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Certified sustainable Jatropha oil from outgrowers

Diligent Energy Systems BV

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Content

1. INTRODUCTION

Diligent is an innovative company with its origin in The Netherlands and a facility in Tanzania. Diligent produces biofuels from the tropical plant Jatropha Curcas. The seeds are produced and processed in Tanzania, in cooperation with small farmers. The company attaches great value to sustainable entrepreneurship according to the principle of the three "P's": people; planet; and profit.

Diligent wants to contribute both to reduction of global warming, and to creation of employment in Tanzania. The overall objective is triple profit: profit for society, for the environment, and an adequate profit for Diligent itself. In practice this means that Diligent educates local independent farmers in Tanzania to produce food crops in-between jatropha plants. The cultivation of jatropha is clearly a welcome source of income but Diligent insists that farmers continue to grow food. The farmers receive advice on the cultivation, but they also receive the first seeds to start their jatropha business. The knowledge about the cultivation is transferred both individually and in joint trainings.

Diligent wants to contribute to combating global warming. Vegetable oil from jatropha is a second-generation biofuel while the first-generation (edible) oils are produced from rapeseed and palm oil. By using renewable fuels we spare the finite stock of fossil fuels. The residue after processing the oil, the press cake, is used to produce briquettes for industrial boilers to burn and pellets for individual households to cook. It is a good substitute for wood that is still widely harvested illegally.

Early 2011, we started certifying Diligent oil, driven by the stricter rules for bio fuels in Europe. Diligent very much wanted to supply the aviation industry. Due to a lacking of a good standard method, Sky NRG, subsidiary of i.e. KLM and North Sea Petroleum, already performed its own sustainability analysis. The Renewable Energy Directives (RED) from the European Union, however, forced their members only to accept certified fuels. Consequently, Diligent chose to certify its fuels also.

The fear to victimize small farm holders caused sustainability criteria to be stricter for bio fuels than for other products such as cocoa and cotton. Bio fuel standard checks on a farmers' level are always very strict.

Certifying small bio fuel suppliers seems impossible because of the high costs of registering each farmer individually. In commodity goods such as bio fuels earnings should be made by bulk and efficiency. The costs per farmer should therefore be as low as possible. Diligent tried to reduce the costs per farmer as much as possible by transferring reporting obligations to cooperatives. Unfortunately, not only did NTA8080 not allow

this, it also proved to be a bottleneck with other certifying standards.

Unfortunately Diligent had to shut down the activities in Tanzania in 2012. If Diligent Tanzania should still have been in business today and had been able to reduce the costs of certifying, over 57,000 farmers should have been certified thanks to the financial support of AgentschapNL. However, the costs for certifying additional farmers and the periodic verification would be too expensive to pay for with the extra revenue from the certified oil.

There has been talk of an added value of € 50 per ton of certified Jatropha oil. This added value, along with the inflationary impact of the shortage in sustainable bio fuels could be used to fund certification. The economic crisis, however, has pushed the importance of sustainable and socially responsibly produced bio fuels to the background. Certified oil at this time hardly has any added value and must immediately be competitive in the commodity market of vegetable oils.

The fact that Diligent Tanzania no longer exists, and that certification of the farmers in the end did not take place has had no impact on the conclusions that can be drawn from this report.

2. CONTEXT

2.1 Rationale and problem definition

Diligent Tanzania was a producer of Jatropha oil, active in Tanzania since 2005. Diligent did not own plantations, but bought seeds from smallholder farmers, through a network of contracted collectors. Before the start of the certification process some 5,000 farmers signed a contract with Diligent; combined they planted a total area of around 3,500 ha. Significant expansion was reached in the following years with 57,000 farmers around June 2011. Contracted farmers received a minimum price guarantee for ten years. In return, farmers agreed to sell exclusively to Diligent and to transfer the rights to any carbon credits for CO2 sequestered in the plants to Diligent.

At the start of the project, production volumes of Diligent were rather limited, due to the relatively long starting time involved in obtaining yields after planting. Diligent has been able to sell its oil relatively easily on niche markets, e.g. for testing as jet fuel or industrial fuel. For the immediate future, Diligent expected that it could sell its bio-oil relatively easy to large-volume diesel consumers on local markets. However, as production volumes were expected to increase quickly and becoming more significant over the next few years, it became more important for Diligent to develop long-term supply agreements with a number of reputable and reliable clients.

Several tests using bio-oil to replace fossil kerosene have already been carried out. For example, in January 2009, Boeing and Air New Zealand successfully carried out a test flight using bio kerosene made from Jatropha to run one of the four airplane's engines. Air France/KLM was one of the first companies worldwide to test bio fuel (from camelina) in a flight with passengers, in November 2009. In both cases, UOP produced the bio-kerosene.

A potentially substantial and very interesting market is the market of aviation. The aviation industry contributes about 2% of the global GHG emissions, but is also a fast growing economic sector. In recent years, it has come under increasing pressure to reduce GHG emissions. Although airplanes have already become much more fuel efficient in the last decades, further major reductions cannot be achieved through technical measures alone. Replacement of fossil fuel with bio fuel is therefore seen as the only possible route to achieve noteworthy further reductions in the future – provided that these bio fuels were produced in a responsible way, with a positive overall greenhouse gas balance.

Following its test flight, Air France/KLM teamed up with North Sea Petroleum and Springer Associates to establish Sky NRG. Sky NRG's mission is to help create and accelerate the development of a market for sustainable jet fuel, by way of:

1. global sourcing and marketing of sustainable jet fuel;
2. promoting R&D throughout the entire supply chain ('well-to-wing'), advancing the technical certification, economic viability and sustainability of next-generation aviation fuels
3. pushing for mechanisms to help create a level playing field for sustainable jet fuel
4. find ways to finance the economic premium to be paid for sustainable jet fuel

Test results show that, from a technical perspective, Jatropha oil is a very suitable feedstock for the production of bio-kerosene. The technical certification of bio-kerosene for use in commercial flights is available since 2011.

