Bioenergy value chains in Namibia: Institutional challenges for rural development and food security

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Abstract: *This paper elaborates on the potentials and risks of bioenergy production in Namibia and the institutions and policies shaping them. Existing and emerging value chains based on the conversion of Jatropha curcas into straight vegetable oil and biodiesel and of woody shrubs (bush) into charcoal, pellets, and woodgas are analysed in terms of their viability and impacts on rural development and food security. We argue that bioenergy value chains can have large positive impacts, but these depend on the specific value chain configuration and institutional and policy environment. Extremely high expectations, unclear land rights, delegated negotiation power, communication infrastructure, long procedures and government anxieties can combine to a politically and socially explosive mix. Even the successful establishment of such large projects will create certain problems, since not all parties will benefit in equal terms, not all politically influential persons will be satisfied, and other effects are difficult to manage. The paper identifies gaps in the institutional and policy framework and proposes solutions for improvement around the policy areas of food security, agriculture, labour, land, output markets and value chain coordination.*

Keywords: *bioenergy, Jatropha, charcoal, Namibia, rural development, food security, institutions*

Introduction

Modern bioenergy production has attracted enormous attention over the last years, particularly liquid biofuels for transport.[1] Sub-Saharan Africa (SSA) has until now only participated marginally in the global expansion of bioenergy production. However, studies show a vast production potential for biofuels in several African countries (e.g. Faaji, 2008; Fischer, 2009). Many attempts are under way to realize this potential, yet mostly at an experimental or very early commercial stage. Many of the upcoming challenges have been recently discussed in the public, some of which are generic, some typically shaped by the African context, and some unique to specific sites. Given that modern bioenergy production (especially that of liquid biofuels) is still a marginal phenomenon in SSA, there is yet little consolidated knowledge on the various potential effects for the producing countries.

This paper takes Namibia as a case study to foster the understanding of the feasibility of modern bioenergy value chains, their potential effects on rural development and food security in SSA, and aims at showing options for governments to influence the processes and outcomes through policies and institutional development. Namibia is regarded to have considerable potential for bioenergy production. The two most promising bioenergy pathways are the conversion of invasive woody shrubs (bush) into bioenergy (charcoal, woodgas for electrification and woodfuel briquettes) and Jatropha curcas cultivation for producing straight vegetable oil (SVO) and biodiesel. The Government of Namibia (GRN) is still hesitant to either fully promote bioenergy value chains through policies and supporting mechanisms or to block it. This attitude is explained by the potentially large effects on local and national food security and rural development (including ecological aspects), which are concerns of many SSA countries, but also by the inertia of government towards innovative, complex sub-sectors which require coordinated action on several grounds and by several ministries. We will first discuss the opportunities and risks of bioenergy production for rural development and food security and then analyse the processes and factors inhibiting the realization of these value chain

[1] Bioenergy is the final product derived from biomass; biofuel is the energy carrier. Following the FAO (2008), biofuel also includes biogas and solid materials (such as fuel wood, charcoal and wood pellets). Fuel wood is the most common energy form in Africa, providing 80% to total consumption. When referring to modern bioenergy, we exclude fuel wood.

impacts. Finally, we identify necessary changes in policies and institutions to support and regulate bioenergy production and shape its impacts.

Conceptual Framework and Empirical Approach

Poverty largely remains a rural phenomenon in SSA and the need for increasing competitive labour-intensive activities is widely acknowledged (World Bank 2007). However, new productive activities with significant use of natural resources such as bioenergy production might face various limitations and compete with other uses. A key question is thus, whether and how agricultural growth and nature conservation can be brought into balance (Vosti and Reardon, 1997). We therefore understand rural development as a systemic and normative concept of sustainability (Brundtland, 1987) of rural areas which incorporates different dimensions (economic, ecological and social) that need to be balanced in order to enhance rural livelihoods. Food security also remains a key policy issue of most SSA countries, particularly after the 2008 food price crisis. It is commonly conceptualized as comprising the dimensions of food availability, access, stability and utilization (FAO, 2009). Adopting such a wide concept inhibits from seeing food security merely as a production problem, but forces to also elaborate on income and poverty, food markets, prices, government transfers etc.

