of good quality to be able to compete effectively with high quality products from elsewhere, notably from South Africa.

The second factor is constraints that are imposed on technology selection by the technical requirements of the transformative process. Specific processes and technologies required by government health or safety standards constrain the selection of processing technology and this must be kept in mind when initial planning with respect to the specific processing technology takes place.

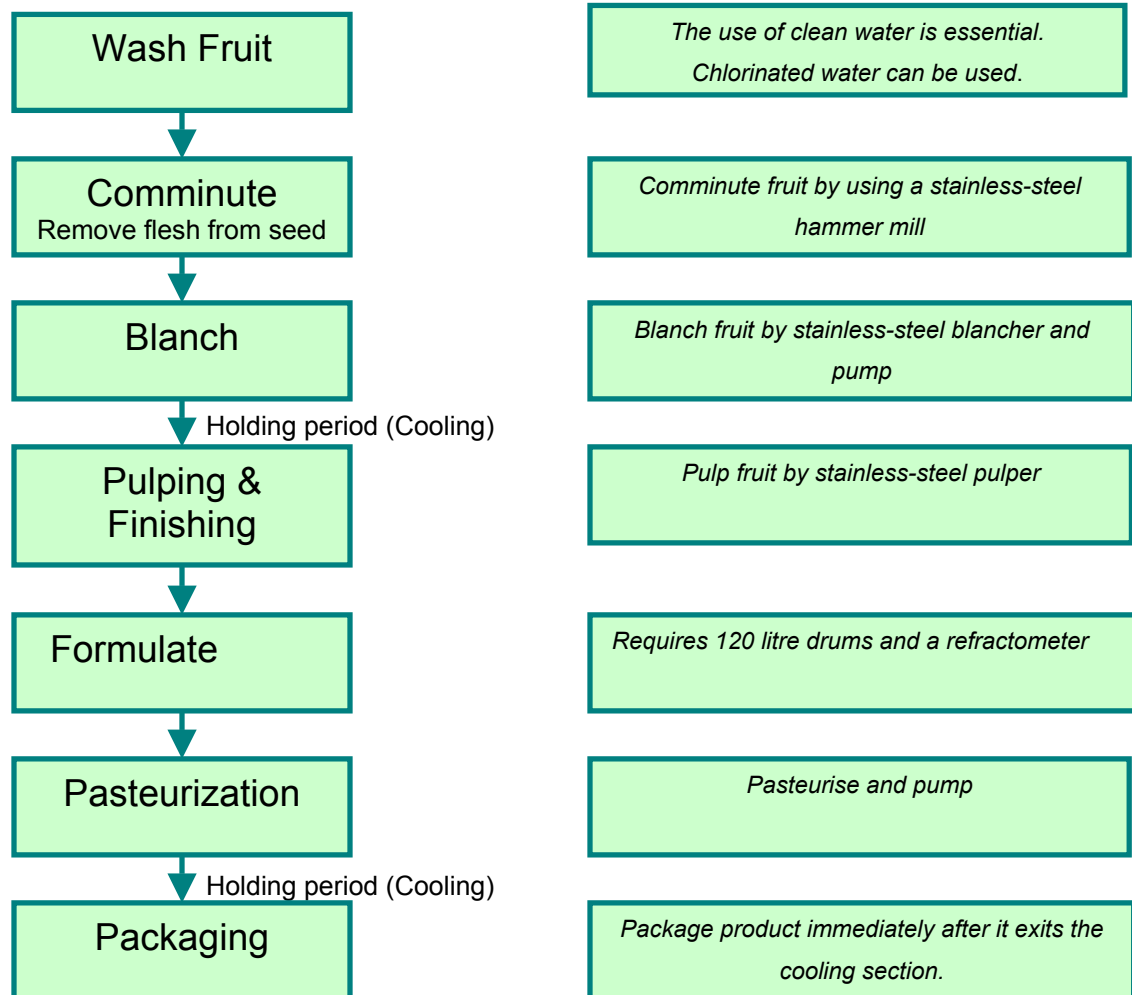
The third factor is the technology's compatibility with the firm's managerial and technical skill capability. Supervisory demands are important decision factors when selecting a specific processing technology and care should be taken so that the supervisory demands of a specific technology are not excessive. The same argument is applicable for the technical demands of a specific processing technology.

The fourth factor is the nutritional effects of the technology. Processing technology can have a profound effect on the nutritional status of the product being processed. The effect that the processing technology has on the quality and quantity of the product's nutrient status should be determined and, if necessary, the technology should be adjusted to minimize nutrient losses.

4.2.1.2 Processing technology for small scale fruit processors

The Agricultural Research Council Infruitec-Nietvoorbij in Stellenbosch, South Africa has developed the processing technology that is proposed for the specific production of fruit products on a small scale.

