



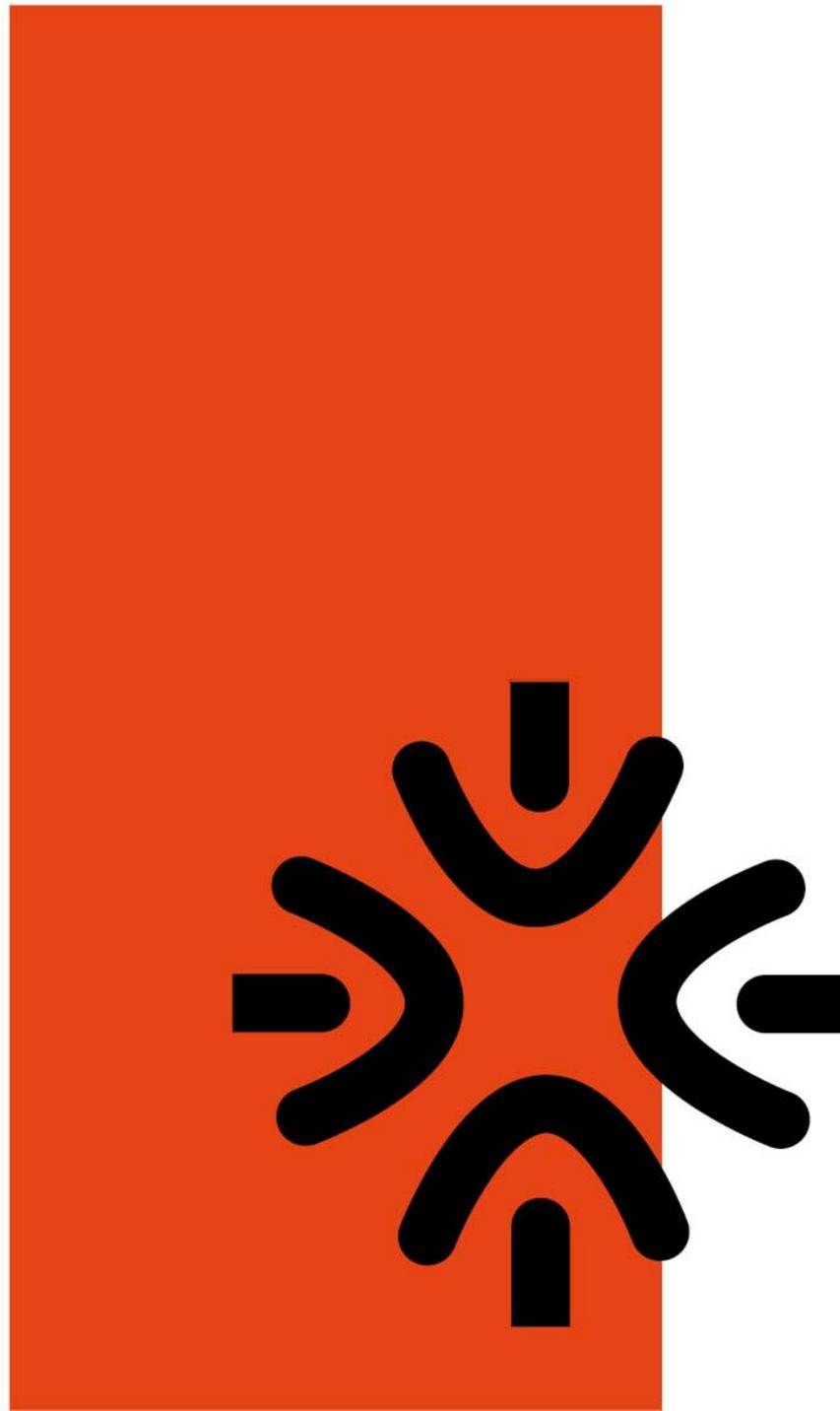
Working towards sustainability

Learning experiences for sustainable biofuel strategies in Mozambique

Executive summary

Marc Schut, Sandra Bos, Lara Machuama and Maja Slingerland

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The Netherlands' Directorate-General for International Cooperation and Wageningen UR are implementing the Partnership Programme 'Globalisation and Sustainable Rural Development'. In the context of conflicting local, national and global interests and drivers of change processes, the programme aims, among other things, to generate options for the sustainable use of natural resources, pro-poor agro-supply chains and agro-biodiversity. These options need to result in improved rural livelihoods, poverty alleviation and economic development in the south. Farmers and other small-scale entrepreneurs in the agricultural sector form the primary target group. The program has a strong -but not exclusive- focus on countries in Sub-Saharan Africa.

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Introduction and objectives

Climate change, rising oil prices and a concern for future energy supplies, have led to a growing interest in the use of biomass for energy purposes. Several studies have shown the biophysical potential for biofuel production on the African continent. Analysts see Mozambique as one of the African countries that may contribute considerably to the continent's large biofuel production potential. Favourable growing conditions, and the availability of land, water and labour are mentioned as the major drivers behind this potential. Moreover, biofuel production in African countries could be a driver for technological, economic and rural development. Nevertheless, the production of biomass energy crops can also result in negative environmental impacts, changing land-use patterns and socio-economic impacts such as competition with food production. In order to deal with these legal, social, economic and environmental impacts, some countries (UK, Netherlands), multi-stakeholder platforms (Roundtable for Sustainable Biofuels) and supra-national institutions (European Commission) have developed sustainability guidelines for biofuel production. The implementation of such biofuel sustainability criteria can have clear consequences for African countries like Mozambique. As a response, the Mozambican government defined the necessary steps to develop their own national system of sustainability principles to guide biofuel investment