The effects of bioenergy production on rural development and food security are determined by factors within and outside the value chain. Factors affecting a chain's viability and the distributional effects within the value chain are, for example, the costs and institutional arrangements of production and processing, the local and national policy and institutional environment, and the bargaining power of the involved actors (see, Kaplinsky and Morris, 2001; Eaton and Meijerink, 2007). Other important effects lie outside the chain's boundaries (e.g. effects on food markets, water, wildlife, tourism, social community structures), which are also influenced by policies and institutions at various levels. In this paper, we adopt this integrated approach to qualitatively analyse value chain dynamics as well as wider rural development effects by drawing from the literature of value chain analysis, institutional and agricultural economics to elaborate on the impacts and institutions and policies influencing the viability and the development effects (see ibid.; Williamson, 2000; Bolwig et al., 2010).

The findings rely on qualitative data collected during a 3 months field research between February and May 2009 in the capital of Namibia and various rural regions. Selection of interviewees followed the value chain structure (actors at different levels along the chains, including local farmers not directly participating) and institutions and policies assumed to exert influence on the value chain impacts (for instance, policy and administrative units in the field of labour or environment). About 130 semi-structured interviews with experts and stakeholders were conducted, including representatives from ministries and decentralised bureaucracies, parastatal organizations, private sector investors, NGOs, commercial farmers and group discussions with smallholder farmers and wood/farm workers. With regard to the value chains (Jatropha and bush), the sample covers most major actors (except small-scale farmers and wood workers which we sampled according to availability). Obtained information was cross-checked with other sources and interviews. Where triangulation did not yield clarification or consensus, a conflict of interest, perception or an information gap is stated. A computer program for qualitative data analysis, called atlas.ti (www.atlasti.com), was used.

Rural Development Challenges and Bioenergy Context of Namibia

In its Vision 2030, the GRN formulates an ambitious national objective of becoming a highly urbanized knowledge society by 2030 (NPC, 2004). The agricultural base is considered to be too weak to offer a sustainable basis for long-term prosperity (Namibia has the driest climate in southern Africa with an average rainfall of 270 mm). On the other hand, Namibia faces the immediate challenge of an enormous income inequality, one of the highest in the world (World Bank, 2008).

Poverty is concentrated in rural areas (particularly in the communal areas in the north) where it reaches 50% of the population with an unemployment of 45% of the labour force (NPC, 2008; Schmidt, 2009). The major pillars of Namibia's development (mining, tourism, urban development) do not provide sufficient jobs for the rural poor.

Agriculture remains the most important livelihood source for the rural poor. A key feature of agriculture in Namibia is the dual land tenure system, dividing the land into 'commercial' farmland with freehold tenure south of the veterinary fence (44% of the country), 'communal' areas without freehold property in the north (41%) and state land (15%) (Odendaal, 2006; SEEN, 2008).[2] Commercial farming south of the fence is well-developed, capital-intensive and export oriented, producing some staple and horticultural crops, often with additional irrigation,[3] but mainly focussing on extensive livestock, game rearing and farm tourism. In contrast, the communal farming sector is dominated by agro-pastoral subsistence farmers with average cropping plots of one to four ha (Mendelsohn, 2006). Use of more advanced technology and inputs is low, and fields are often left fallow because of declining fertility after some years of production (ibid.; Mendelsohn and Obeid, 2007). In the extreme north, rainfall is sufficient for staple food production (mahangu or pearl millet, maize and sorghum), mainly for subsistence (Odendaal, 2006). Still, a majority of the farmers does not meet their basic food needs from subsistence farming, but relies on food purchases for a considerable time of the year (NPC, 2006). The underperforming agricultural sector in the north and overall lack of alternatives exacerbate rural poverty and food insecurity (UNDP, 2004; NPC, 2008).