The production of fruit juice concentrate according to the ARC Infruitec-Nietvoorbij's small-scale technology can be characterized as follow:



(As supplied by Dr. Chris Hansmann – ARC Infruitec-Nietvoorbij, Stellenbosch, South Africa)

The process outlined above is preliminary subject to more experiments to optimise the process. The basic steps in the process are:

Washing of the fruit – This operation should be performed in chlorinated water (100-150 ppm hypochlorite) to ensure that the fruit is clean when moving onto the next step in processing.

Removal of the flesh from the seed – After the fruit has been washed the flesh is then removed from the seed. This part of the process can be performed by hand. If a hammer mill is used to comminute the fruit the peel need not be

removed in this part of the process provided that the hammer mill is able to reduce the peel size prior to blanching.

Blanching – Blanching should be performed at at least 90°C. As more experience is gained, especially with the fruit in Malawi, it might still be possible to eliminate the blanching from a technological point of view. The retention of the blanching process is, however, favoured even though the product is pasteurised later. The reasons for this are:

- The yield during pulping/finishing would be higher after a heat process such as blanching; and
- The use of two heat treatments would significantly eradicate microbes.

The holding period and cooling will be performed as a single process with blanching (i.e. the holding period will consist of a tube between the heating and cooling sections).

Pulping – Pulping/finishing entails pulping and finishing the blanched fruit and is performed in one operation by the finisher.

Formulation – Formulation entails mixing the pulp, sugar and water required with preservatives (sodium benzoate and sodium metabisulphite). The acidity would also require adjustment through the addition of food grade citric acid.

Pasteurisation & Packaging – Pasteurisation, the holding period, cooling and packaging should be performed as a single operation to reduce the risk of re-contamination. The pasteurised product should be packaged immediately after exiting the cooling section.

This processing technology has been specifically designed to suit the requirements and skills base of rural processors and therefore it is ideally suited

to the circumstances at Magomero where production will take place on small scale.

4.2.2 Processing facility location

When choosing the location of a processing facility various factors need to be taken into account. These factors include:

- Access to raw materials
- Access to the market
- Labour supply at the processing facility location
- Infrastructure at the processing facility location
- Developmental effects of the location

After giving due consideration to the criteria as set out above it has been decided to locate the fruit juice concentrate processing facility at Magomero Vocational College outside Zomba. This decision has been made based on the following:

- There is infrastructure available in the form of buildings that can accommodate the fruit processing plant.
- Communities in the region have received training in fruit processing and have formed a women's processing group. The women's processing group would be the primary source of labour for the processing facility.
- Consistent supplies of high quality fruit are available from communities in the vicinity.
- Access to other production inputs such as ingredients, packaging, labels etc is easy because of Magomero's close proximity to Blantyre, the source of all possible production inputs. (30 km from Blantyre)
- Land is available for expansion.
- All utility services like water and electricity are reliable and readily available.
- Access to a road infrastructure.

- Access to the market is easy because of Magomero's close proximity to Blantyre, the largest market for fruit juice concentrates in Malawi.

4.2.3 Processing technology required

The processing technology that is required for the manufacturing of fruit juice concentrate from pulp via the Agricultural Research Council's proposed process includes:

- Pulper (stainless steel contact part - 220V) with spare rasper.
- Finisher (stainless steel contact part - 220V) (with spare sieve and set of brushes).
- Stainless steel peristaltic pump (380V) (with 1,5m food-grade hoses).
- Blancher / Pasteurizer (12kW) with control panel with temperature controller and sensor and stainless steel insert rods.
- Set of spanners (for dismantling to clean).
- Pull-through brush cleaning set.
- 50 litre food grade drums.

All of the abovementioned equipment is available in a readymade and compatible format from an equipment manufacturer in South Africa. This equipment manufacturer is Dryers for Africa. The postal address is Dryers for Africa, P.O. Box 3423, White River, 1240. The telephone, fax and e-mail details for Dryers for Africa are +27 (0)13 751 3743 and hbrebner@mweb.co.za.

Over and above the fact that the proposed processing equipment can be used to manufacture fruit juice concentrates it can also be used to manufacture an array of other fruit products like fruit pulp, natural fruit juice, jellies, jams and pickles. The versatility of the equipment is a desirable trait that would allow the users a variety of options in processing rather than limiting them to one option.

4.2.4 Status of the infrastructure

The status of the current infrastructure at Magomero is seemingly sufficient to accommodate a processing facility that is proposed by this feasibility study. The facilities at Magomero are connected to both water and electricity supplies. The supply of water is reportedly from a clean and reliable resource. To ensure a final product of high quality the water will however need to be subjected to UV treatment.

