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Biofuels and sustainable development: hope on a slippery slope

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BIOFUELS ARE increasingly being considered as alternative sources of renewable energy; they have the potential not only to reduce dependence on fossil fuels, but also to assist in meeting targets for reducing carbon dioxide (CO2) emission. Biofuels, also known as agrofuels, include ethanol produced from sugar cane, corn, sorghum, and other crops, or biodiesel produced from oil-bearing seeds such as jatropha, palm, rapeseed (canola), sunflower, and soya.

Bioethanol can be used as a substitute for petrol or as an additive to it. Brazil is the industry leader; the country developed ethanol production from sugar cane in response to the 1970s oil shock and to lessen its dependence on oil from the Middle East.

By 1985 more than 90 per cent of cars produced in Brazil ran on ethanol. The European Union (EU) and United States (US) have set ambitious biofuel targets: the EU aims to replace 10 per cent of transport fossil fuels with biofuels by 2020, although this may be contested. Knauf et al(2008) point out that the EU biofuels directive demands that 5,75 per cent of European fuel comes from biofuel by 2010. In the US, a goal of 35 billion gallons, replacing approximately one-fifth of oil-based transport fuels is proposed by 2017 (*ibid*).

According to the Regional Hunger and Vulnerability Programme (2007) policy brief, the US supplies 70 per cent of all grain traded internationally, but the amount available for export is likely to shrink, as increases in the world price of grain are expected (Sugrue and Douthwaite 2007).

Food price inflation

At present biofuels are in the spotlight partly because they are perceived as contributing to food price inflation – for example, they were an important item at the recent G8 Summit in Japan, where concerns were raised that demands for these fuels have been a contributing factor in food price hikes. A recent confidential World Bank report states that biofuels have forced a 75 per cent increase in food prices. The implication is that they present a critical dilemma for food security. Moreover, the biofuels conundrum brings many issues into play: land ownership, control and redistribution; productive capacity; local energy access, particularly in African countries; trade and investment dynamics; genetically modified organisms proliferation; and biodiversity and climate change.

This policy brief will examine these issues in the context of the sustainability of biofuels. For the African sub-system the key question is: could biofuels be another 'resource curse' or can they revive the agricultural potential of the African region and become an alternative source of local energy production and consumption?

Global Insight aims to provide members of the policy community with concise but trenchant analyses of topical issues. Comments and suggestions are invited.

Africa's dependency on natural resources

Despite its vast natural resources, Africa remains the poorest and least industrialised region in the world. Over the years the continent has had to grapple with multiple challenges, including HIV/AIDS, massive poverty, jobless growth, resource degradation, primary product-dependent economies, and poor infrastructure. Agriculture, the main stay of the economy of most countries in the region, has witnessed a decline in half of the southern African states in the period 1987–1997, and a marginal increase in the other half.

Natural resources accounted for nearly 80 per cent of African exports in 2000, compared to 31 per cent for all developing countries, and 16 per cent in developed countries. Many African countries have created enclave economies, dependent upon a single commodity for exports. These include crude petroleum, mostly from Angola and Nigeria, copper from Zambia, diamonds from Botswana, and coffee from Ethiopia, Uganda, and Burundi. While minerals play an important role in African economies, especially with burgeoning demand from Asian countries, production has become highly capital intensive and offers few social dividends by way of educational investments and job creation.

Even though commodity prices are currently booming, primary commodities are subject to price volatility. Furthermore, developing countries often do not have the resources to cope with market shocks. They are also vulnerable to political, social and environmental shocks.

Erik Reinert (2000) provides an apt description of the situation in many African countries when he notes that 'The nations whose comparative advantage has led them to specialise in natural resources (diminishing return activities) are locked into a historical trajectory where technical advances are fighting a losing battle against diminishing resources in the export sector. The resulting downward pressure on wages and employment in its turn leads to more pressure on the natural resources, by desperate human beings in the informal sector trying to carve out a miserable living from nature.'

The perceived environmental friendliness and economic advantages of biofuels have generated increased interest, including considerable potential for foreign direct investment (FDI) flows and the physical presence of multinational companies in biofuel production.

In Mozambique, for example, the government signed a US$510 million investment agreement with London-listed Central African Mining & Exploration Company (CAME) to build and establish an energy plant that would produce 120 million litres of ethanol per year, as well as fertiliser (Biopact 2007).

Moreover, the EU is likely to experience a 'vegoil' deficit for its biodiesel production. Currently the total potential availability from the EU has been between nine and ten billion tonnes, of which six to seven billion tonnes was rapeseed/canola, the main biodiesel feedstock in Europe (World Ethanol and Biofuels Report 2008). With demand for biodiesel increasing, the EU is likely to import feedstock for biofuel production. In addition, China, which mainly used corn as feedstock for ethanol production in 2006 and 2007, aims to shift from corn-based ethanol, which impacts negatively on food security, to alternative feedstock such as cassava, sweet sorghum or sweet potatoes (*ibid.*).

