



**THE EASTERN AND SOUTHERN AFRICAN MANAGEMENT INSTITUTE
MSM/ESAMI DOCTORATE OF BUSINESS ADMINISTRATION DEGREE**

**THE DEVELOPMENT OF JATHROPHA-BASED BIOFUEL
IN TANZANIA AND ZAMBIA
(building competitiveness and sustainability in the bio-fuel sector – the
value chain approach)**

**THE LOCAL JATROPHA-BASED BIOFUEL VALUE
CHAIN ANALYSIS IN TANZANIA**



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In Partial fulfilment of the requirements for the award of Doctorate Degree
in Business Administration**

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May, 2008

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Acronyms

KAMA	KAMA Herbal Products Limited
JPTL	Jatropha Products Tanzania Limited
KAKUTE	Kampuni ya Kusambaza Teknolojia
MMA	Match Makers Associates
ARI-MONDULI	Alternative Resources Income project for Monduli women
FAIDA MALI	FAIDA Market Linkages Company
FAIDA-SEP	Finance and Advice in Development Assistance for Small Enterprise Promotion
SVOs	Straight Vegetable Oils
UNEP	United Nations Environmental Programme
TaTEDO	Tanzania Traditional Energy and Environmental Development Organisation

1. Introduction

Tilman Altenburg July 2006 (rev. 9 January 2007) quoting Downing et al. (forthcoming) defines a value chain as “the full range of activities that are required to bring a product from its conception to its end use. These include design, production, marketing, distribution, and support to get the product to the final user. The activities that comprise a value chain may be contained within a single firm or may embrace many firms. They can be limited to a single country or stretch across national boundaries.” This paper is about biofuel value chain analysis in Tanzania and relates specifically to the production, marketing, distribution and support of *Jatropha*-based biofuel.

Janske van Eijck and Henny Romijn (2007) in their research paper on “Prospects for *Jatropha* biofuels in Tanzania: An analysis with Strategic Niche Management” conclude that “the development of a *Jatropha*-based biofuels sector in Tanzania is still in a very early phase, and that its future is still unclear. Despite the favourable constellation of many contextual ‘landscape’ factors, there remain prominent barriers within Tanzania’s existing energy regime and agricultural regime. These include structural infrastructural and logistical problems; technical skill and knowledge gaps; a limited local research infrastructure; vested interests of powerful actors in the extant energy regime; cultural barriers associated with traditional uses of *Jatropha*; psychological obstacles emanating from known poisonous qualities of the crop; and a considerable price disadvantage for *Jatropha* oil except in remote locations. Moreover, the government’s role has not been facilitative enough.” The little research that has been done to date and the literature available reveals the following situation in as far as the development and production of *jatropha*-based biofuel in Tanzania.

2. The commercialisation of *Jatropha* in Tanzania

A conference handout on Biofuels for transportation submitted at a conference in Germany (2006) on Global Potential and Implications for Sustainable Agriculture and Energy in the 21st century states in part that “currently, there is no commercial biofuels production in Tanzania. However, several stakeholders are engaged in the development of biofuels, such as FELISA (palm oil), KAKUTE, Diligent, PROKON and D1 Oils (*jatropha* oil) in the field of commercial biodiesel production as well as the 4 main sugar companies (Kilombero Sugar Company, Mtibwa Sugar Estates, Kagera Sugar Limited, Tanganyika Planting Company) in the field of sugarcane-based bioethanol production.

Roughly, the handout continues, the current biofuels activities and opportunities in Tanzania can be divided into large-scale and small-scale approaches. Thereby, large-scale biofuels production, such as the production of ethanol from sugarcane promoted by the sugar industry, will have a prime focus on biofuels for transportation and will require supportive policies and regulations in place for

start-up in order to secure the rather large investment required. On the other hand, smaller-scale activities by organisations such as FELISA and KAKUTE are currently mainly concerned with the creation of rural income and revenue opportunities from oil seed crops, either through the production of plant oils (for food and/or fuel) or other commodities such as soap production from jatropha oil.