4.2.5 Level and availability of human resources and skills

The Agricultural Research Council Infruitec-Nietvoorbij in Stellenbosch, South Africa developed the processing technology that is proposed for the specific production of fruit products on a small scale. The technology is aimed at small-scale processing with low operational and maintenance requirements in terms of human resources and skills.

4.2.6 Inventory management

4.2.6.1 Best storage capacities for raw materials and finished goods

Inventory management is an important part of the processing procedure, as the raw material is highly perishable. It would therefore be necessary to determine how quickly the raw material must be processed into a product to ensure the desired levels of quality.

It should also be determined whether processing would make the storage of the product easier. Generally in the case of fruit the partial processing of the fruit to pulp or the complete processing to nectar and/or concentrate does indeed make the storage of the product easier by reducing perishability.

It is also important to determine the spatial and qualitative requirements for the inventory of raw materials, finished goods, processing supplies and equipment parts. At Magomero it should be seen to that there is sufficient, high quality storage space to accommodate an inventory of raw materials, finished goods, processing supplies and equipment parts.

4.2.6.2 Adequacy of physical facilities

The standard of physical facilities play an important role in inventory management. Quantitative and qualitative losses in the inventories of raw material and finished goods are often a direct result of the standard of the physical facilities. It is therefore important to weigh the economic costs and benefits of adjusting the size and the quality of facilities for inventory handling and storage to reduce losses.

4.2.7 Packaging and other processing inputs

4.2.7.1 Functions performed by packaging

Packaging performs many very important functions as an integral part of a final product. These functions are:

- Packaging protects the quality of the product
- Packaging provides consumers with convenience
- Packaging conveys a certain image
- Packaging can also be informative with regards to the product
- Packaging adds value to a product through differentiation

4.2.7.2 Packaging choice

For fruit juice concentrates produced at Magomero to compete in the specified target market, careful consideration should go into choosing packaging. The following aspects need to be considered when selecting the right packaging:

- Requirements of the consumer and the distribution channels.
- Requirements imposed by the intrinsic nature of the product.
- Packaging characteristics determined by government regulations.
- The possibility of unmet consumer needs that could be satisfied with a different type of packaging.
- The effect of transportation infrastructure conditions on packaging requirements.
- Ecological considerations for the packaging alternatives.

4.2.7.3 Procurement of packaging, ingredients and chemicals

Much of the proposed packaging material, ingredients, chemicals and other inputs needed in the processing of fruit juice concentrate are either unavailable, of substandard quality or very costly in Malawi. For the cost effective production of a high quality fruit juice concentrate those production inputs that are difficult to procure in Malawi will have to be imported. These types of production inputs can typically be procured through regional distribution networks.

4.2.8 Programming and control

As with the inventory management the programming and control will be important. Control must start at the collection of the fruit to ensure that only the best quality fruit is collected and used in the pulp-manufacturing process. After the pulp-manufacturing process the production and distribution process must be synchronised to prevent bottlenecks.

Control is thus very important throughout the whole nectar manufacturing process to guarantee a quality end product for the consumer.

4.2.9 Distribution

Since there is currently no production of fruit juice concentrate at Magomero there is also no distribution channel from the Magomero processing facility. When production commences a distribution system will need to be established. The most obvious channel of distribution is delivery of the fruit juice concentrates directly to the fruit nectar manufacturers.



Direct delivery of the fruit juice concentrates can be achieved in one of three ways. The first is for Magomero Fruit Juice Concentrates to transport, with their own transport, the fruit juice concentrates to their clients in Blantyre. The second alternative is for the fruit nectar manufacturers to collect the fruit juice concentrates from the processing facility at Magomero. The last alternative is for either party to hire a third party to transport the fruit juice concentrates from the processing facility at Magomero to the manufacturers in Blantyre.

The ultimate choice of distribution channel will depend on the profits that can be gained as a result of using a specific channel, the initial costs required to establish a distribution channel and the ease with which an effective and efficient distribution system can be established. At face value the option where the fruit nectar manufacturers collect the fruit juice concentrate from the processing facility at Magomero appears to be the best option. Since many of the fruit

nectar manufacturers undertake the distribution of their products throughout Malawi themselves, it is highly likely that on returning from deliveries via Zomba (and Magomero) back to Blantyre the trucks used for delivery are empty and could accommodate the concentrates. This option is attractive since it would be easy to establish, it would be effective and it would save on transport costs making the concentrates more affordable.

4.2.10 By-products

The main by-product of the fruit juice concentrate production process is a fibrous material that can be used as animal feed in a dried form. A process to dry this by-product without the use of expensive drying equipment has to be developed.

