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A typology of Southern African biofuel feedstock production projects

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ABSTRACT

Biofuel expansion is happening rapidly within Southern Africa, and already tens of thousands of hectares have been planted, with millions more being contemplated. As is expected with such a new and dynamic industry, this development has taken place in a relatively *ad hoc* fashion with the various role-players adapting as they respond to lessons learnt from experience, a changing policy environment and other external factors such as the global recession of 2008/2009. This emerging industry is extremely diverse and it is clear that biofuel projects differ enormously in their intent, feedstock choice and management practices. Some projects aim at satisfying local fuel self sufficiency whilst others focus on national and export markets driven by mandatory blending targets. In addition the area planted by a single farmer or company can range from under 1 ha intercropped with food crops to monocropped plantations of tens of thousands of hectares. In attempting to understand the potential sustainability of the industry there is a clear need for a typology which groups projects with common sustainability issues and concerns. Comparing like with like can greatly reduce the complexity of the biofuel debate; help identify areas of most concern and assists in identifying strategies for enhancing sustainability.

1. Introduction

A combination of rising oil prices and the perceptions of a guaranteed market for biofuels created by the introduction of mandatory blending in the European Union (EU) [1] has sparked a massive interest for liquid biofuel (hereafter simply referred to as biofuel) production in the South African Development Community (SADC) [2,3]. This has resulted in a number of foreign investors actively seeking out areas with land available for large scale biofuel feedstock plantations [2,4–7]. During the initial stages these investments were based almost entirely on the assumption that the biofuel produced would be used for export markets [8,9]. In a largely parallel process Non-Governmental Organisations (NGOs) started identifying biofuels as a potential mechanism to bring modern energy to rural areas, often as a means to generate electricity or as a fuel for what are termed multi-functional platforms, i.e. a series of applications such as pumping,

Abbreviations: ha, hectare; EU, European Union; USA, United States of America; SADC, South African Development Community; NGO, Non-Governmental Organisations.

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milling and power generation that can all be run of a single engine [2,10–12]. As national governments became aware of this drive for biofuel expansion they found that existing policy frameworks were failing to deal with this new and rapidly expanding industry [13]. South Africa was the first of the SADC countries to respond with a formal biofuel strategy, whilst most other SADC states initiated a policy formulation process. One key outcome of countries' biofuel policy development wasa move toward policies where biofuels would form part of national fuel mixes and not simply as a commodity for export [13,14].

The United Nations (UN) classifies Africa is one of the least developed regions in the world with eight of the world's poorest countries located in SADC (Lesotho, Madagascar, Malawi, Angola, Congo, Mozambique, Zambia and Tanzania) [15]. Within SADC there is a huge divide between the relatively prosperous South Africa, Namibia, and Botswana and poor countries such as Zimbabwe, Zambia, Malawi, Madagascar, Mozambique, Tanzania and the Democratic Republic of the Congo (DRC). It is the rural areas of Africa that are most improvised and hence in most need of economic development [16]. Though South Africa is functionally food self sufficient, all of the other countries struggle to meet their national food requirements; this despite the fact that Zimbabwe, Zambia, Malawi, Tanzania, Angola, the DRC and Mozambique have extensive agricultural potential [17,18]. It is this untapped potential that has caught the imagination of the biofuel investors. Mozambique and Tanzania are particularly favourable as, in addition to the land resource, these countries have good harbour facilities allowing for easy export [2,11,17].

One consequence of the poverty in sub-Saharan Africa is that an estimated 93% of the rural population and 58% of the urban population is dependent on biomass, mostly in the form of wood or charcoal, as their primary energy source (Table 1) [19]. In rural areas firewood is the main energy source, and though firewood remains an important urban energy source, there is pattern of charcoal replacing firewood as the principle urban woodfuel [20,21]. The irony of many large scale biofuel projects is that they are targeting Africa as a source of biofuel feedstock for the developed world, whilst in no way dealing with the lack of modern energy in the areas from where the feedstock is being sourced. In addition they may be displacing the traditional biomass fuels used locally with new biofuel feedstocks destined exclusively for export. A few biofuel projects are, however, targeting biofuel as a mechanism to bring modern fuels to deeply rural areas [2,10,22,23]. At the national level most SADC states are 100% dependent on imported fossil fuels to meet their transportation fuel needs. Exceptions are Angola, which has extensive fossil fuel reserves, South Africa which converts coal and gas to liquid fuels using the Fischer-Tropsch process and Malawi which uses an ethanol blend in its petroleum [3]. The use of the term biofuel in this report will be deemed to apply exclusively to liquid biofuels (i.e. ethanol, pure plant oil or biodiesel) and not traditional biomass fuels such as fuelwood, crop residues, animal dung, or charcoal. Methane from biomass, though a potential biofuel, is not specifically considered in the analysis which has been limited to liquid biofuels.

The aim of this study is to develop a typology of biofuel projects in southern Africa (here defined as the SADC region, but excluding the small island states of Reunion, and the Seychelles). The typology, in addition to providing a common language around which to understand projects, will also assist in identifying the unique determinants of sustainability in different types of projects. In addition, understanding the unique aspects of different project types will assist in developing mechanisms to enhance sustainability in the overall biofuel sector.

The nature of biofuel feedstock production largely parallels the production of other cash crops in developing countries. The analytical basis derived from empirical evidence that has built up around this can greatly facilitate the understanding of biofuel production models [28]. In this regard the land tenure systems are a key determinant of the types of farming models implemented, the relative tenure security farmers enjoy and how biofuel investors acquire land for feedstock plantations. The nature of contract farming and outgrower models for cash crop production in the food, tobacco and fibre sectors has also informed the nature of farming models that are developing in the biofuel sector [29].

African land tenure is typically in one of two variants; statutory and customary [30] though the details are extremely complex and country dependent. Current tenure evolved from customary rights, colonial tenure models (including freehold) and post independence tenure reform. South Africa, Namibia and Zimbabwe (particularly prior to the redistribution programme of 2002) have a high proportion of land in private statutory tenure and this land tends to be farmed on a large commercial scale where individual farms range from tens to thousands of hectares. Most other countries in the SADC tend to have the greater proportion of land in some form of customary tenure, though large scale leasehold or freehold farms dating from the colonial period are still found in most countries. In a number of countries, including Mozambique, Botswana, Swaziland and Lesotho the legal perspective is that all land belongs to the state and developers or individual large scale famers can only acquire land under long term lease agreements [31]. Land allocation in Africa is very inequitable, in 2000 for instance in South Africa 13.7% of the population controlled 89% of the land, in Namibia, 11.1% controlled 43%, and in Zimbabwe, 0.8% controlled 49% [32]. With the exception of Zimbabwe, land reform has had limited impact on these proportions over the past 10 years.

Land tenure also has major impacts on options open to existing smallholder farmers. Through most of Africa it is small scale peasant farmers that form the bulk of the agricultural sector; both number wise and for most countries, land area wise. Land tenure places a number of constraints on this sector when they wish to engage in biofuel production. Land allocations are made through customary processes and existing land allocations are typically less than 2 ha per farmer [33]. Land in communal tenure cannot be bought and sold. For local small scale farmers it is difficult to increase personal land holding. In addition the land cannot be used as collateral for loans, making access to start-up or operational capital difficult.

Despite customary tenure being relatively secure, when new large scale developments are proposed on customary land, often through a lease agreement with government and or local authorities, this can lead to the displacement of existing land users [2,34,35]. Quoting from Adams [36]: