Jatropha: the broom of poverty; myth or reality?

A critical analysis of the Zimbabwean jatropha programme in Mutoko district

By James Mubonderi

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Author: James Mubonderi
Reviewers: Ben Muok (ACTS), Agnes Mwakaje (University of Dar es Salaam)
Editors: Thomas Molony, Davide Chinigò (University of Edinburgh)
Main image: Jatropha tree (Photograph: James Mubonderi)
All images: James Mubonderi

List Of Acronyms

BUN	Biomass Users Network
EU	European Union
FEC	Finealt Engineering Company
GoZ	Government of Zimbabwe
NGOs	Non-Governmental Organisations
NOCZIM	National Oil Company of Zimbabwe
RBZ	Reserve Bank of Zimbabwe

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Executive Summary

This working brief critically examines the socio-economic and rural livelihood impacts of the Zimbabwean Jatropha biodiesel programme on rural farmers. With the biofuels discourse shifting from the use of first generation feedstocks, which can also be used as food crops, to second generation biofuels which use exclusively non-food feedstocks, jatropha emerged as the plant of choice in many countries including Zimbabwe. First generation biofuels are heavily criticised for threatening food security hence the use of non-edible jatropha was believed to have less social, economic and environmental risks. This is because the plant was believed to grow well on marginal land, which allows degraded land to be reclaimed, hence avoiding competition with food crops. However, this study refutes these perceived benefits of jatropha mainly because they are premised on unfounded propositions. This study critically analyses the Zimbabwean jatropha programme to unravel the benefits and risks of jatropha to rural farmers. In addition, the study discusses the Zimbabwean jatropha programme within the contentious global debate on the positive and negative impacts of biofuels.

Based on the data gathered from selected key informants and rural farmers through semi-structured interviews, this study found that growing jatropha under the national biodiesel programme could not achieve the desired goals of rural development and feedstock production. This is due to different reasons, among them, lack of proper planning. The programme that made use of the out-grower scheme was hurried and implemented in a policy vacuum. Despite the failure of the programme, this report does not discredit the growth of jatropha since the plant proved to have various social, cultural, environmental and economic uses to local rural farmers who traditionally grow it as hedge. This study therefore advocates the support of small scale non-commercial cultivation and processing of jatropha so that rural farmers can use it locally. Selling the seeds should therefore be an added advantage rather than a primary outcome. In that respect, the government must have its own source of feedstock (for example, making use of the estate or plantation scheme) which can be supplemented by local producers.

Introduction and Background

In recent years, the global production of biofuels has increasingly galloped due to the global North's desire for energy security and mitigation of climate change. Political instability in the Middle East and the rising price of high carbon, and environmentally unfriendly fossil fuels have also contributed to this increase. Additionally, the global South has envisaged potential benefits such as foreign investment opportunities, revenue from exports and economic development. This initiative has, however, stirred heated debate between policy makers and scholars on the presumed benefits and the adverse effects of biofuel development.

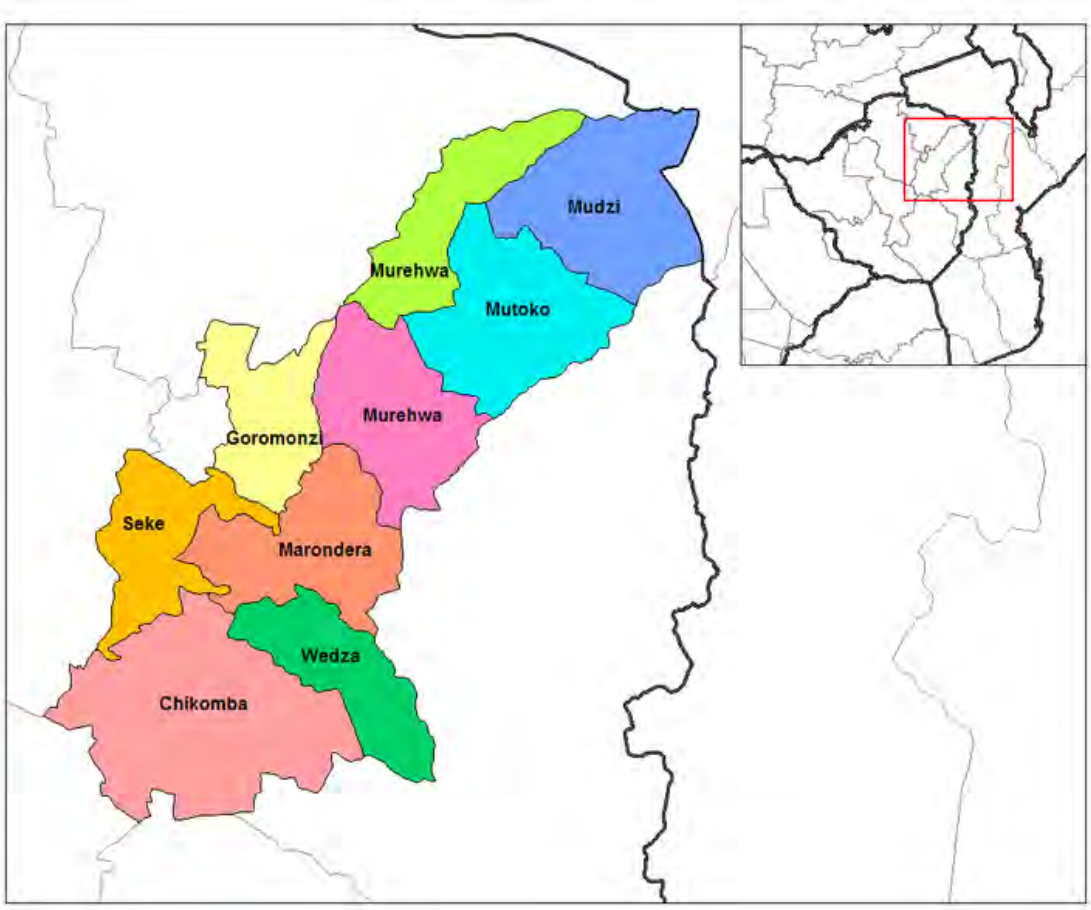
Proponents of biofuels such as the European Union (EU) and United States of America (USA) argue that the production of biofuels, particularly in developing countries, provides an opportunity to diversify energy provision and agricultural activity, reducing dependence on fossil fuels and contribute to sustainable economic growth (ActionAid, 2010). They also contend that it offers the additional benefit of poverty reduction through increased incomes provided by the growing export market for energy crops. Critics such as the Biofuelwatch, Econexus and ActionAid however, dispute these perceived benefits arguing that despite initial excitement, biofuels are questionable in the light of their harmful effects on agriculture and land use (Biofuelwatch et al., 2007; Scott, 2009).

