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BUSINESS PLAN

DEVELOPMENT: MORINGA

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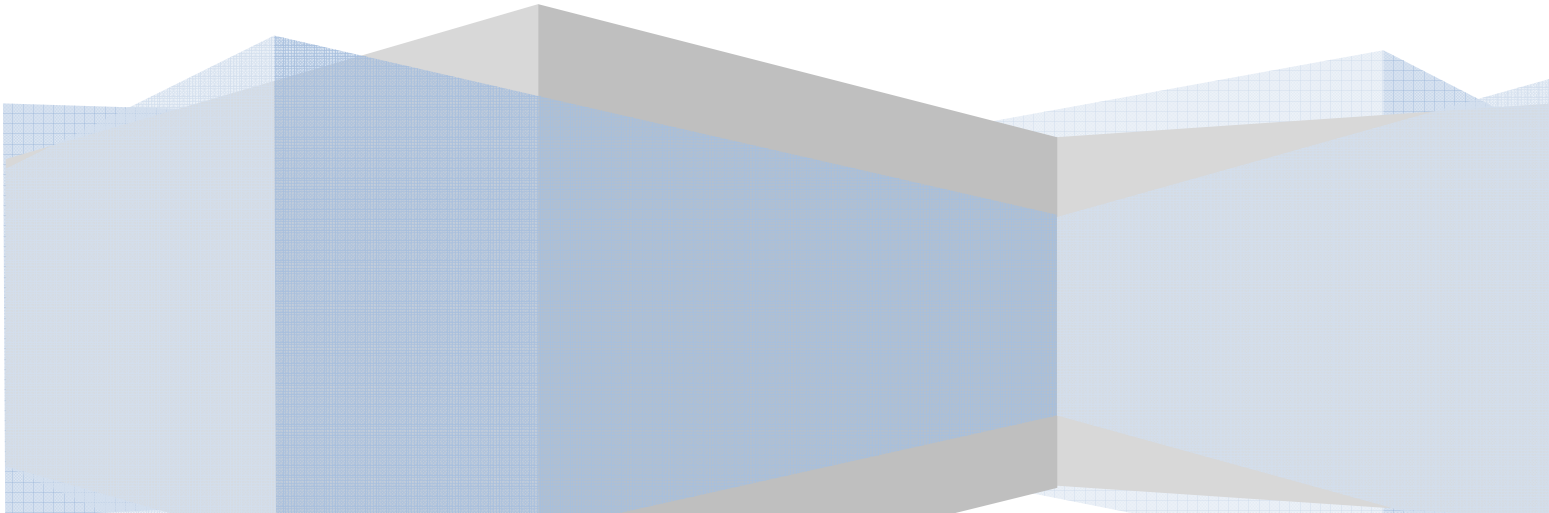

1. INTRODUCTION

Moringa has recently received a lot of attention in the press, yet few people understand the background and true value of the tree. Misconceptions are widespread. Many yield and income predictions are overstated and incorrect. This situation opens the door to unhealthy business practices that would only harm the moringa industry in the long run. All information supplied via the web and press, in general, have limited application to African conditions. This document must be seen as an introduction to the business plan development for potential Moringa projects in Africa. This is an introduction to the services that we as a consultancy group can render to possible investors and stake holders in the Moringa industry.

2. VISION

The vision of the team is to develop sustainable production systems for moringa and other crops that can be implemented in Africa for long term financial gain, job creation and poverty alleviation in rural areas. We work from a conservative and responsible point of view and favour an integrated farming system with the production of both primary and secondary moringa products and by thus reducing risk to the minimum and optimizing the potential for long term success of moringa and other projects. All recommendations are science based and if possible tested under practical production conditions.

3. CONSULTANCY TEAM

Prof E.S du Toit (PhD(Agric): Horticulture) is Associate Professor in the Department of Plant Production and Soil Science at the Faculty of Natural and Agricultural Sciences, University of Pretoria. Her main research interests include the development of plant propagation and cultivation protocols for potential multipurpose crops to be used in bio-fuel, food and medicinal industries. Prof du Toit published more than 30 peer-reviewed articles, 2 chapters, 9 technical reports, and several governmental documents related to the above. Her latest contribution as project leader was to write a business plan model for commercialisation of *Moringa oleifera* for poverty alleviation, job creation, food security and bio-fuel production for proposed sites in Gauteng Province.

