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Towards a certification of biomass: Feasibility of a certifications scheme of sustainability standards for trade and production of bioethanol in Brazil

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Abstract

Bioenergy produced from biomass is increasingly used to substitute fossil energy sources. Trade of biomass is expected to increase in the following years due to disparities in production costs and potentials in countries and regions. In this paper the possibility of a certification scheme for minimizing negative socio-ecological impacts and for increasing a sustainable production of biomass is discussed, taking Brazilian bioethanol as an example. This case-study comes up with a first set of feasible sustainability standards for Brazilian bioethanol and discusses issues to be considered when developing sustainability standards. At the same time problematic aspects are identified. When incorporating opinions of different stakeholders, the setting of sustainability standards holds the inherent danger of being used as non-tariff trade barriers. This leads to the need for a regionalisation of sustainability standards and raises questions on structure and level of a certification scheme.

Keywords: certification, sustainability standards, bioethanol

JEL-classification: F18, Q24

1 Introduction

Bioenergy produced from biomass is increasingly used to substitute fossil energy sources. Main reasons are the reduction of greenhouse gas emissions and concerns about security of energy supply. Trade of biomass is expected to increase in the following years due to disparities in production costs and potentials in countries and regions (HENKE 2005, p. 12, ERICSSON & NILSSON 2004, p.206, IEA 2004, p.18). In addition, changes on the global sugar market (closely related to the market for bioethanol) may allow surplus sugar to be used for the production of bioethanol, particularly in ACP states. The key questions are, how a switch from a non-renewable resource to a renewable one like biomass can be achieved in an ecologically, economically and socially sustainable manner, and what contributions a certification system for trade and production may be able to make.

Theoretical justification for a certification can be found in the principal-agent-theory (see e.g. (MENARD & SHIRLEY 2005, NORTH 2002, WILLIAMSON 1975), and in the occurrence of external effects. The principal agent problem (PAP) oc-

curs, when potential consumers of biomass (principals) have little or no information about circumstances of the production important to them as well as about the quality standards in place along the process-chain. For PAP using certificates is a solution for the producer to signal "better" characteristics of its product providing consumers with information relevant to them. This takes place at a voluntary, private level. Currently, for producers of biofuels (agents) there exists no system to effectively demonstrate this advantage.

The switch from fossil fuel to biofuel in the EU and North America is mainly due to policies of governments searching for different aims like protection of climate and diversification of energy supply (HENKE 2005, p. 4ff). These can be regarded as public goods. Thus, environmental policy aims to reduce external effects by using renewable energies as substitutes. In this process, creating new negative external effects has to be prevented. The state is responsible for the avoidance and internalisation of (negative) external effects which might result from the production or use of renewables. Hence, if policies support bioethanol, external effects in producing countries need to be considered. It is therefore an important question to what degree this problem can be addressed by certification.

2 Problem statement

Motivated by the encouragement of biofuels in general and bioethanol in particular a demand for or interest in a certification of biofuels has risen from different sides (e.g. NGOs, governments, industry). The mineral industry, blending bioethanol in gasoline, is interested in the quality of bioethanol itself and in buying it at lowest price. The customer of gasoline is demanding a low price, but is also concerned about environmental and social issues. With relatively similar prices at gas stations, environmental and social aspects of bioethanol might influence the choice of the customer about from which mineral company to buy the blended gasoline. Therefore, a certification is useful to provide reliable information to the customer and to enable producers to signal the observance of certain standards. On European level, the support of renewable energies is mainly justified by the avoidance of greenhouse gases, security and diversification of energy supply, and employment in rural areas (cp. EUROPEAN COMMISSION 2003, (15), (17), (22), (28), Art. 1). However, these positive environmental and social effects in the countries using renewable energies might be "neutralized" by negative effects in producing countries (in European or third countries). That is why the European Commission states that "only biofuels whose production in the EU and third countries complies with minimum sustainability standards will count towards the targets." (EUROPEAN COMMISSION 2006, p.8). Currently, no bio-energy standards exist relating to environmental, social, and economic issues. Previous research into the possible production of energy crops mainly dealt with technical and economical potential (see e.g. HENKE 2005, MORRIS ET AL. 2002, PESSOA-JR.

ET AL. 2005, SCHMITZ 2005). Analysis concerning local country-specific, social and ecological impacts is missing (ÖKO-INSTITUT 2005, p. 22). Currently, on European and German level minimum standards are discussed, but neither industry nor policy have defined minimum standards yet. Thus, there is increasing demand for a certification scheme, but which indicators are feasible for such a certification scheme is not known. In this study demands of private consumers and public concerns are considered when analysing possible criteria and indicators for a certification system for Brazilian bioethanol.