Diligent felt that there was also significant interest for its oil on export markets, including from the aviation industry. Having been the supplier to a Boeing/Air New Zealand test flight, Diligent was also invited by Sky NRG in 2009 to discuss the supply of Jatropha oil as feedstock for its bio-kerosene production. A key reason for this interest is the fact that Diligent's bio fuel is socially and environmentally sustainable, and more so than many other bio fuels: it reduces global greenhouse gas emissions, contributes to

environmental protection of degraded farmlands, and generates additional income for rural households in impoverished areas. To enable long term export transactions, however, Diligent will need to demonstrate this sustainability through independent verification and certification.

Such certification schemes did not yet exist, but were somewhere under development. At the start of the project, the NTA 8081 certification scheme was the closest of relevance to becoming operational. This scheme has, however, not been fully elaborated yet for smallholder/outgrower models of bio fuel production. In order to make this applicable, several questions remain to be addressed, such as: what level of organization is required to enable certification at a group level; what sort of data is necessary for certification, and how feasible is obtaining this data; what monitoring structures will suffice? In particular, further research and testing is to be done to establish the least-cost method for data collection and monitoring at the level of individual smallholder farmers, to enable the evaluation whether the costs for this data collection and monitoring is indeed paid off by the better market prospects from the bio-oil products.

Compared to plantation concepts, smallholder schemes for bio fuel production are very positive in terms of sustainability, particularly in relation to social rights and socio-economic aspects. Their drawback is that it is more complex and costly to certify them because of the higher costs of data collection and monitoring. This project was a pilot project, aimed to test and demonstrate the possibility of obtaining sustainability certification for a smallholder scheme for bio-oil production. It is applied to the production of Jatropha oil in Tanzania, but its lessons should be applicable to many other smallholder/outgrower schemes in other countries or with other crops.

3. PROJECT OBJECTIVES

3.1 Objectives

The 2 major objectives for this project are

1. To investigate the feasibility of obtaining NTA 8081 certification for a smallholder outgrower scheme in Jatropha production, and to promote the implementation of such certification for smallholder outgrower schemes through a pilot certification activity and dissemination of lessons learned from it;
2. To investigate the feasibility to set up a sustainable biofuels chain to The Netherlands and/or Europe.

Additional objectives of the project included:

- enabling the aviation industry to use the NTA8081 certificate as a proven, independent sustainability certification scheme to prove towards its stakeholders the sustainability of the certified feedstock for bio kerosene production
- enhancing prospects of production of Jatropha bio-fuel for export to the Dutch and European markets
- gaining a better understanding of the sustainability aspects of Jatropha farming through a smallholder scheme
- promoting general acceptance of the NTA 8080 certificate as a measure for a high standard of sustainability in bio-oil production
- aiding the government of Tanzania (and other developing countries) in determining the minimally required standards of sustainability in bio fuel production

3.2 Background information

3.2.1 Sustainability certification schemes

At the time we started the project, there were various schemes operational or under development addressing various aspects of sustainability of bio fuel production. Relevant schemes included:

- NTA 8081: this was to become the new certification scheme belonging to the NTA 8080 standard for sustainable biomass-for-energy production. NEN is scheme owner of the NTA 8081 certification scheme. The NTA 8080 standard is based on a large extent on the Cramer criteria for sustainable biomass production, and as such is significantly more ambitious than the minimum standards of EU regulation for (imported) bio fuels and bio liquids.
- Voluntary Carbon Standard (VCS): VCS is not a proper sustainability standard, but instead a scheme to issue carbon credits that can be traded on the voluntary markets for carbon credits. However, to obtain VCS certificates, projects must still meet various strict environmental and social standards and sufficiently demonstrate responsible and transparent business management. Nonetheless, VCS certification does not apply to the final bio-oil products and hence does not help to improve its market position much.
- Roundtable on Sustainable Bio fuels (RSB): the RSB has drafted generic principles and criteria for sustainable bio fuel production, and established specific certification schemes for palm oil and soy bean oil.
- FLO/Max Havelaar-certification: the FLO certificate is concentrating on 'fair trade', i.e. on the position of farmers' vis-à-vis other actors in the supply chain, and the income they can generate from producing their crops. FLO does incorporate environmental standards, but not as complete as the other three standards above. On social aspects and the position of the farmers, the scheme is stricter than others. In Tanzania, Max Havelaar explored the feasibility of introducing FLO certification for Jatropha production. Max Havelaar is primarily aimed at consumers hence ENECO explored the possibilities to market electricity and heat generated from Max Havelaar-certified bio fuel to its individual consumers.

With much overlap in the different certification schemes, we hoped that obtaining one certificate automatically makes it relatively easy to also obtain others. For this project, only NTA 8081 is relevant in relation to export markets for the bio-oil itself.

3.2.2 Diligent outgrower network

Between 2005 and 2011, Diligent invested heavily in extension work towards farmers with a view to establish a network of contracted outgrowers. By the end of 2008, Diligent contracted about 5,000 farmers, who collectively are believed to have planted around 3,500 ha of Jatropha. Approximately

2,000 ha of this were planted in 2008 alone. At the end of 2011 more than 57,000 farmers had been contracted (directly or indirectly) by Diligent. Farmers planted Jatropha around villages in various specific regions selected by Diligent, but these areas still cover large parts of the country. Typically, these regions include areas that are otherwise poorly suitable for farming, and tend to have very poor access to markets for farm products.