The past 6 years her research mainly focused on developing innovative systems in plant production, including micro-propagation (organogenesis; somatic embryogenesis etc.) and conventional propagation (cuttings, air-layering and grafting etc.) protocols for tree and shrub species which are reliable and reproducible. Cultivation and post-harvest research were done in

order to create and transfer innovations that will facilitate the establishment of sustainable plant production systems for rural communities and small-scale farmers.

Currently, Prof ES du Toit is leading a research programme on developing potential crops for bio-fuel purposes in her Department which focuses mainly on tree species such as *Moringa oleifera, Pappea capensis, Jatropha curcas, Ximenia caffra etc.*

Mr DR du Toit (BSc (Agric) Plant Production, BSc (Agric) Hons Horticulture and B Hons Institutionis Agrariae) is an agronomist and horticulturist. He has 20 years experience in the set-up and management of commercial nursery greenhouse operations and horticultural consultancy. Recent bio-fuel and food security projects that Mr du Toit has been involved in include:

2005: Production of 100 000 saplings (*Moringa oleifera* & *Pappea capensis*) for Mafikeng Bio-diesel Company

2007: Feasibility study: Preliminary design and management proposal for the East Caprivi Irrigated Biodiesel Project. By Agro-Projects Dev. (N.Y) L.P (Israel) under Dr D Dvoskin for LL Biofuel Plt. Windhoek Namibia. The study included Biodiesel market analysis, assessment of proposed irrigated project area, assessment of potential crops (including moringa), initial investment costs, design of water delivery system and irrigation design, crop production systems including nursery set-up, economic and financial analysis including short and long term crop budget models, socio-economic impact and final business plan. The final report as well as recommendations are confidential and the property of LL Bio-fuels.

2008: Assessment of potential for Biofuel and production of Other Crops in Katanga Province, Democratic Republic of Congo. Submitted to Mei Golan, Navon- Levi Group (Israel) by Dr D Dvoskin and D.R. du Toit on behalf of Agro- Projects Dev. (N.Y) L.P (Israel).
In this study the potential for bio-fuel feedstock and other food crop production was examined for 3 areas in the Katanga province, DRK. The study included the assessment of current infrastructure, survey of production areas, soil sampling, assessment of water availability and quality for irrigation from the Congo River and other sources, current socio-economic conditions and potential impact. Recommendations of the report included potential investment into infrastructure, agriculture production systems, crop budget models, post harvest and industrial processing. The final report is confidential and the property of Mei Golan, Navon-Levi Group Israel.

2011: The Business Plan Model. Establishment and commercialization of Moringa crops for poverty alleviation, job creation, food security and bio-fuel production in proposed sites in Gauteng Province. Compiled for the Innovation Hub 2011. Part of team and responsible for on

farm cost and development of economic model for the production system. The final report is confidential.

4. BUSINESS PLAN DEVELOPMENT

The team is able to develop a business plan for any proposed production system and product to be produced. Depending on funding, different areas would be addressed. In general the plans consist of:

- General overview of Moringa/ crop (Horticultural aspects as well as current production)
- Production plan including Job creation, processing etc. (Developed to client's needs)
- Sapling production plan
- Economic model/plan including financials (needed for funding)
- Marketing overview and potential
- Contingencies and conclusion.

4.1 Overview of Moringa

Moringa oleifera Lam. belongs to a monogeneric family of shrubs and trees, Moringaceae. *M. oleifera* is cultivated throughout the Middle East and in most of the tropical belt. It was introduced in Eastern Africa from India at the beginning of the 20th century (Fuglie, 2001).

M. oleifera is a medium-sized tree that reaches about 10m in height. It has a straight trunk about 10-30cm thick with bark that is whitish grey, corky, with longitudinal cracks. It also has a tuberous taproot to tolerate drought conditions. The umbrella shaped tree comes with a loose crown of feathery foliage (National Research Council, 2006). The foliage is evergreen or deciduous depending on the environment. In season the tree is covered with creamy white, honey-scented flowers arranged in drooping panicles. Flowers are insect pollinated and require a large number of insect visitations, with bees the most common.