and production. To elaborate on this, an Inter-ministerial Biofuels Taskforce was formed, which includes a subgroup 'Sustainability Criteria and Development Models'. One of the objectives of this subgroup is to develop a national strategy for sustainable biofuel production that reflects the Mozambican reality and long-term market-requirements for developing a sustainable biofuel sector.

This study seeks to support the work of the subgroup 'Sustainability Criteria and Development Models' by providing learning experiences in three distinct ways. Firstly, we provide experiences from biofuel production in Brazil. Secondly, we looked at other commodities produced in Mozambique which apply sustainability criteria or certification frameworks such as FSC, GlobalGAP and fair-trade. Thirdly, we offer an overview of biofuel developments in Mozambique and analyze to what extent reality fits to the suggested potential in the country, and the sustainability objectives of the Mozambican government and international institutes. Data was gathered through analysis of literature, by doing field visits and by conducting semi-structured interviews with investors, farmers, extension-workers, researchers, NGO-representatives and policy-makers.

History of biofuels in Mozambique

The biofuel discussion in Mozambique started in 2004. During visits to the provinces, the government encouraged Mozambican farmers to produce *Jatropha* on all unused, marginal soils so the country could become oil-exporting instead of being fully dependant on oil imports. The idea was that: "Biofuels will not dislocate Mozambican farmers from their lands, and that government policy will require the use of underutilized or empty lands, avoiding land used for food production, and that the country will refine its own raw materials" (Frontier Markets, 2008). The initial proposal was that five hectares of *Jatropha* was to be planted in each of Mozambique's 128 districts. The Mozambican extension service started organizing and distributing *Jatropha* seeds. Most of the seeds had a very poor quality; they had been stored for a long time and often under adverse conditions, resulting in low germination rates (TechnoServe and ICRAF/IIAM, 2006: 18). Apart from distributing the seeds, there was no real follow-up or agronomic knowledge on crop management. Hence, crop maintenance was neglected and many trees died. The few farmers who had some yield did not know what to do with the *Jatropha* seeds, as organized markets and supply chains were absent.