Most farmers were not visited by Diligent field officers at their farms, but received training, planting materials, and planting instructions through sessions in their villages. During these sessions farmers also signed contracts with Diligent, which specify the location of their farms. Contact is since maintained in part via field officers visiting farmers, but more frequently via the network of collection centers that Diligent maintains. All farmers are in principle able to sell all their seeds at all times at these collection centers.

Farmers have generally been instructed to plant Jatropha as hedges around their field. In this way the Jatropha hedge marks the boundaries of the farmland; keeps out cattle and large wild animals and combats erosion. Occasionally, farmers also plant Jatropha through intercropping with food crops. Diligent has been careful, however, not to overstate what farmers can expect in terms of yields, as significant yields can be expected only after about three years.

In 2008, Diligent made a start with establishing a much more extensive database which includes a fairly broad range of data from individual farms, such as GPS data, general observations on quality of plants. other vegetation. soil etc. From early 2009 onwards, this activity was halted due to the fact that it could not be connected to sustainability certification (and thus, improved market positioning), and because demand for bio-fuel in export markets dropped as a consequence of the economic recession and low fossil oil prices.

3.2.3 Production volumes

At the moment, production volumes of Jatropha worldwide are still very small, though growing quickly. In 2010, Diligent too produced approximately 100 metric ton of bio-oil, and with this volume remained one of the larger producers. No data on global production exists, but Diligent believes this to be a few thousand tons at the most. At these volumes production is clearly neither commercially viable nor a significant alternative to fossil fuel, and the interest of Jatropha lies therefore mostly in its potential for future growth.

Diligent assumption is that with its extensive concept of production, a yield of circa 0.8 ton of oil can be expected per hectare planted with Jatropha (as hedge or through intercropping). At the start of this project, farmers had already planted 3,500 ha Jatropha for Diligent. Diligent should be able to produce close to 3,000 tons of oil annually with this stock and all plants matured. However, the model allows for relatively easy expansion to much larger

areas, given proven commercial success. In 2010, at the start of the project, Diligent believed that, given time to develop the outgrower network and organizational support structures, 1,000,000 ha should easily be available in Tanzania, which would yield over 800,000 tons of oil annually, not counting any improvements that can be made to yields due to improved genetic materials, cropping techniques etcetera. Unfortunately, Diligent did run out of funds and could not find new investors. The expansion stopped at approximately 57,000 farmers.

3.2.4 Sustainability aspects of Diligent

While Diligent has never been the subject of a proper sustainability certification assessment, various studies have looked into sustainability aspects of its bio fuel production. These include:

- RIVM/Senter Novem study and documentary "Shinda Shinda" (2008). This study reviewed greenhouse gas balances and sustainability aspects of Jatropha production in two different scenario's, one of them being the actual Diligent model (the other a 'nucleus' farming model proposed by ENECO under a cooperation scheme with TU Delft, but not yet realized). Based on actual measurements in the fields as well as various assumptions with regard to growing conditions, the study aimed atproviding an overall assessment of the net greenhouse gas balance if applied in a Dutch energy production. The results of this study are very relevant for this project in terms of its focal area, but due to the uncertainties in its assumptions the conclusions are not very definitive.
- WWF Tanzania Office "Bio fuel Industry Study" (2008). This study compared the sustainability performance of the most important bio fuel initiatives in Tanzania and scored them on 'sustainability scorecards'.
- Sulle, E. and F. Nelson (2009) "Bio fuels, Land Access and Rural Livelihoods in Tanzania", IIED, London. This study assessed the consequences of the introduction of bio fuels on land ownership and access and impacts on local livelihoods in the Tanzanian situation. It finds no significant negative impacts from the decentralized smallholder model practiced by Diligent Tanzania, in marked contrast with large plantation-based schemes.
- Wiskerke, W.T. et al. (2010) "Cost/benefit analysis of biomass energy supply options for rural smallholders in the semi-arid eastern part of Shinyanga Region in Tanzania" Renewable and Sustainable Energy Reviews, 14 (1): 148-165. This study estimated the economic livelihood impacts for smallholder farmers of cultivating Jatropha. It concluded that Jatropha hedge cultivation as recommended by Diligent is a promising option.

On the basis of these (and other) studies, Diligent is convinced that its bio fuel production is very sustainable both in ecological and social terms, and has a strongly positive net carbon balance. Nevertheless, seeking confirmation of this through certification requires that specific information is to be collected for each individual farmer, as

well as data to be generated at generic or regional level.

3.3 Common ground

The underlying project has 'common ground' with the following other projects:

- Tanzania: feasibility study on FLO/Max Havelaar certification for Jatropha bio fuel production. This project, carried out by Max Havelaar, ENECO and ICCO, considered the feasibility of introducing Max Havelaar certification in Tanzania, primarily through the introduction of Jatropha as a new crop in existing farmer cooperatives that are already certified for FLO in relation to other crops (mostly coffee). Diligent has a constructive working relationship with the participants in this project. Possibly, smaller parts of the Diligent outgrower network may be included as a pilot for certification, but this only concerns outgrowers already represented through an existing cooperative structure. For the majority of Diligent's network such a cooperative structure would still need to be established.
- Malawi: establishing Jatropha bio fuel production through a smallholder/outgrower concept (BERL). This project was carried out by TNT as part of their social responsibility program and later on adapted by DOEN Foundation. This project is very similar to Diligent's model. Other than Diligent, they aim strictly for local markets only. This project is, however, more advanced than Diligent in pursuing certification under the VCS standard. Diligent has a constructive working relationship with TNT and their team in Malawi.

4. PROJECT ACTIVITIES

4.1 Approach and activities

The project was implemented over a period of 30 months, and covered the following main steps.