50% of food consumed in Namibia is imported, while temporary import restrictions assure the viability of domestic commercial food production (Mendelsohn, 2006). Food markets appear to be well developed, reliable with low price variability, apart from areas with sporadic periods of inundation in some northern areas. Food availability therefore does not appear to be a major problem, but access is limited due to lack of incomes. A special situation exists in the commercial farm areas where markets are lacking due to low population density.

A major problem closely linked to bioenergy is the severe bush encroachment which degrades around 26 million ha of woodland savannas in Namibia (de Klerk, 2004), severely limiting the grazing potential for cattle and sheep and affecting the livelihoods of 65,000 households in communal areas and 6,283 commercial farmers and their employees (about 35,000 wage labourers) (ibid., Hager et al., 2008; SADC, 2006). The economic loss was calculated at more than N$700 million annually (ibid.), while also causing severe environmental damage (reducing biodiversity, water-use efficiency etc.). Converting bush into biomass energy on a large scale has been named as possibility to reduce rural poverty and the invader bush problem at the same time (SADC, 2006). A total energy potential of 40.8 TWh (Terra Watt hours) per year had been calculated (Leinonen 2007), far exceeding national energy needs (12.6 in 1999). The National Biofuel Roadmap of 2006 (IBC, 2006) identified Jatropha as major feedstock of a domestic biodiesel industry for export production and a yet to be established domestic market. Given the ecological conditions of Namibia, Jatropha was identified as most suitable biofuel crop to grow in the north east (IBC, 2006). Jatropha received much attention throughout SSA as highly promising crop for biodiesel production due to its oil-yielding seeds and apparent low-input requirements. Doubts have come up in recent years concerning the validity of these assumptions when opting for high yields (Jongschaap et al., 2007).

Bush Value Chains: Viability and Development Impacts

There are three main bioenergy pathways in Namibia using bush as feedstock – charcoal, woodgas (for electricity generation), and woodfuel briquettes. Only the charcoal value chain is already

[2] The dualism of communal and commercial land tenure dates back to the first land policy by the German Colonial Authority in 1892 when fencing-off white owned, commercial lands in the cattle pest free southern zone from the pest burdened black owned communal lands. For a long time, this line also demarcated the area of free settlement for black people.

[3] Water scarcity is an extremely important limitation for Namibia's agriculture. Food security considerations advise the use of water resources only for food crop production.

commercially viable and widespread. The others are at an experimental stage: woodfuel briquettes are produced by a NGO but not (yet) at commercially viable scale; a pilot woodgas facility was to be established in 2009 by a joint venture of a NGO and private actor. Most information below is therefore based on charcoal.

All three value chains reveal similar characteristics on the production and initial processing stage which are the most relevant for rural development and food security. In particular, they have in common the legal regulation, the mix of production goals for bush clearing, and the very laborious activities around harvesting of bush. When setting up bush-to-energy activities, at least two of the following goals are pursued: selling the energy, clearing land for increasing livestock carrying capacity, and improving the ecological conditions of the land. In the charcoal industry, farmers or charcoal producers employ teams of mainly male charcoal workers who manually chop and burn the trees and bushes to charcoal in mobile kilns. Small farms employ five to 10 wood workers, larger charcoal producers employ up to several 100 charcoal workers. Some communal farmers are also engaged in charcoal production. Labour and transport costs have been mentioned to be the main cost components and supervision of charcoal workers is seen as a major problem.

Large differences between the value chains exist in transformation and marketing the final products. The products transported are partially more bulky (woodchips, briquettes), which makes transport costs more important, partially they require special infrastructure (grid). Also, the demand and prices for the innovative products are yet not clearly established: Woodchips are marketed under a special NGO conservation label, creating especially high prices which may not be achievable for "ordinary" successors. The feed in regulations for locally produced electricity are not yet clearly established, and the future of the electricity market in Namibia is highly uncertain, being almost completely dependent on South Africa.