In addition to the production of the primary product this by-product could also provide an additional source of income to the processing facility and indirectly to communities involved with the processing facility.

4.3 Resource and environmental feasibility

The assessment of resources and the environment entails investigation into the availability (in time: seasonality; in space: time needed to find and harvest); of the raw materials; the regenerative potential and the impact of harvesting on the survival of the species and the impact of harvesting on the environment.

How to develop products without destroying the resource base is a fundamental concern of the market analysis and development methodology. A product will be considered for development only if its resource base will not suffer as a result of an increase in the harvesting rate or if harvesting can be supplemented or substituted by cultivation. Therefore, it is important to get a clear picture of the status and quantity of natural resources before starting an enterprise. This can

also be a tool to monitor environmental impact once an enterprise gets under way.

4.3.1 Raw material supply

The procurement of raw material inputs must be studied before investing in a processing plant. Raw material input supply is of great importance because the transformation of inputs is one of the basic tasks performed in a processing facility. If inputs are defective, problems will occur in processing and marketing.

Efficient procurement is dependant on five basic characteristics:

- Sufficient quantity of inputs
- Correct quality of inputs
- Time sensitive operations
- Reasonable costs
- Efficient organization

4.3.1.1 Raw material quantity

It is estimated that the production of 12 tons of concentrate per month would require approximately 12 tons of fruit. (50% of fruit recovered for pulp, 50 kg of fruit pulp per 100 kg concentrate).

Information on the quantity of fruit that is available for processing in the vicinity of Magomero is not available. If consideration is, however, given to the apparent spare distribution of the areas where fruit can be found the availability of raw material to produce fruit juice concentrate from could pose a problem to the feasibility of the enterprise. In relation the Magomero the nearest significant sources of *Uapaca* are at Malosa (30 km from Magomero), Mulange (100 km from Magomero) and Phalombe (100 km from Magomero). Magomero is also not a main mango growing area but mangos can be found everywhere especially

towards Machinga and Mangochi (towards the lake) and south west of Blantyre at Chikwawa. Large volumes of *Ziziphus* fruits could be procured from the Tete Province of Mozambique (Appendix C).

The following example illustrates the volume requirements. It is estimated that an average *Uapaca* fruit weighs 25 g and up to 6000 fruits have been recorded per tree with an average yield of 2000 fruits per tree. This equates to an average yield of 50kg of fruit per tree per fruiting season. The 12 tons of *Uapaca* fruit that is needed per month for the processing facility will have to come from 240 trees.

The supply of raw material is also very dependent on climatic factors and sustainable forestry practices. Drought and poor management would see feasible supplies of raw material diminish drastically. This would result in a feasible enterprise becoming infeasible overnight.

Though concerns can be raised about the availability of raw material from wild populations commercial cultivation and harvesting could supplement the raw material supply from wild populations and benefit the continued existence and distribution of the indigenous trees. It has also been noted that once communities become aware that there is money to be made from the fruits of indigenous trees and that the survival of the trees would ensure future income effort is made to cherish and conserve the trees.

4.3.1.2 Raw material quality

The quality of the raw material that can be sourced from the communities in which the resources reside is highly variable. In the absence of a strictly controlled production process that ensures a constant supply of high quality raw material it is to be expected that the raw material quality would be variable. Factors affecting the quality of the raw material are timing of harvest, harvesting

methods, handling of the fruit, transportation of the fruit and storage conditions of the fruit.

In Malawi people generally employ crude harvesting techniques for harvesting fruit such as beating trees with a stick and/or breaking branches. This generally leads to unsustainable harvesting and poor quality fruit that might not be ideal for further processing. People are generally uneducated regarding proper harvesting methods and need to be informed that only high quality fruit will be considered for processing.

This can be remedied through the procurement process that should ensure that a very large proportion of the best quality raw material is sourced. Only under circumstances where the production process is in need of more raw material than can be satisfied by the high quality raw material, should poorer quality raw material be considered and only for very short periods of time.

The processing plant could also consider providing assistance in ensuring raw material of good quality. By setting certain quality standards within which the raw material will be bought and by providing handling, transport and storage support this can be brought about. The improvement in quality and the resultant economic benefits should, however, be weighed against the cost of providing this support.

4.3.1.3 Appropriate timing

Fruit trees only bear fruit for a limited time during a year limiting the availability of raw material to a couple of months per year.