A. **Feasibility study**: a feasibility study was carried out to review the detailed requirements of NTA 8081 certification in relation to data that was already available, data that remained to be collected, the organizational structure that needed to be in place and the monitoring needed once the baseline data was collected. Furthermore, to review the possibility to add additional certification schemes. The study result provided a conclusion on the feasibility of NTA 8081 and other certification schemes, and a detailed action plan proposing the least-cost option for achieving the certification standards.
B. **Organizational structure**: as individual certification would certainly not be economically possible, group certification was sought for the outgrower farmers. Such group certification requiresd establishing a specific organization to address various requirements. As part of the process the structure should be established, operational procedures had to be prepared and field officers had to be trained in the use of these procedures.
C. **Baseline data collection**: the group certification requires that a significant amount of information, partly generic, is available for the assessment. A significant part also refers to information to be collected from every individual farmer. Collection of this information was a time consuming task, but inevitable for meeting the certification requirements.
D. **Pilot certification:** once the basis for certification appeared to be into place, a certifying institute had to be invited to visit Diligent initially for a scoping visit, which is likely leading to additional homework for data collection, but possibly also for clarifying aspects of the certification standards. At the time, Diligent felt ready for it; the certifying institute would be invited again for a preliminary assessment, and eventually a final assessment.
E. **Evaluation**: the project result included an evaluation report available for wider dissemination (via NEN, TUE, Senter Novem and other partners/stakeholders) as well as an action plan for future follow-up by Diligent Tanzania.

4.2 Task assignments

Tasks within the consortium are assigned as follows

Diligent Energy Systems

- Overall project management
- Leading activities for establishing a judicial organization for group certification and an action plan for follow-ups
- Provide expertise on strategic and managerial aspects of certification throughout the project

Diligent Tanzania Ltd

- Provide practical knowledge and expertise as input in all study components
- Provide access to its farmer contract database
- Provide access to its network of national and regional government partners and other stakeholders in agricultural and rural economic development
- Supply field officer capacity for data collection at farm level
- Train field officers in monitoring of procedures
- Contract and supervise certifying institute
- Provide logistic facilities in the country

SKY NRG

- Provide technical support on feasibility assessment of certification scheme
- Participate in scoping visit and (pre-) assessment visit of certifier to assess suitability of the procedures for their own requirements
- Contribute to the evaluation of the NTA8081 scheme for smallholder farmers

TU Eindhoven

- Provide technical input in the feasibility study
- Provide technical/scientific support in collecting and analyzing data on regional and generic level
- Advice on monitoring and assessment of procedures
- Contribute to the certification assessments and the evaluation thereof.

NEN

- Contribute to the feasibility study phase, clarifying any aspects that are ambiguous or not yet elaborated
- Contribute to the pilot certification assessments, briefing certifying institutes as and when required and clarifying any matters in the standards that are ambiguous or not sufficiently elaborated yet
- Contribute to the evaluation of assessments and lessons learned from the overall project

NEN acted as a linking pin between the project and the Committee of Experts of the NTA 8081 certification scheme. In this project, issues raised concerning the interpretation of sustainability requirements of the NTA 8080 standard in relation to smallholders/group certification and regional specific matters. NEN addresses these issues in the Committee of Experts and brings forward the experiences gained in this project to facilitate and accelerate the interpretation process. Every day experiences are important for a practical certification scheme. During all project stages the (preliminary) results, plans and procedures (excluding confidential matters) were verified by the Committee of Experts to ensure that no divergence would take place in the next steps. The intention was that this would ultimately result in interpretation documents concerning smallholders and group certification, and regional specific matters (e.g. Tanzania, East Africa).

5. PROJECT RESULTS

5.1 Certification

Baseline studies in the field

5.1.1 Water, air and soil samples

According to the NTA8080/81 water, air and soil samples had to be collected from a predefined number of smallholders. This is necessary to enable future group certification after the formation of smallholder cooperatives. The original project document drafted less than a year earlier, had foreseen a manageable total of 5,000 smallholders in two regions, to be organized into two cooperatives of 2,500 members each. According to the NTA8080/81 requirements, this situation would require baseline water, air, and soil samples to be taken from at least

the square root of the number of members per cooperative, i.e. a minimum of 50 smallholders per cooperative. However, the response from the Tanzanian subsidiary's manager indicated that reality moved ahead of the original plan:

"We have expanded into several new regions. I believe we are now sourcing from around 57,000 farmers. The exact number is not known because the administration by the local collection centers is not exact and many farmers are not yet officially registered with us as suppliers. Many people who come to sell seeds are not the farmers themselves, it's mostly children and old people, they could be farmers' relatives but they could also be unrelated poor vulnerable groups. Therefore, I think we need a different division for the cooperatives, and we may also have to review the number of members per cooperative. The original plan does not make sense anymore … it is not feasible to audit the square root of the members of each cooperative, and then taking samples from them on an annual basis! This will become a completely unmanageable undertaking." (e-mail excerpt, from Tanzanian subsidiary's manager to university team leader, May 21st, 2011).

There were other reasons for apprehension on the part of the project team. The NTA8080/81 text spoke of the requirement to form homogeneous cooperatives in terms of climatic conditions, water availability, soil type, and agricultural practices. On this, the manager wrote:

"Another problem that I foresee is the heterogeneity of the soils and water availability. In Mi… there is kichanga soil and there is no water source, hence no irrigation. In contrast, in Mb… where we are active now, there is Tifutifu soil

"there has always been a clear difference in vision between 'people on the ground' and between policymakers and academics, and that is no different this time." (Manager, Tanzanian Jatropha subsidiary)

and people can regularly use water from a nearby river. These are big differences in what is considered to be one and the same region. The other regions have again quite different soils and climate variations. There is a lot of local and regional variability – and we are talking of vast sourcing areas, spanning hundreds of square km, some are over 600 km away from our processing site. The NTA8080 requirement of homogeneity of soil and climate within each cooperative group can only be met if we form very small cooperatives of a few hundred farmers each, but that is absolutely no option for the reasons I already indicated [too many cooperatives]. Please ask NEN to relax this requirement." (e-mail excerpt, from Tanzanian subsidiary's manager to university team leader, May 21st 2011).