While bush-to-energy value chains are partly operational, there are several challenges constraining their viability. Labour is the most sensitive issue. Unions recently demanded a remuneration of 700N$ per ton of charcoal for workers which, according to commercial farmers, would make production unprofitable.[4] An even more fundamental risk seen by commercial farmers is the position of the Ministry of Labour (MoL) towards self-contracting, claiming that wood workers need to be treated as workers under the Labour Act. Charcoal producers, however, insist on more flexible contracts to provide sufficient incentives for wood workers given the difficulties of labour supervision. They criticise that political negotiators and unions do not have sufficient knowledge of the charcoal business realities. Unions', namely the Namibian Farm Workers' Union (NFWU), lack capacity to reach out to the people. Negotiations between the charcoal producers association, unions and government representatives are going on for years without any agreement so far. A Woodland Management Council (WMC) is foreseen as discussion forum, but only exists in an interim form with low prospects of becoming fully operational soon. All these challenges lead commercial farmers to choose more mechanised harvesting techniques enhancing labour productivity, payments and working conditions but reducing demand for unskilled labour.

Rural Development Impacts of Bush-to-Energy Value Chains

A major potential contribution to poverty reduction of bioenergy production might be the incomes generated by wood workers, potentially affecting the sending regions through remittances. A study on wood workers (Karamata 2006) found that farm workers sent 22% of their wages home. Our interviews with wood workers confirmed this pattern. Communal farmers might earn income from selling bush or charcoal and by regaining rangeland. Whether this actually reduces poverty requires a more representative poverty assessment.

[4] The Namibian Charcoal Producers Association had agreed with labour unions to pay 40% of the selling price to the labourers (around 350-400N$ per ton). As stated by farmers, workers can produce between 2-4 tons of charcoal per month, resulting in earnings of 700-1400 N$/month, clearly above minimum salaries. However, performance varies considerably.

There are several problematic aspects overlooked when only analysing wage levels. Workers are highly dependent on farmers given the remoteness of charcoal areas. During the first months repayment of initial credits for working material can often absorb a substantial share of the wage. Food from the farmer's shop, medical expenses and, in some cases transport are other expenses often deducted from the wage. Workers often become indebted from borrowing at farmers' shops. Prices at those shops were said to be higher than at markets due to transport costs and profit-making objectives of the farmer. The additional incomes might enhance food security, which, however, also depend on the food prices paid at the farmer's shop. Further insecurities for the wood workers result from the fact that they are self-employed contractors and therefore not covered under the Labour Act as farm workers (see above). Contracts are usually oral agreements and make the worker responsible for their own social security. Informal and mostly seasonal arrangements do not secure workers with cash income throughout the year. Unclear are the impacts on health and education. While higher incomes might improve access to these services, the sites studied were all relatively far from larger populated areas with health centres and schools. Negative health risks also arise from the hard working conditions without proper clothing and little control by labour inspectorates.

Positive environmental impacts of debushing arise from the impacts on water tables by reducing evapotranspiration of trees, which in a drought prone country like Namibia is important for agriculture, livestock keeping, and drinking water. The overall ecological impacts, however, depend on the scope of bush removal. The law restricts total bush clearing and requires certain species to be protected. Therefore the goal is usually to only thin out bush infested areas (JPC, 2008). Complete removal through chemical debushing techniques and cutting of protected species, however, was mentioned to be a problem. Debushing permits are needed for areas exceeding 15 ha, which are issued by the Department of Forestry (DoF). These, however, only regulate protection of endangered species while more extensive sustainable harvesting is only ensured through FSC (Forest Stewardship Council) certification. If debushing is done with a co-objective of rangeland recovery, ecological requirements might be met more easily since complete open areas are not in the farmer's long-term interest.[5]

Jatropha Value Chains: Viability and Development Impacts

Three models of Jatropha production are envisaged in Namibia: small-scale village production of straight vegetable oil (SVO), medium size commercial farmers, and large-scale projects. The drivers of Jatropha promotion in the Biofuel Road Map (see above) were commercial farmers. Unsuccessful initials trials of some of them due to frost and other natural calamities lowered the interest of this group, and shifted hopes to sites in the communal areas, where frost does not pose a threat, rainfall is higher and irrigation easier feasible. Foreign and national investors tried to establish projects (between 20,000 and 300,000 ha), including MAN, Lev Leviev Biofuels and Caparo Investment (e.g. Caparo 2009; Etango, 2008; EnviroDynamics, 2009). These tried to establish contract farming schemes (Mendelsohn and Obeid, 2007) or to acquire large pieces of land for plantation schemes.[6]

Our focus here is on the large-scale plantation and contract farming schemes. Non of these large-scale projects studied had yet reached a larger production level, while several seemed to have had already stopped activities. In both models, difficulties were met in obtaining land or securing production by outgrowers, caused by problems of local- and ministerial-level decision-making processes concerning land rights and land-use planning. The financial crisis created additional liquidity constraints and dropped oil and alternative energy prices.