The debate is further complicated by a lack of authenticity in the biofuel positions and this is evidenced by the prominent use of the prefix "potential" or "opportunity" in discussion of the proposed biofuel benefits or effects. Van der Horst and Vermeylen (2011:2436) also present negative accounts of biofuels which contrast starkly to their perceived benefits. They argue: "there is a world of difference between the promise of the benefits that liquid biofuels could bring and what actually happens on the ground." Amigun et al. (2011) contend that whether biofuels development enables the achievement of the predicted goals and benefits is an issue that remains uncertain and therefore needs comprehensive investigation. Given this dichotomisation in biofuel positions, this study seeks to inform the biofuel discourse by providing an empirical analysis of the Zimbabwean jatropha programme. In doing so, the study will delve into critical issues such as food security implications, questions of land use, effects on biodiversity, environmental degradation and the impact of such a programme on rural livelihoods.

Study Area

This study focuses on Mutoko district in Mashonaland East province of Zimbabwe. Mutoko district is located in the North-eastern part of the country about 160 kilometres away from Harare (see figure 1, below). The district comprises mainly communal villages and the administrative centre is situated at Mutoko Centre. Mutoko is a mountainous area with limited flat land for cultivation and veld grazing. The main livelihood activity is subsistence farming with maize and ground nuts being the major crops grown.

Figure 1: Districts in Mashonaland East province of Zimbabwe



Map available at http://en.wikipedia.org/wiki/File:Mashonaland_East_districts.png

Rural Livelihood Strategies in Mutoko

In addition to subsistence farming, a considerable number of people are involved in small scale horticulture, mainly geared towards producing vegetables for sale at Mutoko centre. As a store of wealth and source of draft power, local people keep domestic animals such as cattle, goats and donkeys.

Data Collection Methods

This study was carried out between May and June 2011 and is based on data that was collected from participants through interviews and participant observation. In total, 21 people were interviewed. A focus group discussion comprising ten members (six men and four women) from Makosa ward was held at Makosa Township where I took advantage of a ward meeting that coincided with one of my field visits. The discussion lasted for about 20 minutes. Another focus group discussion was held at the Finealt Engineering Company (FEC) plantation with six workers (two women and four men). In addition, five more individual interviews with both key informants and individual farmers were conducted in the district and this included interviews with FEC officials, extension officers and village leaders. Further insights were gained through observations during the field visits. All interviews were administered in the vernacular language (Shona).

Sampling techniques

In identifying key informants and recruiting members for the focus group discussion, I adopted the purposive snowball sampling technique which makes use of personal judgement to identify people with certain characteristics (Neuman, 2006). Key informants were selected on the basis of the knowledge and level of participation in the jatropha programme and the target comprised government officials, village and ward leaders and leaders of other grassroots organisations such as farmers unions. According to the guiding principles of the technique, the researcher has to identify one person who will help identify other people and the chain goes on and on. Therefore, to get hold of key informants I first contacted the CEO of FEC who revealed other local leaders and villages (Makosa) where jatropha cultivation is at advanced stages. In selecting participants in the focus group discussion, people who had hands-on experience with local processing of jatropha were selected with the help of the ward leader. This snowball sampling technique proved to be effective in saving time and eased the identification of all key informants. Random sampling was used to select farmers for individual interviewing. This technique was used mainly because almost every farmer in Mutoko is, or was, involved in the jatropha programme at some time, thus ensuring that all residents were given an equal chance of participation making the sample more representative.

Conceptual Analysis

Biofuels

Traditionally, biofuel is a term used to refer to energy produced from bio (degradable)-waste in both liquid and non-liquid forms (Franco et al., 2010). Recently, the term has acquired a more narrow meaning. It now refers to liquid fuel that is derived from purpose-grown plant material such as maize, sugarcane, jatropha and soya beans (Molony and Smith, 2010; FAO, 2008; Clancy, 2008). The most common liquid biofuels are bio-diesel and bio-ethanol. IEA (2004) defines biofuels as fuel derived from biological, mainly agricultural sources (using conventional technology) and can be categorised into two main categories which are first generation and second generation biofuels. However, there is no clear cut distinction between the two categories but seemingly, contemporary literature on biofuels use the type of feedstock as the main distinctive feature (Larson, 2008; Findlater and Kandlikar, 2011; Charles et al., 2007).