If production of fruit juice concentrate is to be continued virtually throughout the year, to make optimal use of the capital outlay, measures need to be taken to mitigate the effects of seasonality. The primary means to mitigate the effects of

seasonality is to process fruit that have different fruiting seasons. By processing Mango, Citrus, *Ziziphus*, *Uapaca* and *Strychnos* the effects of seasonality on continuous production can be reduced. These fruits are available during the following months per year:

Mango – September to December

Citrus – April to October

Ziziphus – June to September

Uapaca – October to January

Strychnos – November to December (store for January to March)

4.3.1.4 Reasonable cost

Supply of and demand for indigenous fruit should be the main, if not the only, determinant of the price. This will ensure that the communities responsible for collecting the indigenous fruit receive a fair price and are not exploited. It will also ensure that fruit is purchased at a reasonable cost so that the processing enterprise stays viable, assuming that all other conditions remain the same.

4.3.1.5 Organization of the procurement system

The organization of the raw material procurement system is a very important aspect that contributes to the sustainability of the fruit processing enterprise. One of the primary functions of the procurement system is to ensure that a sufficient quantity of high quality fruit is procured and/or stored throughout the year for continuous production of fruit juice concentrate.

One of the main challenges that the procurement system for indigenous fruit faces is seasonality with many indigenous fruit only available for a few months during a year. To be able to organize the procurement system efficiently a strategic decision will need to be made whether to have a continuous supply of fruit juice concentrate of a certain specie of indigenous fruit or to produce fruit

juice concentrate from those species that are available at the specific time of production. If a decision is made to sustain production of a certain species throughout the year, despite the fruit only being available for short periods, it will be necessary to collect and store a sufficient quantity of fruit during the season for later processing. This strategy could be very valuable when viewed from a marketing point of view since it would be good to have indigenous fruit nectar on the market while the specific fruit is out of season. This strategy would, however, require that investments be made in equipment necessary to preserve the unprocessed or semi-processed fruit. If a decision is made to produce fruit juice concentrate from those species that are available at the specific time of production it will not be necessary to make investments in preservation equipment but this might be, as stated previously, unfavorable from a marketing point of view.

To ensure that a sufficient quantity of fruit is collected to produce fruit juice concentrate at economically viable levels it will be necessary to convey the information regarding volumes required and prices paid to the communities that have access to the fruit trees. This can be achieved through a community liaison officer that can interact with both the community and the manufacturing plant.

Provision should be made to receive the fruit at the processing plant and/or to collect fruit from designated points. This decision should be based on the economic viability of the two options. Upon the receipt of the fruit, they should be processed to such a state that the quality remains intact to ultimately ensure a final product of high quality.

4.3.2 Environmental sustainability

Currently there is a lack of a comprehensive analysis of the current natural resources that are available (in terms of species, distribution and quantities) in Malawi. Furthermore no research appears to have been done to investigate the

long-term sustainability of harvesting (i.e. long term availability of inputs) nor the impact that harvesting will have on the regenerative potential of the respective species.

4.4 The social and institutional feasibility

The assessment of the social and institutional environment entails investigation into the indirect benefits of the project for the community; the contribution of the project to the income of the community members; the potential for creating employment and the gender impact that the project is bound to have.

Social and institutional criteria are as important as the economic, resource management and technical criteria of a potential enterprise. Potential activities should help, or at least not harm, the most economically vulnerable members of the community.

4.4.1 Socio-economic characteristics of Malawian population

The socio-economic characteristics of the Malawian population have been documented in the Malawi Demographic and Health Survey of 2000 carried out by the National Statistics Office of Malawi and ORC Macro.

The survey reports that Malawi has a population of approximately 11.7 million people that are predominantly rural with only 14% of the population living in urban areas. The Malawian population is growing at 2.21% per annum, with a population density of 123 people per square kilometer. Average life expectancy is 38 years; the birth rate is 44.7 and the mortality rate 22.6 per 1000 of the population. One in every 5 Malawian children dies before the age of 5 years. Malawi has a broad based population pyramid with almost half the population 14 years old and younger.

The report notes that malnutrition is one of the most important health and welfare problems facing Malawians today. Young children and women of reproductive age are especially vulnerable to nutritional deficits and micronutrient deficiency disorders. Prevalence of chronic malnutrition or stunting is observed among 49% for children under 60 months of age. The HIV infection rate is estimated at 15 % for people between 15 – 49 years old and about three quarters of all AIDS cases occur among people in the most economically productive age group of 20 – 45 years old.

Almost half of Malawian women, the general target group to be involved in the processing facility, are currently employed. Of these women 20% are employed year – round, 30% seasonally and 5 % occasionally. Two thirds of the women that are employed are self-employed while 23% are employed by a relative and 10% are employed by a non-relative.

4.4.2 Socio-economic characteristics of communities in the vicinity of Magomero

An atlas of Malawi's social Statistics compiled by the National Statistics office of Malawi in Zomba (Benson, Kaphuka, Kanyanda & Chinula, 2002) details the socio-economic characteristics of communities in the vicinity of Magomero.