[5] Effects on GHG emissions are yet unclear: harvesting invader bush immediately releases carbon but reduces emissions if replacing fossil fuel use elsewhere in the value chain.

[6] The most promising project aimed at contracting 8,000-13,000 farmers in Kavango to plant Jatropha on 70,000-130,000 ha of land deforested prior to 1990 to capture carbon credits through the CDM mechanism (Christian, 2006). Given the long time for Jatropha to mature the investors subsidised farmers. A farmers association was established holding shares in two companies for feedstock production and processing. The shares were to increase to 100 and 49% respectively after 2014.

In the contract farming model, where acquisition of land was not an issue, uncertainties regarding the legal claims between farmers and investors for carbon credits on Jatropha trees arouse: The investor demanded long-term leaseholds by the farmers to assure ownership of trees, while communities and the government feared loss of long-term land access or rights of farmers.[7] In the plantation models, on the other hand, violations of the Communal Land Act were reported as investors consulted on traditional authorities who did not consult their communities. In one case, land promised to the investor had already been gazetted by another ministry for alternative use in livestock production a couple of years earlier. This right had not been used and expired, but degazetting took a long time and was still ongoing. The lack of a clear government position on Jatropha had further created uncertainties and risks for investment decisions. Two major factors mentioned were the food security effects and the fear of invasiveness and toxicity, although Jatropha had existed already for a long time and a thorough EIA (though financed by investors) had found no negative signs. Communities and regional governments insisted on proofs of technical viability before dedicating own land.[8] Doubts in the viability of the projects and in investor objectives were fuelled by the lack of reference Jatropha projects elsewhere in SSA and failures of past cash crop initiatives (cotton, sugarcane and others).

Rural Development Impacts of Jatropha Value Chains

The field research showed that the impacts of Jatropha production will differ especially according to how value chains are organised. Most obvious are the potential economic gains for the regions. The massive employment generation potentials in regions with high (especially youth) unemployment and the enormous increase of cash circulation in the regions might lead to significant poverty reduction effects of Jatropha production and processing on a larger scale (Mendelsohn and Obeid, 2007; Mitchell, 2009). In general, opportunities as well as risks increase with the size of the projects, but how scale is achieved does matter, and risks are different. While a multiplicity of small scale projects for SVO production for local use may be able to produce large quantities, it will require heavy support from state of donors and will not generate new market access, whereas conversion of oil into biodiesel opens new markets but needs some economies of scale in processing. Producing the required large quantities of feedstock through contract farming will not change the rural structure fundamentally, while large project investments will. On the other hand, supply risk is certainly larger in contract farming than if at least some share of Jatropha is produced by the investor himself, and plantation production does not require tackling the lack of productive capacity of smallholders. In addition, larger formal employment creation through plantations might engender additional creation of health facilities, schools, roads etc., leading to further rural economic and social development. As was mentioned in interviews with local communities, availability of formal wage employment might reduce prevailing youth problems, though also fear of increased alcoholism was expressed (see also Mitchell, 2009).

Indications for a negative nexus between Jatropha production and food security were hardly found. Increasing incomes might rather improve food access without jeopardising food availability as people already depend on relatively well-functioning food markets and the main cause of food insecurity is seen in the high unemployment and lack of jobs in rural areas. On the other hand, projects of large size increase the exposure of the regions to large risks, of which the overall project failure is most crucial leaving the communities with huge open lands or Jatropha fields. Even if these areas are hardly used for other purposes (almost complete absence of water in most of the earmarked areas makes even livestock rearing difficult), the structures are long-term and costly to reverse. The communities might also face the risk that a company exploits its monopoly position and not fully complies with contracts.

