

Feasibility Analysis of Leaf-Based *Moringa oleifera* Plantation in the Nigerian Guinea Savannah: Case Study of University of Ilorin Moringa Plantation

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ABSTRACT

This study examined the profitability and economic feasibility of a leaf-based Moringa production and processing under a plantation system in the Nigerian guinea savannah using the University of Ilorin Moringa Plantation as a case study. To achieve this objective, data on production and processing cost and revenue for the 2011/2012 planting season were collected and a simulated 10-year production and cost and revenue scenarios were scheduled based on the assumption of a constant cost and cash inflow over the same period. The cost-benefit was reported using the Return on Investment (ROI), Benefit Cost Ratio (BCR) and the Net Present Value (NPV) analyses. Result indicated an estimated average net profit of ₦827,109 (USD5,137) ha/annum from a Total production cost of ₦1,371,360 (USD8,580) ha/annum and a gross revenue of ₦2,200,000.00 (USD13,750) ha/annum derived from the sale of an average of 110kg of processed dry leaf powder output. This indicates the relative profitability of the enterprise. Furthermore, at varying discount rates of 17.5%, 20%, 22.5%, and 25%, the BCR indicated that for every ₦1 invested in cost, the investor could realize ₦1.60 in returns, the ROI indicate a profit return turnover of 26.7% of the cost of investment and a NPV estimate at the end of the 10-year period considered the project to be financially worthwhile. Based on these findings, this study recommends the encouragement of Moringa production and value addition development due to the potential it portends for income generation.

Key words: feasibility analysis, Moringa leaf and enterprise

INTRODUCTION

Moringa oleifera, is a multi-purpose food plant, which originated from India, and is produced and used in many African countries, South America (Nicaragua and Bolivia), and New Zealand. Studies have shown that Moringa is a Relatively inexpensive as a source of nutrition packed food and supplement for humans and animals and is rich in health-promoting phytochemicals, various vitamins and minerals (Becker and Siddhuraju, 2003). Moringa leaves have a characteristic distinctive, strong, mustard-like taste; they are a good source of provitamin A, vitamins B and C, minerals (particular iron) and the sulphur containing amino acids methionine and cystine, and are eaten as a supplement to the major staple foods. In the Northern part of Nigeria, the cooked leaves of Moringa are frequently eaten as the principal ingredient of a sauce. These leaves are generally

harvested from trees found within household gardens or planted as part of hedges around gardens.

The value chain for Moringa product, if properly developed, offers considerable investment opportunities, and potential job creation, foreign exchange earnings and export diversification for Nigeria. It provides several interesting products, of which leaves and oil seem to be economically most attractive. Moringa products are demanded at the international markets (USA, China, and India) mainly in the form of leaf powder tablets and drinks and are regarded as a healthy nutritious food supplement. The seedcake, a cheap by product of oil extraction can serve as an inexpensive, protein-rich feedstuff for livestock. In several African countries the local market for dried leaves and leaf powder is expanding as awareness of its nutritional benefits increases. Equally, demand is set to rise as the seed oil is used in the cosmetics industries and it is considered an alternative and cheaper source of biodiesel.

Despite the enormous potentials of Moringa, evidence on large scale production of the plant in Nigeria is relatively scanty. This may be due to inconsistent and unrealistic empirical findings on the economic feasibility and profitability of the plant under commercial plantation (Fodl et al, (2001); Gamatie and Saint Sauveur, (2006); Sogbo et al, (2006), Van der Heijden, (2011). In most cases, analysis on economic feasibility of Moringa cultivation did not come from existing Moringa plantations but from controlled and laboratory conditions which often reflect ideal conditions with regard to soil, rainfall, management, and markets etc, which in most cases do not exist in practice. Furthermore, cost and returns analysis of Moringa cultivation have principally been based on data collected from small-scale farmers which might not be representative of actual expected returns on investment as economies of scale might increase profit. Therefore, most published figures on inputs and Moringa yield are assumptions, extrapolations and consequently undependable Van der Heijden, (2011).

This study therefore examined the feasibility of leaf-based Moringa Plantation by the use of empirical data at the University of Ilorin, Ilorin, Nigeria. There is a well established Moringa Plantation at the University which can provide conservative and reliable data on cost and returns on investment which could be used in defining economic feasibility. The resultant feasibility report which is grounded on an empirical data can serves as a robust guide to potential investors, developmental agencies and governmental bodies for further decision making and policy formulation.