The standardization institute (NEN), however, responded by asking for proper scientific evidence before considering any relaxation of their norm requirements. The university team then had to trace detailed soil maps for Tanzania (ultimately located at the FAO), and superimpose on these the approximately 2,000 smallholders who had already been registered in a central database with their GPS coordinates, in the absence of any physical addresses in rural Tanzania. The pictures that ultimately could be produced with the help of a specialist from Wageningen University were still rather primitive, as they could not go beyond a resolution of blocks of 20 square-km and covered only one sub-region of the sourcing area. The maps showed great soil diversity in Tanzania, and smallholders within one and the same region were seen to be located on several different soils. The NEN was ultimately satisfied with the maps and relaxed its homogeneity assumption, but the amount of effort involved in getting this one obstacle removed was enormous.

5.1.2 Nutrient depletion

Structural nutrient mining is a big problem for large areas in sub Saharan Africa. Many scientific studies report about this issue. However, the influence of jatropha harvesting on this is minimal. This can be concluded from the nutrients in the oil and the press cake. A part of the nutrients that is collected from the fields will not be brought back to the same location but this will not have an great effect on the nutrient depletion compared with the existing nutrient mining. This is especially the case for smallholder farming in the Diligent model with jatropha growing in hedges. In that model there is hardly any nutrient competition with food crops. The soil quality of the food plot will not have a negative effect on the harvest of jatropha. We have to consider that similar disadvantages also occur with other common hedge species. An example is the harvest of fodder from hedgerow (eg from Leucaena) for farm animals also leads to local nutrient removal. There is no direct implication for the diligent jatropha project.

Of course nutrient depletion in rural Africa is an issue that has to be addressed but is not a primarily under the responsibility and within the scope of this project since the nutrient removal has an minimal impact on the soil fertility. It should not be an barrier for the NTA8080 certification. See also the following publications:

- J. Henao and C. Baanante (2006) "Agricultural production and soil nutrient mining in Africa: implications for resource conservantion and policy development", IFDC, International Center for Soil Fertility
- Agricultural Development, Muscle Shoals, Alabama. http://www.scidev.net/en/sub-suharan-africa/news/african-soils-being-mined-of-life.html
- H.A. Romijn, S. Heijnen and S. Arora (forthcoming, 2013) "Standardizing Sustainability: Certification of Tanzanian biofuel smallholders in a global supply chain", Chapter 26 in: A. Lindgreen, S. Sen, F. Maon and J. Vanhamme (2013) Sustainable Value Chain Management: Analyzing, Designing, Implementing, and Monitoring for Social and Environmental Responsibility, London and Burlington: Gower Press.

5.1.3 Changed number of smallholders

The university researchers meanwhile began to assess the implications of the changed number of smallholders (57,000 instead of the original 5,000) to be included in the project. The new numbers required to take samples from about ten times the number of farmers specified in the original plan. Their concerns were aggravated by reports coming in from the field regarding the actual work involved in the sampling (more on this below). Furthermore, the NTA8080/81 text gave rise to many questions about how to conduct the water, air and soil sampling and how to put the analyzing procedures into effect. The university team was unsure to find laboratories in Tanzania capable of executing the analyses. Taking thousands of samples back to The Netherlands was obviously no option.

5.1.4 African realities v/s EU standards

The foregoing discussion illustrates the collision between Tanzanian agrarian realities and the context in which the NTA8080/81 norm was designed. Although the designers of NTA8080/81 had taken care to consult different stakeholders, this obviously did not include African smallholders. The norm design was done in several iterations, with possibilities for feedback and suggestions from an interest group, the so-called Committee of Experts, constituted by Dutch environmental and fair-trade foundations, governmental representatives, and the private sector, in order to ensure broad support for the eventual results through a participatory process. But the Dutch designers of the norm did not or could not consider the institutional complexities of scientific and agrarian realities in different parts of the world. The scenario of a bio fuel value chain built on tens of thousands of smallholders without physical addresses, who are cultivating plots of 0.5-2 acres each, was not conceived by NTA8080/81's designers. The so-called 'inclusive' group certification option allowed by

NTA8080/81 clearly does not work for this type of production system.

5.1.5 Monitoring nutrient supply

Ultimately, the main hurdle in the way of a feasible operation turned out to be the requirement of soil samples taken and analyzed from the square root of the number of cooperative members on an annual basis. Although the water sampling requirements in the NTA 8080/81 were similar to this, and equally tenuous in principle, the lack of surface water in the close neighborhood of smallholder plots and groundwater levels of at least several meters deep finally convinced the NEN to relax its requirement of water sampling. The logic of measuring the Biological Oxygen Demand (BOD) in the water, in any case, was ludicrous for Tanzania. BOD is useful for monitoring excess nutrient supply, a requirement inspired by the Nitrogen-surplus situation in The Netherlands with its huge pig population. In contrast, as noted above, sub-Saharan African soils widely suffer from nutrient depletion problems.