In a study conducted by Match Maker Associates Ltd.,(MMA) June 2007 on the “The Jatropha sub sector: With emphasis on Jatropha Soap Value Chain in Arusha and Manyara regions they report that “In Tanzania, Jatropha has been used as living fence for many years by agro-pastoralists especially the Maasai in the semi arid areas of north-eastern Tanzania. It was not used otherwise until 2000 when McKnight Foundation through HPI gave funds to develop the commercial use of Jatropha in order to support rural marginalised women in Arusha and Manyara regions. KAKUTE was then commissioned by HPI to be implementing agency of the project.”

MMA (2007) continues to say that “The Jatropha commercialisation was initiated as Alternative Resources Income project for Monduli women (ARI-MONDULI). This project spanned between June 2000 and October 2007¹ and is funded by The McKnight Foundation of USA and executed by HPI-Tanzania. HPI contracted KAKUTE Limited to manage the day-to-day activities of the project in collaboration with FAIDA-SEP and UNDP-GEF Cross Border Project. Specifically, FAIDA-SEP (currently FAIDA MALi) was responsible in the supervision of market study and market linkages activities. UNDP-GEF Cross Border Project was responsible in the management and supervision of the demonstration sites and assisted FAIDA-MALi with market study.”

The purpose of the project MMA (2007) reports “was to help reduce bio-diversity loss while increasing household livelihood security and income of rural women. The project, therefore, promoted the Jatropha crop through provision of seeds, seedlings, cuttings together with technical assistance, training, extension, production and marketing so that at the end of the project the result will be a well developed subsector with new rural industries of soap making and fuel production through which rural women can increase their income.”

Janske van Eijck et al quoting Chachage (2003) say that the Jatropha plant is easy to establish and drought resistant. It can grow up to 8m high and is not browsed by animals. Therefore, it has been traditionally used as a hedge, and as markers for graves. It can live up to 50 years and can produce seeds up to three times per annum.

3. Mapping of the jatropha-based biofuel value chain in tanzania

3.1 Functions

Janske van Eijck et al (2007) have identified three major functions that take place in the jatropha production chain to include cultivation which pertains to growing the jatropha plant and harvesting the seeds; production (or processing) which includes the activities of pressing the seeds to expel the oil, leaving the seedcake; and the usage stage, where the oil and seedcake are consumed or further processed to generate final products.

MMA (2007) identifies similar functions and activities as quoted above namely the supply of seeds, seedlings, cuttings and technical assistance, training, extension, production and marketing.

A feasibility study conducted by Diligent Energy Services and Ameco Environmental Services of the Netherlands (2006) for UNEP on Local Biofuel Production for Use in Telecommunications Applications in South Eastern Tanzania in Mtwara and Lindi regions identifies the following functions related to the biofuel production in Tanzania. Cultivation and production to include the identification of appropriate crops, planting and harvesting, processing for Straight Vegetable Oils (SVOs) to include pressing and filtering and processing for biodiesel and consumption (usage) either of SVO to engines with some slight engine modification or of biodiesel straight to engines. The study also identifies the marketing function as part of the chain.

3.2 Stakeholders (actors)

MMA (2007) identifies the following stakeholders (actors) in the jatropha-based biofuel up to oil production namely producers/collectors, collection centres, agent/transporters and Diligent Tanzania. The chain extends to KAMA, Distributors, Medical Stores and Supermarkets in soap production chain. In a discussion held with Janske van Eijck, the General Manager of Diligent (T) Ltd (January, 2008) the SVO production chain extends to tour operators in Arusha at the consumption stage.

The study by Diligent Energy Systems and Ameco Environmental Services (2006) identifies a number of possible stakeholders (actors) in the biofuel chain in Tanzania to include clients for biofuel (SVO or biodiesel) namely Rural Netco (Ericsson), Regional fleet owners; and Retail fuel traders at local markets. Agricultural producers to include smallholder farmers (individual or in farmer groups), large farmers operating as contract farmers (outgrowers), and plantation owners. Processors (oil pressing and processing, storage, marketing) to include private businesses, and farmer associations or groups. Government

(regulation, taxation and duties, land provision, infrastructure) to include National and Regional/local, other stakeholders listed include Financiers local/regional microfinance organisations and SACCOs, National banks, Investment funds & private equity, Subsidy schemes. Knowledge providers are also listed by the study as potential stakeholders to include Dar es Salaam University, Naliendele Agricultural Research Institute, Mtwara and expert NGOs (TaTEDO), Consultants.