Figure 1: ***Moringa oleifera*** **leaf, flower and seed (Fuglie, 2001)**

Flowers and fruits (pods) occur once or twice a year depending on the climate, however, in tropical areas, flowering and fruiting may occur year-round (National Research Council, 2006). The fruits are initially light green, slim, and tender, but turn dark green and firm to brown at maturity stage. Most fruit shapes are straight but few are wavy and some curly. Fully mature dried seeds are covered by a lightly wooded shell with three papery wings (National Research Council, 2006).

4.2 Moringa tree uses

The Moringa tree has many potential uses, and as a result a great deal of research and development has been done. Moringa is regarded as the "poor-person's plant" with the promise to benefit rural Africa. It shows the capacity to provide many different foods and other profitable

uses with minimum growing and harvesting input. The tree can also be used to combat deforestation and to beautify streets and informal settlements.

Moringa leaves are an inexpensive source of proteins, vitamins and minerals for developing countries. It is reported that the leaves contain more beta-carotene than carrots, more protein than peas, more vitamin C than oranges, more calcium than milk, more potassium than bananas, and more iron than spinach. Dried and milled leaves are easily stored and used by families who can then add the powder to their daily meals. The powder can also be used by food businesses as a nutritional additive to their products. Moringa leaves can help decrease developing countries dependence on imported goods. Crushed seed of *Moringa oleifera* has been shown to be an effective natural coagulant for the treatment of river waters exhibiting relatively high levels of suspended solids (Fuglie, 2001). The leaves and twigs can be used as fodder for cattle.

Seeds of *Moringa oleifera* yield 25 - 30% of a non-drying oil, known as Ben oil, used for lighting, in arts and for lubricating watches and other delicate machinery. Oil is clear, sweet and odourless and turns rancid slowly, and as a result it is edible and useful in the manufacture of perfumes and cosmetics This oil resembles olive oil and may be of some value as a constituent of non-yellowing, non-drying plasticising alkyds It is highly valued by perfumers as it absorbs and retains fugitive odours.

For the development of potential investment opportunities the three main uses of moringa can be summarized as:

- Dried leaf powder for human an animal consumption
- Oil for human consumption and bio-fuel
- Leaf, twigs and press cake as animal fodder.

Production systems could be developed for single product use or for multi- product use.

Figure 2: Regrowth on pruned *Moringa oleifera* trees

Source: Moringa bio-fuels research: web.up.ac.za

NUTRIONAL VALUE OF THE MORINGA LEAVES

Figure 3. Nutritional Value of Moringa leaves (adapted from Palada and Chang, 2003)

In Africa a multi-purpose crop, such as the Moringa tree, will benefit the food, biofuel and several other industries. Several reports from Southern Africa strongly support that this "miracle tree" would benefit the rural communities of Africa in which large scale plantations will provide substantive real employment opportunities and provide a sustainable income for marginalised communities. Moringa produce can be consumed or sold as a food source, cooking oil, fodder, biofuel, as well as contribute to the improved quality of water supply in rural areas. This tree is a suitable candidate for commercial establishment in different areas in Africa, as it, despite

mostly naturally occurring in the tropics and sub-tropics, can tolerate higher temperature extremes and/or survive light frost and tolerates a wide range of soil and rainfall conditions.

Benefits and potential uses of Moringa tree products include:

- Leaves rich in vitamin C, potassium, calcium, protein and antioxidants, including flavonoids and carotenoids for human consumption.
- High quality cooking and edible seed oil
- Oxidative stable biofuel
- Seedcake for water purification
- Seedcake and plant material for feed fodder

The development of Moringa plantations to improve socio-economic conditions of rural communities is supported by various NGOs, the Trees for Life-, Church World Service- and Educational Concerns for Hunger organisations.

4.3 Production plan development

As Moringa is a multi- product plant, the first step would be to identify the main products that would be produced (leave powder, oil, feed fodder, etc). From this knowledge a specific production plan (plant density, pruning, harvesting and processing practices) and actions would be developed to optimize production of the specific product under specific growing conditions. It is also advised to develop an integrated farming system whereby primary products from the moringa tree can be used to produce secondary products on an in-farm basis.The secondary produce could be realized from cattle, pig or chicken farming and composting etc. Such an integrated system should stabilize income in volatile economic conditions and thereby minimize risk.