As there are so far no international guidelines for the trade and production of bioenergy, a checklist needs to be developed, that can be applied on different kinds of biomass originating from different regions. Initial development of standards and certification system research has been started by different institutions, like in Germany the ÖKO-INSTITUT, German Technical Cooperation (GTZ), and the Task 40 of the International Energy Agency. For the latter, LEWANDOWSKI & FAAJI (2004) have developed a multiplicity of criteria and indicators applicable to bioenergy from different existing certification systems, fitting for bioenergy.

Out of this first collection of criteria, this paper aims to develop a selection of criteria and indicators which are suitable and particularly feasible for Brazilian bioethanol. At this stage we do not focus on the legitimisation of discriminating against products that do not fulfil certain requirements, but analyze to what extend indicators named by different stakeholders can actually be obtained in a comprehensible and litigable manner. We are aware of the fact that certification may be abused to build up technical barriers to trade. We will come back to that point in the conclusions.

3 Approach to develop criteria and indicators

In this paper, criteria are defined to be *"'requirements' (...) that have to be fulfilled for the certification of a product or a production process"* (LEWANDOWSKI & FAAJI 2004, p.6), an indicator is defined as "*a parameter, or a value derived from parameters, which points to, provides information about, describes the state of a phenomenon/environment/area, with a significance extending beyond that directly associated with a parameter value*" (OECD 2003, p. 5).

To include criteria into a certification scheme those criteria must be backed by theory, they must be important to relevant stakeholders, and they must be measurable and verifiable to reasonable costs. Therefore, the development for criteria and indicators which are feasible for Brazilian bioethanol proceeded in four main steps:

a) Collection of possible criteria and indicators:

The sampling was based on a list with 127 criteria for the trade of biomass, selected from existing certification systems for agriculture, forestry, biomass for

energy, fair trade, and general ones by LEWANDOWSKI AND FAAJI (2004). The criteria were then supplemented with indicators from a check-list for vegetables and fruits from EUREPGAP as recommended by researchers of the GTZ and other consulted experts. During research in Brazil local literature was reviewed. A publication of the Brazilian certification company IMAFLORA was incorporated, using their socio-environmental standards (particularly important for social criteria). International, national, and federal legislation, affecting the production of bioethanol has been included. Furthermore, a publication of BORRERO ET AL. (2003) gave information on potential indicators. As part of their research, three mills in São Paulo were examined.

Assuming that Brazilian actors possess important local knowledge and cannot be excluded from a successful certification process, interviews were held with actors, and different groups of interest were identified (see Table 1). Interview partners were selected according to "theoretical sampling" (LAMNEK 2005, pp.190-192). All interviews were taped and subsequently transcribed in a summarized form[1]. The transcriptions followed a list of criteria which can be interpreted as „units of meaning"(see MAYRING 2002). The summarized results were listed in a table according to the criteria and indicators. In addition to the collection of criteria and indicators, interviews gave first estimation of the suitability, allowing an assessment of the importance of indicators to Brazilian experts (see d).

Table 1: Interviewed Groups

Group of interest	**Number of Interviews n= 14**
1) Producers and Industry	3 (Brazilian)
2) Governmental	3 (Brazilian)
3) Buyers and Consumers	3 (German)
4) NGOs	1 (Brazilian)
5) Research institutes	4 (Brazilian)

b) Filtering according to theory

Following SMEETS ET AL. (2005), overlapping criteria, criteria deemed difficult to be operationalised, and with no relevance for trade of bioethanol were dis-

[1] According to MEUSER & NAGEL (1991, p.448), a complete transcription is not necessary. A summarizing protocol can be directly summarized from the tape, though the summary has to be done methodologically controlled (MAYRING 2002, p.94).

carded. This first list of criteria was revised during discussions with researchers from the GTZ, and the University of Utrecht.