3.3 Market segments

In their study MMA (2007) report that the present value chain is not fully driven by the market focus. There is still a lot of production drive. Understandably, there is a tension between market development and production base development at this stage of the value chain. Any future success however, can only be achieved with developing ability to read the market and respond to it.

They noted further that a lot of promotional campaigns through consumer mobilisation to test the product, raising awareness through participation in trade fairs (recurrent participation in Nane-nane agricultural shows), and production of leaflets and pamphlets available in outlets and in different spot areas. All these are considered efforts worth sustaining for future success

The study by Diligent Systems and Ameco (2006) report that in the case of biofuels, in Tanzania the demand is presumably very large, although much of it is still latent. Potential clients include:

1. organisations (community based or private) providing electricity with generators for rural villages;
2. energy depending companies seeking (backup) power supply by generators;
3. regional fleet owners; and
4. retail fuel traders at local markets

The first two groups of clients (which would include Rural Netco Ltd) the study says, could be quite easily served with SVO (or biodiesel), if production was available. Companies piloting biofuel production such as Diligent find that they receive many requests for supplies from such customers, which they currently cannot meet. In addition to production and selling of SVO, such clients may need some additional technical assistance to help address questions regarding required modifications, warranties and quality control, but this would not amount to a major challenge.

If the number of clients becomes larger, the study says, the need to establish more elaborate marketing and sales capacity would also increase. Servicing groups 3 and 4 requires SVO or biodiesel to be sold

as a transport fuel, which may be more complex from an administrative (taxation, licensing) and technical (biodiesel production, quality control) point of view. In particular the administrative aspects remain difficult to assess, as the government is still elaborating its policy. The study also says wholesale selling to retail traders may also require a more elaborated marketing and sales capacity.

The study concludes that for the assessment of the feasibility of the project, the market demand from groups 1 and 2 is already more than sufficient for any project that can be implemented in the near future. The feasibility of the project, and the scope at which it should be implemented, therefore depends much more on the potential of entrepreneurs and investors to develop production capacity, and their ability to control costs such that end products can be sold at prices competitive with conventional fuel.

3.4 Governance

In their study MMA (2007) observe that governance in a value chain exhibits the degree of organisation and interactions in a value chain. In *Jatropha* case, there are many actors, as exhibited in the map below, starting from producers, collectors, agents, oil processors, soap manufactures, distributor and marketing outlets etc. The key question is if there is any governance in this chain? Probably due to the fact that the chain is still developing there is presently very little governance exhibited by any actor or outside agent in this chain. Suppliers' contracts at different points in the chain are just being developed with the main objective of securing sufficient supply. Parameters regarding quality and mechanism for quality control are not yet in place.

In the chain as charted out below, Deligent (T) Ltd is the firm that is next to the final consumer and going by the assumptions in the value chain analysis, it should take the leading role in this chain. However, the MMA (2007) study says "the key partners in the chain are lined up but their commitment to each other is still very low. Diligent Tanzania is willing to treat KAMA as a preferential buyer but is unwilling to enter a fixed agreement. Also, the relationship with the distributor is still to be developed." However, if we go by the current relationships that exist between Deligent (T) Ltd and the small farmers, collection centres and commercial farmers, Deligent is the lead firm. It buys seeds from the outgrowers and provides them with seeds in return and technical assistance. According to the General Manager of the company, It also sets the price of the seeds they buy from the small farmers and some of SVO they sell to KAMA.

The governance issues, though, are still to a large extent exercised by the Government. The feasibility study conducted by Deligent Energy Systems and Ameco Investment Services (2006) observe that "the Tanzanian

government welcomes private investors to invest in the agricultural sector. Because of the number of requests for large areas for oil holding crop production and the cross-ministry involvement of the production and use of biofuel, a Biofuel Task Force has been established to streamline all policies and regulation. A. Keamey (2006) lists the following mandate for the National Biofuel Task Force:

- Designing biofuels policies and regulations suitable for Tanzanian conditions (e.g. mandate, obligation, tax breaks, enabling fuel standards)
- Ensuring co-operation between Ministries involved in the development of biofuels policies
- Acting as an information channel between Government and biofuels stakeholders
- Establishing biofuels demonstration facilities
- Encouraging the sale of flex-fuel vehicles and vehicles which run on Pure Vegetable Oils
- Designing financing options (e.g. capital allowances, tax breaks) and set-up incentives for (local and foreign) investors
- Securing international funding for biofuel development, such as the EU Partnership Dialogue Facility, the FAO International Bioenergy programme, and the G8 Global Bioenergy Partnership
- Promoting applied research and development
- Promoting awareness of the benefits of biofuels among the population

The expectation was that at the end of 2007 all policies and regulations regarding the development of biofuels in Tanzania would have been established and put in place.

3.5 Jatropha-based biofuel value chain in Tanzania

Figure 1 below presents the Jatropha-based biofuel value chain as it at present. MMA (2007) report that Diligent Tanzania Ltd is active in renewable energy services related to the production, promotion and usage of vegetable oil, Jatropha oil. They are producers of Jatropha oil and biodiesel for transportation fuel purposes and offer consultancy services for anyone who wants to grow or use Jatropha. Diligent Tanzania Ltd. is continuously researching all aspects related to vegetable oil. Their office is located in Arusha, but their activities stretch to a much larger area of Tanzania and Africa. Diligent Tanzania Ltd. currently promotes the cultivation of Jatropha Curcas and provides farmers with a guaranteed market for their seeds. The seeds are processed into oil, called biofuel, which can be used as diesel substitute. They are related to the Dutch

company, Diligent Energy Systems, (www.diligent.nl) and a flower seeds company, Multiflower, located at the same premises in Arusha.

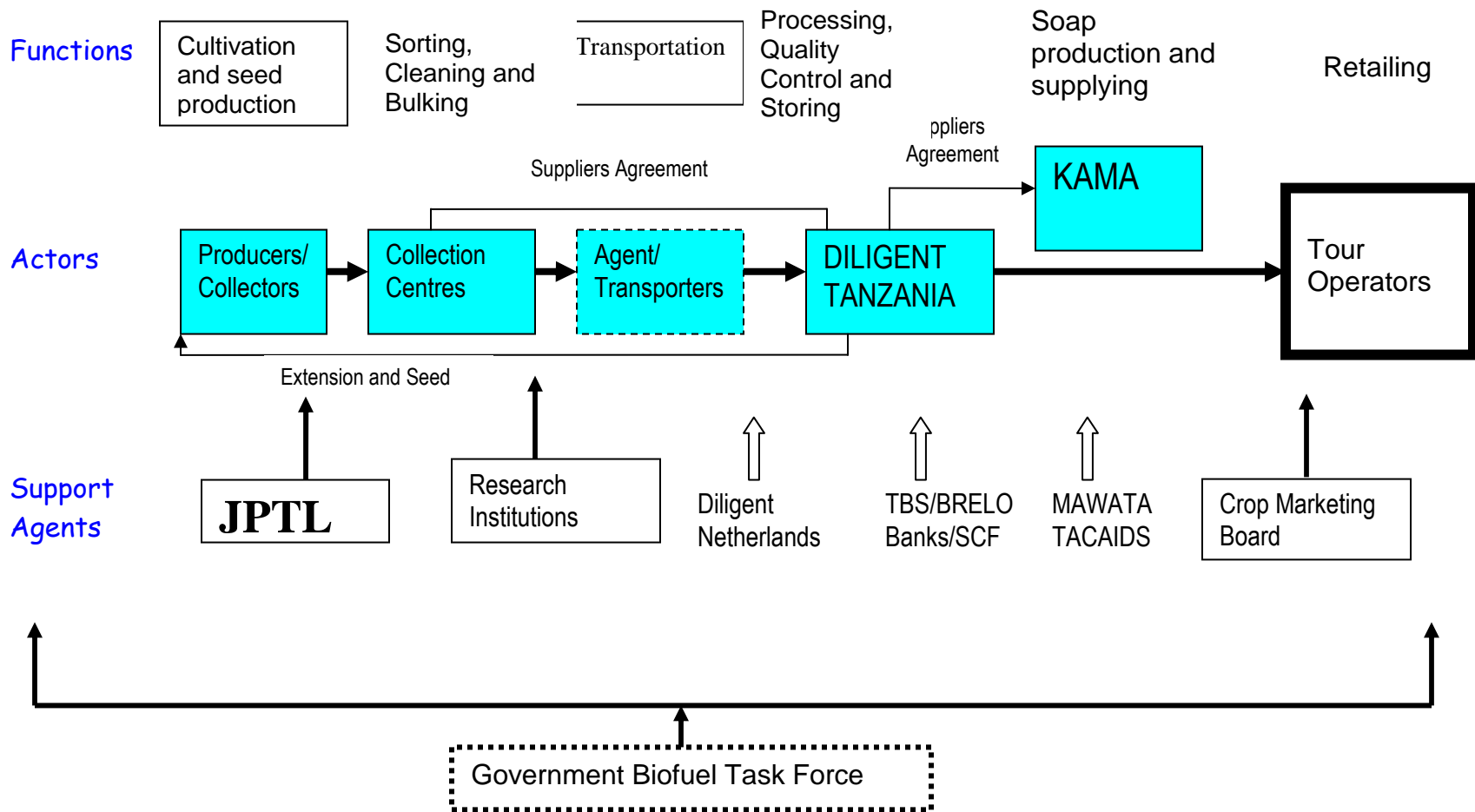
Diligent (T) Ltd provides farmers with Jatropha seeds and offers consultancy services in the growing and caring for the Jatropha plant until harvest. The company then buys the seeds from the farmers and processes it into oil which is used as transportation fuel and sells it directly to few Tour Operators around Arusha. Currently they have over 100 collection points across Tanzania and are expanding. The total acreage is estimated to be 3500 ha. The Jatropha business in Tanzania is yet to be linked with the global value chain.