An Overview of Management Practices, Economics and Usages of Moringa

Moringa oleifera belongs to a family of trees that consist of 13 different species. It is native to the sub-Himalayan parts of Northern India, Pakistan, Bangladesh and Afghanistan (Fahey, 2005) and has been cultivated in many parts of the world for millennia particularly, the tropical countries (Fahey, 2005). It is a fast growing soft wood tree that can reach a height of around 10 meters. Several component parts have a huge economic value, including the leaves (dark green, feathery and 1-2 cm long), "flowers (cream coloured, 10-15 cm long) and fruits (or 'pods') it produces. Pods are initially green and turn brown and dry at maturity. Each mature pod contains 15 to 20 seeds.

Each tree may produce up to 3kg of seeds per annum (10,000-12,000 seeds or 600 pods at 20 seeds).

Moringa grows best in well-drained soils with pH of between 5.0 and 9.0 and in temperatures between 25 and 35°C and a rainfall range between 250 mm and 4,000 mm (Crosby, 2007; Palada and Change, 2003). However, studies have shown that agro-climatic conditions do have an impact on the anti oxidant and proximate composition of the plant (Iqbal and Bhanger, 2005). Moringa can be planted from seeds or from cuttings, however, direct seedling is a more preferred choice as the germination rate of Moringa seeds is high (Saint Sauveur and Broin, 2010). Seeds generally germinate within two weeks of sowing and seedlings are trimmed regularly to encourage branching (Amaglo, 2006; Palada and Chang (2003). For leaf production, it has been suggested that Moringa can either be planted as intensive production, semi-intensive production or as part of an agroforestry system, with spacing ranging from 0.75 m x 1 m to intensive culture of 10 cm x 10 cm (Sanchez et al, 2006). High density planting of between 300,000 to 1 million plants per hectare is optimal for biomass production. At this density, harvests need to occur every 35 to 75 days (Amaglo, 2006; Sanchez et al, 2006). For pod production, high density has a negative effect on yields so recommended spacing is 2.5 m x 2.5 m.

Moringa is fairly resistant to pests and diseases since its relatively fast vegetative growth allows it to regenerate quickly from any disturbance. However, fungal diseases like *Cercospora* spp., *Septoria lycopersici*, Root rot (*Diplodia* spp.), Powdery mildew (*Levellula taurica*, *Alternaria solani*) and insect pest like Grasshoppers, crickets, Termites, caterpillars represent the highest risks for Moringa plantations as they are hard to detect Saint Sauveur and Broin, (2010); Palada and Chang, (2003).

Productivity and reported yield value of Moringa leaf vary widely and are inconsistent across and within the same management practices

Table 1: Moringa Leaf-Cutting Yields across selected Countries and Management Practices

Country	Technique	Yield (mt/ha/yr)	Source
Nicaragua	Intensive (1 million plants/ ha, 9 harvests per year, irrigation, fertilization)	580	Foidl <i>et al</i> (2001)
Senegal	Intensive (1 million plants / ha, 6 cuttings per year, irrigation)	40-80	Olivier (n.d.)
Niger	Semi-intensive smallholder (1m x 1m, 18 harvests per year)	47	Gamatie and Saint Sauveur (2006)
Togo	Semi-intensive smallholder (1m x 1m, 7 harvests per year)	5-10	Sogbo <i>et al</i> (2006)
Benin	Semi-intensive smallholder (1m x 1m, 7 harvests per year, irrigation every 5 days)	6	Ogoudadja and Saint Sauveur (2006)
Benin	Intercropping (500 plants / ha, 6 harvests)	1-2	Ogoudadja and Saint Sauveur (2006)

Source: Muller and Rebelo (Assessed on 06/08/12)

Processing fresh leaves into leaf powder produces around 12.5% to 15% of leaf powder per unit of fresh leaves.

Table 2: Planting Density and Moringa Leaf Yield

Planting density (Plant/ha)	Fresh matter (metric ton/ha)	Dry matter (metric ton/ha)
350 000	29.7	5.05
900 000	52.6	8.94
1 000 000	78.0	13.26

Source: Muller and Rebelo (Assessed on 06/08/12)

Detailed processing costs under commercial production are rarely available. However, published figures for production costs under small scale managerial practices were calculated at USD 4.30 per kg of leaf powder in Senegal and in Benin at USD 2.80 (Ogoudaja, 2006).