Magomero falls in the Mpama Traditional Authority and is bordered by the Chitera Traditional Authority and the Nchemba Traditional Authority.

When considering the three-abovementioned traditional authorities table 8 details the population and number of households per traditional authority and in total in the immediate vicinity of Magomero.

Table 8 – Population and number of households in the vicinity of Magomero

Area	Population	Households
Mpama Traditional Authority	46 914	11 675
Chitera Traditional Authority	15 789	3 944
Nchema Traditional Authority	27 542	6 862
TOTAL	90 245	22 481

The communities in the immediate vicinity of Magomero therefore number approximately 90 000 people with a population growth rate of 1.5% to 2.0% per annum. Women head 35% to 45% of households and the mean household size in this region is 4.0 to 4.2 people per household.

The percentage of people living in the communities in the vicinity of Magomero whose daily consumption is below the poverty line is 64% to 80% and the percentage of people living below the ultra poverty line is 36% to 50% (Ultra poverty set as 60% of poverty line – A level of material welfare considerably below that at which ones basic needs are met)

4.4.3 Direct and indirect benefits of the processing enterprise for the community

The direct benefits of the processing enterprise for the communities in whose vicinity the enterprise is to be established include the creation of employment opportunities, the creation of a market for currently under-utilized resources and on the job training of participants in growing, harvesting, processing, packaging and marketing of fruit products.

The indirect benefits of the processing enterprise include a possible decrease in the number of households that are classified as living under the ultra-poverty and poverty line in the vicinity of Magomero as a result of the increased income (both direct and indirect). As a result the level of malnutrition and the severity of the

impact HIV/AIDS, which are both very prevalent, can be alleviated – although marginally.

Future cultivation of indigenous trees by rural farmers would increase the benefits derived from the processing enterprise. Through a system of small grower co-operatives farmers can provide the enterprise with a more sustainable and guaranteed supply of raw material.

4.4.4 Contribution of the processing enterprise to rural livelihoods

An estimated USD7 000 – USD8 000 of fruit will need to be procured from communities in close proximity to the processing plant at Magomero for the processing facility to operate optimally. The implication is that USD7 000 – USD8 000 will be “spent” in communities that earn on average USD146.44 per person per year (http://www.nationmaster.com/graph-B/eco_gro_nat_inc_cap).

If a 2.5% rate of participation is assumed approximately 2 250 people will collect and deliver fruit to the processing facility. These people would therefore share the USD7 000 – USD8 000 that the processing facility would spend on fruit. This equates to an estimated increase in the average annual income of 2.3% by an estimated 575 households – a small yet significant increase in annual income.

4.4.4.1 The processing enterprise’s potential for creating employment

The processing enterprise envisaged at Magomero has the potential of creating a number of direct and indirect employment opportunities. The current size of the proposed enterprise would provide direct and permanent employment for 1 permanent manager and 3 – 5 permanent labourers.

It is estimated that the processing enterprise would provide 2 250 indirect opportunities of employment for people in the communities in close proximity to

Magomero if it is assumed that 2.5% of the total population in the specific region would take part in harvesting and delivering fruit to the processing enterprise.

4.4.4.2 Gender impact of the processing enterprise

Women are bound to benefit the most from the establishment of such a processing enterprise. Although both men and women will be free to participate directly and indirectly in the processing enterprise women in the area are more likely to be the main participants as a result of their current involvement in fruit processing activities.

Currently there is a well-established women's processing group at Magomero called the Magomero Food Processing Enterprises that have received basic training in the processing of fruit including hygiene, processing and business management (1 week courses). The members of the processing group have also completed a 3 month – 3 days a week – course on enterprise development and regularly exchange skills with other processing groups.

5 Conclusions

A feasibility study is generally defined as a structured way to efficiently organize the information that is needed for confident decision making regarding the profit potential and technical, financial, social and environmental viability of a specific proposal.

This feasibility study was conducted to determine the viability of a fruit juice processing enterprise that manufactures fruit juice concentrates located at Magomero, Malawi.

Based on the framework set out in this feasibility study the following conclusions can be made regarding the feasibility of the proposed fruit juice processing enterprise.

5.1 Market and financial feasibility

A market opportunity was identified for the domestic production of good quality fruit juice concentrates in Malawi to be sold to manufacturers in the growing fruit juice nectar producing sector. The domestically produced fruit juice concentrate would compete effectively with imported fruit juice concentrates of similar quality from countries like South Africa and Swaziland.