Nevertheless, the promotion of biofuels by the Mozambican government had attracted numerous private investors as well as biofuel-related development projects. Plantations of *Jatropha* were established on poor agronomic knowledge regarding seed varieties, nursery practice, system of production and disease control, together with weak business planning regarding to markets, scale of operations, and poor technical knowledge of processing. To aggravate it, the concept of marginal land was not well defined and several projects were established in areas that were not suitable for growing *Jatropha*. While interest in *Jatropha* as a 'miracle crop' spearheaded the political promotion of biofuels, there was also significant private sector and government interest in the production of bioethanol. The principal feedstock was considered to be sugarcane, although an increasing level of interest began to be shown in sweet sorghum.

Concerns about the potential pressure on land, water, food production and lack of control over this process resulted in an intense discussion between government institutions, private sector, farmers, NGOs and academics. As a result, large-scale land requests were frozen between October 2007 and May 2008, while the government undertook agro-ecological land zoning. At the moment, the first biofuel projects have been formally approved and implemented, and in March 2009, the Mozambican government approved its national biofuel policy and strategy (Resolution 22/2009). The Resolution aims to contribute to energy security and sustainable socio-economic development by exploiting agro-energetic resources through stimulating the diversification of the energy matrix, contributing to the well-being of the population and promoting socio-economic development, particularly in rural areas (Government of Mozambique, 2009 15).

Learning experiences from Brazil

Brazil has been chosen for this study because it is one of the world's leading biofuel economies. Moreover, the Brazilian biofuel sector has been studied extensively, which provides tangible experiences for a country like Mozambique. Some prominent similarities between Brazil and Mozambique that may facilitate the exchange of experiences include: (i) colonial history and language; (ii) climatic conditions; (iii) importance of agriculture as economic activity; and (iv) both countries have similar policy objectives related to the promotion of biofuel production (socio-economic development and reduce dependency on fossil fuel imports).

Over the years, Brazil has managed to develop a stable internal market for biofuels (especially bioethanol), which has reduced the country's dependency on importing fuel. A mandatory blending regime, the availability of ethanol at numerous gas stations, and active promotion of flex-fuel vehicles, shows that it is possible to reduce fossil fuel consumption and to develop a domestic market for biofuels. For Mozambique, this would mean investing in the development of the domestic market by adopting mandatory blending targets; issues which are covered in the Mozambican national biofuel policy and strategy.

An important prerequisite for the development of the biofuel sector is the availability of financial resources that provide incentives for the sustainable development of the sector. The Brazilian Development Bank (BNDES) offers financial support by providing credit and loans to biofuel projects. In Brazil, the *Programa Nacional de Agricultura Familiar* (PRONAF) and the Social Fuel Seal are examples of how legislation can stimulate partnerships between smallholder and commercial producers. Subsequently such partnerships also promote rural development by providing training on agricultural and technical practices, loans and access to credit, employment and income generation. The choice of crop also determines the degree to which smallholder producers can be linked sustainably to the biofuel sector. Crops for which value-chains already exist (like soybean) are more likely to contribute to rural development, as farmers have the know-how on how to grow the crop and have off-take, which reduce the risk for smallholders.

Under the National Agro-energy Policy, Brazil carried out land-use and agro-ecological zoning to facilitate sustainable natural resource management. The objective of agro-ecological zoning is to promote or restrict occupation of new land, as well as to diversify and maximize crop production potential in different parts of the country. This is amongst others used to monitor investments and to identify the environmental impacts. The Brazilian example shows that strict legislation is necessary for the sustainable growth of the biofuel sector. Such legislation should provide realistic country-specific guidelines for the production, processing and use of biofuels, inline with existing (inter)national policies and criteria relevant to the sector. Brazil has several biofuel related policies, which are monitored by government, NGOs and other actors involved in the production chain through regular inspections.

Because biofuels in Brazil have a long history, valuable learning experiences on legal, social, economic and environmental issues have evolved. Economic development and energy independence are no longer the only objectives related to biofuel production in the country. As the sector has been established, Brazil now focuses on making the sector more efficient and sustainable, for example by promoting good working conditions, reducing GHG-emissions and improving the sector's energy balance. Although Brazil does not have a distinct set of sustainability criteria or rules, the country did develop some adequate mechanisms to promote the sustainability of its biofuel sector. Brazil's biofuel sector is governed by a number of national and international

outlined policies and legislation, such as the Clean Development Mechanism, the Program of Incentives for Alternative Electricity Sources, the National Biodiesel Program, and the National Agro-energy Policy. Brazil is also represented in several international sustainability platforms such as Round Tables for Responsible Soy (RTRS), the Better Sugar cane Initiative (BSI) and the Round Table for Sustainable Biofuels (RSB).