Although there are still many gaps with regard to scientific knowledge about Moringa, most researchers agree that this tree has high potentials not only as a food source but also as a 'nutraceutical' (Siddhuraju and Becker, 2003). All parts of the Moringa tree have applications as food, biofuel, forage, plant growth hormone, medicinal, cosmetics, water treatment, Wood Paper and alcohol production applications. The Bark is used in rope making and gum for tanning hides. More importantly, many sources quote that an equal weight of Moringa leaves contain more beta-carotene than carrots, more iron than spinach, more potassium than bananas, more Vitamin C than oranges and more protein than peas' (Palada and Chang, 2003). Given these qualities it is considered to have high potential in combating malnutrition. A review of medicinal literature (Fahey, 2005) summaries the medicinal applications of Moringa as follows; Antimicrobial / Biocidal agent (especially against bacteria causing gastritis), Asthma, Cancer prevention (Tumor prevention, tumor inhibition, not proven yet in humans), prevention and treatment of Circulatory / Endocrine Disorders, Digestive Disorders, Inflammation, Nervous Disorders, Nutritional, Reproductive Health and Skin Disorders and a booster of immunity. The author however cautioned that most of these results have not been verified through a placebo-controlled, randomized clinical trial, nor published in well-known scientific journals.

METHODOLOGY

The present study was carried out in Kwara State, Nigeria. The state has two main climatic seasons; the dry and wet season. The natural vegetation comprises wooded and rainforest savanna, with annual rainfall ranging between 1000 to 1500mm while the average temperature lies between 30°C and 35°C. Over 90 percent of the rural populace is involved in farming (KWADP, 1999). Agriculture is the mainstay of the economy in Kwara State. Varieties of cash and food crops produced include cereals, tubers, cocoa, kola-nut and livestock (KWADP, 1999).

Specifically, primary data was purposively sourced from the University of Ilorin Moringa Plantation located in Kwara State, Nigeria. The University has an established pilot-scale Moringa plantation. Moringa seedlings were transplanted from nursery to the field at a planting density of 4,444 Moringa seedlings per hectare. Data collected were on cost of fixed and variable inputs used in the management and production as well as estimate of yield of leaf output in kilogram, price per unit output of processed leaves and the total revenue from the sale of dried Moringa leaf. Data on production cost used were estimates of land lease, land clearing, land preparation, supervision, blender, fertilizer, herbicide, seedling planting, Planning and management (logistic), Risk management and operational staff. Data on benefits were equally collected on output of leaf yield per annum, unit sale price of packaged Moringa dried leaf at the current market price in Ilorin market, cost of packaging and processing of Moringa leaf powder.

LIMITATIONS OF THE STUDY

The authors of this study consider this study representative of what Moringa farmers in the study area may anticipate in terms of costs and yield. However, due to some underlying basic assumptions used in gathering the data used in this study, cautions that different factors may alter the costs and benefits reported in this study when compared with a particular individual's

operation. The primary value of this report is to identify the type of inputs, yields, and costs considered to be typical of well-managed Moringa enterprise in the guinea savannah. As such, it should be helpful in estimating the physical and financial requirements of Moringa plantations in several other plantations in the same agro-ecological zone to test the representativeness of the data reported in this study.

Analytical Technique

Empirical data formed the foundation for deriving the economic indicators used in estimating the profitability and economic feasibility of the Moringa dried leaf production under plantation system venture. These economic indicators are;

Cost and Returns Analysis

$$\text{Net Benefit} = \text{Gross Revenue} - \text{Total Production Cost} \dots\dots\dots (1)$$

Where, Gross revenue = Quantity x Price;

Total Production Cost = Total Fixed Cost + Total Variable Cost

Benefit-Cost Ratio (BCR)

The Investment Decision Model also utilizes the Benefit-Cost Ratio, which is another indicator of the worthiness of an investment decision. It is given as the ratio of the sum of discounted benefits to the sum of discounted costs. Thus, for a cycle of 10 years duration, the benefit-cost ratio can be represented by the formula:

$$\text{BCRI}_{i,t} = \sum_{t=0}^{10} \left(\frac{\text{DREV}_{i,t}}{\text{DTC}_{i,t}} \right) \dots\dots\dots 2$$

Where:

$\text{DREV}_{i,t}$ = discounted revenue (benefits) per hectare from i-year-old Moringa in year t;

$\text{DTC}_{i,t}$ = discounted total costs per hectare from i-year-old Moringa in year t;

The decision rule is that for any project to be economically viable, the ratio must be greater than unity (Brealey and Myers, 1991; Bierman and Smidt, 1988).