First generation biofuels mainly make use of agricultural food crops such as cereals, grains, sugar crops and other starches that can be easily processed to produce fuel. Second generation biofuels use non-edible lignocellulosic biomass feedstocks that are exclusively used for energy production. This includes residues of crops or forestry production (corn cobs, rice husks, sawdust), whole plant biomass (energy crops such as switch grass and other fast growing tress), and from municipal solid waste products that can be converted into fuel (Carriquiry et al., 2010; Helena and Ernsting, 2007). Converting these materials into fuel is a complex process and techniques are still under development and not yet commercially available. Fuel produced from non-edible oil seeds such as jatropha and microalgae can also be categorised as second generation biofuels mainly because they do not fall in the bracket of food crops.

Given that the majority of biofuel sources are agricultural, some critics of biofuel such as Helena and Ernsting, (2007), Fernandes et al., (2010) and ActionAid (2010) reject the term "biofuels", preferring "agrofuels" instead. They argue that the term biofuels harbours the harmful social and environmental effects including food insecurity.

There are three main facets of food security; availability (supply), affordability (pricing or accessibility) and quality (nutrition) (Mukute et al., 2002; Pingali et al., 2008). For biofuels to threaten food security, they have to affect one or all of the above mentioned components. Biofuels threaten food security either when food crops are converted to fuel or when feedstocks compete with food crops for resources such as land (Mitchell, 2008). The importance of second generation biofuels which make use of non-food feedstocks therefore becomes evident. Due to this consideration, jatropha has become the crop of choice in many biofuel schemes. This is because the plant was believed to grow well on marginal land, which allows degraded land to be reclaimed, hence avoiding competition with food crops.

However, empirical evidence from all over the world shows that jatropha rarely strives on marginal land and is therefore not economically viable for rural farmers. Ariza-Montobbio et al. (2010) argue that the presumed agronomic viability of jatropha in marginal lands, its economic returns for small scale farmers, and its lack of competition with food crops are all fallacies. Recent studies from across the globe also show that to do well jatropha requires fertile soil and proper management. Pohl (2010), writing on Mozambique, argues that jatropha, like any other cash crop, needs fertiliser, pesticides and a lot of water to produce economically viable yields. In the same vein, Louma (2009) reasons that "if you grow jatropha on marginal conditions you should expect marginal yields as well."

Jatropha curcas L

Jatropha curcas L (jatropha) is a non-edible and oil rich plant or shrub which can grow up to six metres in height. In Mutoko the plant is commonly referred to as "mujirimono" and in other regions such as in Masvingo they call it "mufuta" (oil tree). Jatropha belongs to the euphorbia family in which both leaves and seeds are toxic to humans and animals, making it a good live fence. On average the seeds contain about 30-45% viscous oil which varies depending on where the jatropha is planted and the care it receives (water and nutrients) (Jingura et al., 2011: 2080). Ripe seeds turn from green to yellow but they can be best harvested when they dry and the hull

[1] The name jatropha is derived from the Greek word jatros (doctor) and trophe (food) which implies its medicinal uses. Curcas is a common name for physic nut in Malabar in India (DoveBiotech, undated: 4).

turns hard and black. If the seeds are not harvested they keep hanging, but if shaken will fall down. Farmers from Mutoko, however, prefer to pick the seeds when they fall as it is comparatively easier than collecting them from the tree. According to farmers' perspectives, harvesting is not as hard and as tedious as the dehulling of seeds which they do manually. Jatropha can be planted by two common methods; seed or seedling propagation and the cutting method.

It is believed that the plant originated from Central America and was first distributed globally by the Portuguese traders starting in Portuguese colonies (Henning, 2009). In Zimbabwe jatropha was first introduced in the late 1990s by Biomass Users Network (BUN) a Non-Governmental Organisation (NGO). The NGO encouraged the planting of jatropha as a hedge around homes. The project started in Mutoko district (Mashonaland Central Province) and in Binga district (Matabeleland North province). Following the training of local people, the seeds were later used for soap and paraffin making. Subsequently, cooperatives for small scale processing of jatropha were established. The programme was aimed at rural development and climate change mitigation. However, the NGO stopped operations when the Government of Zimbabwe (GoZ) exclusively promulgated jatropha as a national programme in 2005.

Background of The Zimbabwean Biofuels Programme

Zimbabwe is an agro-based economy with 70% of its population living in rural areas with their livelihoods earned through subsistence farming (Magumure, 2012). However, there has been a decline in agricultural productivity since the late 1990s. This decline can be attributed to many factors among them the controversial land reform programme that disturbed the sector by resettling peasant farmers on commercial farms (ibid). Additionally, a chain of droughts played a part. The country has also experienced an unprecedented political and economic crisis haunted by hyperinflation, foreign currency shortages, and political turmoil. Consequently, people's livelihoods, especially those of rural dwellers, were tempered with, leaving people exposed to hunger. It was during this economic dark period when the jatropha project was introduced. Since everyone was looking for anything to survive, the jatropha project provided economic hope for the rural populace. One respondent argued: "It is like gambling, you never know what will happen hence people just accept any programme presented to them". The government therefore find it easy to market the programme.