The oil they produce is sold to Tour Company's who fill their vehicles with slight modification. Some of the oil is sold to Kakute who in turn sell it to women groups who make soap out of it. Diligent also sells seeds to Kakute for the same purpose. The soap made by the women groups is then sold in the open market.

The report also identifies support agents among them are Diligent Netherlands, the parent company of Diligent (T) Ltd and financial institutions including banks and microfinance institutions. There is also a non-governmental organizations called Jatropha Products Tanzania Limited (JPTL) which supports small scale farmers with technical assistance and extension services. Research Institutions have been actively involved in contributing to the promotion of Jatropha as a viable oil seed for the production of SVO and biodiesel in Tanzania.

As mentioned earlier, the Biofuel Task Force has a major role play in the governance structure.

Figure 1: Jatropha-based value chain in Tanzania – map and relationships



Source: Match Maker Associates Ltd (2006) as modified by the researcher

4. Risks and constraints

The study by Diligent and Ameco (2006) and MMA (2007) seem to have identified similar constraints that relate to the development and production of jatropha-based biofuel in Tanzania. These constraints include:

Table 1: sub-sector constraints

Type	Constraints
Technology/Product Development	<ul style="list-style-type: none"> • The technology of processing seeds into oil is very rudimentary and as a result female processors depend on (male) casual labourers and their profits are affected • Standardisation (quality, size, shape, colour) is difficult to achieve due to the cold fusion applied by KAMA and affects its marketing • There are still a lot of unknowns about commercial production of jatropha, since there is very limited experience with large scale production to date, and the crop takes several years to mature • A laboratory setting is required to be able to monitor the quality. This requires staff with adequate skills and education
Market Access	<ul style="list-style-type: none"> • The (female) soap makers (I suppose it is also true of those engaged in SVO production) are not supported to market their products outside Mtu Wa Mbu which reduces their returns (lower prices) • The acceptability to use edible oils for fuel is yet unclear
Organization and Management	<ul style="list-style-type: none"> • The producers of Jatropha are not organised which makes it difficult to reach them and hence, production stagnates
Regulatory/Policies	<ul style="list-style-type: none"> • The absence of a performing national body to regulate the development and production of biofuels makes it difficult to determine the quality of the SVO currently produced both by the female producers in the villages as well as Diligent (T) Ltd.
Finance	<ul style="list-style-type: none"> • Unavailability of appropriate (commercial) finance for input supply and investments in appropriate technology for small scale producers/processors, affects efficiency and increases dependency on project funding
Input Supply	<ul style="list-style-type: none"> • The input costs of TShs 150/= per seedling is too high for small scale farmers, which may hinder new entrants in the production and hence, the dependency on subsidized input supply. • Seasonal influences in the supply of seeds • Not enough supply of the caustic soda, methanol or ethanol.
Infrastructure	<ul style="list-style-type: none"> • Lack of communication means and high transport costs causes dysfunctional supply management and affects the income for producers