Returns on Investment Analysis (ROI)

The Return on Investment (ROI) is similar to BCR, but compares the net benefit (total discounted benefits minus total discounted costs) to costs. To estimate the ROI, we first calculate the net benefits, and then divide the net benefits by the total costs. The result of the ROI is typically expressed as a percentage. The ROI indicates how much of the investment policymakers can expect to receive as a benefit.

The Discounted Net Present Value (NPV)

This discounts the values of future earnings and losses to provide for today's values. For this analysis, an appropriate discount rate needs to be chosen. Following Brealey and Myers, 1991 and Luehrman, 1998) the net present value of the expected cash inflow from one hectare of Moringa in year t for a 10 years duration amounts to:

$$V = \int_0^{\infty} e^{-pt} E[(PtQ_w, t) - (PtQ_o, t - C_o, t)] dt \dots\dots\dots (3)$$

Where p is the real discount rate; t is the time period; E is the expectations operator; P is the output price; Q is the output quantity; C is the variable costs of production; and subscripts w and o indicate production with and without the investment respectively. The acceptance rule adopts projects where incremental net revenues are greater or equal to incremental investment costs (V = I). The formal selection criterion for the net present value is to accept investments with net present value greater than zero. Hence the revenues are insufficient to allow for the recovery of the investment. An investment is technically and economically feasible if the net present value is positive. We decided on a realistic discount rate of 17.5%, 20%, 22% and 25% based on the prevailing interest rates available for medium-term loans in commercial banks in Nigeria.

RESULTS AND DISCUSSION

Gross Margin Analysis of Moringa Leaf Production and Processing

The depreciation schedule of inputs used in Moringa production and processing activity is presented in Table 3.

Table 3: Depreciation Schedule for Fixed Inputs used in Moringa Leaf Production and Processing

Items	Expected lifespan (yrs)	Quantity	Unit cost (N)	Total cost (N)	Annual depreciation (N)
Blender	10	1	150,000	150,000	15,000
Knapsack sprayer	10	1	20,000	20,000	2,000
Spade	10	2	1,000	2,000	200
Machetes	10	2	1,000	2,000	200
Hand trowels	10	5	500	2,500	250

Source: University of Ilorin Moringa Plantation, 2011/2012 season

As revealed in the Table, the inputs are expected to have an average lifespan of 10 years and are assumed to possess zero salvage value at the end of their productive use.

Estimated Average Annual Cost Analysis of Moringa Leaf Production/ha

The result of the estimated fixed and operating costs of Moringa dry leaf production and processing are presented in Table 4.

Table 4: Estimated Average Annual Cost Analysis of Moringa Leaf Production/ha

Items	Cost (₦)\ Annum	% of total Investment cost	Total
Cost			
Land-lease	15,000	0.0542	
Land clearing	9,600	0.0347	
Factory house rent	120,000	0.4338	
Plantation management and logistic	84,710	0.3062	
Pest and disease prevention and control	30,000	0.1085	
Blender	15,000	0.0542	
Knapsack sprayer	2,000	0.0072	
Spade	200	0.0007	
Machetes	200	0.0007	
Hand trowels	250	0.0009	
Seedlings (N100 each)	444,400	0.406	
Labour (2 permanent workers for weeding, harvesting and processing)@ N18,000 each/month	432,000	0.395	
Utility bills	30,000	0.027	
Labeling and Packaging	120,000	0.110	
Fertilizer (@N100/kg)	15,000	0.014	
Fertilizer application 2 man-day	2,000	0.001	
Miscellaneous expenses @ 4% of cost	51,000	0.048	
Total Operating Cost			
Total Production Cost (TPC)			1,371,360

Source: University of Ilorin Moringa Plantation, 2011/2012 season

As shown in the Table, the estimated annual mean investment outlay is N276, 960 (Table 4). This covered the cost of land lease, Management and logistics, factory rent, pest and disease prevention and control and depreciated fixed inputs of production. The fixed cost outlay represents about 20% of the total production cost of the Moringa leaf production and processing enterprise. The Table also reveals the estimated annual mean operating cost of leaf based Moringa plantation production and processing enterprise. The Table indicates an average mean operating cost of 1,094,400 which represents about 80% of the Total production cost outlay (Table

4). This cost covers seedling cost, labour cost, labeling and packaging cost, fertilizer, utility and other miscellaneous expenses at 4% of the Total production cost.