The cost of plantation establishment would be determined by the production system (low, medium or high density planting) used. In general this would vary from R 45 000 – R 150 000/ha. Indications are that a net profit of R 10 – R 15 per tree could be realized after year 3 with a mix product production system. At a relative low density planting of 3300 plants/ha this would realize a net profit of R 33 000- R 49 500/ha/year.

4.4 Job creation.

Moringa is an ideal vehicle for job creation and poverty alleviations in rural areas. From production plans developed by us, the indications are that around 300 permanent jobs are created form the establishment of every 1000 ha of moringa plantation. Seasonal jobs are not accounted for in this value.

Table 1: Estimated total products per annum at full production (as from year 4) on 1000 ha

Total products Per Annum as from year 4

Products/ Quantities	**ha**	**1000**	**Minus 5% waste**
Dried Moringa leaf powder	kg	902 500	857 375
Fodder from Pruning	kg	8 686 800	8 252 460
Oil	l	143 560	136 382

According to our preliminary research results with harvesting of trees (3-4 years old) at Hatfield Experimental Farm of The University of Pretoria, Gauteng, the following leaf yields were obtained:

Table 2. Preliminary harvest results.

Harvesting %	**Fresh mass (g)**	**Dry mass (g)**	**Dry mass (4 harvests/tree/year)**	**Dry mass per ha (3330 trees)**	**Remarks***
pruned					
25	895.23 g	200.60 g	802.40 g	2672 kg	Pod development guaranteed
100	2569.44 g	533.64 g	2134.56 g	7108 kg	Pod development not guaranteed
not pruned					
100	4583.68	572.96 g	2291.84 g	7631.8 kg	Pod development not guaranteed

*Climatic conditions not included in assumptions.

Figure 4. A tree of which 25% of foliage has been removed.

Figure 5. A tree of which 100% of foliage has been removed. The tree will survive this treatment as the buds in the axils of the current season branches are still intact.

Possible fodder from pruning estimate:

Year 1: no pruning, no fodder

Year 2

- 1.741 kg fresh weight /tree
- Fodder yield: 5 800 kg / ha/year

Year 3

- 2.40 kg fresh weight /tree
- Fodder yield: 8 000 kg / ha/year

Estimated animal fodder price: R 0.70/ kg

Press cake yield estimate:

- 18% oil yield from seed kernel
- For each kg oil, 4 kg press cake is delivered

4.5 Sapling production system (young plants)

Moringa is an easy germinator, but the production of quality saplings for field production is difficult. Young plants are prone to various insects, diseases and viruses and in general do not grow very good in bag grown nursery conditions. Through experience we have developed a successful sapling production system that addresses all difficult areas in the production of strong healthy saplings. We have designed and are in the process of manufacturing " THE MORINGA BAG " that produces better saplings that normal standard bags. Dosing and spray programmes have been developed and are implemented commercially.

Figure 6: *Moringa oleifera* seedlings in seedling trays :Source: Moringa biofuels research: web.up.ac.za

Figure 7: Moringa trees grown in plastic bags

Source: Moringa biofuels research: web.up.ac.za

4.6 Economic Model development

An Interactive economic model template for *Moringa oleifera* has been developed. The model links all technical, horticultural and economic data and serves as a financial decision making tool. It is the function of the model to incorporate all quantifiable assumptions, uncertainties and risk involved in the potential project. The model is used to forecast economic activity in such a way that conclusions can logically be related to assumptions. Assumptions that are used include, economic, pricing and yield assumptions. From the assumptions the Moringa crop budget on a hectare basis is developed. The Moringa crop budget summarizes all cost and potential income associated for Moringa production on a hectare basis. From the crop budget, job creation as well as cost of job creation can be determined.

The model also focuses on the investment needed, direct cost, indirect cost, depreciation, loan repayments and discounted cash flows. From these values the financials (income statement, cash flow analysis and balance sheet for 10 years) are complied. To determine the viability and rate of return the following discounted economic indicators are calculated namely: NPV (net present value) and IRR (internal rate of return). A sensitivity analysis is included to determine the sensitivity of NPV and IRR, if one or more of the main parameters in the crop budget changes. For these types of projects, yield and price constitutes the main risk and should be incorporated into the sensitivity analysis. A relevant economic model is developed for each specific production plan.