Economic criteria, suggested by LEWANDOWKSI & FAAJI (2004) were debarred from the list, as fair trade issues are taken into account in the social criteria, and companies are expected to have an own interest in the viability of their business.

c) Filtering according to relevance for users:
The criteria named by Brazilian interest groups were then filtered using the interests of German market actors (mineral oil companies) and European directives. They were then divided into two groups:

Group A (private level): Using qualitative interviews, mineral oil companies in Germany were interviewed in order to discuss their opinion towards the blending obligation for bioethanol and their preferences regarding sustainability standards for Brazilian bioethanol. They are assumed to represent their costumers. These criteria directly address the PAP of adverse selection.
Group B (policy level): By analysing the EU Directive 2003/30/EC, and the Commission Communication "An EU Strategy for Biofuels" (2006), goals and potential criteria from Group B have been obtained. As a certification scheme on the policy level can only be justified with public goods theory only those criteria which affect public goods were considered.

d) Filtering according to measurability
This step included checks for the availability of information to satisfy the draft criteria list's indicators and verifiers. The draft check-list was tested during discussion with two experts representing UNICA in the state of São Paulo and on three mills in the North-East states of Pernambuco and Alagoas. Collection of data in each mill in the Northeast took place using visits of different sites of the company (plantation field, laboratory, and industry), interviews, and provision of internal documents.

A classification of the requirements (importance to consumer and public, and measurability) allowed for a selection of indicators. With different efforts different qualities and quantities of information can be received. Information gained was used to divide indicators in three groups of measurability. The first requirement for an indicator to be measurable is that it is quantifiable in principle. "High measurability" then includes indicators which need only easily available information. They are either verifiable by documents, or can directly be assessed when visiting the mill. "Medium measurability" results if additional information needs to be consulted like remote sensing data, or the opinion of third persons. "Low measurability" follows from unreliable sources of information, or high costs to get information.

After giving an overview on the study areas, results of the analysis are discussed in detail.

4 Description of study areas

The overall case-study "certification of bioethanol from Brazil" was subdivided into case-studies in the two regions Centre-South and North-East. In the latter, 85% of the production of sugar cane is concentrated (61,4% São Paulo) while the rest is located in the North-East of the country, where sugarcane production has its origins (MACEDO 2005, p. 44). Nowadays, the production in the North-East is less competitive than in the Centre-South-Regions due to climatic and geographical conditions. These two regions of production have been chosen, as they show disparities regarding the natural factors such as climate, and social, economic- and production structures for the production of bioethanol:

4.1 South-East region (São Paulo)

In São Paulo about 250.000 workers are employed in the sugarcane sector, that is 35,6% of the agricultural workforce (SEADE 2002). The cultivated area in 2004 embraced 49,7% of the total land area (12 355 967 ha) in the South-East, thereof 14,1% for sugarcane (IDGE 2006). In the state of São Paulo 45,6% of the cultivated area was used for sugarcane in 2004 (IGDE 2006). The state represents 62% of sugarcane, 76% of sugar production, and 71% of the Brazilian bioethanol production is concentrated there (SCHMITZ 2005, p. 137). 70% of the cultivated land (with sugarcane) is controlled directly by the 235 mills. Most companies producing sugarcane are owned by sugar- and/or bioethanol-factories (SCHMITZ 2005, p.137).

4.2 North-East region (Pernambuco, Alagoas)

The North-East includes nine states and had a cultivated area of 2.773.227 ha in 2004, 1.137.706 ha of which was sugarcane (IBGE 2006). The production of sugarcane in 73 industrial units is concentrated in the states Pernambuco, Alagoas and Paraíba (Ramon & Marques 2001, p. 11). The agricultural potential[2] limits land used for sugarcane to coastal areas giving the producers the advantage of low

[2] The agricultural potential is calculated from soil fertility, climate and relief. It is classified into seven sections: good, good-medium, medium good, medium, medium-restricted, restricted, and inappropriate by the IBGE.

transport costs (this is most notably the case for the cooperative visited in Alagoas, where the longest distance from a mill to the harbor is 60km. However, the agricultural potential is medium and medium-restricted in the main production areas. In colonial times, the North-East was the political and economic centre of Brazil and became famous for its dominant landowners (Coronelismo) (PEREIRA 1999, p. 2). The land is still distributed very unevenly (ibid, p. 3).

5 Results

The results of the sampling and subsequent filtering processes are described and discussed below.

5.1 Sampling results

Simply adding up the criteria from the aforementioned sources (see section 3) resulted in a list of 241 criteria, ranging from economic concerns like the "viability of enterprises" over social concerns like " paying average regional wages" to ecological ones like "crop rotation in place". We classified them into "general criteria" like, for example, traceability or compliance with national laws; into social criteria mainly concerning the livelihood of workers and their families; and into ecological criteria. These constituted the "long- list"[3] which had to be condensed by the different filtering steps.