Gross Margin Analysis of a Leaf-based Moringa Plantation Production and Processing
The gross margin analysis of Moringa dried leaf production and processing enterprise under a Plantation system is presented in Table 5.

Table 5: Estimated Gross Margin Analysis of Moringa Leaf Production and Processing/ha

Items	Quantity (Kg)	Unit Price (N)	Total	Net profit
Dry Leaf Yield of Moringa crop/ha	120			
Gross revenue (from actual sales)	110	20,000	2,200,000	
Total production cost			1371360	828,640

Source: University of Ilorin Moringa Plantation, 2012/2012 season

According to the Table, revenue is derived from the sales of the dried leafy part of the Moringa plant. Actual revenue from the sale of 1 kg of Moringa dried leaves was ₦20,000.00 and at a saleable average of 110kg per ha, a gross revenue of ₦2,200,000 (\$13,750) is expected /ha/annum (Table 5). By deducting costs from the gross revenue, a mean net profit of ₦828,640 (USD 5,137) was obtained from 1hectare per annum.

Feasibility Analysis of Moringa Dried Leaf Production under a Plantation System

Feasibility analysis involves the determination of how viable an enterprise is. The Net Benefit analysis in the preceding section gives us a rough estimate of profitability of the Moringa enterprise but, it lacks a very important component, namely time. Because money has time value, the best way to compare cash flows that occur at different times is to convert all those cash flows to their present values in order to determine its economic feasibility. The techniques used in this study for the determination of enterprise viability are the Net Present Value (NPV), Returns on Investment (ROI) and Benefit-Cost Ratio (BCR) analysis.

The result of the economic feasibility indicators; the NPV, BCR and ROI are presented in Table 6.

Table 6: Estimated Net Present Value (NPV) of a Leaf-Based Moringa Production and Processing at Discount rates of 17.5%, 20%, 22.5% and 25%

Year	@ 17.5 Discount rate		@ 20% Discount rate		@ 22.5% Discount rate		@ 25% Discount rate	
	Cash Inflow	Cost	Cash inflow	Cost	Cash inflow	Cost	Cash inflow	Cost
1	1872340	1167114	1833333	1142800	1760000	1097088	1760000	1097088
2	1593510	993307	1527778	952333.3	1466667	914240	1410256	879076.9
3	1356350	845474	1271676	792693.6	1202186	749377	1128205	703261.5
4	1154249	719496	1062802	662492.8	977777.8	609493.3	901639.3	562032.8
5	982581	612487	887096.8	552967.7	797101.4	496869.6	721311.5	449626.2
6	836183	521231	735786	458648.8	650887.6	405727.8	577427.8	359937
7	711513	443518	614525.1	383061.5	531401	331246.4	461215.9	287496.9
8	605560	377475	512820.5	319664.3	433925	270485.2	369127.5	230094
9	515343	321236	427184.5	266283.5	354267.3	220830.9	295302	184075.2
10	438596	273397	355412	221544.4	289093.3	180205	236305	147299.7
Total	10066225	6274735	9228414	5752490	8463306	5275563	7860791	4899988
NPV	N3,791,490		N3,475,924		N3,187,743		N2,960,803	
BCR	1.604							
ROI	27.6%							

Source: University of Ilorin Moringa Plantation, 2011/2012 season

As shown in Table 6, it is observed that the Moringa leaf production enterprise at discount rates of 17.5%, 20%, 22.5%, and 25% is feasible and viable. The returns on Investment (ROI) of University of Ilorin Moringa Plantation were 27.6%. This implied that the investment (i.e., the cost) will generate a return (i.e., net benefit) that amounts to 27.6% of the cost of the investment. The ROI is a relative measurement of how much of the investment investor can expect to receive as a benefit. If the ROI is positive, the benefits exceed the costs and the investment should be considered. A negative ROI means that the costs outweigh the benefits. An ROI of 0 means the benefits equal the costs.