Source: Match Maker Associates (2007) and Diligent and Amesco (2006)

5. Business models

The study by Diligent and Amco (2006) identifies several combinations of business models ranging from a model that limits the production of biofuels to Smallholder farmer in farmer groups to that which relies on outgrowers/Contract farming and the third model involving company owned farms/ plantations. The study comes up with descriptions of how the models should be set up and the potential linkages between the various players locally and potential international investors. The study recommends two models. One that allows the investor to purchase of SVO from selected entrepreneurs, assistance with development of pilot plantation and processing facility and one that allows the investor to purchase of SVO from selected entrepreneurs, assistance with development of a delivery network from farmer groups and contract farmers.

ICRISAT (2007) discusses at length the success stories of the “white revolution” and soybean experience in India and the cotton production in Burkina Faso. These examples could also be emulated to fit the Tanzania experience with regards to the development and production of Jatropha-based biofuels.

6. Financial assessment

MMA (2007) attempts to derive Simplified Gross Margins (SGM) at the production, trading and oil extradiation stages for women groups in Arusha and Manyara regions came up with the following SGMs.

Production (1 acre)

Assumption: 2,000 kgs per seasons and 2 seasons per year

Selling at 80 X 2 seasons (middlemen)	320,000.00
Selling at 120 X 2 seasons (collection centres)	480,000.00
Seedlings 1000 seedlings at 150.00 /40 years	3,750.00
Labour (Planting)	10,000.00
Harvesting	10,000.00
Packaging / storage	10,000.00
Gross Profit (middlemen)	286,250.00
Gross Profit (traders)	446,250.00
Simplified Gross Margin (middlemen)	89.4%
Simplified Gross Margin (collection centres)	92.9%

SGM trading (collecting, buying and selling) of seeds [1 bag of seeds (6 tins)]

Unit is 6 tins (70 kg)

Selling price TShs 120 per kg	8,400.00
Buying price TShs 70 per kg	4,900.00
Transport / logistics	100.00
Gross Profit	3,400.00
Simplified Gross Margin	40.5%

SGM Oil extraction by Women groups [6 tins giving 10 litres of oil]

Unit: 10 litres oil (6 tins of seed = 70 kg)

Sales Value; TShs 2,000 per litre (at factory gate)	20,000.00
Buying of seeds TShs 100 per kg	7,000.00
Handling (sorting, drying) (1 day)	1,500.00
Firewood required to boil 10 litres of Jatropha oil	3,000.00
Depreciation filtration and storage equipment (TShs 44 per kg)]	3,080.00
Days required: approximately (1 day hard labour)	3,000.00
Gross Profit	2,420
Simplified Gross Margin	12.1%

Table 1: below reproduces information from the study by Diligent and Amco (2006) on the viability of a Jatropha-based biofuel production. Some of the figures might have changed over the last two years. For instance Diligent now charges TAS150 per kg as opposed to TAS 120 in 2006.

Table 1: Potential SGM for jatropha-based SVO – source Diligent et al (2006)