5.2 Filter 1: theoretical considerations:

After theoretical filtering criteria that address principal agent problems remain for group A, and those that concern public goods are kept in the list for group B. But not all of them are feasible for a certification scheme which in general discriminates between products of specific producers on the basis of their actions or characteristics. Problems like "food security" and "pressure on eco-sensitive areas" result from changes in the agro-economic system and cannot be attributed to single companies. Thus, they had to be discarded from the list of indicators. After this theoretical filtering 41 criteria remain for the private level, 12 remain for the policy level.

5.3 Filter 2: relevance for users

As aforementioned, the concerns for a certification scheme were divided into two groups, whose demands are summarized in Table 2. The interviews with different mineral oil companies (Group A) showed that medium size companies seem to be sceptical towards bioethanol imports and would prefer using domestic sources if possible. Mentioned criteria were the fulfilment of standards regarding environ-

[3] The "long list" extravagates the scope of this paper, but can be provided on demand.

mental engineering, structural engineering, and calibration. Different qualities of domestic and imported bioethanol were assumed. Two big oil companies stated that the most important criteria were the positive CO_2-balance from "well to wheel" and the quality of bioethanol regarding its final use. These criteria appeared to be directly important for the companies. And additionally due to publicity aspects socio-environmental issues were named as well (see Table 2). This step of filtering resulted in 31 criteria for the private level and 12 for the policy level.

Analysing EU documents for biofuels, the EU Directive 2003/30/EC contains mainly general demands on the production of bio-fuels e.g. environmentally friendly security of supply (see Table 2). The EU Strategy on biofuels gets more detailed, demanding to address concerns like pressure on eco-sensitive systems, soil fertility etc. (see Table 2). Still, the strategy includes very general demands like "being environmentally positive and respecting the Lisbon Strategy".

Table 2: Issues for criteria from mineral oil industries and guidelines of the European Union

Group A*	**Group B****
Positive CO_2-balance along the supply chain	Part of the package of measures needed to comply with the Kyoto Protocol (EUROPEAN COMMISSION 2003, p.6)
	Reduction of CO^2-emmissions (EU 2003 p.5, in: The Commission White Paper 'European transport policy for 2010)
	Production and use is globally positive for the environment and that they contribute to the objectives of the Lisbon Strategy taking into account competitiveness considerations; (EUROPEAN COMMISSION 2003, p.4)
	Environmentally friendly security of supply (EUROPEAN COMMISSION 2003, Art. 1)
Quality of bioethanol and handling	Compliance with the quality standards laid down to ensure optimum engine performance. (EUROPEAN COMMISSION 2003, p.14)
Conservation of biodiversity (rain forest)	Pressure on eco-sensitive areas, like rainforests. (EUROPEAN COMMISSION 2006, p.7)
	Concerns regarding the effect on: - soil fertility, - water availability and quality, and - pesticide use (EUROPEAN COMMISSION 2006, p.7)
	Ensure the sustainability of biofuel feedstock cultivation in the EU and third countries (EUROPEAN COMMISSION 2006, p.9)
	Appropriate minimum environmental standards apply to feedstock production for biofuels, adapted to local conditions in the EU and third countries (EUROPEAN COMMISSION p.10)

Social issues in countries of origin	Potential dislocation of communities and competition between biofuel and food production (EUROPEAN COMMISSION 2006, p.7).
No child labour	
	Any system of certificates would need to apply in a non-discriminatory way to both domestically produced and imported biofuels and comply with WTO provisions. (EUROPEAN COMMISSION 2006, pp.8-9)

* *Group A represents a collection of aspects quoted by interviewed mineral oil companies in Germany*

*** Group B is a collection of statements, goal and strategies, citied from the Commission Communication "An EU Strategy for Biofuels" (2006) and the EU Directive 2003/30/EC of The European Parliament and of the Council (2003)*

This step of filtering results in two different lists of criteria and indicators: one for private certification (group A) and one for a politically demanded certification (group B).

5.4 Filter 3: measurability

The measurability of indicators is determined by the availability of information which is defined by the efforts necessary to receive them. Additionally, the reliability of data is considered. According to the availability of information, the criteria and indicators were classified into the three groups "high, medium and low measurability" mentioned in section 3. For group A, out of 23 social criteria only four can be classified into the category "high measurability, as can five from six environmental criteria, and zero from seven general criteria. For three general criteria, no exact indicators could be defined. A DIN-norm is demanded by the German mineral oil industry, but there is no standard for bioethanol yet.