The analysis of the financial feasibility of the proposed enterprise revealed that, based on the assumptions that were made, the enterprise is potentially profitable, is projected to have a healthy cash flow and is viable over the longer term.

The positive market and financial feasibility assessment is however dependant on the following:

- Stable inflation and macro economic conditions
- No serious new competitors (from within Malawi or lost cost imports)
- Continuous and reliable production of a high quality products
- Reliable procurement of production inputs and relatively reliable and stable prices
- Professional management of the business (in all aspects from input procurement to production management to marketing management to financial management)

5.2 Resources and environmental feasibility

As a result of a lack in a comprehensive analysis of the current natural resources that are available (in terms of species, distribution and quantities) in Malawi it is difficult to comprehensively assess and draw conclusions regarding the environmental and/or natural resource feasibility of the enterprise. The implication is that no clear-cut conclusions can be made with regards to the quantity and quality of fruits that are available, what a reasonable cost for the fruit is nor how and when the fruit will be procured. The lack of information also means that no clear conclusions can be made regarding the long term sustainability of harvesting (i.e. long term availability of inputs) nor the impact that harvesting will have on the regenerative potential of the respective species.

This feasibility study has assumed, as a result of a lack in information, that sufficient quantities of high quality fruit will be available to the processing facility at a reasonable cost and that fruits can be harvested sustainably and without adverse impact on the regenerative potential of the trees.

5.3 Technical feasibility

The analysis of the technical feasibility of the proposed processing enterprise revealed that the manufacturing process and the processing technology from the ARC Infruitec-Nietvoorbij, Stellenbosch, South Africa is ideally suited to the specific technical requirements of the proposed processing enterprise at Magomero. This processing technology has been specifically designed to:

- Produce products that meet the qualitative requirements of the marketplace,
- Adhere to government health and safety standards,
- Be compatible with the managerial and technical skills available at small scale, rural sites such as Magomero,

- And have a minimal effect on the nutritional status of the product being processed.

Furthermore the location at Magomero is ideally suited to the establishment of a processing enterprise of this nature since it is reasonably well located with regards to resources, input supplies and access to distribution channels. The existing infrastructure at Magomero is also of a relatively high standard and could easily accommodate a processing facility of this nature.

The level and availability of human resources and skills to fulfil the requirements of the processing enterprise at Magomero are currently under-developed to manage (in all aspects from input procurement to production management to marketing management to financial management) the proposed enterprise. This shortcoming can, however, be very easily addressed through appropriate training. The training of women in the basic processing of fruits that has taken place at the Magomero Vocational Training College will, however, prove to be very valuable once the enterprise has been established.

The technical feasibility of the intended enterprise is primarily dependant on:

- The selection of appropriate processing technology
- Choosing an appropriate location for processing after taking into consideration the infrastructure and human resources that are available, the, accessibility to raw materials and markets
- Management capacity to manage the whole process from input procurement through processing to the final marketing of the products.

5.4 Social and institutional feasibility

The assessment of the social and institutional feasibility of the proposed enterprise reveals that the Malawian population is predominantly a poor rural population characterized, by amongst others, poor socio-economic

characteristics (life expectancy, infant mortality and population distribution) rampant malnutrition and marked prevalence of HIV/Aids

The social and institutional feasibility assessment of a fruit juice processing enterprise at Magomero reveals that the surrounding communities would benefit in a number of ways from the establishment of the proposed enterprise. The direct benefits of the establishment of the proposed enterprise include the creation of employment opportunities as well as the creation of a “market” for currently under-utilized resources in fruits, especially indigenous fruits. The indirect benefits of the proposed enterprise include an anticipated decrease in the number of households living under the poverty and ultra poverty line, a decrease in malnutrition, a decrease in the severity of the impact of HIV/Aids and an increase in incomes for communities, especially for women in communities. Taking the net social benefit of the proposed processing enterprise into consideration it can be concluded that the processing enterprise is anticipated to be socially and institutionally feasible.

5.5 Overall feasibility

Based on the framework set out in this feasibility study where feasibility is assessed in four core areas it can be concluded that the proposed processing enterprise at Magomero is feasible though some shortcomings can be found in the resource and environmental feasibility as a result of a lack of information. This positive result of the feasibility analysis is, however, heavily dependant upon the assumptions made during the study and on conditions (political, environmental, economical etc.) remaining relatively stable within the enterprise’s operating environment. If either the assumptions or the operating environment were to differ substantially from actual circumstances the actual feasibility of the processing enterprise at Magomero could differ from the current result.