Costs of Jatropha Curcas Production					
	Pessimistic		Optimistic		Notes
Yield assumptions					
Plants per hectare	1650		1650		Intercropping with rows 3m apart, 2m spacing in between
Seeds per plant (kg)	2		3		Literature data suggests yields up to 6kg/plant, but practical experience does not support this.
Seeds per hectare (kg)	3300		4950		
Initial costs, per ha					
Planting (EUR), per ha	€ 50.00		€ 50.00		Assumption based on own experiences
Planting (EUR), total plantation	€50,000		€ 50,000		
Annual production costs					
Yearly maintenance					
Labour costs (EUR), per ha	€50.00		€ 50.00		Assumption based on own experiences
Labour costs (EUR), total plantation	€50,000		€ 50,000		
Harvesting: Labour costs, per worker per day (EUR)	€2.00		€ 2.00		Assumption based on own experiences
Seeds picked per worker per day (kg)	100		140		Assumption based on own experiences
Number of labour days required, per ha	33		35		
Length of harvesting season, in days	60		60		Assumption based on own experiences
Number of workers required	550		589		
Harvesting costs (EUR), per ha	€66.00		€ 71.00		
Harvesting costs (EUR), total plantation	€66,000		€ 71,000		
Total annual production costs, total plantation	€116,000		€ 121,000		
Summary data, per kg seed produced					
Maintenance	€0.015		€ 0.010		
Harvesting	€0.020		€ 0.014		
Costs of production	€0.035		€ 0.024		
Market price per kg of seeds	€0.050		€ 0.075		Current market price paid by Diligent is TSh 120/kg (€ 0,075/kg), prices will presumably fall if supply increases
Gross margin per kg of seeds	€0.015		€ 0.051		Excluding planting costs, general investments and overhead

Both, the study by Diligent and Amco (2006) and MMA (2007) attest to the fact that Jatropha-based biofuel development and production is a viable business proposition in Tanzania. Diligent and Amco (2006) for instance say “in the Consultant’s opinion, the project’s feasibility can be justified on a ‘pilot commercial’ scale, for SVO production only, based on a combination of sunflower and jatropha production. ‘Pilot commercial’ scale means a production level sufficient to meet Rural Netco’s demand plus some excess capacity, in order to have sufficient flexibility to test assumptions, learn from practice, and gradually develop the project. Substantial further expansion should be possible after the initial years, once more data and knowhow have been gathered. The most critical challenge for this will be to establish a volume of seed production that is sufficient to make the processing commercially attractive, and to do this quickly enough while maintaining costs within limits.”

7. Value Chain Development

In study quoted above, Match Maker Associates (2007) recommend a number of upgrades in the development of Jatropha-based biofuels in Tanzania to include Process, Product, Functional, and Marketing upgrades. The MMA recommendations, however, related to the production and commercialization of soap in Tanzania. Following the discussion held by the researcher and the General Manager, Diligent (T) Ltd, the following potential upgrades in relation to SVO and Biodiesel are recommended:

Process

As noted elsewhere in this presentation, the process currently in use by the women processors as well as Diligent (T) Ltd is not sophisticated. It results in some inefficiencies thus the high price of SOV. More sophisticated technology is required to make the process more efficient.

Product

Both Diligent (T) Ltd and women groups are currently engaged in the production of SOV for domestic use (women groups) and for running motorvehicles (Diligent). An opportunity exist to upgrade this product to producing biodiesel which can be used in combination with fossil diesel or straight for transportation purposes.

Functional

The study by Diligent and Amesco (2006) recommends one business model that allows the involvement of large scale plantation farmers of agrifuels. This should be the direction that the development of Jatropha-based biofuel should take in Tanzania to become competitive and sustain the production of biofuel. The Plantation Farmers could work together and support small holder farmers organized in efficient and well managed cooperatives societies.

Marketing

To remain sustainable, the production of jatropha-based biofuel should (in the short and medium term) be promoted to meet the energy requirements of the local market. To remain competitive, in the long run the biofuel could be marketed in the region and beyond using a competent Crop Marketing Board.

8. Key issues and questions

The examination of the existing studies and reports on the development and production of jatropha-based biofuel in Tanzania reveals the following key issues:

8.1 Key issues

- Jatropha-based biofuel in Tanzania is not fully developed.
- Its value chain is mainly local and confined to the Northern regions of Arusha and Manyara.
- The technology in used by Diligent (T) Ltd and women groups in extracting oil from Jatropha is not sophisticated
- The local market is still skeptical in the use of Jatropha as a source of biofuel/diesel partly due to cost considerations
- The government is not moving fast enough in providing regulatory policy framework for the biofuel sub-sector.
- Much of the promotion of the jatropha as a source of biodiesel is done by NGOs and small commercial companies such as Diligent.
- The diminishing margins as the product moves from production to trading and SVO extraction requires the upgrading both of the processes and the final product.

