Potentials of Jatropha Contract Farming Arrangement for National Development in Nigeria: A Case Study Approach

Animashaun, J.O, Omotesho, O. A; Adewumi, M.O; Fakayode, S.B; Muhammad-Lawal, A and Matanmi, B.M*

Department of Agricultural Economics and Farm Management, University of Ilorin
*Department. of Agricultural extension and rural sociology, University of Ilorin
E-mail: reals4u@yahoo.com, Mobile number: 08038550618

Abstract

Sustainable development and diversification of income sources are goals that are pursued through the Nigerian Agricultural Policy and which can all be satisfied through biofuels. However, the extent to which small-scale farmers will be able to realize the benefits derived from bio-fuels depends on many conditions Identification of business models that can incorporate the concept of sustainability and prevalent local cultivation systems will prove successful in the eventual commercialization of the biofuel industry. This study employed a case study analytical approach to propose a contract farming business model that may be applied in the commercialization of jatropha production in Nigeria as well as to identify the key constraints to successful commercialization of jatropha production in Nigeria. The result indicates the practicability of the Diligent Tanzania business model, a variation of the contract farming, in Nigeria due to its compliance with sustainability issues and the similarities in the small-scale jatropha cultivation practises by farmers prevalent in both countries. It further identified that technological, finance and policy constraints act as barriers to commercialization and the model utilization in Nigeria.

Keywords: Bio-fuel, contract farming models, and Jatropha plant

Introduction

Biofuels could offer unprecedented opportunities to support agricultural industries and provide rural employment in developing countries. Bio fuels not only meet growing rural energy needs, but form the basis of large-scale rural livelihood promotion programmes. Modern bioenergy production and utilization systems, wisely implemented, can help alleviate poverty and simultaneously free many of the poorest and most vulnerable people from the drudgery and health risks of being dependent on unsustainable forms of bioenergy (*FAO Draft Corporate Strategy for Bioenergy, 2007-09*).

However, the extent to which farmers will be able to realize the benefits derived from bio-fuels production depends on many conditions, including access to markets, information and access to technological innovation. This is because implementation of new and renewable energy technologies is always difficult due to the initial costs involved, the low availability of finance for frontier projects, the frequent need for successful public/private sector participation and adverse public perception (APEC, 2009). On a global scene, there are many economies that have actively pursued the introduction of bio-fuel and both governments and the private sector have contributed. Some of these initiatives have been successful and some have not.

An understanding of the factors that lead to the successful commercialization of bio-fuel energy can help in establishing effective implementation programs, minimizing risk, overcoming the impediments involved and avoiding mistakes which have been made in other countries. Specifically, identification of the business models that have been applied successfully in both developed and developing economies can promote early commercialization of bio-fuel energy technologies and can be instrumental in driving down the costs of these technologies. This study therefore draws on, and analyze, past experiences in bio-fuel production with a view to identifying those business models that have proved successful in sustainable bio-fuel energy production and to identify which models, or components thereof, are applicable to Nigeria.

To this end, this study examined the applicability of the Diligent limited model which is a type of contract farming business arrangement could be apply for Jatropha production in Nigeria. in used in Tanzania could serve as an inspiration for Nigeria,

It is believed that this paper will be of benefit to entrepreneurs in the bio-fuel business and development agencies in the public and private sector not only in the country but also in other developing countries

Materials and Methods

The analytical approach of this study is framed as a case study. Usually, the case study is employed due to its relevance to the objectives raised in the study. Furthermore, a case study is a way of producing concrete, context dependent knowledge, which can be used to assess existing theories and explanations. This study employed Dilligent Tanzania limited model, a variation of contract farming model, as a case study that could be adopted in Nigeria. This is due to the similarities between socio-economic characteristics of the jatropha farmers in the two countries. The study equally reviewed existing literature to understand the

theoretical framework for understanding contract farming, prospects and constraints as it applies specifically to jatropha production.

Conceptual Framework

According to Hobbs (1996) transaction costs can be described as "the costs of carrying out any exchange, whether between firms in a market or a transfer of resources between stages in a vertically integrated firm". Transaction cost can be divided into information; negotiation and monitoring cost which occur when a transaction takes place (Hobbs 1996). Generally there are five dimensions of transaction costs: asset specificity, uncertainty /complexity, frequency, difficulties in measurement and connectedness of transactions (Milgrom and Roberts 1992).