Since Zimbabwe is a landlocked country without petroleum products, it relies on oil imported through South Africa and Mozambique. Foreign currency shortages coupled with economic restrictive measures, have resulted in the GoZ failing to import enough oil for the nation. Consequently, petrol stations ran dry and petrol was only found in the informal market with a litre costing "US$4" (Mtisi and Makore, 2009:8). This situation forced some motorists to devise blending mechanisms such as paraffin blend. Lack of blending knowledge cost some people their engines.

As the situation deteriorated, GoZ started to think of strategies to curb the oil crisis. At one time in 2007 top government officials had to visit Rotina Mavhunga, a local traditional healer in Chinhoyi (Nkatazo, 2009) who claimed to have powers to extract diesel from a rock. This

[2] The economy has been in recovery since the country substituted its currency (Zimbabwean dollar) for the US dollar in 2009.

[3] Interview with Mr X, 11th June held in Mutoko.

illustrates the desperation of the GoZ in its attempt to deal with the nagging problem. When the jatropha biodiesel initiative was presented by the Reserve Bank of Zimbabwe (RBZ) to the government in 2004, the idea received considerable political scaffolding and financial resources were channelled to support the project. The RBZ investment in the jatropha biodiesel materialised in 2004 when a test vehicle moved providing a sigh of relief to the malaise Zimbabwean population. In 2005, the government launched the national jatropha programme aiming at providing feedstock for biodiesel production, an initiative promoted under the banner of rural development. The programme quickly filtered across the country with the aid of the public media. It was advertised as "jatropha mutsvairo wenhamo" meaning "jatropha the broom of poverty" (Tsiko, 2010). With this background, the Zimbabwean jatropha programme can be regarded as an act of desperation both from the side of the government and the population, mainly rural dwellers. Matondi (2010) describes the Zimbabwean biofuel project as the "wacky fuel-economics".

Since the institutionalisation of the programme in 2005, the government has been making efforts to entice rural farmers to produce biofuel feedstock, mainly jatropha. In 2007, a biodiesel processing plant was constructed at Mt Hampden just outside Harare. It was built through a joint venture between the RBZ and Youn Wool Investment, a Korean company. The now white elephant plant has an operating capacity of about 90-100 million litres per year and is described as one of its kind in Africa and fifth in the world (Matondi, 2010). It cost the partners more than US$80 million to build the plant. FEC recently established another biodiesel processing plant at Mutoko centre with capacity of about 10,000 litres a day. To reach the capacity of both plants, at least 700 tonnes of jatropha seeds are required annually which translates to mean that at least 200 hectares of land has to be under jatropha cultivation. The National Oil Company of Zimbabwe (NOCZIM) was commissioned to spearhead the cultivation of the required jatropha. NOCZIM is the national company responsible for providing oil products to the populace. Surprisingly, the government mandates it to spearhead the cultivation of jatropha whilst the Ministry of Agriculture is there.

The Zimbabwean Jatropha Programme

The jatropha biodiesel programme, institutionalised in March 2005, initially adopted the out-grower scheme and after its collapse, the GoZ resorted to the estate or plantation approach (still budding). The two approaches are discussed below.

The flopped Out-grower scheme

Under this scheme, NOCZIM contracted individual farmers, farmers' groups, women's groups and any other group or organisation which had access to land. At least five hectares and proof of ownership or title to land was required to enter the ten year contract. Farmers with less than five hectares or without formal entitlement to land, such as communal farmers, were free to participate in the scheme but on a non-contractual basis, which means, they were not obliged to exclusively grow and sell jatropha to NOCZIM. Alternatively, they could pool their land together and be contracted as a group. Each village was supposed to reserve a piece of land to grow jatropha. Individual communal farmers were also encouraged to have at least 100 plants.

[4] Interview with Mr Mpala, the CEO of FEC, 6th June 2011 held in Harare

[5] Focus group discussion in Makosa ward, 15th June 2011 held at Makosa Township.

The contract stipulated that NOCZIM would provide free seeds and technical assistance and in return farmers would sell their yields to the company for biodiesel production. Farmers participating on non-contractual basis also had access to free seeds and would freely sell their produce to NOCZIM. Farmers received jatropha seeds to grow in nurseries for later transplantation once the seedlings were either three months old or 1.5 cm tall. NOCZIM additionally bought seedlings from independent producers at a cost of US$ 0.0015 per seedling and distribute them to farmers for free (Gandure, 2009: 43). In 2006, NOCZIM targeted 40,000 hectares to be under jatropha cultivation, in 2007 it projected 87,000 acres and 65,000 hectares was the target for 2008. However, by the end of 2008 only 10,000 hectares had been achieved (Matondi, 2010).

Reasons for the collapse

A combination of different factors led to the collapse of the scheme in late 2008. NOCZIM abandoned the project due to financial problems and unilaterally cancelled the contractual agreement with out-grower farmers. Although financial woes contributed to the failure of the scheme, the root cause could have been poor planning. Since NOCZIM is not an agricultural company, it suffered from lack of expertise and that explains why there were no tangible results since the inception of the project in 2005. For three years, its focus was misdirected towards distributing jatropha seeds without following up to see how the trees were growing. Farmers were told just to plant the seedlings and let them grow on their own. After three years, seedlings still remained seedlings (as shown in figure 2 below) and government decided to terminate funding after realising that the project was unsuccessful. Farmers abandoned the project too. The common belief that jatropha is a wild plant that strives on marginal land with little or no care was proved a fallacy.