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Appendix A - Income Statement for Magomero Fruit concentrate processing plant

Items	Unit	Price per unit	Quantity	USD total	USD per liter
		USD	#	USD	USD
- Fruit juice concentrate (20 kg can)	can	14.77	7,273.20	107,396.32	0.74
Gross total value of production				107,396.32	0.74
CONSUMABLES					
- Fruit juice concentrate (20 kg can)	can	6.56	7,273.20	(47,731.70)	(0.33)
				(47,731.70)	(0.33)
MARKETING COSTS					
- Advertisement (5% of gross income)	USD/month	447.48	12.00	(5,369.82)	(0.04)
- Distribution	USD/month	447.48	-	-	
				(5,369.82)	(0.04)
MISCELLANEOUS VARIABLE COSTS					
- Bank fees	USD/month	21.46	12.00	(257.51)	(0.00)
- Telephone & fax	USD/month	35.77	12.00	(429.18)	(0.00)
- Professional fees	USD/month	-	12.00	-	-
- Maintenance (2.5% of capital value)	USD/month	35.77	12.00	(429.18)	(0.00)
- Licensing	USD/month	10.73	12.00	(128.76)	(0.00)
- Insurance	USD/month	71.53	12.00	(858.37)	(0.01)
				(2,103.00)	(0.01)
FIXED COSTS					
- Rent of premises	USD/month	71.53	12.00	(858.37)	(0.01)
- Telephone subscription	USD/month	7.15	12.00	(85.84)	(0.00)
- Water subscription	USD/month	2.15	12.00	(25.75)	(0.00)
- Electricity subscription	USD/month	2.15	12.00	(25.75)	(0.00)
				(995.71)	(0.01)
SALARIES					
- Production manager	USD/month	143.06	12.00	(1,716.74)	(0.01)
				(1,716.74)	(0.01)
DEPRECIATION					
- Depreciation on equipment (5yr period)	USD/month	314.74	12.00	(3,776.82)	(0.03)
				(3,776.82)	(0.03)
Total costs				(61,693.79)	(0.42)
Nett total enterprise income				45,702.53	0.31
Corporate tax (35%)				(15,995.89)	(0.11)
Nett profit				29,706.64	0.20
Nett profit (%)				27.66	27.66

Appendix B – Sensitivity analysis

Items	% of total costs
CONSUMABLES	77.37
- Fruit juice concentrate (20 kg can)	77.37
MARKETING COSTS	8.70
- Advertisement (5% of gross income)	8.70
- Distribution	-
MISCELLANEOUS VARIABLE COSTS	3.41
- Bank fees	0.42
- Telephone & fax	0.70
- Professional fees	-
- Maintenance (2.5% of capital value)	0.70
- Licensing	0.21
- Insurance	1.39
FIXED COSTS	1.61
- Rent of premises	1.39
- Telephone subscription	0.14
- Water subscription	0.04
- Electricity subscription	0.04
SALARIES	2.78
- Production manager	2.78
DEPRECIATION	6.12
- Depreciation on equipment (5yr period)	6.12
Total	100.00

Appendix C – Review of Ziziphus availability in Tete Province, Mozambique

Myles Mander

Masau trees are extensively distributed along the drainage lines and floodplains of the rivers in western Tete. The trees are actively protected by the communities in the region, and large numbers of trees are located in the crop lands in alluvial soils (see Figure 1). Densities may go up to 20 trees per hectare. Vast stands on masua are visible along the Zambeze floodplain, and along other river floodplains in the region. There is likely to be some 400 trees per kilometre of river, where a modest floodplain of 200 meters is located on each bank of the major rivers.



Figure 1: The dark equal sized trees on the alluvial plain above are masau in crop lands.

Large stocks of trees are accessible in high densities along river, making commercialisation viable. The distribution of trees across crops lands will mean that any commercialisation has the potential to benefit a large number of residents. However, as the masua plays a key role in supplementing rural food consumption in the winter months, consideration will need to be given to ensuring that the most vulnerable community members are not denied access to the benefits of the fruit.

The trees fruit extensively in the winter months, with active harvesting taking place from June to August. Households harvest fruit from the trees in their crop lands, while the community at large harvest fruit from trees on boundaries, tracks and roads. The fruit is stored on the roofs in the region, with up to 50kg been stored per household (see Figure 2).



Figure 2: Masau stored on the roof for later use.

Households may also walk to more remote areas outside of villages in order to harvest communal trees, in order to supplement their own fruit stocks from crop land trees.

There appears to be limited local trading of the fruit in villages due to the abundance of the fruit available to all villagers. However, at the bigger towns, masua is traded to a limited degree as not all urban residents can access fruit.

There is reported to be a trade in fruit from Tete to Maputo, with vehicles driving up to the province to buy fruit from local villages. The fruit is then transported in pickup trucks from Tete to Maputo where it is sold in the informal fresh produce markets of the capital.