However, small holder farmers' engagement in market is low, this might be due to the high transaction costs they face when engaged in business activities. Furthermore the lack of access to producer inputs as seeds and fertilizer is a reason for the low production and thus high transaction cost per unit. Dorward (2005) stated that the coordination challenge facing smallholders is to develop a supply chain system that provide smallholders with access to the range of pre-harvest services, like production inputs, credit, technical advice. According to Dorward (2005) this requires non market coordination to deal with the problem of mutually dependent investments which are held back by market failure and high monitoring costs.

Simmons (2002) defined contract farming as a system where a central processing or exporting unit purchases the harvests of independent farmers and the terms of the purchase are arranged in advance through contracts. According to Key (1999) contract farming is an institutional response to imperfections in markets for credit, insurance, information, factors of production, and raw product; and in transaction costs associated with search, screening, transfer of goods, bargaining and enforcement. According to Simmons (2002) the most common arrangement in both developed and developing countries is where farmers sell their products on local or city spot markets where prices are based on purchaser valuation based on quality and quantity. One type of alternative arrangement is contract farming and usually involves agribusiness firms that form alliances with small holder farmers. Often they make agreements with written or verbal contracts for providing inputs and they offer a guaranteed delivery and predetermined prices (Simmons 2002). Therefore private vertical coordination systems are initiated by processors, traders, retailers or input suppliers to improve their profitability or manage risk by diversifying their sources (Swinnen and Maertens 2007). Contracting is fundamentally a way of allocating risk between producer and contractor (Simmons 2002).

Contract Farming Models

Five models of contract farming can be identified. These models differ in the type of contractor, the type of product, the intensity of vertical coordination between farmer and contractor, and the number of key stakeholders involved (Bijman 2008).

- The centralized model: In this model a processor buys products from al large number of small farmers. This model is characterized by the strict form of coordination which means

that they work with controlled quality and pre-harvest determination of quantity. The products that are traded under this model require a high degree of processing, such as sugar cane, tea, coffee and milk.

- The nucleus estate model: The nucleus estate model is a variation of the centralized model. Besides sourcing the products from smallholder farming the firm also has its own production plantation. This plantation is usually used to guarantee throughput for the processing unit. This model is mainly used for perennial crops like oil palm.
- The multipartite model: This model is collaboration between state owned institutions and private company contracts with farmers. This liberalization process of the African agriculture has been described by (Dorward 2005). In this model public or private providers of production inputs and services can be included. When the private and public institutions have a lot of control the degree of vertical coordination in this model is high.
- The informal model: This model is characterized by individual entrepreneurs or small companies who make arrangements with farmers on a seasonal basis. This model is mainly used for crops that require a small amount of processing like fruits and vegetables. The success of this type of contracts depends on the availability of supporting services like producer inputs. In this informal model the degree of vertical integration is lower than in formal relationships.
- The intermediary model: This model is characterized by the presence of at least three parties in the contract farming arrangement. A processor or trader has formal contracts with a collector, who has formally contracts with a number of farmers. The collector is functioning as a middleman, due to the absence of a direct link between the processor and the farmers the degree of vertical coordination is low.

Annelie and Romijn (2011) also noted that new hybrid models are emerging in the Jatropha industry, and according to their study, these models namely are:

- Block Farming: in which groups of farmers allocate individual plots adjacent to each other to form one large block;
- Employment Guarantee Schemes: in which the government is a large employer of farmers using biofuel cultivation as part of Employment Guarantee Schemes, practised in India);
- Rural Electrification: in which jatropha is cultivated for local use, for instance in hedges around a village for electrification, for instance by NGO as community based projects;
- Railway Track: in which jatropha is planted along railway tracks to fuel trains this is done in India, and,
- Research Plot: in which jatropha is planted for research only for instance in University of Ilorin, large expanse of land is made available for jatropha cultivation for research purposes.

The importance of crop characteristics to contract farming model development

The study of Biswanger and Rosenzweig (1986) showed that technological conditions and crop characteristics have influence on the choice for contract farming

as most favourable. Examples of crop with special characteristics that need a more sophisticated contractual arrangement are perennials. Perennials need much maintenance and take a long time to mature; this is why crops such as cocoa, coffee, rubber and palm-oil are grown under contract. Baumann (2000) also stated that tropical perennial tree crops favor organizational structures with a strong hierarchical authority. According to the author such a vertical integrated structure is needed by large investments, new crops and dependent and less commercialized farmers. Bauman (2000) provided an overview of the characteristics of a crop that co-determine the contract system:

- Perishability: if one cannot store and needs to find a market
- Bulkiness: high value per unit and economic to transport
- Permanence: growers of tea/coffee etc. cannot abandon. Locked into relationship with processor.
- Processing: need for processing creates dependence which can be exploited
- Variations in quality: contracting is encouraged where crops vary in quality and quality is Important for processing. Includes many tree crops.