Figure 2: A three year old derelict village jatropha plot on degraded land. Photo taken on the 15th June 2011

The observations from the pilot plantation further confirm conclusions made by Louma (2009), Ariza-Montobbio et al., (2010) and Pohl (2010) that jatropha needs good soil and proper management to grow well (see figure 3 and 4 below). In places where the soil is fertile, such as near anthills (figure 3), plants grow more rapidly than in other places (figure 4).

Figure 3: jatropha plants on fertile soil

Photos taken from FEC plantation on the 20th July 2011

Figure 4: jatropha plants on less fertile soil

Most respondents blamed the propagation method that was employed by NOCZIM. They argued that the seed propagation method is labour intensive as the land has to be prepared before planting and above all transplanted seedlings need intensive care. This concurs with Henning (2009) who argue that tight weed, and pest control, and disease management are required when planting jatropha from seedlings. In some instances, some seedlings might die and need replacement but NOCZIM did not do that. Although the propagation method helps plants to develop a long tape root that allows it to reach nutrients, helps bind the soil together preventing soil erosion by run-off and reclaiming degraded land (see figure 2 above), farmers criticised it for its labour intensiveness taking into consideration that the panting period coincides with the food crop farming season. Farmers were therefore frustrated when the project collapsed; they felt that it was wasted labour as they did not get anything from the project.

Farmers in Mutoko regretted that NOCZIM should have let them use the vegetative propagation method which they were familiar with. They argued that, they have been using this method since jatropha was first introduced to them in the 1990s. The method uses 40-50 cm long cuttings. Unlike seedlings, cuttings are planted during the dry season mostly two to three months prior to the commencement of rainy season. This is mainly because the plant has so much water that it can decompose if planted during the rainy season. This has resonance with Henning (2009) who observes that the jatropha cuttings have a thin layer of wax that prevents the easy evaporation of water hence they have to be planted early to lose some water. Interviewees felt that this type of propagation could have been ideal for them since it is done at a time when there is less farm work. Furthermore, they believe that the plant can produce seeds within a year vis-a-vis two or three years from seedlings. This confirms that the programme was designed in an old fashioned top-down ideology that can also be referred to as the “know-it-all approach” which is non-participatory. Government did not consult Jatropha growers in Mutoko about the programme; rather it (the government) imposed the project on them.

Another aspect that contributed to the failure of the project according to farmers from Mutoko who traditionally planted jatropha as a hedge is the unfavourable jatropha market. Selling jatropha was projected to be the greatest benefit of the programme to rural producers. The government believed that rural dwellers will earn extra income through selling jatropha seeds. Rural farmers’ hope and motivation to join the programme was hinged upon this promise. Results from Mutoko district, however, proved to be disappointing. Jatropha producers who participated in focus group discussion in Makosa unanimously showed discontent with the jatropha market. They said that the prices are non-negotiable, relatively low compared to other income generating activities and above all, not reflective of the amount of labour applied in growing and harvesting it.

The price of jatropha is pegged at US$0.10 per kilogram compared to a kilogram of tomatoes going for US$2. Farmers from Mutoko were therefore unhappy with the price and consequently, many people decided to abandon the jatropha programme and those who already have jatropha as hedge were de-motivated to the extent that some do not even bother harvesting it. Furthermore, participants condemned the government for unilaterally setting the price. Although the government gazetted the price, most rural farmers were not aware of it and hence suspect corruption may be an issue. They believe that government workers are given more money by the government to buy jatropha at higher prices but they lower the prices and keep the difference.

Another issue that was raised is that when FEC comes to buy the seeds, the pickup points are not convenient for most people. Usually the buyers are only stationed along the main road disadvantaging those not living in proximity to it. Consequently, most farmers were discouraged and abandoned the project which they described as full of empty promises and, above all, exploitative. As one respondent argued: "kana tani richikupa US$100, zviri nani kurima matomatisi pakurima jatrofa" (if you get US$100 per tonne, it is better to grow tomatoes than jatropha). On average, a farmer could harvest and sell 100 kilograms of jatropha per season, which gives him/her US$10. Therefore, rural people had no reason to continue with the project whose economic returns were very poor.

The failure of the Zimbabwe jatropha programme concurs with Van der Horst and Vermeylen (2011) and Van Eijck and Romijn (2008) who argue that central processing of jatropha biodiesel overshadows small scale production of jatropha that have the potential to benefit local people.

The plantation scheme (pilot)

In 2009, FEC took over the project without adopting the out-grower contracts, preferring instead to buy the feedstock from individual farmers who already have jatropha as hedge and produces biodiesel. The company also resorted to the estate or plantation scheme so as to produce their own feedstock. The company has acquired forty hectares of presumed marginal land in Mutoko of which twenty hectares currently have five year old jatropha plants with the rest under clearance in order to plant more plants before the end of this year. The justification is that the large scale monoculture plantation scheme can produce economically viable yields required to meet the capacity of both plants. This is made possible by the use of agro-techniques such as improved management of the plants through irrigation, use of fertilisers and improved germplasm (for example, the use of mutation breeding techniques). Jingura (2011) therefore argues that the projected 120,000 hectares of land needed to meet the 10% substitution of fossil fuel can be reduced if intensification is practised because it increases both the yield and oil content. This can be supplemented by individual farmers who freely grow jatropha as hedge.