5.1.6 Organic farming

The soil management (and associated sampling) requirements presented challenges of a different order. The overwhelming majority of Tanzanian smallholders farm organically, if only because they cannot afford to buy expensive mineral fertilizers and chemical pesticides. In general, their Jatropha plants do not displace food production because Jatropha yields much lower values than common staple foods such as corn, beans, cowpeas or cassava. The few (larger) farmers who tried to introduce mini-plantations during the initial Jatropha hype, about five-six years ago have long since uprooted their shrubs in disappointment and frustration. Thus there is very little land use change to speak of. Currently, among Tanzanian smallholders, Jatropha largely survives as a wind-break hedge, an anti-erosion device, a pen for farm animals, a grave marker, a land dispute settlement mechanism, and a privacy-yielding hedge around homesteads. Labor, water, animal manure or any other major resources are first allocated for food production, while Jatropha is treated as residual crop. Thus, in broad terms, the smallholders satisfy the NTA8080/81 principle 5, which states that "In the production and conversion of biomass the soil and soil quality are retained or improved." The only problem is some localized nutrient mining due to the Jatropha seed removal, but this is something that other actors further down the value chain have to address (e.g., by returning seedcakes to the farms, see above). The main problem with the soil requirements in the NTA 8080/81 is that the smallholders simply do not have the means to prove their organic practices according to the demands of a European standard with its specific and rigid interpretation of what passes as 'adequate scientific proof'. This case exemplifies the nature of unequal power relations operating in the certification process, due to which only some actors' knowledge and practices are considered legitimate and scientific.

5.1.7 Excess or deficient governance?

The experiences with NTA8080/81's cumbersome and often superfluous provisions, as discussed above, may be considered as cases of "excess governance" by the standard. These provisions seemed to serve no purpose except satisfying EU and Dutch bureaucratic requirements. The project also encountered the opposite problem of "deficient governance". For instance, NTA8080/81 did not require the collection of samples from a control group of farmers who have not been cultivating Jatropha. Without this control group it is difficult to separate any ecological impact of Jatropha cultivation from other factors creating similar impacts. In particular, soil fertility deterioration may not be limited to Jatropha growers alone. However, the NEN

was unconvinced of the need for control samples and during one of the project progress meetings, the collection of control samples was even flagged as a waste of budget.

5.1.8 Key issues for data collection

The foregoing analysis of the tension of fusing different realities may be depicted in a schematic diagram as shown in Figure below. The upper half of the figure represents the official NTA8080/81 requirements, while the lower half of the figure schematically depicts the Tanzanian smallholder reality with which the NTA8080/81 norms were confronted. Deficient governance cases are placed on the

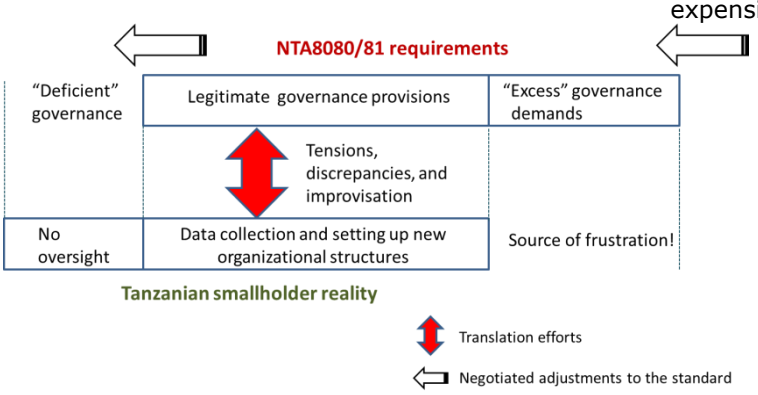

Figure: NTA8080/81 sustainability standard meets Tanzanian smallholder reality

left side of the figure, while cases of excess governance are placed on the right. In the 'middle ground', where governance was felt to be feasible and operable, the norm requirements were subjected to major translation efforts involving brainstorming in Tanzania, remedial research to identify acceptable ways forward and perhaps most importantly significant improvisation in the field.

As the fieldwork for the collection of baseline data in Tanzania proceeded, many newer instances of excess and deficient governance were encountered. Due to lack of space, we only discuss some key issues below. Before doing so, however, we first hone in on some problems falling in the intermediate category of "legitimate governance provisions" of NTA8080/81. The list given here is not exhaustive. These problems were experienced during prolonged discussion and mutual adjustments by the parties in The Netherlands and Tanzania which were eventually able to reach a compromise.

- **Where to measure soil quality?** The NTA8080/81 emphasized that adverse effects on food production must be avoided, but the Jatropha hedge is obviously located beside the food plot or even some distance away from it. The university team ended up taking samples from both food plots and under Jatropha hedges, since the NEN was unaware of the requirements that would be posed by the auditors. This was laborious and expensive.
- **How deep to dig for the soil samples?** Again, the NTA8080/81 did not provide adequate guidance. NEN indicated that this must be determined locally. But for assessing the soil quality of a food plot, one should not go deeper than 40 cm in order to obtain meaningful estimates of e.g., soil carbon, whereas a depth of 40 cm is barely sufficient for determining effects from deep Jatropha roots on the soil under the hedge. At the same time, the sample results from both the food plot and the hedge must be mutually comparable and this is only possible if the same soil depth is used for both. A compromise depth of 50 cm was decided upon for all samples, but this is obviously a rule of thumb.
- **How to dig?** Soil probes were recommended, but they were found to be useless in stony ground. Heavy-duty shovels pick axes and pangas were required to get into some Tanzanian soil, but that meant obtaining rough, "disturbed samples" – another unavoidable problem that would reduce the reliability of the soil quality data.
- **Where to analyze?** A local laboratory was contracted for the analysis of almost 440 soil samples that needed to be processed. The first results that came back revealed values that were outside theoretically possible ranges, and the laboratory had to be requested to analyze

everything again. About 8 months later, the final values for some of the key nutrients still had to come through. By this time it had become obvious that the laboratory was not equipped to handle large numbers of samples. The future scenario of certifying 60,000 odd smallholders who are supplying to the Tanzanian Jatropha subsidiary acquired nightmarish proportions.

