Task 1.2.2 Map of horizon scanning components: relevant developments, threats and opportunities

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Abstract

This paper focuses on scanning and analyzing the horizon of social sustainability issues in order to provide a strategic background for anticipating future developments and thereby gain lead time.

While environmental and economic impacts of bioenergy production have been studied and assessed for many years, the social aspects are still often neglected. There are substantial challenges in identifying and understanding the social impacts associated with bioenergy production activities.

The increasing complexity of bioenergy sector, quite often uncertainty and the rise of hidden social issues created the obvious growing demand for tools which can be used for anticipatory intelligence, such as modelling , tendency analyses, scanning and simulation tools

Using horizon scanning to identify potential social issues related to bioenergy sector will help to priorities future research and inform policy developers and strategic planners about upcoming emerging issues.

Research issues:

1. Systematic search and data collection for trends, opportunities, challenges and constraints that affect the social sustainability of the bioenergy chains. Explore novel and unexpected issues as well as persistent problems and trends.
2. Assessing the probability of achieving national bioenergy goals and its impact on social capital, ecosystem services and biological diversity in the longer term
3. Longevity and competitiveness of biomass supply in varying economic, societal and policy conditions
4. Potential changes in human behaviour and their impact on bioenergy systems.
5. Discover the key elements for successful sustainability (among bioenergy and other industry sectors) and assess companies' readiness and competitive positioning for the future in this respect.

Contents

1 Introduction

During the last decade, high demand and growing potential for renewable energy exports from developing countries to the EU have raised public and private sector interest and attention to the issues surrounding the production of renewable fuels. Infrastructural and political factors in developing countries, especially variety of land and low labour costs made biofuels production potentially highly profitable sector.

In 2011, 83% of the biofuels consumed in the EU were produced in the EU, fifth part of which is produced from imported feedstock, which is the first and most socially vulnerable stage of bioenergy value chain (EU Biofuel Annual, 2012). Considering the fact that the main countries exporting biodiesel to the EU are Brazil, Argentina and USA for soy biodiesel and bioethanol, and Indonesia and Malaysia for palm oil, it was noticed that the most alerting case of social injustice are coming from these regions.

While environmental and economic impacts of bioenergy production have been studied and assessed for many years, the social aspects are still often neglected. There are substantial challenges in identifying and understanding the social impacts associated with bioenergy production activities.

The increasing complexity of bioenergy sector, quite often uncertainty and the rise of hidden social issues created the obvious growing demand for tools which can be used for anticipatory intelligence, such as modelling , tendency analyses, scanning and simulation tools.

Several European countries have initiated new horizon scanning programs, which may help to identify disruptive events which are not covered by policy yet. The main goal of bioenergy social sustainability horizon scanning is to develop an effective system for early identification of *emerging issues* inside the bioenergy sector. Usage of effective horizon scanning systems will help to identify challenges, trends, opportunities and constraints, and dissemination of outcome materials among decision makers. It will also help to characterize the social impacts of bioenergy production throughout the entire life cycle of a product.

Since bioenergy value chains are so complex, the social impacts occur almost at every stage of *bioenergy value chains* from the level of a feedstock production to the level of the end user.

Bioenergy stakeholders not only represent production sector, but also include consumers and affected parties along the entire value and particularly population groups whose living conditions are changing rapidly due to biofuel production expansion (Starick, 2013). As a result, both the landscape and society are constantly changing. All social impacts must be taken into account to ensure a sustainable development under the signs of growing demand for new biofuel sources exploration.

Need for an effective social sustainability management tool has appeared. This paper concentrates its attention on horizon scanning methodology to define the most important social issues and applying approach of drawing exploratory qualitative tendencies for the potential development of bioenergy industry in a social context on the global level.

2 Horizon scanning, Baseline

Usually, the word *scanning* is used in connection with frequent and systematic observation of a space or a body, in order to identify and differentiate phenomena that for some reason need to be watched more carefully in the nearest future. It is used not only for warfare tactics to develop early warning for attacks (for example radar) but also in medicine, where it is used to detect infected tissues (e.g. ultrasound, MRI).

In the dynamic and complex business world environmental scanning is often performed by strategic managers. Using systematic observation of developments helps them to identify threats or opportunities for the business earlier. Those threats and opportunities may appear in the immediate business environment, as well as can show other broader social or regulatory trends (Rij, 2008).

There are many definitions of horizon scanning. Perhaps the most detailed one has been developed by the UK Foresight Horizon Scanning Centre (HSC) in the framework of *Foresight Program* launched in 1994:

"Horizon scanning is the systematic examination of potential (future) problems, threats, opportunities and likely future developments, including those at the margins of current thinking and planning. Horizon scanning may explore novel and unexpected issues, as well as persistent problems, trends and weak signals. Overall, horizon scanning is intended to improve the robustness of policies and to identify gaps in the knowledge agenda" (Foresight Program, 1994).

Based on the previous experiences and results derived from UK Governmental Foresight *Program,* Professor Zoology Bill Sutherland from the University of Cambridge together with other scientists and conservationists developed methodology which allows 'scanned the horizon' for potential issues that could become a problem for life on Earth in the near future. He and his colleges, including other horizon scanners, academics and researchers perform the horizon process annually since 2010. His methodical exercise helps to define what threats and opportunities might appear in the immediate future. Being surprised by unpredicted events can be costly and threaten the well-being of next generations. That is why the main idea behind horizon scanning is to spot issues that needed attention and deeper research before they turn into significant problems (Sutherland, 2009).

Using Sutherland's approach and depending on researched area *Horizon scanning* can be divided into six stages:

- ✓ **scoping the issue;**
- ✓ **gathering information**
- ✓ **spotting signals**
- ✓ **watching trends**
- ✓ **making sense of the future**
- ✓ **agreeing the response**

Source: Sutherland 2009

Table 1 describes scanning stages which should be used for successful horizon scanning. It shows methodology, approaches, as well as strengths and weaknesses of each stage.

Table 1. A taxonomy of horizon-scanning methods used in identifying and prioritizing future possible issue (modified from, Sutherland 2009)

Scanning stage	Method	Approach	Strengths	Weaknesses
Scoping	Screening	Identify issues and explore important driving forces and areas of uncertainty	Well understood, so generally accepted, technique. Can be highly structured	No interaction among individuals with an interest or expertise
	Issue tree	Breaks down key question into a mutually exclusive and completely exhaustive set of sub-questions	Identifies the information needed to provide a complete answer to the key question	Less suitable for general or imprecisely scoped issues
Gathering information	Literature searches and state-of science reviews	Search for published threats and opportunities	Makes use of only published evidence (which might have been peer-reviewed)	Can be backward-looking unless a deliberate effort is made to produce outlooks of the future
	Expert workshops	Bring together team of experts to suggest possible issues based on their own experience and knowledge of the literature	Use of experts provides credibility; interactive nature of workshops draws out deep ideas, and refines issues	Findings will depend on who is involved; can also depend on process used to elicit their knowledge
Watching trends	Trend analysis	Study historic performance to identify future trends	Aids identification and understanding of drivers	Past performance is not necessarily a guide to the future
Making sense	Global Tendency	Consider a range of possible future states and then explore the possible consequences of each	Help organization prepare for change, and test robustness of current strategies	Require substantial resources (time and expertise) to produce
	Systems maps	Show the relationships between all factors influencing the central issue, and whether their effect is positive or negative	Provides an understanding of the range of issues influencing the central issue	Requires pre-existing knowledge
Agree the response	Backcasting	Describe a vision of the preferred future, then identify the key steps needed to reach it	Can be done as a stand-alone exercise	Requires careful structuring to identify all relevant factors

3. Scanning social sustainability for bioenergy sector

Although modern bioenergy represents only small share in present global bioenergy use, currently only 10 % of the total, it is quite diverse. On the other hand, increasing bioenergy supplies and bioenergy sources diversification is the main objective in EU that is financially supported and politically encouraged. This challenge of diversity of bioenergy sources and high demand create risks and undesirable developments if the expansion of bioenergy development is unregulated

The roots of those issues can be tackled back in 2006 when US president Bush declared commitment to promoting biofuels and the EU then also followed with similar commitment. Unfortunately the prior research of the potential impact of biofuel had not been done. This research was performed only after the strategic policy decision had been approved. This research revealed many negative many environmental and socioeconomic impact of the biofuel expansion which could be prevented if the policy making was based on prior scientific research (Sutherland, 2009).

Using horizon scanning to identify potential social issues related to bioenergy sector may help to priorities future research and inform policy developers and strategic planners about upcoming emerging issues. The need for horizon scanning of social sustainability issues is illustrated by recent failure to predict the wide spread of diverse biofuels, which lead to the rise of serious socioeconomic issues in developing countries (Harvey, 2011).