The Chisumbanje ethanol project in the eastern part of the country proved that the estate or plantation scheme is the best way to secure enough feedstock for such gigantic projects. The feedstock comes from the 40,000 hectares Chisumbanje estate and the 10,000 hectares Middle Sabi estate. The estates provide 90% of the feedstock and the other 10% is provided by the out-growers and individual farmers. More than 4,000 local people are employed on the estates and 10,000 more jobs are estimated to be created by 2014 (Mambondiyani, 2012). FEC would like to replicate the same model and currently they are doing research and experiments so that they can properly design the project and acquire appropriate land.

If the plantation scheme proves to be viable, FEC is planning to have at least a jatropha estate and a processing plant in each of the country's nine provinces. To be able to do that, FEC will need approximately five million US dollars. However, the company is currently underfunded. More so, the failure of the initial programme is still fresh in people's minds hence to source funds from the government is a big challenge.

[6] ibid

[7] ibid

[8] Interview with Mr Mpala, the CEO of FEC, 6th June 2011 held in Harare.

[9] ibid

Despite the estates or plantation scheme's potential to secure enough feedstock for the biodiesel plants and to create employment opportunities, extra caution should be taken in the conceptualisation of the project to protect the livelihoods of local people who may be negatively affected by the development. For example, in Chiredzi district in the Nuanetsi range, the government has re-allocated the 100,000 hectares of land it had settled poor rural communities on to a private company in order to establish sugarcane plantation for ethanol production. At least 10,000 families were moved (Shumba et al., 2009: 13; Mujere and Dombo, 2011). According to Hall (2011) these people had spend years building their livelihoods on that land and their eviction means that they have to start again if they are given alternative land. In affirmation, local people who stay close to the FEC jatropha plantation indicated that their livelihoods has been tempered with when the land they used to fetch firewood, collect forage (mainly thatching grass) and wild fruits, for selling at the centre, was converted to jatropha production. Although the use of large tracts of land in increasing jatropha outputs is plausible, it is detrimental to the surrounding communities as discussed above, hence the initiative should be done prudently.

The Legal and Policy Framework

The national biodiesel feedstock production programme that promoted the planting of jatropha nationwide was hurried and implemented in a legal and policy vacuum. There was neither a national legal nor policy framework guiding it; hence the course of action was ad hoc, reactive and unpredictable. The programme did not have the vital blue print detailing how investment will be regulated in order to benefit all. Thus, the programme started at the end moving backwards which contrast with Amigun et al's biofuel development model. Amigun et al., (2011) present a three stage model for biofuel development that needs to be followed. The first phase comprises the conceptualisation of the programme where ideas and thoughts about biofuels are digested at the same time gathering the necessary political support. The next phase is the most crucial and the success or failure of the programme is determined by the amount of effort applied. It is the stage where pilot projects are established to foster research efforts that lead to the formulation of a framework or policy. The last phase is marked by the implementation of the programme. According to this model, Zimbabwe skipped the second and most crucial stage.

Mtisi and Makore (2009) argue that no investment in comprehensive research on biofuels was done before the project was launched and implemented in 2005 in Mutoko district. The government rushed to construct such a huge processing plant without conducting pilot studies to see the feasibility of the project. A comprehensive research is a necessity in the formulation of a policy. A policy guides action and provides a road map to a project and also minimise any future disruptions. Currently, the Chisumbanje bioethanol project has suspended operations mainly because of distribution problems. Many fuel dealers do not have the facilities to store the ethanol petrol blend and there is no legal basis for them to create such facilities. If there was a legal and policy framework guiding the biofuel project, such disruptions would have been prevented. Rather, the project is led by an ad hoc framework that is developed to address the immediate project problems.

In addition, Shumba et al., (2009) argue that no land assessments and zoning exercises to determine which land type is suitable for jatropha production was done.

This exercise should have been led by the biofuel legal and policy framework detailing procedures for all land appropriations and compensation mechanisms. This would minimise conflicts with people that are affected by the development of the project. This problem is epitomised in the case of Naunetsi range, where local people who are supposed to make way for the ethanol project are opposing the initiative arguing that they rightfully own the land (Mujere and Dombo, 2011). As the government's appetite for land increases, a policy directing the new wave of (re)redistributive land reform is crucial. This (re)redistributive land reform programme involves the appropriation of land from local people who benefited from the Fast Track Land Reform Programme and Hall (2011) expresses it as a process where former "grabbers become grabees".

A draft white paper on principles for biofuels development was however prepared and presented to the cabinet by the Ministry of Energy and Power Development in 2007. Regrettably, to date it remains a draft and is the only policy document that leads the programme. Rural farmers and other key stakeholders are not being involved in the formulation of the biofuel policy. The draft policy was, and still is, not available for public comments, including jatropha producers. This will result in a shallow and blinkered policy document. The lack of detail in the draft does not augur well for the final policy.

The draft states that the country seeks to pursue biofuel development by growing jatropha plants and processing their seeds into biodiesel and to expand sugar-cane to produce ethanol which can be blended with petrol. Also stated is the objective to reduce the fuel imports by 10% by the year 2015 which would require an estimated 100 million litres of biofuel a year (Gandure, 2009: 44). To hit that target, approximately 120,000 hectares of land need to be brought under jatropha cultivation (ibid). In terms of participation, it clearly spells out that all rural dwellings should be involved in the project including villages, churches and schools. The document encourages the use of marginal land although it does not clearly define what it constitutes.

Uses of Jatropha Plant In Mutoko

Live fence

Figure 5: A jatropha live fence at a homestead in Makosa Village
Photo taken in Makosa village on the 10th June 2011

Residents in Makosa ward have explored some of the modern uses of jatropha. They started planting jatropha (before the biodiesel programme) as hedge to protect their homesteads as well as gardens and fields from cattle, goats and wild animals. The jatropha biodiesel scheme was thus an added advantage to them. Jatropha makes a good live fence if the plants are positioned about 30cm apart. After two years, the cuttings develop the branches closing the 30cm gap hence making it difficult for animals to pass. In addition, jatropha cannot be consumed by animals so hedges are not destroyed. In Makosa Village, almost every homestead has jatropha as fence (see figure 5 left).

Residents from Makosa argue that jatropha is the easiest and cheapest fencing material since no cost is incurred as the hedge is planted from cuttings which are widely available from established trees. They further contend that the financial resources to purchase proper fences are not available due to a lack of income generating opportunities in the community. Jatropha live fence is therefore of great use to them. It allows households to save the money that would otherwise be spent on a live fence. Furthermore, the use of jatropha as hedge is of vital importance in preventing deforestation and the loss of biodiversity because jatropha is now used in place of bush (ruzhowa) for protecting residents' homes and fields. This therefore means that the forest which is vital for rural livelihoods is preserved. Residents also indicated the danger of using bushes as fence around homes. The bush fence dries out easily and is prone to fire. Moreover, the bush fence has to be changed two or three times a year. The idea of jatropha live fence was warmly welcomed by other communities in the district who are busy planting jatropha hedge around their homes, fields and gardens. They did, however, indicate that the primary motive for cultivation was the potential for income generation through selling the seeds.

Repelling agent

Apart from being used as a live fence, residents believe that jatropha protects the home from evil spirits and snakes. In Mutoko, witchcraft is a common social phenomenon hence jatropha is believed to have the power to repel witches and bad omens.

Local Uses Of Jatropha By-Products

Respondents from Makosa ward who traditionally planted jatropha as live fence praised the multiple functions of jatropha which helped them during the country's decade long (2000-2010) economic turmoil. As discussed above, this period was characterised by hyper-inflation, as well as a lack of petroleum products and empty shops. Consumer goods were hard to find and if one was fortunate to find them in the black market, the prices would be exorbitant and the situation was even worse in rural areas. Jatropha by-products saved the lives of Mutoko residents.

Soap making

The most commonly used by-product of jatropha in Mutoko is soap. With the aid of NGOs, local people-mainly women-were able to produce jatropha soap for sale in the district. The NGOs organised women into groups or cooperatives and trained them how to press the jatropha seeds to produce jatropha oil that was subsequently mixed with caustic soda, dyes and perfume to create soap. Almost all women who were interviewed testified that the jatropha soap was very useful to their families as it was used both for bathing and washing. In the face of the Cholera pandemic that claimed almost 4,000 lives between 2008 and 2009 (Mason, 2009), the soap was used to enhance residents' hygiene and subsequently helped to prevent the spread of the deadly disease.

Even though many women complained about the negative effects of the soap, they agreed that it was better than bathing and washing without soap. They raised the concern that the jatropha soap, however, leaves the skin with an itching sensation after bathing. Despite that concern, the soap was marketable and became a source of income for female producers. Nevertheless, the exact financial returns are hard

to ascertain due to the hyperinflation during that period. When asked why they abandoned the soap making business, the women pointed out that since better and industrial produced soaps are now widely available on the market at cheap prices, rendering the production of jatropha has become undesirable. One woman stated: “ndiyani angada kushandisa chimugondiya iyo green bar yazara kudai” (who wants to use the jatropha soap whilst the green bar is widely available).

In addition to soap making, the jatropha oil was also used by women to condition their hair. The women said the oil is a good chemical for relaxing hair giving it a fine straight finish. They however cautioned that a bit of knowledge is needed to produce the best results because if wrongly applied it can burn the hair. Most women burnt themselves in the early days of using jatropha oil but with time they became acquainted to the right mixtures.

Household uses

In Mutoko communal areas, jatropha oil and seeds are commonly used in households for lighting. These areas are not electrified and paraffin is expensive and sometimes unavailable in local shops. Just like paraffin, the oil is put in a small container and a wick is dipped in through the top lid to make a lamp. Alternatively, the jatropha seed can be joined with a thin wire and when the top seed is lit it can slowly burn, producing light. This method is commonly used especially when a household does not have money to buy paraffin. Respondents in Mutoko did not report any discontentment with the smoke produced by such lights. Similarly, results from Tanzania confirm the socio-economic benefits of local processing of jatropha. Kakute, an NGO provided out-grower farmers with cooking stoves that uses jatropha oil and it proved to be beneficial to local people (Van Eijck and Romijn, 2008; Marjolein and Romijn, 2010).

Medical uses

A veterinary officer in Makosa ward highlighted some medical uses of jatropha leaves. Although the leaves are toxic when consumed, the green pigment that comes out of the leaves and the latex that comes from the stem can be used to stop bleeding wounds on both humans and livestock.

[10] Green bar is a common soap in Zimbabwe used for washing and bathing. The name is derived from its green colour.

[11] Focus group discussion in Makosa ward, 15th June 2011 held at Makosa Township.