The availability is particularly low for several social criteria as most of them rely on third person information or documentation of companies. Those were assessed as not being reliable by experts. Regarding ecological criteria, the indicators for positive carbon effect, minimization of waste and crop rotation have been analysed to be only of medium measurability. As those social and ecological criteria were assessed to be relevant by private consumers and/or on the policy level, there is a clear gap between ideal and feasible indicators. In many cases information on the indicators could be made available if someone were ready to pay the

costs. In some cases a monitoring system would have to be constructed by the Brazilian government to overcome difficulties. We will now discuss problems of measurability for important indicators in more detail:

Important indicators with medium or low measurability

General indicators: As already mentioned mineral oil companies demand reliable information on the quality of ethanol concerning its use in vehicles. This requirement cannot be fulfilled at the moment as relevant norms have not yet been conceived. Considering the high priority, oil companies assign to this problem it will only be a question of time, though, until the stipulated norm will be developed. Thus, it is included in the final list of criteria and indicators (see table 3).

The conformity with local, national, and international legislation for environmental issues is basically certified by a license which each producer has to apply for at the IBAMA (Ministry for environment and renewable natural resources) which indicates compliance with national law. Furthermore, all social criteria are based on Brazilian legislation. Of course, some violation of national laws may remain undetected, but no other certification system can exclude this possibility either. Another problem arises, when Brazil doesn't enforce obligations from international agreements. In this case it would be more costly to detect compliance to international legislation. Demanding credible information here may as well give additional incentive to Brazil to enforce obligations from international treaties. Hence, this criterion is also included in the final list.

According to some experts, traceability is so far not possible for Brazilian bioethanol, but it can be enforced if it is demanded. In the case of one company visited in the North-East there is documentation from the mill to the harbour, but in the harbour eleven mills use the same tanks for shipping overseas. Possible solutions might include assigning each mill its own tanks for each type of bioethanol, or labelling whole harbours or cooperatives, which make sure that all suppliers conform to the certification rules. Thus, though presently not measurable but essential for a certification, this thorough monitoring has to be included in the list of sustainability standards.

Social criteria which were particularly named are:

All workers receive a minimum salary; Availability of legal contracts

These two criteria are essential to guarantee a fair payment, and are vital for the fulfilment of other social criteria. All indicators for these criteria relate to employment contracts. Verifiers can basically be checked with the staff records of the companies. This is possible in the case that all workers are registered in an employee book which each entrepreneur officially has to keep. During expert interviews, however, it was mentioned that the verification is problematic, as

some workers are not officially registered, and do not receive legal contracts. A solution might be the comparison with data of the PNAD (Pesquisa Nacional por Amostra de Domicílios) based on official employer declarations, and RAIS (Relação Anual de Informações Sociais) based on declaration of workers. Both sides are controlled by the Ministry of Labour. Unfortunately, these data are mainly collected for city-based employers and do not provide information on certain companies. Hence, they cannot be used for the verification of the indicators. Another option is consulting the labour unions. They do not have data of each illegally employed worker or single companies, but can give a credible approximate overview for their region. The mills visited stated that all of their workers were legally contracted. In one mill, an outsourced contractor employs the seasonal workers, but this depends on the size of the company. Starting at a certain size, companies use sub-contractors (personal information of an interviewed manager). For the Centre-South, the problem of outsourcing mainly results from migrating workers. As a result the law has recently been changed, moving the responsibility from subcontractors to the mills, and meaning more incentives to mechanize the harvest. Hence, the measurability of this criterion was assessed to be low by interviewed experts, and has been debarred from the final list.

Child-labour:

All interviews showed that this criterion is very important to NGOs and consumers and still presents a problem in Brazil. Moreover, the fulfilment of this criterion is important for reputations of both producers and consumers. Child-labour is an issue which is often discussed in public and is therefore a subject of reputation, with much potential for bad publicity. The indicator to prevent child-labour is that all workers have valid working contracts, which points to the aforementioned problem with legal working contracts.

The mills visited in the North-East (all mills in the CRPAAA) are certified according to the "Fundação Abrinq"[4]. It was suggested to use this existing certification as an indicator for this criterion. Still, the credibility of the certificate has to be examined before using it. It was not possible though to assess the credibility of this certificate, and therefore, the criterion has been excluded from the final list.