Learning experiences from existing certification in Mozambique

Certification is often related to a system of voluntary standardization and/ or governmental regulation. Both are important for international trade and define what can or cannot be exchanged. Moreover, it provides criteria or standards under which such exchanges are, or are not permitted. These standards are established by organizations or countries and focus on social, economic and environmental issues, or other aspects such as food safety and quality. Key-questions that were addressed in this study are: What does it mean to develop and implement certification systems in Mozambique? What can be learned from existing certification experiences? In addition, how can we use these lessons towards developing a sustainable biofuel sector in Mozambique? In the study, three standards that are currently implemented in Mozambique were analyzed:

1. **The Forest Stewardship Council (FSC)** is an independent, non-governmental, non-profit organization, which promotes responsible forest management. FSC is an association of members consisting of representatives from environmental and social groups, timber trade, indigenous people's organizations, community forestry groups and forest product certification organizations from around the world.
2. **GlobalGAP-certification** (Global Partnership for Good Agricultural Practice) provides insights in the requirements needed for entering the European market. GlobalGAP is a voluntary system driven by private sector that sets standards for the certification of agricultural products.
3. **Fair-trade** organizations work to improve market access and trading conditions for smallholder producers and plantation workers. Fair-trade organizations pay a minimum guaranteed price to the producer, plus a fair-trade premium, which is used for organizational strengthening and community development.

Based our analysis of the three standards, field visits to companies that are implementing the standards and interviews with entrepreneurs, the following lessons can be learned:

- **Traceability and record keeping versus exclusiveness:** Traceability and record keeping are important within both GlobalGAP and FSC, as the quality of the product must be guaranteed throughout the whole value chain. Traceability and record keeping are generally seen a burden, but do promote mechanisms that support efficient and sustainable business. On the other hand, traceability and record keeping might exclude smallholder producers due to the lack of human or financial resources to comply with them.
- **Law and legislation compliance:** Compliance to (inter)national laws and legislation receives most attention within FSC-certification, mainly related to natural resource management and the rights of indigenous communities. Fair-trade certification specifically focuses on human, community and workers' rights. GlobalGAP is guided by EU-legislation on safety and the use of agrochemicals, which does include health of employees and their families. Overall fair-trade and FSC have more attention for the rights of employees.
- **Consumers' influence on value chain:** Both FSC and fair-trade certification have their origin in strong public concerns about un-sustainability and inequality. Strong social movements, led by environmental organizations, created a transparent, voluntary system, which seeks to respect producers in their local context. GlobalGAP certification is a business-to-business system, mainly between commercial producers and retailers. Both ideologies are applicable for the biofuel sector, as both commercial and smallholder producers will be involved.
- **Heterogeneity and alternative procedures:** At a certain stage, both FSC and GlobalGAP certification identified the need for a more flexible system that could deal with the different realities of commercial and smallholder producers worldwide. Developing a biofuel sustainability framework should address these different realities of biofuel producers in Mozambique, to make sure that it does not work exclusive. As the initial costs of complying with certification are enormous, gradual certification systems are preferential as it allows starting companies to grow within the system.

- **Address different markets:** The forest sector in Mozambique taught us a valuable lesson that certification alone does not stop unsustainable production. Therefore, certification should not be the only way forward. Other fundamental issues that need attention are awareness-raising, training, law enforcement, attention for alternative models such as social venturing with local communities and stimulating private-public partnerships.
- **Attention for economic sustainability:** If Mozambique wants to develop a competitive biofuel sector, it is essential to promote efficiency and economic sustainability. None of the three studied certification frameworks spend considerable attention on economic sustainability, although some standards promote economic sustainability by stimulating effective production and processing.