Economic model for Moringa olifera

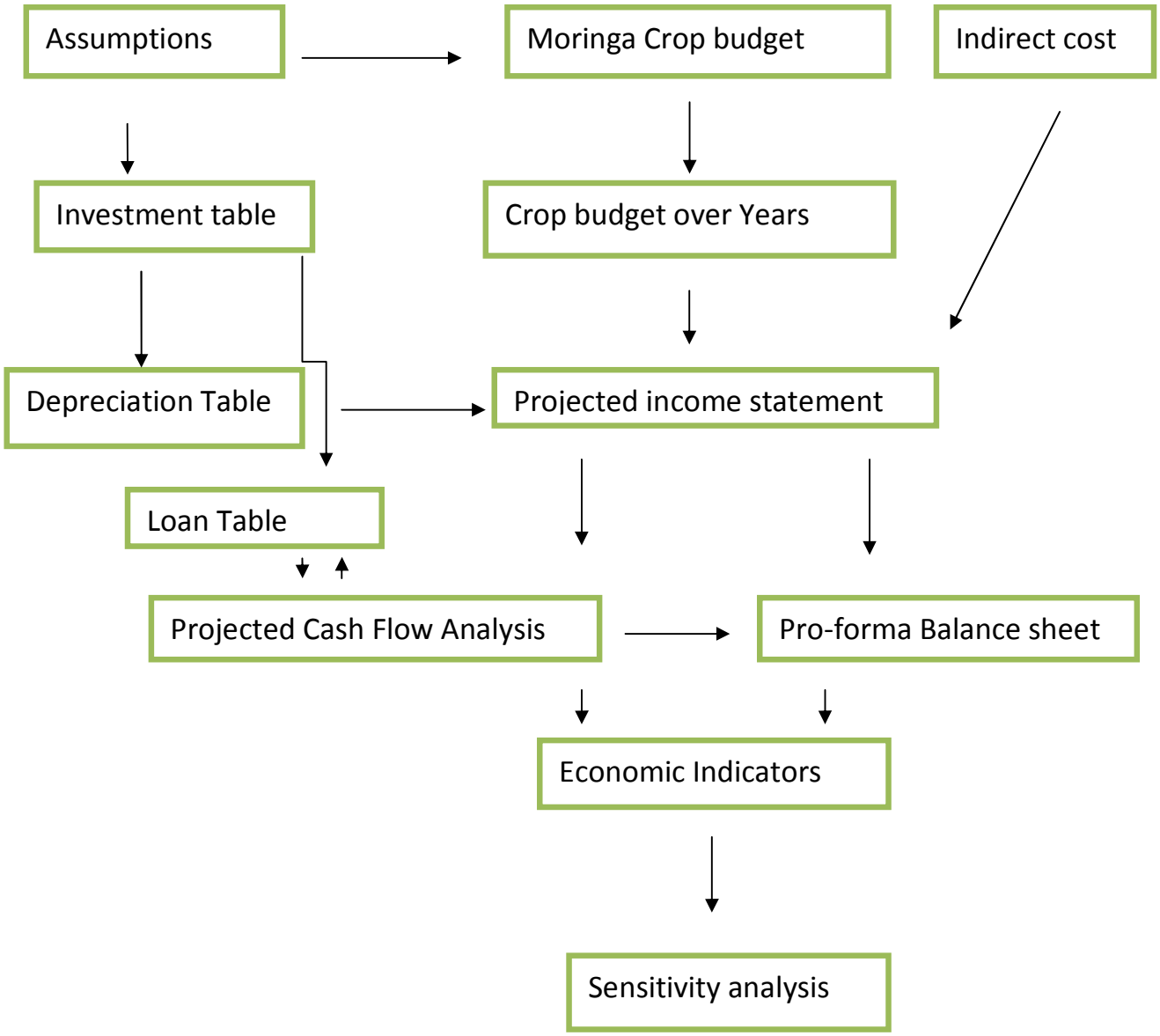

Figure 8: Economic model outline: *Moringa oleifera*

5. OTHER SERVICES.

We have established a commercial sapling production system set up for the production of field ready saplings. Depending on orders we have 80 000 plants in various growth stages on hand at any stage. Thus we can supply sapling at competitive rates for projects. We undertake contract growing for projects.

We can also assist in the set up and production systems for commercial nurseries for moringa sapling production.