Conclusions And Recommendations

The foregoing discussion reveals that the Zimbabwean jatropha programme provided little socio-economic impact upon lives of rural participants. The programme failed to reap the intended target of rural development and feedstock production mainly because of poor planning. The programme was neither participatory nor empowering and it is revealed by the fact that the government unilaterally set the selling price of jatropha. In addition, the conception of the programme was done by the central government without the involvement of the public particularly the farmers who were going to produce the jatropha feedstock. Consequently, the seedling propagation method used by NOCZIM did not produce good trees as compared to the traditional cutting method which rural farmers are familiar with. The programme therefore adopted a conventional top-down approach which is heavily criticised for failing to meet the needs of the people.

A jatropha programme predominantly aimed at securing jatropha feedstock for central production of biodiesel proved to be economically less viable to both producers who only benefited from selling jatropha seeds and to the government which produces biodiesel. The size of yields determines the economic returns, the larger the yield, the larger the profit and vice versa. However, the study found that the yield from jatropha planted on marginal land produces marginal yields and the situation is worsened by low selling price. Solely relying on the out-grower scheme for feedstock is not therefore sustainable, especially when jatropha is grown on marginal land.

However, the failure of the Zimbabwean jatropha programme does not discredit the growth of jatropha. Rather, my argument is that when non-commercial small scale plantation of jatropha and local value addition is promoted, rural farmers will benefit from the growth of jatropha. Farmers in Makosa ward, who planted jatropha as hedge prior to the national jatropha project, experimented with small scale processing of jatropha in 2008 before the government imposed itself as the sole buyer of jatropha. They produced soap, paraffin and candles. Also, jatropha plants proved to be of great importance to rural farmers as they can be used to reclaim degraded land, protect crops from animals (live fence), for medical and cultural or traditional purposes. In addition to these local uses, rural farmers will have the option to sell excess seeds to the government. This therefore implies that the growth and processing of jatropha on a non-commercial small scale have positive economic, social, cultural and environmental benefits.

To have a successful biofuel project, the out-grower scheme should therefore supplement the large scale estate or plantation scheme. The government should produce own feedstock rather than relying on small scale producers. In that respect, the report recommends;

Urgent need of a national biofuel policy

The Zimbabwean government needs to finalise the national policy on biofuel production and use. Instead of letting the Ministry of Energy and Power Development to develop the policy alone, all stakeholders including communal farmers, commercial farmers, civil society organisations, women organisations, youths organisations, general public, fuel dealers and related government ministries such as Ministry of Agriculture, Forestry Commission, Science and Technology need to be consulted and participate in the process. This will produce a coherent policy that will clearly spell the duties of each stakeholder. Also, the policy should clarify on the process of land acquisition and compensation mechanisms that are fair and transparent to protect citizens' land rights.

[12] Interview with Makosa ward veterinary official, 23th June 2011 held at Makosa Township.

Incentives for jatropha production

To encourage the production of jatropha the government should provide incentives to lure more people to join the programme. This is not limited to make the selling price more attractive relative to other income generating activities and goods such as cash crops and tomatoes, but also extends to the promotion of private investment in the programme through various ways such as tax exemptions to participating organisations and Public Private Partnerships (PPPs). This will ensure funding as well as the creation of competition necessary for efficiency and widening the choice for jatropha producers. Ethanol production in the Eastern part of the country (Chisumbanje) proved that private investment is crucial. In 2008, the Government of Zimbabwe brokered a PPP agreement with Mcdom Private Limited company to take charge of ethanol production. The company managed to build the processing plant and is currently producing 120,000 litres of ethanol per day yet the government led jatropha biodiesel programme is not yet operational (ZimEye, 2011).

Support for local value chain and intensification

Rather than buying seeds from small scale farmers, the programme should be readjusted to encourage local processing of jatropha. Just like any other cash crop, jatropha producers only enjoy the first part of the value chain which is basically producing and selling raw materials often at low prices. Local processing of jatropha would enable producers to fully embrace all the prophesied benefits of jatropha. To do this, government with the help of other agencies such as NGOs, should provide both technical assistance and financial resources necessary for local people to start processing the seeds into different by-products like soap.

The initiative should be empowering and sustainable to enable local people to be self-reliant. However, this does not mean dropping the biodiesel project. For biodiesel production, the government should consider making use of the plantation mode although careful planning is necessary to avoid the risks associated with large scale mono plantation such as appropriation of land from local people and loss of biodiversity (Davison, 2011).

The use of intensification

Instead of using large tracts of agricultural land, government should consider employing agro-techniques on small pieces of land, also known as intensification. Further research is, however, needed on the sustainability of this scheme before it is implemented. Davison (2011) argues that large scale biofuel investments have a high risk of failure due to lack of proper planning. To substantiate the argument he provides a couple of failed projects in Mozambique, Namibia, Tanzania, Kenya and many more (see Davison, 2011: 19-20). Therefore, the Government of Zimbabwe should invest heavily in research before the institutionalisation of this scheme.

The use of social organisations

Small scale jatropha producers should make use of the institutional resources available to strengthen their negotiating power and to air out their concerns. Instead of selling jatropha as individual producers, farmers can make use of social organisations that already exist such as village or ward committees. These committees will collect and sell jatropha on behalf of farmers. Within which collective voice is effective agent of change.

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For more information contact project manager Bernard O. Muok at b.muok@acts.or.ke and visit http://www.pisces.or.ke