Equally from Table 6, we estimated the BCR at 1.6 at the same prevailing discount rates. A benefit-cost ratio of 1.60 means investors can expect ₦1.60 in benefits for every ₦ 1 in costs. Clearly, because the BCR is greater than 1, the benefits outweigh the costs and the investment is considered relatively feasible. Had the ratio been less than 1, the costs would outweigh the benefits and alternative advice would be followed as regards feasibility of project. If the BCR is equal to 1, the benefits equal the costs.

The estimated Net Present Value of a hectare of Moringa Plantation at 17.5%, 20%, 22.5% and 25% discount rates were ₦3,791,490 (\$23,696), ₦3,475,924 (\$21,999.11), ₦3,187,743 (\$20,175), and ₦2,960,803 (\$18,739). This value reflects the absolute net benefits of the Moringa Plantation in Naira terms. A positive NPV means that benefits outweigh costs and the investment should be considered. A negative NPV means that the costs outweigh the benefits. An NPV of 0 means the benefits are equal to the costs.

This result of our analysis confirms the economic sustainability prospect of the University of Ilorin, Moringa Plantation Management system. The Returns On Investment (ROI analysis), Benefit Cost Ratio Analysis and the NPV all confirmed positive and hence we accept the decision that the Moringa enterprise is a feasible enterprise at prevailing discount rates.

The analysis in this study is premised under the following modest and realistic facts:

1. a total of two harvests leaf is made each year and maintained for the 10 year period;
2. the analyses was based on discount rates of 17.5%, 20%, 22.5% and 25%;
3. the harvested part of the Moringa tree processed for sale was exclusively the leafy part, and the stalk, stem and other fibrous part were left out;
4. a total of 4,444 Moringa seedlings were established on 1 ha of plantation;
5. based on the local market demand in University of Ilorin, a modest sale of 110kg of dried Moringa leaf is estimated to be absorbed each year and
6. a kilogram of dried Moringa leaf powder is sold for ₦20,000.00.

CONCLUSION AND RECOMMENDATIONS

This study conducted a 10-year economic feasibility analysis of production and processing of leaf-based Moringa enterprise under Plantation system using primary data and simulated estimates from University of Ilorin Moringa Plantation. The result showed that a mean annual net profit of ₦828,640 (USD 5,137) was obtained from one hectare and cumulative net returns of ₦8,286,400.

However, at varying discount rates of 17.5%, 20%, 22.5% and 25%, the Benefit Cost Ratio indicated that for every ₦1 invested in cost, the investor could realize ₦1.60 in returns indicating the relative profitability of the enterprise. Equally, the Return on Investment Analysis indicated that the enterprise could generate a return (i.e., net benefit) that amounts to 27.6% of the cost of the investment. Finally, the NPV estimates reflect that the Moringa Production and Processing enterprise under Plantation system benefits outweigh costs and the investment should be considered.

This study, which is based on empirical and some estimations show the type of inputs, yields, and costs considered to be typical of well-managed Moringa enterprise in the guinea savannah; hence

it is meant to be an investment guide for prospective investors in to the Moringa plantations enterprise. Although it still remains unclear what the yield and profitability results would be if there are other products of interest aside from the leaves which this study focused on and what would be the effect of intercropping and planting Moringa under an irrigation system on yield and profitability.

Given the feasibility of this enterprise and the potential it carries for sustainable development, income generation and job creation; it is recommended that governments and non-governmental bodies should encourage Moringa production, consumption and value addition activities with the ultimate aim of nutritional security, youth empowerment, liberation of rural communities from existing poverty traps and export diversification in Nigeria.

The relatively high operating expenses of Moringa leaf value chain development could serve as a disincentive for would-be Moringa farmers who may be resource-poor, hence, commercial banks should be compelled by legislation to reserve a reasonable portion of their portfolios for Moringa value chain development at relatively low interest rates. In other words, this study advocates for a type of selective credit policy which would make funds to be available to interested individuals who wish to venture into this enterprise. To facilitate this, farmers may be formed into cooperatives with each group focusing on a particular segment of the Moringa value addition process from input provision to production, processing and marketing.

Furthermore, it is recommended that a follow-up study of the estimate of the true size of Moringa leave market, demand and supply elasticities and requirements for growth which should be in line with any increase in production of the leaf product be conducted. The required studies are now underway.

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