Based on our experiences, one could argue that mainstream certification systems will always form an obstacle for the integration of smallholders. Even with a certification system as fair-trade, which is especially designed for smallholder producers, incentives are required. Without support from government, NGOs or private sector, the majority of Mozambican smallholder farmers will not be able to comply, as the financial and administrative burden is too high.

Learning experiences from existing biofuel developments in Mozambique

We have studied and analyzed the geographic spread of implemented biofuel projects and expressions of interests, processing and storage facilities, and compared our findings to studies on Mozambique's biomass production potential per province and government objectives. Subsequently, we provide fieldwork experiences on the sustainability of the emerging biofuel sector in Mozambique.

Up to December 2008, the Government of Mozambique had officially received 17 biofuel-related investment proposals, covering nine of Mozambique's ten provinces. Of the projects, twelve were related to biodiesel production, five to bioethanol production. Four projects had been formally approved, others are still in the process. In December 2009, the government voided the contract of one approved projects (Procana Ltd.), because the company failed to comply with its contractual obligations (United Press International, 2009). Table 1 provides an overview of the characteristics of the projects.

#	<i>Bioethanol projects</i>		<i>Biodiesel projects</i>		<i>Total:</i>
#	5	29%	12	71%	17
Land formally requested (ha)	66,000	27%	179,404	73%	245,404
Investment (US\$)	1,003,000,000	77%	298,000,000	23%	1,301,000,000
Average investment per requested hectare (US\$)	15,197		1,663		5,303
Employment (jobs)	Between 8,925 and 11,956	26% - 28%	Between 25,093 and 30,264	74% - 72%	Between 34,018 and 42,220
Employment per requested ha	Between 0.14 and 0.18		Between 0.14 and 0.17		Between 0.14 and 0.17
Main crop	Sugarcane		Jatropha		-
Other crops	Sweet Sorghum, Cassava		-		-
Average estimated yields	113.3 t cane ha ⁻¹		2.64 t Jatropha oil ha ⁻¹		-
Market	Mostly EU		Mostly EU		-

Table 1: Analysis of the 17 biofuel investment proposals based on collaboration with CEPAGRI

Besides these 17 projects, a wide variety of other biofuel initiatives are being implemented and explored in Mozambique. These other projects are very heterogeneous, ranging from large-scale commercial projects to smallholder development projects each with their own specific approach and objectives. Again, some projects are already implemented, others are expressions of interest. We have gathered all projects (the 17 'formal' projects, other implemented projects and expressions of interest) and added existing and planned biofuel-related processing and storage facilities to provide a geographic overview of biofuel developments in the country in figure 1.

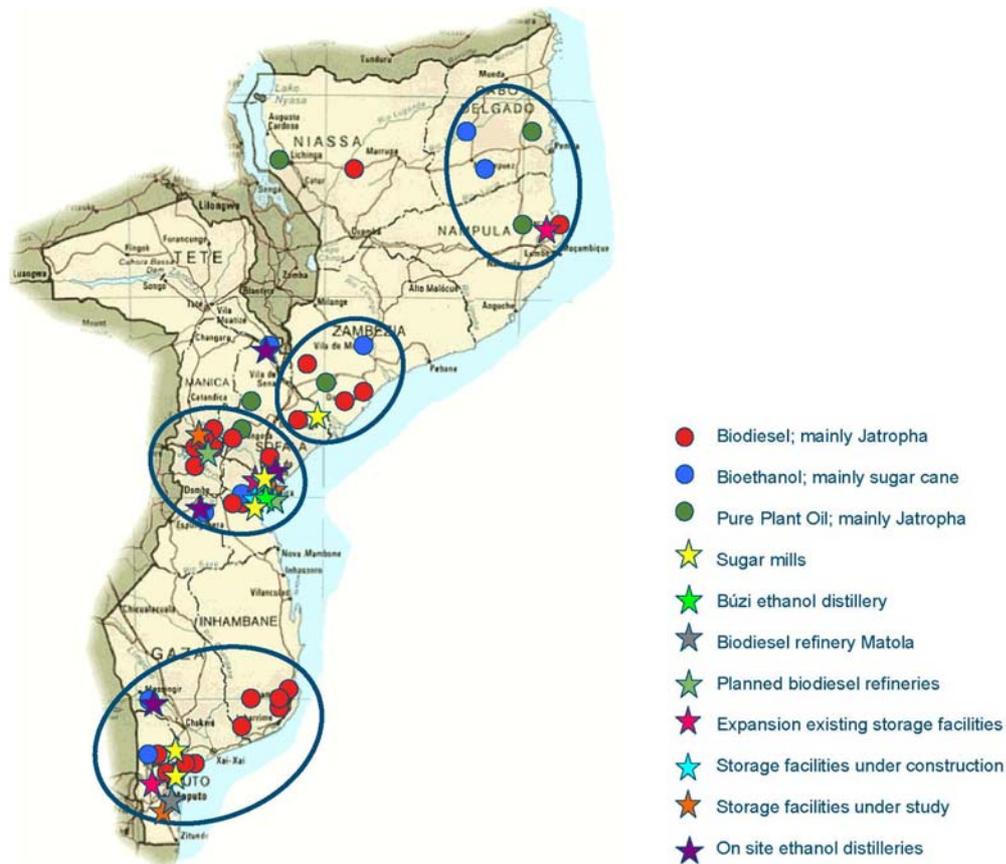


Figure 1: Geographical spread of biofuel developments in Mozambique

The majority of commercial projects are situated around existing good infrastructure (roads and ports), processing and storage facilities, where there is access to communication, (skilled) labour, services and goods. When comparing this with the government's objectives for promoting biofuel production to stimulate socio-economic development, particularly in rural areas, we conclude that the majority of commercial biofuel projects seem to have limited interest in locating themselves in remote rural areas in Mozambique. Moreover, focussing on remote rural areas influences the competitiveness of biofuel production in Mozambique. The production of biofuels in remote areas is more costly as compared to areas near processing and storage facilities, with good infrastructure, access to (skilled) labour, goods and services. Additional mechanisms for providing incentives should be put in place to make biofuel production in remote rural areas more attractive. Although it is still early to comment conclusively, job creation might be lower than expected. The 17 formally submitted proposals claim to generate between 0.14 and 0.17 jobs per ha for the whole biofuel sector, which is lower than government expectations of 0.33 new jobs per ha, including self-employment (Government of Mozambique, 2009 18).

The Mozambican national biofuel policy and strategy aims at promoting biofuels for both domestic processing and use, as well as for export to create tax-revenues and foreign currency. At the moment, most investors – in absence of any domestic or regional markets – focus on supplying external markets. The majority of commercial projects are located close to ports aiming at exporting to premium markets in the EU. Although this partly contributes to the government's objectives, it does not yet contribute to solving the energy dependency problem Mozambique is facing. For biofuels to play a role in diversifying the country's energy matrix, the rapid development of the domestic biofuel market is therefore essential.

If we compare our findings with the projection of provincial biomass annual production potential for 2015, we see that 32% of the biofuel projects¹ are located in Maputo, Gaza and Inhambane provinces, whereas these provinces only represent 6.3% of the country's total annual biomass production potential according to Batidzirai *et al.* (see figure 2). In provinces with high annual biomass production potential such as Niassa,

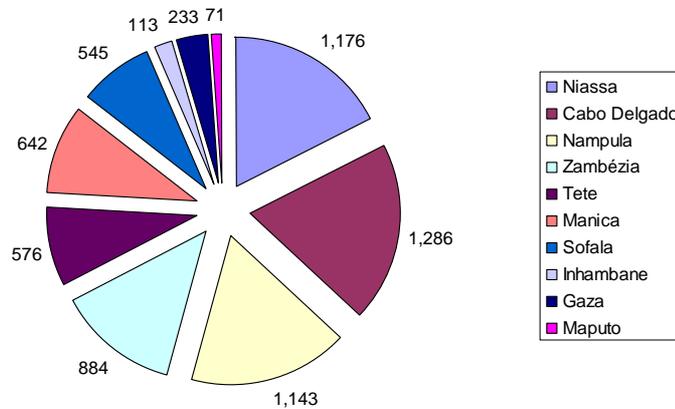


Figure 2: Estimated annual biomass production potential by Mozambican province (in PetaJoule, projected for 2015) after Batidzirai *et al.* (2006 61-62)

Cabo Delgado and Nampula (54.1% of total projected annual biomass production potential), only 16% of the biofuel projects are located.

The land zoning exercise from 2008 identified 6,966,030 ha of land available for commercial agricultural activities (IIAM & DNTF, 2008). The general scale of the zoning (1:1,000,000) does not allow us to draw very firm conclusions about whether or not biofuel projects are located in the available areas. However, we can observe that the provinces with highest interest for biofuel projects

(71% of the projects are located in Maputo, Gaza, Inhambane, Manica and Sofala) only represent 39% of available land. This difference becomes even more visible if we zoom in on Maputo, Manica and Sofala provinces. In these provinces, 50% of the implemented and planned biofuel projects are located, whereas the provinces only represent 11.6% of the 6,966,030 ha identified as available during the zoning. Currently, a new phase of zoning has started. The scale of 1:250,000 should provide a more secure framework for future agricultural investments.

When analyzing our field-experiences from a sustainability point of view, our major concern is not so much whether or not the Mozambican biofuel sector is or can be sustainable, but more if objectives of different stakeholders and their time-horizon can be compatible. The existing international biofuel sustainability standards very much focus on long term, global impact, which might obstruct the development of the sector on the short-term. Where most sustainability schemes have little to no attention for the economic sustainability of the sector, this currently seems to be the most crucial success-factor for the sustainable development of biofuel sector in Mozambique. The impact of the financial crises is becoming tangible, as some projects face difficulties getting their activities financed. At least one project was abandoned by its main investor, after which their contract was voided by the Mozambican government (United Press International, 2009).

Conclusions and recommendations

The most important conclusions and recommendations based on this study are as follows:

- Integration of smallholders:** One of the challenges we encountered during the research is responsibly linking smallholder producers to the biofuel sector. Working with outgrowers makes complying with certification systems or sustainability criteria more complex. By expanding the boundaries of production, the complexity and transaction costs related to control, traceability and transparency increase. Many investors have expressed the intention to work with outgrowers, but first establish their plantations, which provides security on the required quantity and quality of feedstock

¹ 'Biofuel projects' relate to the formal and other implemented biofuel projects and expressions of interests. It does not include the existing and planned processing and storage facilities

necessary to be competitive. The Brazilian biodiesel sector showed that government incentives (PRONAF and the Social Fuel Seal) can promote beneficial collaboration between commercial companies and smallholder producers. Smallholders are provided with access to credit and training, and guaranteed off-take, whereas the companies receive tax breaks, access to soft loans, and can participate in the Brazilian biodiesel auctions (whereas companies without Social Fuel Seal cannot). To enhance biofuel production by smallholders, alternative procedures for group-certification should be examined. Integrating smallholders should be done responsibly as risks and uncertainties are high. The way *Jatropha* production was introduced in Mozambique showed us that if appropriate support mechanisms and off-take markets are absent, involving smallholder producers can be a very irresponsible, as they do not have the luxury of experimenting or taking risks (Bos et al., 2010).