- **How to deal with 'illegitimate' target groups?**

  As already forewarned by the Tanzanian subsidiary's manager, the main seed suppliers proved to be children and elderly people. Does this, then, involve child-labor? This is the inevitable question asked by European parties, and absence of proof to the contrary usually stands firmly in the way of any certification involving labor standards. The Cramer Criteria, on which NTA8080/81 is based, likewise include a clause which forbids the use of child-labor. Information from interviews with the 2,300 database farmers seemed to indicate that their children were indeed attending school. But school time is limited to the morning hours, so the children can help out on the farm after school. Of course, this could also include picking, peeling and selling Jatropha seeds. Such farm work by children is a sheer necessity for many poor farming families. Is this child-labor, or not? The auditors' verdict is still out there.

We move on to the problems with deficient or missing governance by NTA8080/81. The NEN was rather uninterested in taking up these issues even though they were found to constitute major gaps in sustainability oversight according to the university researchers who argued that these gaps could easily undermine the future credibility of the standard. Here is a sample of these issues:

- **neglected key shortages of minor minerals:** significant removals of Calcium and Magnesium from local biomass production systems can occur due to frequent harvesting of woods and/or crop seeds. Scientific research in East African settings has shown that this can have an adverse impact on local soil productivity. However, NTA8080/81 does not require their measurement and monitoring. It only asks for the measurement of macro nutrients, basically Potassium, Nitrogen and Phosphorus, and of soil organic carbon (SOC).
- **no requirement to measure soil moisture contents:** this non-requirement was a huge oversight since some bio fuel crops, including Jatropha, are known to be water hungry (an observation made also by some farmers in our study area) and hence could affect water availability for adjoining food crops.
- **no need to measure toxic effects from Jatropha by-products:** the NEN argued that the NTA8080/81 is solely meant to capture the sustainability of "production units" in the Jatropha oil supply chain. This meant that any by-products emanating from oil production could remain not scrutinized. Bizarrely, NTA8080/81 prescribes in great detail the monitoring of soil, water and air effects on smallholder plots, even where these can be expected to be minimal, whilst completely disregarding any similar effects after the seeds have left the smallholder plots. In view of persistent reports about the high toxicity of Jatropha, especially due to phorbol esters, this was deemed a particularly unacceptable omission in NTA8080/81 governance by the university team and their Tanzanian co-workers.

supply a mere 11-12% of the oil processors' estimated break-even level of oil production (source: Tanzanian subsidiary's manager). The other 88-89% would presumably still need to be certified later, without any subsidies from the NL Agency and assistance from the technical university. Furthermore, according to NTA8080/81, a certification auditor would need an average of 3 hours to audit one smallholder (excluding travelling time and costs). Overall the cost of certification was estimated to exceed the benefits (for the value chain) by a large margin. The benefits, to recall, consisted primarily of market access to the EU aviation sector which paid a more attractive price than would be possible on local markets. But clearly despite the NTA8080/81's provisions of group certification, it did not cater to the needs or appreciate the realities of thousands of smallholders in Tanzania.

5.1.9 Certification cost per farmer

Perhaps the most serious problems arose from the "excess governance demands" depicted in the right-hand side of Figure 1. The requirement to register all smallholders in a database with their GPS details turned out to be expensive, with the average cost per farmer exceeding €4 for the initial 5,000 farmers included in the certification project. This is due to the time consuming nature of the registration process, which has to be done on location in remote rural areas, to take proof such as photos of the hedges, and measure the hedge length and width. On top of these costs there would be annual soil sample analysis. As stated before, the number of farmers from whom baseline soil samples were taken had to be at least one hundred. The costs of this initial baseline sampling and analysis amounted to around €4,500 for laboratory costs, while additional amounts were spent for labor and transport involved in the collection of the samples. Since a substantial number of these farmers are to be re-analyzed on an annual basis to meet the NEN's requirement of monitoring, these costs were deemed to be prohibitive for the prospective cooperatives. It is also worth noting that these were the approximate costs of certifying the first 5,000 farmers only, who

5.1.10 Cost reduction

As the financial and logistical consequences of certification became clearer, the university team along with the Tanzanian subsidiary's manager began to explore ways to reduce costs. First, they suggested replacing a part of the sampling with estimations based on calculations of nutrient removals due to seed harvesting, and limiting primary soil measurements to once every five years. But the NEN was unwilling to modify prescribed NTA8080/81 procedures without consulting the Dutch council of accreditation (a body that supervises the quality of procedures used by the NEN and other standardization institutions in The Netherlands). The accreditation council was extremely reluctant to get drawn into such operational issues and referred the NEN to the European Cooperation for Accreditation (ECA), of which the Dutch accreditation council is a member. The ECA had recently drawn up a

guiding document for group certification, which was duly sent to the NEN. This rather bulky document revealed that the NEN's NTA8080/81 did not meet all of ECA's group certification guidelines, and that it would have to comply with these guidelines by mid-2013. This discovery did not bode well for the project. At the time of writing, the NEN was still trying to find out from the Dutch accreditation council how it could or should interpret the ECA group certification guidelines.

5.2 Development of the chain

After a multi-year technical review from aircraft makers, engine manufacturers and oil companies, biofuels were approved for commercial use in July 2011. Boeing, Rolls Royce and UAP had a leading role in this development and they had performed several test flights on biofuels. These fuels have been developed from manly jatropha oil from Diligent. One of the goals of the project is to test and develop a chain for sustainable biofuels to Europe, in this particular case for the aviation industry. In September 2011, Shortly after approval for commercial use of bio jet fuel diligent supplies their first jatropha delivery to SkyNRG.

5.2.1 Logistic cost

UOP has developed and commercialized technology that converts non-edible, second-generation natural oils like Jatropha and wastes to Green Jet Fuel that meets all critical specifications for flight and reduces your greenhouse gas emissions. UOP is located in the USA. Another company with a similar technology for oil conversion is Nesté oil in Finland with their NExBTL jet fuel. For both conversion suppliers additional logistic cost has to be made.