The social dimension of sustainable bioenergy involve embracing long-term well-being considerations, such as preserving affordable access to food and water, guaranteed energy supply and ensuring the safety of people, facilities, and regions. Also the transparent participatory processes such as active engagement of stakeholders, establishing obligations to respect human rights, and emplace a long-term sustainability plan with periodic monitoring are helping are playing an import role for improving social sustainability of bioenergy sector.

Economic aspects of bioenergy sustainability include keeping reasonable production, distribution and consumption of goods and services. Marketing communication and consumer behavior change, which often affect rural economic development of bioenergy production regions, are also very important aspects of sustainable bioenergy.

Economic factors are influenced by government policies, technology, energy and raw material prices, demand resulting from diverse energy uses, and environmental costs (Dale, 2013).

4. Scanning Horizon, Issues tree

The Horizon Scanning of social sustainability requires clear understanding of issues, which creates the highest concerns among senior experts and stakeholders. Interactions and one-on-one interviews with major players of the industry help to identify issues. It also reveals the main driving forces and areas of highest uncertainty and risks.

A specific set of social sustainability indicators is needed for socioeconomic assessment of bioenergy (See deliverable 4.7.1). Selecting appropriate and effective socioeconomic indicators potentially may help new bioenergy projects and stakeholders to identify and measure sustainability elements of their future developments. Each issue should through go through a range of stages before it becomes a problem. A major challenge is to be ready at each stage against the costs of preparing for issues that may never become important. According to Sutherland's horizon scanning methodology, before setting an issue tree the following key questions must be addressed once a relevant issue has been identified.

- ✓ **How might the issue impact upon the interests of the organization**
- ✓ **If the issue does develop, then how long would the organization need to respond to, for example, carry out research or national or regional develop policies?**
- ✓ **How much advance warning of developments is likely?**
- ✓ **What planning and preparation is appropriate considering the uncertainty, the speed at which it might develop, and the time required to act?**
- ✓ **What specific developments (such as extension of biofuel production in the region) could change the potential impacts or urgency?**
- ✓ **Is the current knowledge commensurate with the identified impact and urgency, and how should gaps be filled?**
- ✓ **If the strategy is to wait until developments occur, then what processes are in place to ensure the organization is informed?**

Source: Sutherland 2009

Following the above methodology the list of bioenergy Social Sustainability (SS) indicator have been identified and described. After discussions and a screening process the large number of issues has been scaled down to 12 most important and critical. **Table 2** represents **Social Sustainability Issue Tree** where 12 most important indicators are represented, grouped based on if they are threats or opportunities.

Table 2. Bioenergy Social Sustainability Issue Tree

SS Indicator	Threats	Opportunities
Labour	Labour rights	Training Employment
Human rights	Indigenous Rights	----------
Society	Land Use Rights	Rural Development (local economy)
Economy	Food Security	Energy Security
Product Development	Consumer behavior change	Marketing Communication
Environment	Water Access	Diversity of Energy sources

5. Threats

5.1 Food Security

5.1.1 Issue

In the last 14 years, energy prices have increased significantly, driving up the costs of farming through higher prices of fuel and fertilizer (World Bank, 2010). Energy prices directly affected food prices since transportation costs have increased. The increase in energy prices came from high demand for fuel. On the other hand, high fuel prices are creating new markets for agricultural crops that can be used for biofuels (Pimentel, 2007; Runge, 2007). High oil prices also put biofuel production into competition with oil and gas, which encourages food crops to be diverted to energy production (Demirbas, 2008). It also increases food imports and when the food comes from the outside the food price index increases (Gunatilake, 2013).

Many countries are trying to set up new goals to increase energy security by reaching new levels in biofuel production. As a result, many traditional food sources such as sugar, grain and palm oil are used to produce ethanol and biodiesel. Especially in developing countries, a significant share of land is set up aside for agriculture crops, which are converted into biofuel plantations rather to produce food. Small farmers are the most vulnerable group affected. Big corporations, which buy large amounts of land, are compromising the ability of farmers to grow food for their families and for local trading.

Biofuel production to raise living standards of people in developed countries can hardly prevent hunger and starvation of poor people in less developed countries. New policies should come from EU and US to diversify ethanol production inputs and shift away from food crops (Runge and Senauer, 2007). In the absence of such policies, the potential threat to food security will prevail.

"The Makeni project in the Bombali and Tonkolili districts of western Sierra Leone was initiated in 2008 on land acquired by Addax, a subsidiary of Oryx, an energy corporation founded by Swiss billionaire Jean Claude Gandur. Sugarcane grown on 10,000 hectares of land will be processed in a neighboring ethanol refinery and a biomass power plant to deliver a total of 100,000 megawatt hours of power for export to Europe once all the infrastructure has been completed later this year.
Addax has planted the fast growing sugar cane on large areas of productive land known as the bolilands even though it promised not to, alleges SiLNoRF's in its 2012 annual monitoring report. "[Addax] has taken away most of the bolilands and the people, they are saying that they have been stolen from them," Abass J. Kamara, programmes coordinator for SiLNoRF, told CorpWatch. (The company has a 50 year lease for a total of 57,000 hectares of land in Sierra Leone).
"Now I don't have a farm. Starvation is killing people. We have to buy rice to survive because we don't grow our own now," one community member told Canadian journalist, Joan Baxter at an April 2012 farmers' conference organized by SiLNoRF and Green Scenery, another Sierra Leonean civil society organization.
For Sierra Leone, a small West African nation that ranks as one of the poorest countries in the world, which is slowly emerging from a brutal civil from war that displaced about half of its population from 1991-2002, this issue of ***food security*** *is a major national problem"*

Quoted from CorpWatch Blog, Jennifer Kennedy March 2013

5.1.2 Possible trends

Future needs for food and for fuel will only increase in the long run**.** The global population is the main driver for the demand for food and increase of the global population directly affects increasing demand for food. Until recently, many studies suggested that food security is the largest threat of biofuel feedstock production. However, more recent research suggests that the threat may not as drastic as many people thought and there are other factors which are more likely to impact on food security (Dale, 2012).

During the last decade, the prices on the global food market have been fluctuating a lot. Many scientists believe that the main reason for these fluctuations is the active use of biomass as energy source. Others (Trostle et al., 2011; Oladosu et al., 2011; Gallagher, 2010), after comparing crop production and price data, made following conclusions:

- Biofuel production is responsible for a much smaller effect on food prices than initially expected;
- Biofuel production has a smaller effect on crop exports from the developed countries than previously estimated.

Furthermore, new studies suggest that long-term food price deviations mostly follow oil prices. Weather and local import/export polices are linked to short-term instability. Thus, biofuels could contribute to reducing food prices and price instability when biofuel production moderates oil price increase and provides a safety pillow for global suppliers in unexpected events such as weather or politics. (IMF, 2011) However, this issue will still continue to trigger problems as long as there are hungry people in the developing world and land is used to produce biofuel.

Even more threat is coming from growing demand for liquid biofuels for transportation needs, mostly in the form of ethanol which in 2013 accounted for 78% of biofuels consumption according to Navigant Research. (Navigant, 2014) With current level of technological development, the most efficient and biggest production of ethanol comes from sugarcane and maize. Those ethanol crops will have the strongest impact on food supply and demand systems, especially if the production takes place on prime agricultural lands in order to reduce transportation costs of both the feedstock and fuel products to and from well-established centralized ethanol production sites.

Another issue that creates potential treat to food security is the balance between food import-export rates should be taken into carefully consideration especially in developing countries. For example if imported food fall by about 30% in India in 2030, food prices will lower substantially, and national health indicators can be expected to improve accordingly (Gunatilake, 2013).

5.2 Access to water

5.2.1 Issue

Sugarcane, oil palm and maize are the crops that are currently used for biofuel production require high volume of water that is why mostly they are cultivated in rain-fall areas, such as Brazil, parts of Africa and Indonesia. For example in Brazil, 76% of sugarcane production is under rainfall conditions. In the United States, 70 % of maize production is under rainfall conditions, with only about 3% of national irrigation water withdrawals devoted to biofuel crops (Hoogeveen et al. 2009). Overall it seem that the most impact on water resources are coming from liquid forms, since gaseous and solid biofuels consuming significantly less water

The threat of water scarcity comes from lack of understanding by investors the impacts on water resources from cultivation of agricultural feedstock to produce biofuels since it is very difficult to assess. Many investors are willing to demonstrate their commitment to sustainable water management when going into new projects. Unfortunately, European retailers that import biofuel products had not adopted specific standards protecting water rights in developing countries (EU Commission, 2013). The recent SEI report "Competing Water Claims in Biofuel Feedstock Operations in Central Kalimantan" states:

"*such retailers do not see these standards as sufficiently robust from a scientific perspective, or adequately supported by the relevant governing bodies and stakeholder forums, leaving their companies potentially vulnerable to criticism. With regards to public regulation, many producer countries in the South are well known to be struggling with inadequately resourced, decentralized governmental agencies* "(SEI, 2012).

The most problematic regions are developing countries where water access issues often arise when large-scale agricultural corporation are launching new biofuel enterprise in developing countries. It triggers water dispossession and adversely affecting livelihoods of smallholder farmers. In the recent years, water conflicts have increased. Those conflicts are complex matrix that consists of large-scale foreign investors, the country government, local villages and bureaucrats, leading to new water access controlling and governing players. Recent conflicts in Africa demonstrate how water access is increasingly being politicized. Even existence of international human rights law to regulate water would not help rural communities in Africa, and their rights to access water have often been compromised (Mutopo 2014).

Not just physical access to water but also the availability of water especial for rural population may became a potential treat in the future. Water scarcity is not an unknown phenomenon for example in African countries and production of crops for biofuels demands large volume of fresh water and will put even bigger pressure on water accessibility (Ishola 2013).

There are also gender implications of water access in developing countries, which lead to women and children being more affected because they are the ones who have to deliver water to local communities and have to travel long distances.

Who owns water in Africa?
Across Africa, water tends to be vested in, and managed by the state. In most places, local people have customary uses but do not hold formal rights. For example, fishermen do not hold a formal water right, nor do pastoralists who use floodplain pastures during the dry season. Even if local people have legally protected land use rights, they rarely have formal control over the water that they use, beyond recognition that supplying drinking water is a basic human requirement that cannot be refused.
In most cases, traditional users of water simply accept water rights as a secure tradition and either see no need to formalise them, or are unable to access the process for doing so. The same is not true of incoming investors, who tend to be anxious to codify their rights and formally ensure access to water resources.
Data on water rights are hard to quantify, although in one documented example — the Ruaha basin in Tanzania — some 40 per cent of rights were held by government bodies, 28 per cent by private land owners and only 10 per cent by local water user associations.

Quoted from IIED, Jamie Skinner 2011

5.2.2 Possible trends

The population growth in the future will definitely trigger demand for more resources. Scarcity of water may become a main factor that will limit production of biofuels in many parts of the world. Currently 70% of world fresh water is given up to agriculture needs, including livestock and feedstock used for bioenergy production. In order to get economic rentable yields, all agricultural products require huge volumes of good quality water

As the result of growing demand for resources water conflicts will intensify in many areas that expected to be affected by climate change in terms of declines of rainfalls, for example, Brazil, some African countries and India. Those countries are already living under challenging conditions**.** Food and Agricultural organization (FAO) observed a number of foreign investment projects in Uganda, Sudan and India and came to the conclusion almost all of them are choosing location within fertile areas with most potential for rainfalls and water access. In many cases it limited water supplies available for local farmers (FAO, 2010).

It calls for better water policies on the biofuel production side with focus on ensuring efficient water use and protecting water access rights. Effective management of water resources for sustainable bioenergy production may reduce the water access risk, especially in developing countries. Use of well-developed policies and instruments can influence how bioenergy production affects water availability in the area. The current situation, where large-scale land acquisitions acquire water rights as well, will stress priorities that will certainly impose revised policies.

Looking on EU experience where the management of water resources is more efficient when it is done at the watershed level, similar principals could be transferred to developing countries. EU has facilitated knowledge acquisition of water statuses in terms of quantity and quality and introduced management plans of how to use water resources. Some countries outside of Europe already established comparable water management principles. For example in South Africa, the State regulates user rights and water allocations. It promotes efficient, sustainable and beneficial use of water while maintaining privileged accesses to the most disadvantaged. In this context, quotas have been allocated to crops based on physically and economically accessible criteria. The South Africa bioenergy production structure is oriented towards socio-economic situations and public authorities are fully involved.

5.3 Labour rights

5.3.1 Issue

The threat of rising issues in diversity and equal opportunities during bioenergy feedstock production are coming from large-scale bioenergy feedstock production enterprises that have been launched in many developing countries. The human costs of biofuels production are often overlooked by international organizations, focusing only on environmental and ecological effects. Many alarming issues about negative impacts on workers, unequal wages between contractors and daily workers, exploitation women and child labour in Indonesia, Brazil and Malaysia have been reported by human rights organizations.

Indonesian Civil Society Petition to the European Parliament on Biofuels Policy, September 2013
Labour rights section:

The current system of large-scale industrial oil palm plantations does not respect the rights of workers, causes gender injustices, and often involves child labour in the production process, resulting in children losing their right to education. Eighty percent of workers in large-scale industrial oil palm plantations - men and women - are casual labourers who have no guarantee of safety at work or job security, and are paid wages which are too low to meet daily needs.

Quoted from Biofuelwatch UK, 2013

Palm Oil Plantation Workers Face Bitter Conditions

As it's grown, the palm oil industry has drawn scrutiny from environmental activists in Europe and the U.S. The human costs of the palm oil boom, however, have been largely overlooked. A nine-month investigation of the industry, including interviews with workers at or near 12 plantations on Borneo and Sumatra—two islands that hold 96 percent of Indonesia's palm oil operations—revealed widespread abuses of basic human rights. Among the estimated 3.7 million workers in the industry are thousands of child labourers and workers who face dangerous and abusive conditions. Debt bondage is common, and traffickers who prey on victims face few, if any, sanctions from business or government officials.

Quoted from Bloomberg Businessweek, 2013

The issue of labour rights abuse in developing countries is not unique to biofuel production industry. Large-scale agricultural production models called "agrarian capitalism" are typical in developing countries. The lack of regulations and accountability on the part of new biofuel production facilities allow them to ignore national labour laws even if it designed to protect the workers and local communities. Usage of low-skilled seasonal workers, many of whom are migrants or come from local indigenous communities and often settle for low-paid jobs with harsh working conditions allow big corporations to play with overall statistics.

Child labour in small-scale and large-scale biofuel production from agricultural feedstock is still an alarming problem in most of the developing countries' economies that omits the labour rights and often denies children of proper schooling. In South American soy growing areas and sugar cane production areas, the progressive introduction of mechanized harvesting is reducing the risk of child labour. In Africa and Asia, change to mechanized harvesting has not yet happened. As a result, the risk of child labour in those areas is higher than in South American countries where increasingly farming is now almost fully mechanised, in relation to biofuel production.

Since many of the works on large plantations are seasonal, the contracts are either not signed or the terms of the contracts are vague, keeping workers uninformed about their labour rights.
Reports about accidents at work that are coming from developing countries are also very alarming. According to a research performed by Guatemalan labour rights activists (?), only half of sugar plantation workers wear some kind of protective 'equipment,' mostly consisting of just long-sleeve shirts and boots. Even though many injuries occur, there are no precautionary actions performed by the owners. No training is provided regarding the use of protective equipment. Long-term health impacts are simply omitted. For example, sugarcane contains tiny particles similar to asbestos that are released during harvesting. In a long run, it may cause dire health consequences (TFR, 2010).

5.3.2 Possible trends

If the demand for biofuel feedstock, production in developing countries continues to grow and it will create even more cases of labour rights abuses. On the global scale, many stakeholders are not aware of the conditions and wages arrangements for bioenergy feedstock plantation workers, for small farmers and minorities in third world countries. There is also a "competition" between the environmental and social issues. Often the environmental issues are noted but the labour rights issues are ignored (DTE, 2013).

The awareness about the social and especially human costs of the bioenergy industry should be increased by media. New EU directives should reflect the labour right for developing countries in a better way. One of the possible trends for EU is priorities that bioenergy feedstock comes from small-scale farmers because they are farming in a sustainable way and labour right violations are in better control, while large plantations carry high social and environmental risks.

Unfortunately, most likely the tendency of launching large-scale biofuel production in developing countries will continue that is why producers, exporters and importers of biofuels should be informed about and required to respect labour laws and relevant local, national and international biofuels' standards, guidelines and/or certifications. New ISO standards such as ISO 13065 that are currently in development and intended to reflected human and labour widely should contribute into tackling social issues and help to avoid technical problems, making bioenergy more competitive and society-friendly.

The introduction of new foreign bioenergy production facilities in developing countries should be accompanied by procedures that will oblige investors to look and to follow national and local labour protections and, if these do not exist, to consider international requirements. New biofuel production businesses should be required to pay sufficient amount of taxes in order to compensate developing country governments and communities for the exploitation of their human and natural resources (Ottinger, 2007).

Currently, according to the voluntary scheme RSB Principles & Criteria for Sustainable Biofuel Production Principle 4. "Biofuel operations shall not violate human rights or labour rights, and shall promote decent work and the well-being of workers." This is the only voluntary scheme that set up number of criteria in terms of labour rights that biofuel production companies suggested to follow.

5.4 Indigenous Rights

5.4.1 Issue

Indigenous rights always have been a sensitive topic and the recent rapid development of bioenergy industry made it even more complicated. The negative effects of biofuel production industry expansion on indigenous peoples' traditional lifestyle settings, which are directly linked to access to land, water and other natural resources, are becoming obvious.

The biggest threat to indigenous communities comes from large, commercial scale biofuel feedstock production. Large corporations come and conquer the land where small communities have been living for centuries. They even force people from communities who used to live there to work cutting sugar cane for the ethanol factories which now occupy their land, paying them pitiful wages and creating inhumane working conditions. As it has been noticed earlier, the failure of developers to adhere to legal requirements happens often due to weak institutional capacity of the particular region (Upham, 2009). There are two regions in the world, Indonesia and Brazil where lack of well-established land-use policies and absence of law enforcement ability created the worse cases of indigenous people rights abuse. Take-overs of indigenous peoples' customary lands without due process are reported often.

Brazil has one of the most highly-developed biofuels industries in the world. Sugar cane plantations were established in the 1980s and rely heavily on indigenous labour. Workers often work for pitiful wages under terrible conditions. In 2007, police raided a sugar cane alcohol distillery and discovered 800 Indians working and living in subhuman conditions.

As many indigenous men are forced to seek work on the plantations they are absent from their communities for long periods and this has a major impact on Guarani health and society. Sexually transmitted diseases and alcoholism have been introduced by returning workers and internal tensions and violence have increased.

Over 80 new sugar cane plantations and alcohol distilleries are planned for Mato Grosso do Sul, many of which are to be built on ancestral land claimed by the Guarani.

Quoted from Report to UN, 2010

5.4.2 Possible trends

As global awareness of human rights abuses within biofuel operations rises, greater and more careful attention should be paid to the rights of indigenous people.

Smaller-scale biofuel production has more potential for Indigenous communities. It may help to have better control for indigenous communities over developments affecting them and their lands rights, access to resources will enable them to maintain and strengthen their institutions, cultures and traditions. UN Declaration on the Rights of Indigenous Peoples adopted by General Assembly Resolution 61/295 on 13 September 2007 has to be followed by the management of new biofuel production operation. EU voluntary and mandatory policy schemes ought to pay more attention to indigenous community's rights.

Indigenous groups should be integrated into dialog and should be able to address different dimensions of risk that concern them, by identifying the 'risk consequences' associated with different actions accompanied biofuel production on indigenous communities territories.

5.5 Land Use Rights

5.5.1 Issue

Since EU countries do not have enough land to grow biofuels, they are increasingly targeting developing countries. As forecasted the global demand for biofuels will be 172 billion liters by 2020, up from 81 billion liters in 2008. (UNEP, 2009) By looking on current production levels, it is easy to see that an additional 40 million hectares of land must be converted to growing crops for biofuel.

Increasing demand for biofuel lands creates rush for land in Africa, Asia and Latin America. Often the activities of foreign companies in developing countries end in *land grabbing* and *illegal land transitions*. They are taking advantage of poor developed land-use policy and limitations of law enforcement. Small farmers are the most vulnerable group, which is affected the most by land grabbing. Most of them are women who are farming on a small-scale to provide food for own family or sell it on the local market. Such land grabbing puts additional pressure on food security and other resources, such as water, since local communities are cut off from direct access to water sources and walk long distances.

Even more attention should be paid to situations where land currently used for agricultural purposes is converted into production of biofuel feedstock, and where land that may or may not be currently used for agriculture is converted to produce non-biofuel crops in response to biofuel-driven displacement of commodity production in a different region, country or even continent (Kim 2009).

Another threat is that in many developing countries the overall economic development takes priority over fair and sustainable land-use policies, and the law enforcement ability is very limited.
Land rights may be violated by placing restrictions on existing rights (e.g. through agreements between foreign investors and small-scale producers that place limitations on use or employ land as a warranty for loans) or via indirect effects on local land markets (BMZ, 2009, De Schutter, 2009 and German et al., 2011c). Figure 1 illustrates how much the difference in land governance and planning is dependent on geographical location.

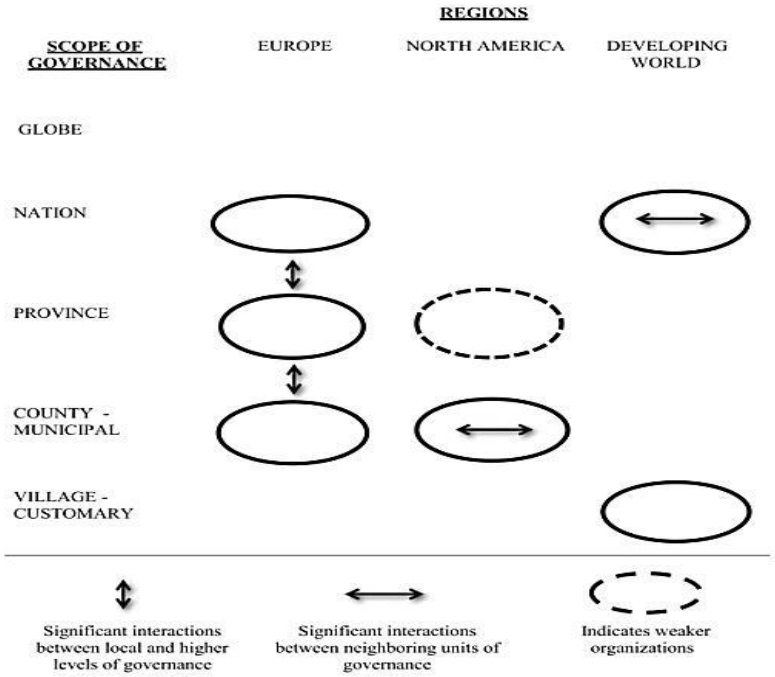


Figure 1. Scale and governance in land use by the region (Rudel, 2013)

It is easy to see that the European land use policies organized much better than such policies in developing countries or even in North America.

> *"The Italian company Tozzi Green cultivates the biofuel crop jatropha on the Ihorombe plateau in the Central South of Madagascar. It aims to cultivate 100 000 ha. The company says that it set up in this region with the agreement of the local people, but locals have no idea whose agreement they refer to. On November 16th last year, ten representatives of nine villages in Ihorombe, came to Antananarivo to show their opposition to this project. "People with no connection to our customs are imposing their own laws on us", said one chief. "Armed people are evicting us from our lands. The loss of grass is leading to the death of our animals on the spot. They have destroyed the graves of our ancestors. Most of the inhabitants are leaving in exodus and becoming homeless." The reactions of the media to the press conference were diverse: some kept quiet, others wrote about it without naming the company in question and others reported on it by accusing the village representatives of being accomplices of bandits."*
>
> Quoted from EJOLT (Environmental Justice Organizations, Liabilities and trade), May 2013

5.5.2 Possible trends

A sustainable land-use policy for bioenergy production must be implemented through effective land-use planning intervention. It is obvious that in developed countries land right are well regulated. There are much more challenges and constrains about land right and land use in developing countries such as absence of clear land-use policies and lack of enforcement capability at the national level. It requires new effective strategies to be developed, including economic mechanisms and institutional improvements using international political action and cooperation (Miyake, 2012).

The International Standardization Organization (ISO) is currently developing new ISO 13065 for sustainable bioenergy. Social sustainability and particularly *Land use rights are* included in ISO/PC 248/WG 3 as of May 2013.

There is scientific evidence that some types of biofuels, such as waste and residues are more sustainable than biofuels from food-based crops and have a lower climate impact (Ackom et al. 2010). As for now, these non-food crops biofuels are more expensive to produce but they have huge potential in the future. Even more, they may help to avoid the biofuel-driven land use changes, which usually lead to completion for land with food production. They also do not generate problems related to increased food prices since they do not come from food crops. Action should be taken now in order to meet EU target plans for 2020, since most EU biofuels are currently coming from food-based crops.

In the future, land still will be needed for bioenergy crops production in order to meet the short and mid-term demands for biofuels. There are several options, which may allow minimizing negative impacts. This review emphasizes that careful consideration must be given to the nature of land-use change pathways to ensure that their impacts are minimized. Sustainable land-use options for bioenergy crop production may involve two solutions: agricultural land-use intensification; and the use of underutilized agricultural land.

5.6 Consumer behaviour change

5.6.1 Issue

The future of bioenergy depends on political social and economic climate, within which consumers have to decide either to use it or avoid them. Often even the best technology will not live up to its potential if consumers do not embrace new technology. On a psychological level, the behaviour of individual consumers is guided by general public attitudes toward the subject and by the norms established within a social setting.

Consumer perception concerning the environment has increased in recent years and has become a major factor in purchasing behaviour for both food and non-food commodities. It also had its influence on green market segment. There are three key drivers for adopting green technologies in industry: motives that are firm-related (such as cost reduction, competitive advantage, and a desire for green market image); regulation threat and green consumerism (Wong, 1996). Studies suggest that the driving forces at the consumer level are the main factors in pushing suppliers' investments into green technologies usage, since only products that are accepted by the public opinion can penetrate the market and bring the biggest profit (Schulteet al., 2004).

Consumers have already accepted wind and solar energy sources. Biomass energy sources still receive very little attention from consumers and there are many misconceptions about biofuel sources among people. Not many consumers know that bioenergy needs a combustion process in order to produce energy. Also there is not much knowledge about carbon cycle among consumers at the moment (IEA, Task 28).

The farmers' group has warned that the European Environment Committee plan to impose a 5.5 per cent limit on the use of biofuels made from arable crops and Indirect Land Use Change factors are totally unacceptable and must be rejected.
The European farmers say that the plans threaten the EU's energy and climate change targets, the future of the industry, feed supplies for animals as well as thousands of jobs mostly in rural areas.
The move comes ahead of European Parliaments vote on a report by European Parliament's Environment Committee on the EU Commission proposal.
In the plea, Copa-Cogeca together with all partners in the biofuel chain, urged MEPs to reject the Environment Committee report which imposes a 5,5 per cent limit on the use of biofuels made from arable crops in 2020 and to support the ITRE Committee amendments. This is so that Europe can continue to achieve the EU energy and climate targets, provide jobs for over 200,000 citizens and ensure adequate feed supplies for animals.
Copa-Cogeca Secretary-General Pekka Pesonen said: "The co-products from conventional biofuel production, such as rapeseed meal, beet pulp and dried distillers grains play an important role on the feed protein market and in the EU food chain, where the EU is facing an ever-increasing shortage.

Quoted from Global Bioenergy Industry News, September 2013

5.6.2 Possible trends

Currently, there is a lack of knowledge biomass-based energy production among European consumers. However, mass media already starting to attract a lot of attention to the cases of social injustice that happen in developing countries while producing bioenergy feedstock. The increased amount of such information will definitely influence future acceptability of bioenergy and may change consumer behavior toward it. Consumer demand is the strongest argument for a company to change to a more sustainable way (Belz & Schmidt-Riediger, 2010).

In the future, companies will experience additional expenses to provide ethically produced fuels, knowing that consumers tend to support socially responsible producers (Trudel & Cotte 2009).

Consumers might require a tracking system that confirms that biofuels entering Europe are not associated with social and environmental degradation. The good tendency is to promote cooperation between developing countries, where biofuels feedstock is produced and the EU is protecting their farmers. It should become more important than promoting the interests of large corporations that create social, economic and environmental degradation.

Taking into account the strength of global networking we may see that consumers in Europe will stand up and raise the question what is really happening on the ground of bioenergy feedstock production. Consumers may push for accountability all the way back through the value chain to the plantation where the feedstock is grown.

6 Opportunities

6.1Energy security

6.1.1 Potential

In order to improve the sustainable way of using natural resources and to increase energy security, mankind has to look for new energy resources and the development of renewable and carbon-neutral energy sources may provide such opportunity and meet increasing demands for energy. According to the recent IPCC scenarios of energy transition, bioenergy sources may subsidise almost to half of the total use of traditional energy worldwide by 2050 (Edenhofer, 2011). The EU, US, Brazil and India reflected in the ambitious bioenergy targets that bioenergy should attribute to a20–30% share of the overall energy mix during the next 20 years (Gabrielle, 2014). In the EU, bioenergy is the fastest growing renewable energy source with a production that doubled during last 15 years.

The level of energy availability is directly connected to the country's economic growth, which is why assuring and stimulating energy security became a priority of any nation in developing biofuel production programs. Since the future of fossil fuels supply is uncertain, increased oil prices and unstable global political situation drive governments seek to diversify options. It is especially important in countries for which imports of oil are currently the main source of energy and it is costly.

Brazil is an example of a country that has significantly improved its energy security through biofuel production and use. Nearly half of Brazil's energy comes from renewable and biomass-based sources compared to an average of less than 20 percent for the rest of the world. Brazilian Energy matrix presented in Figure 2 shows how Brazil has achieved it energy security goal thought energy sources diversification. Sugarcane ethanol and bioelectricity produced from leftover fiber, stalks and leaves make sugarcane the largest source of biofuels in Brazil.

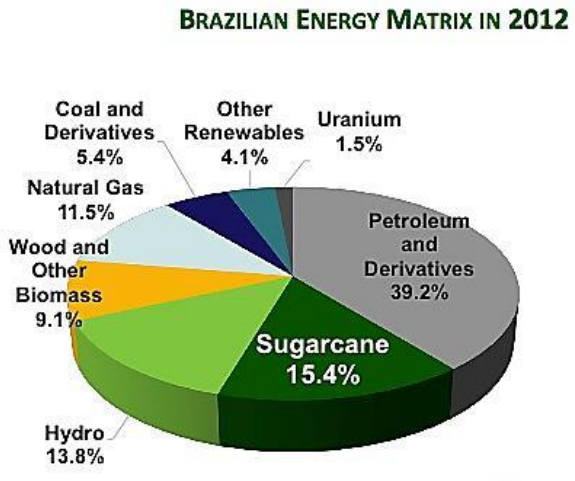


Figure 2. Brazilian Energy Matrix 2012, (Source: Balanço Energético Nacional and international Energy Agency: World Energy Outlook 2012)

6.1.2 Possible trends

The tendency of achieving energy securing through biomass-based sources will mostly depend on global political situation and technological development. Political situation may create a strong drive for funding research and development in the area of advanced biofuels production.

Achieving energy security thought well-developed bioenergy industry has a great potential in the future. Small-scale projects as well as large enterprises may bring energy security benefits in a different way depending on geographical location and overall energy strategy in particular region. Since biofuels have been identified as a way to decreasing dependence on fossil fuels, it could provide energy security by providing small farmers especially in developing countries with the possibility to turn those crops residues into bio-fuel themselves and use it for personal needs or sell to bigger energy buyers in the area.

For many African countries a positive future trend can be achieved by moving from global fuel supply to local self-supply giving them energy security. Regional policy objective will move forward local biofuel production that increases rural access to energy, and not just rural access to income-generating activities. Having the ability to produce fuels on farms allows small farmers to avoid the additional costs associated with logistics and off-farm fuel processing. Furthermore, the use of biofuels could become a solution for easing rural poverty in developing countries by providing a cheap and diverse alternative fuel.

There is a large potential for improving energy security in remote villages and rural households in India. A significant number of remote villages in India are still having very limited access to reliable electricity. For India, bringing energy security on higher level is not only connected to increasing productivity and economic activities but also has its effect on poverty alleviation. India has very limited resources and strongly depends on oil imports to satisfy its increasing energy demand. Moreover, it makes Indian economy vulnerable to any oil price fluctuations on the world market. That is why the Government of India approved the National Policy on Biofuels on December 24, 2009. The policy encourages use of renewable energy resources as alternate fuel to support transportation fuels needs and promotes use of biofuels for increasing energy security in rural areas. Indian government set up the target to replace 20 percent of conventional fuel consumption with biofuels by the end of 2017.

6.2 Rural development (Local economy)

6.2.1 Potential

As many scientists agreed, sustainable development depends on not only on a country or region's overall economic performance; in fact in recent years indicators of development incorporate the social aspects of the population at all levels (Goldemberg 2010). In addition, it has been defined that there is a direct link between insufficient energy supply and poor development. New biofuel production projects especially in developing countries tend to improve correlation between these two factors.

Depending on the region and policy framework bioenergy and rural development could be considered to be interconnected fields with positive outcomes. Especially in EU countries, biofuel is conceived as an opportunity for small farmers to diversify their income and foster the development of local economy. The success of rural development in combination with bioenergy often depends on the country's policy instruments and on socio-political dynamics. The most important element is ownership of refineries by local farmers and community members. Local ownership assures that the facility is based, to some extent, on local resources and needs, and money generated from biofuel production stay in the local economy. Comparing large-scale projects to small ones, studies have shown that the benefits of smaller, locally owned refineries for communities is much higher, including a one-time boost of income to the local economy; creation full-time jobs; and an increase in annual direct spending inside the community (Kleinschmit, 2007).
Looking on current examples from EU, the most interesting countries to study are Sweden and Finland where two projects targeting rural development through bioenergy are taking place now.

Policy in Sweden

At the start of 2006 the Swedish government removed the reduced duty rate import option for ethanol destined for blending at 5% with petrol (E5), with an extremely short forewarning (Lexmon, 2006). The rise in imported fuel cost (circa €0.16/L to circa €0.48/L) effectively removed the price advantage over domestic (and other EU) production at the time (Lexmon, 2006).

Sweden- Skaraborg Västra Götaland: Bioenergy as key driver in agricultural and green business development for rural development

Skaraborg is a European focus point for farm-scale production of biogas. Farmers are constantly building new plants and the municipalities are in the forefront in the world
The bioenergy development in Skaraborg involves many actors throughout the value chain. From farmers and forest owners, municipalities, technology and competence suppliers to end consumers.
Farmers and forest owners are working togehter to develop renewable energy in general and bioenergy especially within the framework of EnergiGården (the Energy Farm).
EnergiGården started as a project about 10 years ago initiated by KanEnergi and is now an autonom organisation placed within the R&D organisation Agro Väst. The purpose of the programme ENERGIGÅRDEN is to be a focal point and driving force in the development of renewable energy production from the west Swedish agriculture from a local producer and customer perspective.

Quoted from GreenPark Sweden, 2013

Even in developing countries, small-scale bioenergy projects may improve the development of local economy. If farmers choose the proper energy crop growing on the marginal land (poor-quality land) it may increase their incomes. There are many areas of marginal lands in developing countries with large population. Bioenergy production on marginal land can create the working opportunities for these labours especially the poor people. When multipurpose trees are planted, the rural economy will be improved in different ways. Selling biomass will increase household income. For example, studies of Chinese bioenergy development possibilities in rural areas suggest that in the remote parts of south-western Sichuan Province of China, each household potentially may have 10 tons of mulberry biomass in excess of need, which can be sold, bringing additional income (Tang, 2010).

6.2.2 Possible trends

In order to make rural development a real opportunity, Europe should re-scale and prioritise biofuel feedstock production from small-scale farmers because they are farming sustainably, since they allow local economy to grow and have low level of social and environmental threats, while large enterprises exploiting huge plantations carry high social and environmental risks.

When referring to developing countries, the future positive trends for rural and local economy development are possible if direct investors do not buy small farmers' land. Joint ventures should be formed with biofuel companies or with private small farmers who participate by contributing into production of at least 30% of feedstock. National, regional and local governments have to create clear policies and laws to guide biofuel production management in a transparent and participatory way. Local communities should be provided with access to clean energy and natural resources. Large percentage of biofuel processing is done in rural areas on the site where biofuels feedstock is produced. The government should also minimize threat to food security by through agricultural land usage control (Mwakaje, 2012).

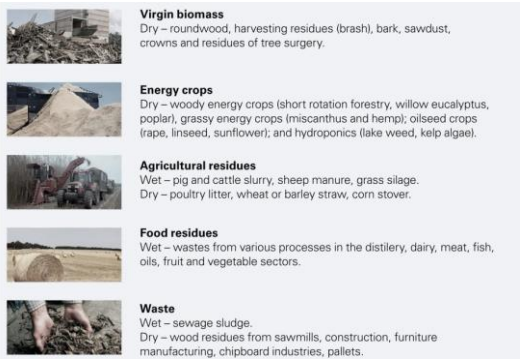
Even developed countries' rural development is already benefits from biofuel production and, if structured well, this tendency will continue. Sweden is the best example. Knowledge-based technology transfer from Sweden may be effectively used in developing countries.

6.3 Diversity of Energy sources

6.3.1 Potential

One of the main opportunities of bioenergy is its diversity. **Table 3** represents 5 different industries where bioenergy feedstock could be produced

Table 3. Range of biomass fuels (Carbon Trust, 2012)



The diversity of biofuels presented in many forms such as solid, liquid and gaseous fuels. Even more diversity comes from geographical range of biofuels production which may come from local use, as well as large-scale export industries (Peck, 2011). Furthermore, bioenergy systems also fit within a diverse group of other anthropogenic and natural production systems: they can be based upon waste and by-product streams (forest and agricultural residues, MSW). Biofuels can be produced as a main product directly from agricultural or forestry resources. Supply chains are also very diverse, may take many forms and can also deliver additional benefits to environment and economy. Bioenergy diversity is also enhancing social benefits such as employment and training opportunities, energy security, economic expansion, and rural development (Peck, 2011). Since the production process of biofuels can range from simple and traditional processes to highly innovative and advanced systems it creates great opportunity for future research and development. Sweden is an excellent example of how the use of diverse energy sources may benefit the overall country economic development.

The use of bioenergy in Sweden has increased from 40 TWh/year in the 1970s to around 140 TWh today. In 2009, various sources bioenergy used in Sweden surpassed oil as the leading energy source for the Swedish energy consumption. The same year, the total use of bioenergy was more than the use of electricity from hydropower and nuclear power together.
Biomass has a dominant position in the Swedish heat market, to a large part as fuel in district heating. Biomass is also the main energy source in the energy intensive forest industry. Bio-electricity accounts for 9 percent of Sweden's power production, and biofuels make inroads as transport fuels. Bioenergy is characterised by diversity, and by expansion in all markets.
The primary reason for the tremendous growth of the bioenergy sector in Sweden is broad political support and the use of strong general incentives like the Swedish carbon dioxide tax (introduced in 1991) the green electricity certificates (introduced in 2003), and tax exemption for biofuels for transport, as well as direct investment supports.
The bioenergy success story also rests on the long-standing Swedish tradition of using the natural resources in our forests, whilst simultaneously protecting and developing these resources. The total stock of wood in the Swedish forests, and stored carbon, has increased year by year, despite the rapidly increasing use of biomass for energy

Quoted with modifications from Svebio Energy Facts

6.3.2 Possible trends

The diversity of energy sources most likely will increase in the future. New technologies and innovative methods will come to market. In EU as it seen on the successful example of Sweden, the domestic biofuel sector can be also diversified in terms of producers, feedstock sources and energy carriers. A biofuel supply mix that uses MSW, forest residues or lingo-cellulosic feedstock can employ various technologies and methods and some of its inherent features may increase diverse supply through shifting away dependency on use of natural non-renewable resources and inadequate unstable markets.

The future development of biofuels diversity may provide benefits into both: improving environment and increasing security of supply. In order to achieve those objectives simultaneously policymakers and decision-makers should focus their attention on the entire supply chain, including aspects of supply and demand, which could require a trade-off with cost efficiency aims, at least in the short-term periods.

Potential developments of various feedstock sources and the wide range of usage for each feedstock will reduce the level of risk across the biofuels value chain. But achieving such diversity depends on future dynamics of investments into biofuel R&D development.

6.4 Marketing communication

6.4.1 Potential

According to GRI, "marketing communications are designed to influence opinions and purchasing decisions. Marketing communications that do not conform to generally accepted ethical or cultural standards, privacy intrusion, dual standards, or attempts to influence vulnerable audiences such as children, can be a significant issue for stakeholders, as shown by the growth of consumer activism" (GRI 2013).

Marketing communication can be considered as a tool, which has a great potential of positive influence on future trends of development in socio-economic sustainability of bioenergy sector. Successful marketing communication tool usually contains a mix of elements, which are coherent and complement one with another, as seen in Table 4. Companies rarely rely only on one element of communication support only, but for each industry the combination of elements will be different.

Table 4. Marketing communication mix

Advertising	The main feature to increase awareness is advertising. For example when a company starts a new biofuel production, it should advertise the social benefits that local communities will receive from the new venue. Social benefits should be visible and delivered to ends-users of bioenergy products as well. Major guidance regarding setting up advertising campaigns is to be very clear about objectives, who is the audience and how will the bioenergy company measures its effectiveness. In order to reach targeted audience, such campaigns should be held on continuous basis depending on the goal set.
Direct mail or email campaigns	The primary purpose of direct mailing and e-mails is to generate leads, via some form of an benefits offer or direct call for action. An example of a direct mail might be a message to local authorities of the area where new biofuel production plant planned to launch that addresses the need for additional training in compliance with approved labour rights for future workforce
Social Media and Networks	The main purpose of Social Media and Networks is to provide "information" about social, economic and environmental opportunities or risks that bioenergy products, services, and enterprises deliver, and to get other people's opinions about all three of them. Social media and Networking in the recent years became the main a source of information for consumer and stakeholders, to research new products or services way before company is recognized any of buyer's interest. When going into new biofuel production business, companies should not underestimate the power of modern social networking which can enhance a new venue or destroy it
Trade shows, seminars, webinars	World Bioenergy seminars, conferences, webinar and trade show play an important role in creating awareness about social sustainability bioenergy aspects among scientific community and biofuel production stakeholders. This element may address many issues collected from case studies from all around the world
Newsletters, Catalogs	Primary use is to convene and spread news and cases, concerns and other information among consumers, stakeholders and workforce involved into biofuel production.

Marketing organizations may communicate certain values developed specially for bioenergy sector by developing campaigns and programs designed to influence behavior that improves both the consumer's well-being and the social aspects of society in general. Marketing communications tool should provide free promotional materials offering "**socially sustainable bioenergy**" tips and to advice on which bioenergy sources use brings benefits to everybody. What is especially important for marketing communication managers in bioenergy sector is the ability to understand and communicate of specific technological and scientific concept and features of biofuels to non-technical audience. Marketing communication directly affects change in consumer behavior.

6.4.2 Possible trends

Marketing communications is a great tool to be used for promoting sustainable bioeconomy of the future. Marketing communications will be considered as fundamental and effective tool for biofuels producers companies that help them to deliver messages about bioenergy social sustainability benefits. Such messages will enhance creation of preferences - a longer-term effort that aims using communication tools to position biomass based products in the minds of the targeted customers.

Population growth, climate change, energy security, environmental pollution and societal problems bring many discussions to the table. Through marketing communications, biofuel producers may prevent negative effects of upcoming social issues using proper marketing communications mix. Marketing communications is the great way to bring message not only to general public but also to scientists, academic researchers and policy-makers.

6.5 Training

6.5.1 Potential

The bioenergy sector is complex, with many potential combinations of feedstock sources, supply chains, pre-processing options, conversion technologies, distribution channels and market segments. That is why ongoing development of new bioenergy technologies along the entire value chain creates training and continued education opportunities almost at every stage of the chain. New technologies call for new skills and knowledge development and create demand for new training and educational programs.

If looking through examples of developing countries, large-scale or small-scale bioenergy production project training should be considered as an opportunity. Overall training may positively influence economic development, especially in rural areas. Even more benefits it may give to stakeholders. Improving knowledge about on-farm technology through transferring of modern technique and agricultural methods and implementing well-structured training and educational programs could be the means to increase productivity of feedstock and reduce bioenergy production costs. It will also benefit bioenergy production labour force through new skill development and potential of higher income.

Bioenergy feedstock production process requires personal with certain skill including personnel with technical training capable of handling industrial equipment and having the ability to manage potential operational problems. In particular, there is the need to have engineers and semi-skilled trade-trained personnel such as mechanics and electricians. As such, a pre-requisite for Tanzania to implement a long-term sustainable successful biofuel program requires a well-designed technology transfer that comprises the involvement of universities in the production of biofuels using different technologies and raw materials and technical teaching centers to support the industry (FAO, 2010)

In order to involved local population and small farmers in particular into new biofuel production, companies have to provide them with general knowledge about future product and about benefits that new product may bring to them

Seminars for small-scale farmers about the benefits of Jatropha

Diligent Tanzania Ltd reflects a commercial project about training in Tanzania

Quite a large number of farmers were familiar with Jatropha as a crop because it is traditionally used as a fence. Now when the new project expected to be launch in the area every farmer need to receive initial seeds for planting for free and in addition training about the benefits of Jatropha.
Initially areas were chosen to train people using a range of criteria: it had to be reachable from Arusha by a field officer, so not more than one day travel away, the area had to be very dry and farmers needed to be present themselves to enable seminars to be given.

Quoted with modifications from *Case Study: The Smallholder Model of Biofuel Production in Tanzania, 2009*

6.5.2 Possible trends

The rapidly expansion of industry of bioenergy and growing demand biomass based products requires a well-trained and educated workforce. Diverse bioenergy sources and products and fuels derived from biomass will continue to receive increasing attention globally. With a rising interest to green products and sustainability, and unstable oil prices, companies will look for individuals with professional training and education in bioenergy feedstock processing, biomass based materials and issues related to sustainable bioenergy development.

From the corporate point of view, training should be considerate as continues process for improvement of technical and knowledge-based skills and competencies of employees involved in biofuel production operations through enhancing knowledge, developing industry specific skills and improving capabilities.

The potential of growing demand for specialized bioenergy training and educational is high. Bio-energy is a newly emerging sector with diverse employments opportunities. Because of industry novelty not many specific training programs have been developed even in developed countries.

6.6 Employment

6.6.1 Potential

Rapid development of new technologies and sources for biofuel production industry significantly influence the rates of economic development and employment. Economic impact of biofuels production in terms of job creation has been measured in different ways using deferent criteria in many countries and regions. It has been evaluated using data from individual processing plants to several plants and supplementary operations at regional and national level (BIO, 2009).

Additional employment opportunities are coming from diverse processing technologies used for biofuels production and feedstock supply options, including wide range of thermochemical and biological processes and feedstock vary from agricultural and non-agricultural crops and forest residues to algae.

Biofuels represent a very promising entry mechanism into developing agricultural and processing sector. The biggest opportunity comes from the fact that in most cases feedstock is locally supplied with potential for domestic processing. On the other hand biofuels industry expands and products and services could be sold into many region. Export opportunities could provide a particular boost to employment of women since many of the supporting jobs would be in areas like information processing and systems integration where employment opportunities are already open to women (APEC, 2010). Table 5 shows the number of jobs generated during the year depending on the biofuels type and the yearly volume production

Table 5 Estimates for job generation (APEC, 2010)

Biofuel	**Employment potential**
Corn Ethanol	About 37,000 total direct and indirect jobs are associated with corn ethanol production of 34,069 million litres per year (MLy) (US data)
Sugar Cane Ethanol	About 96,000 total direct and indirect jobs would be created in achieving a sugar cane ethanol output goal of 5,000 million gallons per year (MGy) (Brazil data)
Palm Oil Biodiesel	Some 41,000 total direct and indirect jobs would be created in achieving an economy-wide palm oil biodiesel output goal of 560 million litres per year (MLy) (Malaysia data)
Soybean Oil Biodiesel	About 9,500 total direct and indirect jobs are associated with soybean oil biodiesel production of 2,650 million litres per year (MLy) (US data)

Data from Global Renewable Fuels Association shows that global ethanol and biodiesel production created overall 1.4 million jobs in all sectors of the global economy in 2010. New jobs have been generated not only from direct biofuels production, but also indirect jobs that came from agricultural sector, and other sectors such as additional supplying and supporting services, retail and wholesale trade that benefit from the economic activity generated by biofuels (Urbanchuk, 2012).

The quantity and quality of potential employment depends on the stage of the bioenergy value chain, the conversion process, particular country settings and the intensity of labour. Currently the difference between developing and developed countries is large and should be evaluated on the different scale. (UNEP, 2013)

Although many studies suggest that small-scale bio-energy production may be better at creating employment, they still should be able compete with large scale bio-energy production. In general they are not very competitive and employment opportunities they generate usually tend to be short-lived. On the other hand, well-developed networks of small-scale plants may survive such completive pressure and enhance energy access to in small villages and have a positive impact on food security at the local level and be more sustainable in the long run. (EU Commission, 2013)

6.6.2 Possible trends

The potential of employment generation is directly related to feedstock type. The future trends can go in different ways and will also depend on bioenergy production technology development. If looking onto biofuels produced from agriculture sector, most employment opportunities come when labour intensive raw materials are grown. This direct employment generated by cultivation, harvesting and processing of the feedstock. However, in the future, if the level of mechanization will increase, fewer jobs will be generated from large-scale projects and the opportunity for small-scale production will appear. Because of potential mechanization, larger projects will have less specific impacts on employment and income as opposed to small-scale projects, due to economies of scale.

Looking on the global trends, it been determined that the largest share of employment for biofuel production occurred in the U.S. and Brazil. On the other hand at the current stage of the development the fastest growth employment market is potentially in the developing Asian and African producing countries. As the biofuels industry progresses the employment impact is projected to grow to more than 2.2 million jobs by 2020 overall (Azevedo, 2010).

7 Bioenergy social sustainability global tendencies

7.1 Driving Forces

Although the demand for biofuels grows globally, bioenergy establishment is still open to different socio-economic development opportunities as well as potentials threats. Understanding of cause - effect relationships may potentially drive bioenergy development and explore different opportunities and threats options and their effects on national, regional and local development. **Qualitative bioenergy social sustainability global tendencies** have been drafted based on the results of an initial screening, literature review and establishment on issue tree, the possible future developments and trends of separate issues were identified and driving forces have been listed Table 6.

Table 6. Tendencies and Driving Forces

Forces	"Conservative" Tendency	"Moderate" Tendency	"Decentralized" Tendency
Bioenergy Policy development and promotion	Aggressive promotion, little policy development	Always in continued development	Well-developed in connection with small-scale bioenergy projects
Economic development growth	High in developed countries , low in developing	Moderate growth globally	Moderate in developed countries, high in developing
Technology development and Transfer	Technology development and transfer for large facilities dominates	Well-balanced	Enhancement and diversification for technology development and transfer of small plants
Stakeholders concern	Stakeholders stay unaware of social issues	Moderate involvement	Highly concerned and engaged

Three global tendencies for future development of bioenergy in relationship with social sustainably and policy development have been identified. These tendencies make it possible to examine potential developments, opportunities and threats and investigate the possible future socio-economic consequences of various development options. Defining such tendencies can stimulate a social learning process among stakeholders and inhabitants in general and facilitate the decision-making process. (Sohl, 2010)

The main purpose for defining bioenergy social sustainability tendencies is not forecasting future events, rather to present possible outcomes under specific circumstances, show particular driving forces that may potentially influence the path of bioenergy development upcoming trends.

Many potential future tendencies and scenarios for Bioenergy Sustainability have been published recently. However, most of them concentrate their attention only to environmental and pure economic indicators and primary based on quantitative forecast methods. The rise for public discussions on national, regional and local level and increase of bioenergy production calls for qualitative analysis that is focus on socio-economic implementations.

7.2 Conservative Tendency - aggressive expansion of biofuel production with no productivity change and little change in policy

In *Conservative Tendency* the demand for biofuels across the regions is growing rapidly. The increase of oil prices will push nations into extended research and development (R&D) for new biofuel technologies that may support the expansion of biofuels supply. At the same time, the productivity will be kept on the same level. Sustainable increase in bioenergy systems productively will be difficult to achieve since the focus is kept on the big picture not on the small issues. *Conservative Tendency* will lead to large profits for biofuel production corporations, particularly in Europe, where they already enjoy high subsidies from using "green products" and consumers do not know the social cost that are hidden inside the product.

The biofuel industry will continue to stay capital-intensive with large-scale enterprises, highly centralised and high demand for year-round feedstock supply to keep operations efficient (Msangi, 2007). As been projected by many studies, the largest increase of biofuel demand will come from transportation needs (Fulton, 2004). It means that replacing liquid fuels for transport is the main priority. As for today, the most efficient ethanol production can be achieved only using dedicated energy crops, such as corn and sugarcane. These dedicated ethanol crops likely to have the greatest and in many cases negative impact on social sustainably indicators including food and water supply security, labour and land rights. Many other social sustainability indicators may be affected along the entire biofuel production value chain especially, if the large biofuel production takes place on prime agricultural land and constantly trying to reduce transportation costs of both the feedstock and biofuel products to and from, centralised biofuel production facilities.

This tendency will stimulate wiliness of farmers to sell land for profit. Small farmers will not survive competition. Large-scale investors including main global energy market players and big agricultural enterprises are attracted by the land potential of southern regions. Their main purpose is to supply developed countries with biofuel products. The energy provider establishes business relationships with these agricultural and other biomass production enterprises. They have no concern about social sustainability.

The *Conservative Tendency* does not require strict policy development. The general policies are followed but social sustainability issues still not revealed to the consumer.

Driven by the progress in technological options, technology research and EU policy on subsides for green products the further enhancement of established bioenergy production technologies takes place. However, technology development and transfer only put its efforts into improvement of large production facilities

Even though bioenergy production stakeholders groups are identified along the value chain, there is little cooperation on local or regional levels. Population stays unconcerned by questions of bioenergy provision and its effects on social sustainability, although big part of global population expresses environmental and economic concerns.

7.3 Moderate or Balanced Change Tendency - biofuel growth but in balance with well-developed social sustainability EU policies and shift to non-food agricultural biomass

In *Moderate or Balanced Change Tendency,* global demand for biofuels is growing but is supported by constantly updated EU policy on Social Sustainability. Current concerns about food-versus energy issues in developing countries and complexity of social issues control make decision-makers to move away from food agricultural biomass products. Non-food agricultural biomass, agricultural and food residues and waste are the main sources for bioenergy feedstock production.

EU created internationally accepted policy instruments for fair and sustainable land-use options for biofuel crop production. The International Standardization Organization (ISO) developed ISO 13065 for sustainable bioenergy. Socio-economic aspects of bioenergy production, diverse value chains and use of bioenergy defined and implemented in harmony with sustainability criteria.

Stakeholders' involvement is moderate; however, growing interest from main players on local and regional in using biomass for energy provision prevails. Farmers, local business and local communities became key players for decision making on launching new bioenergy feedstock enterprises in the area. The size of enterprises is varying. Local power companies and municipalities play an important role in bioenergy providing. In general, the stakeholders' activities are selective but their overall commitment increases.

Large-scale foreign investors are faced with scepticism. Large enterprises are not welcome if they do not present structured and legally supported social programs complimenting new developments. The rate of social acceptability in the regions and consumer behaviour of the end-user will be the main driving force to sustain bioenergy production.

New facilities are installed on the basis of the existing local infrastructure and logistics, bringing new technological and knowledge-based developments and involving local labour forces. Transfer of new technologies improves energy storage practices that allow energy supply to be based on demand. These new technologies are efficient.

Due to diversity, and complexity of technological development stakeholders have to face new options and challenges. Small farmers and medium size companies in particular must choose among various economic opportunities, partnerships with various interested parties and social perception of feedstock production.

As a result of rapid bioenergy technologies development, bioenergy training and educational needs are high.

7.4 Small-scale Projects Shift Tendency (global biofuel growth but EU policy allows only small-scale projects)

The number of negative cases of large-scale biofuel production is increased, EU policy development is pushed to its limits, biofuel production stakeholders are not happy and the consumers are concern about social sustainability impacts from biofuel production. This could be a milestone where *Small-scale Projects Shift* tendency can become a solution for continuous sustainable development. EU develops strict policy into favor of decentralized bioenergy production.

Even now, many scholars suggest that small-scale decentralized bioenergy production enterprises may have higher potential for social, economic and environmental sustainably development. Large centralized production systems are driven by production efficiency benefits with high commercial validity and have been criticized for hiding social cost of production and increasing risks of unsustainable practices. Small-scale decentralized projects support local and rural development, create employment, provide energy security, and contribute to climate change control. They could be better controlled by local governments.

As for today, the main constrain for *Small-scale Projects Shift Tendency* is economic validity. However, there are many opportunities for combined benefits generated through value chains of integrating small-scale decentralized bioenergy projects with other production systems. Integrated bioenergy production that includes closed loop models, allows waste materials from one process to be consumed as inputs in other production processes, increasing economic, social and environmental benefits. Synergies may create many opportunities along the bioenergy production chain, including feedstock production and bioenergy marketing and distribution. Those opportunities could be exploited by communities and other investors to minimize risk from decentralized bioenergy production (Mangoyana, 2011).

Some examples of decentralized bioenergy production are seen in the small to medium scale biomass based heat and power plants in Europe, particularly in Sweden, where a number of small bioenergy enterprises successfully operate already for years. An important element of *Small-scale Projects Shift Tendency* is localization of ownership, overall management, production, and well-developed marketing communications system of bioenergy production organization.

Another positive outcome that *Small-scale Projects Shift Tendency* can deliver is combination of right policy implementation at place and an effective technology transfer practices. It becomes applicable not only to developed countries like Sweden but also to the developing world.

This tendency has a great potential if implemented properly. New investments into R&D of biofuel industry and knowledge based technology and practices transfers into agricultural sector from countries with proficient experience in biofuel production can lead to more favorable outcome, and enhance consumer-level impacts. Moreover, *Small-scale Projects Shift Tendency* seems to be the most acceptable from social sustainably development point of view. Issues like labour rights abuse including child labour are easier to tackle on the small-scale project level.

Small-scale Projects Shift Tendency is possible if only current debates on Bioenergy Sustainability Policies and Certifications Systems will address the importance of expansion rate for biofuels and relate it to particular biofuel source, level of economic development, set-up of farming or industrial systems and available technologies of each country.

8. Conclusion

The objective of this task was to perform a horizon scanning of social sustainability issues inside the bioenergy industry and its sectors. Bioenergy social sustainability reflects how production of biomass for energy impacts national, regional and local development. In particular, it shows how social sustainability aims to ensure food and energy security and addresses any issues in respect with labour, land and water rights.

Our study was inspired by research of Professor Bill Sutherland from the University of Cambridge and his colleagues, conservationists who developed methodology which allows 'scanning the horizon' for potential issues that could become a problem in the near future. Bill Sutherland's horizon-scanning system allows the identification of challenges, trends, opportunities and constraints related to different sectors of bioenergy globally. We applied and developed his taxonomy of horizon-scanning methods into more generic approach for studying impact of social sustainability issues on future development of the bioenergy industry. Our research contributes with the *Bioenergy Social Sustainability Tree* and identified *Three Global Tendencies* for future development of bioenergy in relationship with social sustainably and policy development.

In the process of building the Issue Tree, we reviewed more than 50 social sustainability indicators suggested by Global Reporting Initiative (GRI) and narrowed it down to 12 indicators, with six potential threats and six opportunities related to bioenergy industry, which, in our opinion, will have the most influence on future development on the industry. The Tree can be further used for defining social impact of bioenergy production throughout the entire bioenergy industry's value chain. The complexity and diversity of bioenergy value chains shows that social impacts occur almost at every stage of the chain from the level of feedstock production to the level of end user. That is why there is a need for developing an effective instrument to assess those impacts. Moreover, all social impacts must be taken into account to ensure a sustainable development in the light of continues growing demand for new biofuel sources and their exploration.

The identified bioenergy social sustainability global tendencies reflect the socio-economic and technological reaction on four major forces within the bioenergy development driving forces. The four major forces are *Bioenergy Policy Development and Promotion, Economic development Growth, Technology Development and Transfer and Stakeholders Concern*. Their effect was categorized into three categories, thus giving us *Conservative*, *Moderat*e and *Decentralized* tendencies with a considerate impact on the future development of the global bioenergy social sustainability phenomenon.

Therefore, after we performed our research and identified the global tendency, we concluded that more focused case studies of bioenergy companies and/or institution in one or several countries and/or regions should be performed for better comprehension of the bioenergy social sustainability phenomenon.

Potentially, the horizon-scanning results can be effectively integrated into the social sustainability reporting process. Horizon scanning is not just about looking for alarming signals, but it is more about grasping the societal contexts behind the entire scanning process of identifying, evaluating and disseminating signals. That is why the diverse information on emerging issues may give an advantage to policy-makers, investors and stakeholder in preventing harmful issues before they arise.

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