[7] Customary rights are already recognized by law in Namibia. Converting such land into private leaseholds might lead to farmers loosing their lands once unable to pay lease fee to the Government (e.g. in case of project failure).

[8] Secured yield data under different growing conditions were not (yet) available in Namibia, at least publicly. Investors calculated that yields of three to five t/ha would be sufficient to make production viable (without by-products). For large biodiesel processing units (20,000 ha of plantations), biodiesel production cost was estimated at 0.62US$/litre (IBC 2006).

Large investments also seem to provoke large social tensions within the communities, which traditional authorities are often not prepared to handle. These might stem from increasing migration from neighbouring countries or regions and the exclusion of minorities and vulnerable groups. During some negotiations over communal lands, conflicts within the communities could already be observed. Traditional authorities are under extreme pressure, never having experienced a similar run on their land and not having knowledge, experience or capacities to deal with such large projects.

Environmental effects from Jatropha also seem to vary substantially between models. The plantation models likely lead to losses of biodiversity through debushing and monocropping. Although the investors promised to make provisions for intercropping and maintain natural vegetation and wildlife corridors in their plans, these efforts would only reduce the negative ecological impacts of a plantation. Other negative effects mentioned regarded the impacts on the natural water cycle due to irrigation, pollution of water and soils due to fertilizer use, and CO2 emissions. In contrast, contract farming schemes partly focussed on land already cleared before 1990 and degraded, fostering vegetation regrowth and rehabilitating soils.

Key Institutional Challenges for Bioenergy Value Chains in Namibia

Whether opportunities of bioenergy production materialize and threats are minimized depends on various institutions and policies. These challenges are valid for many rural activities. However, modern bioenergy animates these as the first massive wave of (potential) investments in the communal areas of Namibia in recent years. Clearly, there are particularities according to the value chain and production model.

Policy Coordination

The fact that bioenergy value chains affect various sectors makes policy coordination critical. Bioenergy chains are new and depend on many factors to become viable. Many ministries are supposed to play an active role in the bioenergy industry, and leadership seems to be a crucial handicap. In the case of Jatropha, a Cabinet Committee was established in 2008 in order to advance the issue. However, the presiding Ministry, the Ministry of Mines and Energy (MME), does not push the issue but waits for other ministries. The WMC merely acts as advisory council to the agricultural ministry (MAWF) and is mostly inactive, though debushing control would ideally be its mandate. In both value chains, no mediator exists to facilitate communication between stakeholders. Compared to the immediate need for regulations, especially in the case of Jatropha, existing procedures are too slow. Most likely due to the 'power vacuum', no policy is in place. The Bio-oil Road Map shows ways how to get involved in the emerging biofuel-economy, but was never elevated to the status of a policy. Though numerous government officials have stated that knowledge is insufficient for decision making in case of Jatropha, no initiatives are taken to close information gaps.

Food Security

A narrow conceptualisation of food security at the political level seems to be a major obstacle for stronger bioenergy support in Namibia. One important issue is that Jatropha production is feared to reduce staple food production of smallholders, and the second is that the income effects of labour intensive debushing are underestimated or overlooked. Both issues are not in line with the general strategy of and lessons in the country which clearly embarks on a wider definition of food security (NPC, 2004) and has concluded from past initiatives *that "the lesson is that subsistence agriculture is not an appropriate mean to reduce poverty in Namibia"* (NPC, 2008, 21). In consequence, the current National Development Plan (NDP 3) puts a greater focus on diversification of rural household incomes (NPC, 2008). However, the interviews showed that many officials emphasise the conflict of biofuels with food production while neglecting the opportunities for diversification strategies away from subsistence farming. Even if this reservation may be understandable for large plantations which

are also under scrutiny for other reasons, such reservation is much less reasonable for Jatropha under outgrower schemes, and even unjustified for bush-to-energy. As a response, food production was introduced in all Jatropha business models. Still, the official support for all these technologies is very low. Agricultural investments require security of government's position regarding cash crop production and their role for food security (see next section).