Constraints to Contract Farming model

Pingali, Khwaja et al. (2005)) argued that contract farming is not a new phenomenon, therefore there is a lot of experience and knowledge available of the problems that arise in this governance structure. For both parties it is important to be aware of this. An overview of the most important problems is provided in Table 1

Table 1: An Overview of risks associated with contract farming model

	Risk for small-scale farmers	Risk for agro-industry
1	Manipulation of quality standards in order to regulate prices and deliveries	Increased transaction costs as the number of suppliers rises (in respect of transport, technical assistance, quality control, administration, etc.).
2	Late reception of products in order to reduce the price	More complex contracts, which, in order to ensure efficiency, must include a number of variables (quality, timeliness, price) that are hard to regulate and can lead to continual disputes.
3	Tying one contract to another, which is less advantageous to the producer, when the agro-industry acquires more than one Product	The risk that contract farmers may sell their goods to third parties when the price contracted with the agro-industry is lower than the price on the market at the time of delivery
4	Encouragement of concentration on a single crop, with the corresponding dependence and vulnerability	The possibility that inputs supplied by the agro-industry may be diverted to other uses than those agreed upon
5	Shortcomings in the technical assistance provided, whose ill effects become the responsibility of the producer rather than of the supplying enterprise	
6	Delays in payment or unclear settlements of amounts due and favoritism in the allocation of the most favorable sowing dates	

Source: (Pingali, Khwaja et al. 2005)

Analysis of contract farming model in jatropha production: Case study of Diligent Tanzania limited

Diligent is a seven-year-old company located in Arusha, Tanzania. It was started by a Dutch investor in 2005 to produce jatropha oil for export and local use. The business model used by Diligent Tanzania consists of two main activities. One is to buy all existing Jatropha seeds through collection centres and the other activity is to train contracted farmers to plant Jatropha following the outgrower model. Jatropha production is exclusively by smallholders who collect jatropha fruit from trees on their farms and shell and dry them to obtain seeds for sale to Diligent's collection agents. The yield of clean oil was about 25 percent of the dry seed weight, and roughly 1,600 tons of seed were purchased from farmers to obtain 400 tons of oil. Farmers are paid 100 Tanzania shillings (T Sh) cash per kilogram (US$0.08) for their seeds. Because Jatropha is traditionally grown in Tanzania, seeds are readily available. This is a huge advantage compared with establishing a plantation where the average time for Jatropha to yield is around three years. Purchasing the seeds from local communities has many benefits, notably it creates trust between the communities and the company, and it generates a cash flow in the factory (Janske van Eijck, 2009).

Sustainability Issues

Diligent's business model ensures a high degree of social and ecological sustainability. Farmers produce jatropha seeds on their own land, with their own plants, and share significantly in the value chain. Their possibilities to produce food crops or engage in other farming activities remain the same, or even become better, because jatropha hedges protect soil against erosion, and the income from the seeds enables farmers to invest in fertilizers, pesticides, and other inputs. No forests are being cleared— nature is not being threatened—because Diligent promotes jatropha outgrowing only in existing agricultural areas. The secondary product, press cake products, if used as a charcoal substitute, reduces the burden on forests, where trees are often cut illegally for charcoal production. Jatropha can be produced in an extensive and environmentally friendly manner, with no pesticide or fertiliser used and limited use of machinery made. However it is the individual farmers that have to work according to these specifications. Vehicles of Diligent Tanzania also use Jatropha biofuel. Since Jatropha is a non-edible crop it does not directly compete with food. This was an important factor for Diligent management, to avoid investing in an energy crop in Africa if it was also a food crop.

Advantages of the Contract Model in Relevance to small scale jatropha gframers in Nigeria

Key (1999) stated that contract farming can offer benefits for small producers in areas where lack of access to markets, technical assistance, inputs and credit constitute a significant problem to agriculture. A significant conclusion of Key (1999) is that when the uncertainty in crop yields or the costs of supervision or contracting are high a contract farming structure is less favourable and a firm producer could choose alternative selling arrangements available. Also when the asset specificity for the farmers is low and for the firm relatively high, the risk of side selling makes a contract farming mechanism unfavourable. Key (1999) argued that when the costs of enforcing contracts are high producer organizations could play a role by lowering the transaction costs. A producer organization can help a firm with organizing the small producers in groups which can result in lower costs for a firm's input and service costs.