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[4] This is a Brazilian organisation which certifies companies for not employing children. They receive a certificate calling them "Empresa Amiga da Criança" (Company Friend of Children)

http://www.fundabrinq.org.br/portal/alias__abrinq/lang__en-US/tabID__112/ DesktopDefault.aspx

Environmental criteria generally show a higher measurability. For some criteria some indicators are classified to have a low or medium measurability, but as most of the criteria possess several indicators of different measurability, none but one had to be excluded:

Positive carbon balance:

The indicator for net savings of bioethanol, compared to fossil fuel is demanded to be measured according to a methodology of the Clean Development Mechanism (CDM). No projects for the use of bioethanol have yet been submitted at the CDM. Therefore, there are no experiences to study the use of their methodology. As bioethanol was already in use in Brazil at the carbon management baseline of 1990 only improvements in the technique and efficiency can be credited. Recognition of these is planned in the future. One of the mills visited has applied to receive credits for producing electricity from bagasse. According to a representative of UNICA, it is possible to measure the carbon reduction benefits, as there have been previous measurements (not according to the CDM methodology, but data is available). Overall, the mills visited do not yet possess techniques to measure their emissions, but already have some documentation about diesel used for their transportation fleet.

In summary, some of the important criteria with low or medium measurability of indicators are generally verifiable in principle and are demanded by the consumer groups. Nevertheless, for the moment there are no incentives for mills to monitor these social and ecological effects, and data are thus not available. This could change easily though, if it is deemed beneficial by the mills.

5.5 Regionalisation

The field study revealed the need for different standardization of indicators in the selected regions, caused by different natural conditions, and political, social and economic structures. Furthermore, we observed different environmental legislations, agricultural and social structures, like employment in the agricultural sector, income, prices, costs, and distribution of land. Examples for the need of a differentiation in criteria fulfilment are:

Living/working conditions: As there are basically no migrant workers in the North-East, it is not reasonable to demand habitable lodging etc. on the site for them. In the North-East, the focus should be put on the supply of appropriate food during work, in particular for field-workers. In the South-East, the latter issue is important as well. Additionally, due to the seasonal migrant workers, the adequacy of their living conditions needs to be addressed.

Compliance with law: Burning of sugarcane: The applicable national legislation is different in the two regions. Consequently, the share of non-burned areas, which

are mechanically harvestable, has to be 30% in São Paulo by 2006, and 50% by 2011. A further share of 10% needs to be harvested without burning in areas where mechanization is not possible by 2011. In Alagoas and Pernambuco, according to their national legislation, since 2003, 25% has to be harvested without burning where possible, and 50% by 2008. In these latter states, regulations for areas where mechanization is not possible have not been established. In the other areas, the phasing out is supposed to happen faster than in São Paulo. Hence, in Brazil, legislation has already been adopted to the differing regional relief and climate, "natural basics" respectively.

Water usage: As irrigation with water from sources outside the industrial process does not occur in the South-East, related indicators are not applicable to them. Water use in the processing industry is to be handled equally in both regions.

In summary, when testing criteria and indicators for feasibility, factors at global, federal and national levels need to be included. Thus, there is the need to adapt criteria and indicators on an agro-regional level.

5.6 Summary

The final lists (Table 3) include feasible criteria and indicators for a certification scheme. Some criteria deemed of primary interest to users and/ or considered in official EU documents are not sorted out due to the possibility to increase their measurability. The lists' criteria and indicators are divided into general, social and environmental criteria. They include those being relevant for public or consumers, and those being classified to have a high availability of information. Due to differences in relevance and structure (private/governmental), the lists for group A and B differ.

Table 3: Final list of criteria and indicators

Results for group A

Area of concern	**No**	**Criteria**	**Indicators**
General criteria			
Traceability	1	Ethanol has to be traceable back to the company where it has been produced (c)	Documents are available which show the movement of the product in each chain of the production chain. (c)
Quality	2	DIN norm has to be fulfilled	
Social criteria			
Protection of human safety and health	3	An assessment of the potential safety and health risks has been performed (a)	Has a risk assessment been used to develop an action plan to promote safe and healthy working conditions? (e)
			Is a member of management clearly identifiable as responsible for worker health, safety and welfare issues? (d)
			Do regular two-way communication meetings take place between management and employees? Are there records from such meetings? (e)
	4	A safe and healthy work environment, with aspects such as machine and body protection, sufficient lighting, adequate indoor temperature and fire-drills (a)	Are workers (including subcontractors) equipped with suitable protective clothing in accordance with label instructions? (c)
			Is protective clothing and equipment stored separately from crop protection products? (c)
	5	Availability of document routines and instructions on how to prevent and handle possible near-accidents and accidents. (a)	Is a record of training kept for each worker? (e)
			Is all staff which has contact with crop protection products submitted voluntarily to annual health checks in line with guidelines laid down in local codes of practice? (e)
			Has formal training or instructions been given to all workers operating dangerous or complex equipment? (d, f)

			First aid boxes must be present at all permanent sites and in the vicinity of fieldwork. (d)
			Are hazards clearly identified by warning signs? (e)
			Do accident and emergency procedures exist? (d, f)
			Is the accident procedure evident within 10 meters of the crop protection product store? (d)
			Are signs warning of potential dangers placed on access doors? (d)
Fair trade conditions	6	Transparency and Accountability of Negotiations (a)	Negotiations between the biomass trader and producer and the results should be documented and be available.
Ecological criteria			
Protection of the atmosphere	7	The biomass trade chain belongs to a category of activities with positive carbon impact. (a)	There is a carbon benefit of the biomass trade chain compared to the trade chain of gasoline from fossil fuels (using the standard methodology published by CDM). (a)
Conservation of biodiversity and existing ecosystems	8	No use of GMOs (a)	Planting of any GMO must comply with all existing regulations in the country of production and all existing regulations in the country of the final consumer (c)
	9	There is no cultivation of sugar cane in protected areas like “Àreas de Preservação Permanente” and of Reserva Legal”.	Are maps available that show the use of land and the natural resources and do these show, that preserved area is not cultivated?
			A conservation management plan has to be established (either individually or on a regional basis) (d)
	10	The farmer has to consideration of the needs of nature and species protection (a)	Does farmer have a management of wildlife and conservation policy plan for his/her property? (e)
			Is this policy compatible with sustainable commercial agricultural production and does it minimise environmental impact? (e)
			Does the plan contemplate the undertaking of a baseline audit to understand existing animal and plant diversity on the farm? (e)

			Does the plan contemplate taking action to avoid damage and deterioration of habitats on the farm? (e)
			Does the plan contemplate the creation of an action plan to enhance habitats and increase biodiversity on the farm? (e)
	11	The development and adoption of environmentally friendly non-chemical methods of pest management should be promoted and it should be strived to avoid the use of chemical pesticides (a)	Is biological control used for sugar cane pests and control?
	12	The application of agro-chemicals must be minimized and be carried through with adequate equipment and dosages. (EUREPGAP, f)	Have anti-resistance recommendations been followed to maintain the effectiveness of available crop protection products? (d)
			Has assistance with implementation of IPM systems been obtained through training or advice? (d)
			Is a current list kept of Crop Protection Products that are used and approved for use on crops being grown? (d)
			Does this list take account of any changes in local and national crop protection product legislation? (d)
			Are chemicals, banned in the European Union, not used on crops destined for sale in the European Union? (c)
			Is application equipment kept in good condition? (d)
			Is the application equipment verified annually? (d)
			Is the farmer involved in an independent calibration-certification scheme? (e)
			Are there facilities for measuring crop protection products? (d)
			Are there facilities for mixing crop protection products?(d)
			Are there facilities to deal with spillage? (d)
			Is the product inventory documented and readily available? (d)

Results for group B

Area of concern	No	Criteria	Indicators
General criteria			
Traceability	1	Ethanol has to be traceable back to the company where it has been produced (c)	Documents are available which show the movement of the product in each chain of the production chain. (c)
Compliance with regional, national and international law	2	There must be conformity with the legislation of the country, state and cities. (f)	
	3	There must be conformity with the agreements and treated international to which the country has signed. (f)	
	4	Burning of sugar cane has to phase out according to national/federal law and be done in a secure way	There is an available technology to harvest cane green? Is legislation enforced?
	5	A rotation of culture or green fertilization in the areas where a new plant of cane has to be planted must be realized. This must be at least 80% of the new area. (If)	Are other crops planted after the sugar cane plant has been removed from the field after an average time of 5 years?
Quality	6	DIN norm has to be fulfilled	
Ecological criteria			
Protection of the atmosphere	7	The biomass trade chain belongs to a category of activities with positive carbon impact. (a)	There is a carbon benefit of the biomass trade chain compared to the trade chain of gasoline from fossil fuels (using the standard methodology published by CDM). (a)
Conservation of	8	No use of GMOs (a)	Planting of any GMO must comply with all existing regulations in the country of production and all existing regulations in the country of the final consumer (c)

biodiversity and existing ecosystems	9	There is no cultivation of sugar cane in protected areas like “Àreas de Preservação Permanente” and of Reserva Legal”.	Are maps available that show the use of land and the natural resources and do these show, that preserved area is not cultivated?
			A conservation management plan has to be established (either individually or on a regional basis) (d)
	10	The farmer has to consideration of the needs of nature and species protection (a)	Does farmer have a management of wildlife and conservation policy plan for his/her property? (e)
			Is this policy compatible with sustainable commercial agricultural production and does it minimise environmental impact? (e)
			Does the plan contemplate the undertaking of a baseline audit to understand existing animal and plant diversity on the farm? (e)
			Does the plan contemplate taking action to avoid damage and deterioration of habitats on the farm? (e)
			Does the plan contemplate the creation of an action plan to enhance habitats and increase biodiversity on the farm? (e)
	11	The development and adoption of environmentally friendly non-chemical methods of pest management should be promoted and it should be strived to avoid the use of chemical pesticides (a)	Is biological control used for sugar cane pests and control?
	12	The application of agro-chemicals must be minimized and be carried through with adequate equipment and dosages. (EUREPGAP, f)	Have anti-resistance recommendations been followed to maintain the effectiveness of available crop protection products? (d)
			Has assistance with implementation of IPM systems been obtained through training or advice? (d)
			Is a current list kept of Crop Protection Products that are used and approved for use on crops being grown? (d)

			Does this list take account of any changes in local and national crop protection product legislation? (d)
			Are chemicals, banned in the European Union, not used on crops destined for sale in the European Union? (c)
			Is application equipment kept in good condition? (d)
			Is the application equipment verified annually? (d)
			Is the farmer involved in an independent calibration-certification scheme? (e)
			Are there facilities for measuring crop protection products? (d)
			Are there facilities for mixing crop protection products?(d)
			Are there facilities to deal with spillage? (d)
			Is the product inventory documented and readily available? (d)

Abbreviations:

a) LEWANDOWSKI & FAAJI 2004.

b) SMEETS ET AL. 2005.

c) EUREPGAP, Check-Lit for Fruits and Vegetables, Major Must.

d) EUREPGAP, Check-Lit for Fruits and Vegetables, Minor Must.

e) EUREPGAP, Check-Lit for Fruits and Vegetables, Recommendation.

d) IMAFLOR 2001.

6 Conclusions

There is a great demand for the development of standardised minimum requirements for imports of bioethanol as its production is not only expected to rise in those countries that are already producing and exporting. Other tropical countries might take the opportunity to enlarge their sugarcane production as well. Of special interest are countries which will be affected by the reform of the European sugar market (LDC and ACP-states). The EUROPEAN COMMISSION has named this as one of the 'policy axes' in its biofuel strategy, demanding support for the development of bioethanol production. In doing so the EU is nevertheless concerned with goals like overall reducing of CO^2-Emissions and globally positive effects for the environment. Social problems like child labour are also high on the agenda of governments as well as NGO's. To ensure the compliance with these goals certification is thought to be an interesting way.

On the other hand certification schemes come at a cost to free trade. They can be used to set up trade barriers. This danger is especially important if sustainability criteria for imported goods contain standards that are not demanded from European producers like "providing schooling for farm workers' children". In order to prevent the use of certification as non-tariff trade-barriers, the principles behind sustainability standards should be universally valid, for the home industry as well as for importers. Due to different social and ecological systems this doesn't mean that standards have to be the same in different countries, but internationally comparable procedures for their elicitation have to be found. In this context our case study made a first step, deducting country-specific standards for Brazil. The case studies have pointed out, that the concrete criteria resulting from these standards differ even from region to region. This pertains to different ecological and social situations as well as to country specific difficulties in measuring and verifying standards, and calls for sustainability standards to be adjusted on their/other agro-regions in order to avoid standards to be used as non-tariff barrier. And of course, only what is measurable at a firm specific base can be part of a certification scheme.

Our study showed that some of the concerns can be addressed by a certification system at relatively low costs. For others like prevention of child labour reliable information can only be gained with considerable efforts. The main ecological concerns "no conversion of forest", "no or little additional pressure on eco-sensitive areas" cannot be addressed by a certification scheme, though. Even if all exported sugar comes from land used for agriculture before 2000 and all the sugar from newly conversed areas goes into domestic or Chinese consumption, European consumption will have enhanced the pressure on eco-sensitive regions. Also food supply will necessarily decrease if a greater share of agricultural land is used for energy production. These problems cannot be approached by a certification

system. There are ecological and social costs associated with biofuel consumption on a large scale and they cannot be fundamentally reduced by a certification system.

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