Rural and Agricultural Development, Land Policies

The role that bioenergy can play for rural development depends on the objectives the country sets for developing its rural areas and how it manages to integrate bioenergy value chains. Adhering to the long-term strategy (NPC, 2004), a fundamental transformation of the country's economic structure is necessary. In the short and medium term, however, rural development must play an important role in reducing food insecurity and poverty, and agriculture and forestry are without many alternatives. At the same time, rural livelihoods depend on the quality of the natural resource base, requiring an integrated approach of reducing rural poverty and conserving nature (Grimm and Werner, 2005, NPC, 2004).

If bush and Jatropha value chains are accepted as elements of rural development strategies, policies and institutions have to be in place, since - as has been shown - they will hardly develop well autonomously. This includes participatory planning of rural areas, which at present is much stronger articulated around conservancies (see section *environment*), but lacks for land and water use planning and, more generally, rural development for productive use of natural resources. This has slowed down especially the implementation of Jatropha projects. The Ministry of Land and Resettlement (MLR) is waiting for decisions of the line ministries. The lack of coherent and foresighted land-use planning also puts enormous pressure on local-level decision-makers. Traditional Authorities (TAs) and Communal Land Boards (CLB) are faced with multiple requests for unprecedented amounts of land and must act as mediators between different interests in the same areas. The TAs not only lack technical capacities for administering formal land allocation processes, such as trained clerical staff and equipment (see Mendelsohn, 2008) but also the expertise. Funding and equipment of CLB is inadequate, reflected in a shortage of human and material resources (see, GTZ, 2004). Conflicts between TAs and CLBs, lack of capacities and policies leave room for exploitation of land allocation processes for personal and political agendas, often causing denial of formal land registration.

There are general weaknesses in supporting small-scale farmers through the agricultural research and extension systems in Namibia, and for bioenergy options in particular. But even for larger farmers and investors there are limits to own efforts. This hinders the introduction of new crops, such as Jatropha, or of sustainable technologies, for instance FSC charcoal production. According to the model, different support is required, for instance in the Jatropha outgrower schemes focusing on integrating small-scale farmers into value chains with many issues attached such as technology development and transfer, credit, farmer organisation, etc., while larger farmers rather need support in research. A central problem is the lack of procedures for handling new crops. There is no institutionalized process to declare new crops invasive or otherwise environmentally harmful. Even if accepted, information on yield potentials as a decision support for small-farmers as well as investors does not exist.

Land tenure is a central issue for the implementation and impacts of bioenergy investments. Lack of access to credit linked to the lack of collateral value of leaseholds and communal land continues to be a limiting factor and reason for low agricultural productivity. In addition, most farmers graze their cattle on land to which they have no exclusive rights and from which they cannot exclude others. Thus, communal farmers not only lack capital for investment, but can neither be sure to benefit from their efforts. In commercial areas farmers face the problem of being uncertain about which farms might be expropriated for redistribution reducing incentives for farmers to invest. The lack of debushing even poses a threat to the success of the entire land reform by leaving less productive land available for redistribution.

In order to improve the living conditions of wood workers, several policies and institutions need to be strengthened such as labour laws, social, health, and information services, with special regards to the particularities of rural areas (see for instance section *labour*). Non-permanent jobs, for instance in Jatropha harvest, should be treated similarly. Financial transfers between rural areas should be facilitated.

Labour Policies

An enormous challenge for the GRN is to create favourable economic conditions for employers and at the same time protect the interest of wood and plantation workers. In both value chains this becomes paramount: labour input is a major cost component, while at the same time, labour conditions in unskilled jobs and informal employment in the agricultural sector pose high social and political challenges. Moreover, Namibia's Apartheid experience makes the treatment of employees and workers an especially sensitive issue.