Jatropha is supplied in a flexibag, transported in a 20 ft. container. The maximum amount of oil that can be transported with one container is 20 Mton of oil, approximately 22.000 litre. The cost for transport from Tanzania to the port of Rotterdam in The Netherlands is US$ 3.000,= That is an cost of US$0,13 per litre or US$136,= Mton. Because the oil has to be converted in the USA or Finland the logistic cost is even higher and van raise up to the double amount. Up scaling the production volumes to realise more efficient logistics is not possible at the moment.

Alternative feed stocks for the production of bio jet fuel are used cooking oil and Camelina. Both can be sourced in the US. The available quantities for used cooking oil is limited.

5.2.2 Export versus local market

There is an growing internal market for jatropha oil in Tanzania. Jatropha oil is a very interesting substitute for diesel to feed electricity generators. Due to regular power cuts most companies and the hospitality market depend on their generators to continue their business. Large volumes of diesel are needed and stored close by the generator, often at more than earing distance and out of sight. By replacing the diesel for jatropha there is less chances on theft since jatropha oil as such can't be used to fuel cars.

At the local market in Tanzania customers are not used to request for sustainability certification. However the story behind jatropha business is very sustainable and does please customers in the hospitality industry.

5.2.3 Additional value for certified oil

There is an indication that certified oils for bio-fuels should have an value approximately €50,- / US$66,- higher than oils that are mentioned for the food industry like palm-oil. However the cost for certification is higher than this additional value. Selling jatropha road as biofuels is only interesting in case the value of the oil on the local market is substantial lower than in Europe. At this moment customers are willing to pay a price equal to local diesel price US$1,32. That is equal to US$1450 per Mton. This price is nearly double the price for palm oil on the international market (us$740/Mton). All prices above are excluding VAT.

At this moment, the local sales of Jatropha oil are only taxed with a deductible VAT (18%), although there is no formal exemption of other taxes which apply to fossil diesel. Fossil diesel is taxed with excise duty (TSH 314 per litre) and fuel levy/road toll (TSH 200 per litre), but not with VAT. If these duties and levies are imposed on Jatropha oil, the sales price excl. duties will decrease with THS 514, approximately US$0,32 (excl. VAT) per litre or US$350 per Mton.

At current market prices the local market would still be more profitable than export.

Sources:

Diesel price:
http://www.mytravelcost.com/Tanzania/gas-prices/

Palm oil price:
http://www.indexmundi.com/commodities/?commodity=palm-oil

Prices at the date of 4/9/2013

6. LESSONS LEARNED

The story of the certification process documented in previous chapters allows us to draw some general lessons about sustainability standards and their implementation in global value chains. It is clear that standard design and operationalization by bodies such as the NEN cannot foresee the issues encountered during implementation, especially in other parts of the world. The institutional and ecological complexity of realities such as those of the Tanzanian smallholders cannot be reduced to guidelines and protocols of a 'universal' globally-applicable standard. This is true even for standards such as the NTA8080/81, designed in a participatory process on the basis of widely accepted sustainability principles that were formulated with the intention of protecting poor and vulnerable people and environments.

6.1 Niche standardization

The irreducibility of complex realities to standards and norms paves the way for ontological effects produced by standards that attempt to make the realities so as to accurately describe them. The pilot stage of the certification process studied by us is perhaps too early to witness such ontological effects. Instead we focused on the adjustments made on the 'official' standard itself when it was confronted with the real world of growers and processors in parts of Tanzania. As a result of these adjustments that the powerful participators in the certification project often resisted, the standard may have become more aligned with the local realities encountered. But other frictions similar and different from the ones discussed in this chapter are bound to crop up as this 'adjusted' standard moves to new locales and encounters various social realities that make up our world.

Perhaps a way of reconciling the heterogeneity and complexity of the world is to reject the idea of universal standards beyond the level of broad core principles, instead opting for regional or niche standardization.[i] With niche standardization it may be possible to take better in to account socially and geographically bounded realities such as those of Tanzanian smallholders growing Jatropha as a hedge. A niche standardization strategy would be better positioned to serve the intended purpose (in terms of fostering 'social' and environmental sustainability), although care still has to be taken not to exclude the poorest farmers from reaping the benefits of the sustainability of their existing practices, a sustainability they cannot afford to be proved 'scientifically'.

6.2 Indirect Land Use Change

On a final note of caution, beyond the confines of the certification, the sustainability of smallholders' existing practices is not something given or unchanging. Farmers may respond to a high demand for bio fuels created by European subsidies and mandatory fuel mix requirements by cultivating crops such as Jatropha on lands that were hitherto used for cultivating food crops. Alternately, in their attempts to increase yields, they may start using greater amounts of water and (organic) fertilizers on Jatropha, diverting these scarce resources away from food and fodder production. Bio fuels are therefore inherently risky technological 'solutions' to a climate change which can jeopardize poor peoples' food security in Tanzania and many other parts of the global south, with or without sustainability certificates.

7. PROJECT FOLLOW UP

Due to the discontinuation of Diligent Tanzania the final certification of Diligent Jatropha oil has not been taken place. A second goal for this project was to make a template for certification of other smallholder projects for biofuel production.

Diligent Consultancy and the TU/e started initial conversations to set up such services for biofuel producers and we had the first discussions already with the company Agroils in Italy, with production facilities in western Africa and South America, for the certification of their jatropha production.

For now the production quantities are still too small for certification, and they will only increase their production once they have their improved specie of jatropha ready for reproduction. Further Agroils prefers to become certified by the RSB standard, however with RSB we will have the same issues as with the NEN certification.

RSB is interested to exchange experiences with the TU/e to see how their standard can be adjusted to make it more accessible for smallholder farmers.