8.2 Key Questions

The major question suitable for research then is “how can jatropha-based biofuel be developed in Tanzania to increase the nation’s competitiveness and sustainability in the energy sector. Specific questions include:

- What should be done to upgrade the local value chain to enable it meet and sustain the local biofuel demand in the medium term and compete effectively in the global value chain in the long run and benefit from this relationship?
- How can the linkage between the various players in the local/national value chain be managed to benefit more the people in the bottom of the pyramid (farmers, collectors and traders) and their communities?

- How can the local jatropha-based biofuel value chain be effectively integrated into the global biofuel value chain, and how can this linkage be managed to benefit those in the bottom of the pyramid?
- What role can the government play in the promotion of jatropha-based biofuel industry in Tanzania (incentives to the producers as well as consumers)?
- What kind of technology will be appropriate in upgrading the the jatropha-based biofuel value chain in Tanzania to meet global standards?
- What business model(s) will make it possible to bring in many players from the bottom of the pyramid to participate fully in the jatropha-based biofuel system to enable them create worth and reduce poverty.
- What needs to be done to upgrade both the process and the product in the local jatropha-based biofuel chain.

9. Investment Climate

Tanzania is ideally placed to become a leader in biofuel production Globally. The following features give Tanzania the comparative advantage in this sector (Kearney, A.T., 2006):

- Tanzania has ideal geographic and climatic conditions for growing a wide range of biofuel crops: sugar cane, palm oil, jatropha, soy, cotton, and others
- Tanzania has over 88 million hectares of suitable agricultural land, of which less than 6% is currently utilized
- Unlike many alternative countries, the vast majority of land in Tanzania that is available for cultivation is not virgin forest or environmentally sensitive
 - Much is former agricultural land that fell into disuse during nationalization
 - Other target areas are open scrub with similar eco-impact to oil plantations
- With three of the largest 10 lakes in the world, and a large network of rivers, most areas of Tanzania have significant irrigation sources
- Local expertise and institutions: with the support of the German Government, have concluded a detailed study of Tanzania's biofuel assets and potential and a National Biofuels Taskforce has been established, to bring together experts in the sector and promote development of the sector
- Local partners: a number of local entrepreneurs and corporate groups have expressed interest in co-investing in biofuel production alongside international investors

10. Government and Institutional Support

The Government of Tanzania and foreign donors have identified biofuel as a priority sector and can provide extensive support for investments. The following

lists of stakeholders and institutions support the development and production of biofuels in Tanzania (Kearney (2006)).

- The President of Tanzania and his Cabinet have identified biofuel as a priority growth sector and are prepared to provide support at the highest levels to accelerate investment
- The Tanzania Investment Centre maintains a database of suitable growing areas and offers a one-stop shop to facilitate the land acquisition, permitting and registration process
- Tanzania's Land Policy gives investors full rights to buy and sell land
- Under the Tanzania Investment Act of 1997, qualified investors are entitled to exemption from VAT and import duties on imported inputs and 100% repatriation of profits and capital investments after taxes and other obligations are met; the Act also provides for full protection of all investor agreements
- A number of international donor organizations (e.g. the World Bank, USAID, DFID) provide technical and financial assistance to develop the productivity and capacity of outgrower associations and communities in palm oil and jatropha growing areas
- The BEST (Business Environment Strengthening in Tanzania) programme is a coordinated multi-donor project to increase competitiveness across sectors. Under the BEST Cluster Competitiveness Project, donor financing may be made available to support capacity development (such as training, yield-improvement, market research, etc.) of outgrowers in key growth sectors
- With significant funding now earmarked for infrastructure development in Tanzania (by the Millennium Challenge Corporation and other donors), potential also exists to leverage these funding sources to offset infrastructure development costs associated with new production facilities (e.g. road linkages, irrigation, etc.)

11. Conclusion

This preliminary investigation on the jatropha-based biofuel in Tanzania has revealed a huge potential for its development. Suitable land is available and the Government is working on the modalities of promoting biofuel production. However, sustainability, calls for the development of this sector in a large scale with small holder farmers being supported by large plantation owners and organized in efficient and well managed cooperative societies. The main study will focus on the development of jatropha-based biofuels to create jobs, increase the incomes of rural poor and meet their gender concerns in a sustainable and competitive manner in Tanzania and Zambia.

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