- **Promoting local spin-offs:** With regard to biofuel-related employment creation, this study shows that the companies' estimated employment per hectare is lower than described in the national biofuel policy and strategy, and are expected to drop due to mechanization and a decreasing labour-demand in the years after plantations have been established. FSC provides a useful framework to deal with some of these challenges. On-site processing of biofuels could increase local benefit and employment creation, as well as enhance competitiveness by reducing wastage and transportation costs. Moreover, it enhances traceability and transparency of production. To stimulate employment creation and local spin-offs, biofuel companies could be obliged to employ a certain percentage of its workers from the area where they are located. Government policies could provide incentives that promote the reinvestment of tax-incentives in local capacity building and other income-generating activities for communities living near plantations to enhance rural development.
- **Dealing with heterogeneity:** A key-question is how a sustainability framework could respect the huge diversity of biofuel developments in Mozambique. Our main concern is that any kind of certification system might exclude smallholders from having access to the biofuel-market, which is unfeasible according to the government's objectives for promoting biofuel production in Mozambique. Adding to that, we want to emphasize that we also witnessed huge diversity between commercial bioethanol and biodiesel production, as both sectors create different opportunities and risks. Respecting diversity and multiple realities led FSC and GlobalGAP to launch a 'flexible' and alternative procedure appropriate to deal with small-scale and low intensity operations. The biofuel-sector could learn from this, as these alternative procedures respect diversity within the system and aim at creating opportunities for different producers. Moreover, this approach offers a gradual certification system that allows a starting company to comply with the basic sustainability standard, whereas more 'mature' companies can expect stricter audits.
- **Sustainability and market-access:** The implementation of certification systems can easily become artificial, as money determines if you can buy in or not. Complying with biofuel sustainability criteria is a costly business. If the Mozambican government would decide to adopt sustainability principles that are less strict than existing western standards, this could mean that implemented projects (that have already invested a lot in producing sustainably), could be disadvantaged on the domestic market. Moreover, the Mozambican government should promote in-country processing and use of biofuel, so the country can benefit from its potential.
- **Speed up the learning curve:** There is relative high uncertainty surrounding biofuel developments, especially in the biodiesel-sector. As our case studies showed, many projects are set up in isolation. Companies are afraid of bad publicity, and the sharing of knowledge with colleagues and researchers carries financial implications for profit-making (cf. Puente-Rodríguez, 2009). Especially in the *Jatropha* sector sharing of information is crucial as *Jatropha*-based biodiesel can only be successful when there is sufficient volume to comply with future blending targets. At several occasions, we have heard the idea to develop 'biofuel learning projects' under Community-Public-Private partnerships. Learning projects are transparent projects with room for experimentation, making mistakes, learning from them, and share experiences with others. Such projects should be able to depend on institutional support and commitment to provide incentives and financial compensation that creates space for innovation and development.
- **Economic sustainability:** Existing sustainability frameworks pay little attention to the economic sustainability of the sector. Dropping fossil-fuel prices and the financial crises have decreased the interest in the biofuel sector in Mozambique. Unless legislative measures are taken to develop the

national biofuel market, large biofuel investments could become very unprofitable (cf. Mitchell, 2006). We know that the World Bank and African Development Bank are interested in supporting a sustainable private sector; but their conditions are strict. In Brazil, the Brazilian Development Bank provides financial support to for biofuel projects. It is unclear if this could be realistic for a country like Mozambique, but the government could lobby for multi-lateral support as biofuel-related objectives such as reducing GHG-emissions are at the interest of the global community.

- **Implementation and monitoring of a standard:** The enforcement of laws, regulations and standards is a huge challenge in the Mozambican context. We know from other sectors, that the governance and legislative system faces difficulties in supporting the introduction of regulatory frameworks. Mozambique can learn from Brazil that it does not necessarily needs additional certification system for biofuel production, if existing biofuel-related laws and regulation concerning production, distribution and use of biofuels deal with the social, economic and environmental sustainability issues. This would reduce the need for additional bureaucratic and administrative structures, and be in line with international sustainability criteria that require compliance with national laws and regulations relevant to biomass production (Cramer et al., 2007; Dehue et al., 2008).

Our advice is that the risks accompanying the biofuel sector should not stop exploring the opportunities for biofuel production in Mozambique, as they provides valuable learning experiences necessary for the sustainable development of the sector. Making optimal use of learning experiences requires public-private partnerships and careful monitoring and evaluation, so that findings from research and practice can be used to facilitate policy-making, but also to adjust existing policies if necessary.

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