The Diligent model support the social and economic objectives of sustainable development through job creation and the

generation of additional income to lower the vulnerability of specific groups such as isolated remote communities, poor farmers, women, children, and/or elderly. In addition the environmental objectives can be the conservation of the local ecosystem, adaptation to and/or mitigation of climate change which the two models support. And finally, these two models are to a large extent technical acceptable for jatropha oil production and use. The oil does not involve elaborate refinement technicalities as it can be extracted and used directly as kerosene for cooking or burnt using a conventional (paraffin) wick after some simple design changes in the physical configuration of the lamp.

Key constraints to Jatropha commercialization

1. Technological constraints

Much of the available technologies for jatropha extraction are designed for rape seed or oil palm extraction. However, very few of these technologies have been proven for commercial use with Jatropha. For use in the context of rural areas in developing countries, and to facilitate decentralised use, hardware which is relatively simple, robust and easy to maintain and operate, is needed. More research needs to be conducted in order to bring the technology used in research or pilot projects to the level required for business. The Jatropha research centers and other research centers can play a role in both dissemination of best proven technologies for small and medium scale commercial use, and coordination of research and testing.

Finance barriers

There is a lot of scepticism on the part of Financial Institutions (international, national, or even micro credit institutions) with regards to production and processing feasibility of crops and creditworthiness of the recipients. Local, regional and international financial institutions and donors need to be sensitised on the economics of Jatropha, and on what appropriate finance mechanisms would be required to stimulate the emerging biofuel sector. Smaller loans may be needed by individual farmers to allow them to make the investment in planting a few hectares of Jatropha, particularly as Jatropha only starts producing significant quantities of seed after the 3rd year. Credit may be required by SMEs/SMIs, or cooperatives to set up oil production or biodiesel businesses in combination with other rural infrastructure projects.

In the Dilligent model presented, a sort of `buyers guarantee` to purchase a certain amount of biofuel per year might help unblock credits needed to start such businesses.

Policy barriers

As shown in the Brazilian experience with biofuels, continuous government support is necessary to help develop a new sector. Now, after almost 30 years of experience, the ethanol production is viable without subsidies, but a new programme to help develop biodiesel, mainly in form of small-scale projects in the poorer northern regions, has been put into place. In most countries, where Jatropha biofuel could be produced, there is a lack of policies to support small-scale Jatropha development at the local level, including fiscal and financial incentives; the emphasis on biofuel development to meet local energy needs is not a priority. Policies are needed to ensure that local households, businesses, and communities receive the benefits of energy services from biodiesel development, as well as associated income and job opportunities. Policies should be long term, stable, and clear, and ensure Jatropha development by local people, for local people. To ensure effective policy promotion, government decision makers will need to engage small farmers and producers in the policy formulation discussions. Policy support will need to consider a range of issues including feedstock production methods, transformation, Jatropha biofuel quality standards and testing to ensure a high

quality of product that will not inadvertently damage the engines it is used in, guidelines for suitable available technology (and maybe even certification), logistics, linkages, outreach, technical assistance, end user acceptance and pricing.

Policy Conclusions

This study examined the applicability of contract farming arrangement system to Jatropha production in Nigeria. However, due to dearth of data on feasibility analysis of commercial production of Jatropha, this study merely reviewed existing literature and did not conduct any empirical analysis to analyse data. This could prompt further studies on the empirical feasibility analysis of Jatropha Production with a view of justifying its economic viability.

Conclusively, to meet pro-poor objectives and employment potentials, international support for research into jatropha agronomy and genetic improvement is needed. The expectation that jatropha can substitute significantly for oil imports will remain unrealistic unless there is an improvement in the genetic potential of oil yields and in the production practices that can harness the improved potential. At the business and entrepreneurial level, there is a need to incorporate a model that will put into consideration the peculiarity of the production system prevalent in Nigeria, moreover, when the country is looking for ways of curbing the massive rate of unemployment in the country. Small feedstock producers can be assisted by legislation that sets quotas, requiring the large oil processors to source minimum quantities from small farmers. For the present, the main sustainable approach to jatropha is within a strategy for the reclamation of degraded farmland along with local processing and utilization of oil in a way that can improve and diversify rural livelihoods, particularly for the disadvantaged rural poor semi-arid regions. Taking advantage of the opportunity jatropha presents for rural development will require reforming the regulatory policy framework and public investment constraints that affect bio-fuel development. Large-scale plantation type schemes should be sustainably promoted as part of the pro-poor development strategy to generate employment and incomes, and make biodiesel affordable to the poor.

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