The Labour Act of 2007 (GRN, 2007) regulates the rights and duties of employers and employees and provides enhanced protection and rights of employees. The labour legislation, however, seems not to sufficiently account for different types of work requirements and arrangements that exist in bioenergy production (e.g. seasonality, piece work, foreign labourers, special situation of remote areas). Problems of implementation and supervision in rural areas increase the ineffectiveness of labour legislation. Because of little flexibility in the legal provisions, a lack of agreement between the stakeholders and little knowledge of the counterpart's situation, wood workers are not covered under the Labour Act and are left in a grey area. Adjustments of the labour legislation seem to be necessary with regards to bioenergy production. Supporting communication channels for the unemployed and informal sectors as well as mediating between the parties might be a solution to make their concerns heard when formulating labour policies. However, long-term poverty reduction requires a long-term oriented approach towards the problem of youth unemployment.

Environment

Namibia's Ministry of Environment (MET) plays the main role of dealing and coordinating environmental affairs. The Environmental Management Act of 2007 is not yet fully in place, but it is expected that all investment projects undertake Environmental Impact Assessments (EIAs). NGOs have argued, however, that the power of EIAs to decide on the realisation of a project is low compared to other, pecuniary interests. A major problem is that the agency contracted to do the EIA is typically financed by the investor that has. Furthermore, EIAs are conducted for single projects, which overlook potential accumulated impacts. The Act provides for Strategic Impact Assessments (SIAs) which attempt to tackle this problem, but have not yet been applied to bioenergy. Major obstacles seem to be the lack of capacity and political will as well as time lag between project initiation and environmental protection measures. Enforcement is a challenge also for bioenergy production. Knowledge generation on the environmental aspects of bioenergy production, distribution and management are difficult with weak capacities to embark on research in new fields like bioenergy.

Bioenergy Output Markets

The domestic market has huge potential for renewable energy, given both its dependency on energy imports and need for further rural electrification. However, no targets for renewable energy production or feed-in quantities exist in Namibia. Currently, highly subsidized conventional diesel prices in Namibia have negative effects on the viability of renewable energy solutions. Generating electricity through woodgas burning and feeding it into the grid would require some important steps. Electricity import is already separated from distribution by creating independent regional supplier which should have more interest in diversifying energy sources. While the right to feed electricity

into the grid has been established, current tariff agreements are too low for independent power producers. A major barrier for entering international markets relates to the necessary economies of scale. Concerning Jatropha, public trade standards are likely to hamper international market access, whereas for bush energy carrier FSC or other standards matter but are challenging for small actors. In general, to establish a future energy mix with bioenergy playing a significant role, a national renewable energy policy would be necessary to define targets, quality standards and appropriate measures (feed-in tariffs, blending mandates, organisational and logistic support etc.).

Conclusions and Recommendations

The paper has shown that bioenergy production can contribute to rural development and food security in Namibia. Especially for the bush-to-energy value chains, small-scale Jatropha schemes and contract farming models based on the CDM promise positive impacts without larger risks, whereas in large scale models higher chances are linked to important risks. Sustainability of bioenergy production requires the production models to be economically viable, which apart from charcoal and woodchips production is currently uncertain with all other models. These need more experimentation and, in one form or another, support. The impacts of bioenergy production are, however, strongly influenced by crop choice, production model and the functioning of a variety of institutions. Potentials as well as risks can be expected to increase with its scale of production.

A key conclusion and recommendation is that the introduction of fundamentally new value chains, which require innovations, organisational structures and market development at several levels more or less simultaneously, is very difficult without coherent government support. In the case of larger schemes where investors dispose of important resources and have access to information, innovation generation and markets, this support can be limited to policy clarification and institutional arrangements that do not hinder value chain development and foster constructive negotiations and contractual arrangements. Strategic research is necessary to improve negotiation and decision making. Weak actors need to be supported more directly to be able to negotiate with stronger partners based on a similar level of information. In case of smaller bioenergy solutions, more immediate support of generally more resource constrained actors is needed, including capacity development and initial subsidies to acquire know-how, organisational structure, and market access. Risk considerations must be an important element of any bioenergy value chain assessment, but much more so for large schemes. In case of major uncertainties around bioenergy production it is advisable to start with small realisations and collect experiences for larger projects.

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