The demand from the EU and China for feedstock holds potential for African countries to increase agricultural production for export. However, previous cash crop exports have had a devastating impact on the social, economic and environmental conditions in many African countries. Furthermore, the perverse agricultural subsidies in the EU and US make it difficult for African countries to compete on the global market. At the same time, the EU and US have imposed tariffs to protect their domestic bioethanol producers from developing country exports, particularly from Brazil (Knauf et al 2008). Despite these constraints, opportunities exist for Africa to revive its agricultural production to first meet local and regional food and energy needs, and subsequently international export demands.

To some, trade and investment in biofuels may seem a positive development, bringing income and jobs to countries in the region. For others, it remains to be seen whether these so-called benefits will accrue to the energy-poor and support sustainable local economic development in the exporting countries in the current global economic climate.

Addressing sustainability issues

Social implications

The food versus fuel choice is the most critical dilemma facing biofuels. At the Food and Agriculture Organisation (FAO) World Food Summit in June 2008, its production was identified as a key contributor to high food prices. Jean Ziegler, UN special rapporteur on the right to food, strongly criticised the US and EU's biofuel ambitions, stating that using arable land to make fuel was a 'crime against humanity' (Planark 2008). While a number of global factors – such as the high oil price, agriculture liberalisation and climate change – are contributing to high food prices, the price of crops needed for biofuels

have skyrocketed. The types of crops targeted for its production are chiefly food crops, such as maize, sugar cane, soya, canola, cassava, wheat, sunflower oil and palm oil. In 2007, the increase in corn prices, a staple food in Mexico, by about 400 per cent was largely blamed on the demand for biofuel. (Sugrue 2007).

Another concern affecting food security, especially in African countries, is the possible diversion of food crops to fuel crops. Although non-food plants like jatropha appear to be more viable, the high demand for it raises the fear that it provides farmers with an incentive to grow fuel crops instead food crops, and also strains limited resources, including land and water.

The International Panel on Climate Change (IPCC), in its April 2007 report, warned that by 2020 between 75 and 250 million people in Africa would be affected by increased water stress due to climate change. The report projects that agricultural production, including access to food, in many African countries and regions will be severely compromised by climate variability and change. In addition, the area suitable for agriculture, the length of growing seasons, and the yield potential, particularly along the margins of semi-arid and arid areas, are expected to decrease, and – in some countries – yields from rain-fed agriculture could fall by up to 50 per cent by 2020 (IPCC 2007).

In the long term, large- scale development of biofuels is likely to raise agricultural commodity prices, increasing the income of poor country farmers. However, the cost will be higher prices for poor consumers around the world. Professor Ed Gallagher, head of the Renewable Fuels Agency, in his report released on behalf of the British Government in July 2008, concluded that the 'increasing demand for biofuels contributes to rising prices for some food commodities, notably oilseeds, that has a detrimental effect on the poor' (Surman 2008). The World Bank argues (Chakarabortty in *The Guardian* 2008) that biofuels production has distorted food markets in three main ways:

- It has diverted grain away from food to fuel, with over a third of US corn now used to produce ethanol, and about half of vegetable oils in the EU going towards the production of biodiesel;
- Farmers have been encouraged to set land aside for biofuel production; and
- It has sparked financial speculation in grains, driving up prices (*ibid.*).

Another concern is competition over land. The redistribution of land to indigenous and local landless people is vital in many developing countries. In South Africa, for example, the land reform process has been very slow, and the majority of poor people do not have access to productive resources, land, water, and agricultural inputs. Despite the rhetoric around land reform, the actual resources needed to implement it are not forthcoming from the government.

Furthermore, the agricultural programme has mostly targeted commercial farmers and has provided very little support for small farmer development. GRAIN, an international non-governmental organisation that promotes the sustainable management and use of agriculture biodiversity, foresees that stronger relationships between transnational capital and local landed elites will emerge as result of biofuels, with consequences for struggles over land and local food production (GRAIN 2007).

Economic implications

There is a great danger that biofuels may undermine sustainable energy and rural development on the continent because of current international trade and investment dynamics.

The export-orientated focus of biofuels to meet transport needs outside Africa raises a number of concerns. Trade in energy and agriculture is marked by huge disparities. Decades of direct and indirect subsidies have supported the current fossil-fuel-based energy system, and 'cheap' oil has fuelled the production of goods for trade (Wakeford 2005). Moreover, the agricultural market in the North is highly subsidised, making it difficult for developing countries to compete on the global market. Massive ethanol production in the US would be impossible without significant government subsidies. Santa Barbara (2007) points out that 'In absolute terms, the US Federal corn subsidies alone amounted to about $4 billion dollars a year up to 2004; with another $3 billion a year going to ethanol subsidies. US corn subsidies are now $10 billion a year, and with the expansion of ethanol production anticipated over the next decade subsidies for both corn and ethanol will continue to grow.'

Another aspect to consider is that international trade and export in biofuels depend on long-distance transport, which requires enormous amounts of energy. In essence, this defeats the purpose of reducing energy dependence on fossil fuels.

The high cost of trading biofuels is another concern that needs to be taken into account, perhaps making biofuels less feasible for export and more feasible for local consumption and producing electricity.

The role of global agribusiness in agrofuel developments

also needs to be carefully monitored. Securing feedstocks is a critical component of the production and maintenance of agrofuels. GRAIN asserts that 'the cost of the feedstock can make or break an agrofuel operation' as it is not easy for an agrofuel producer to control the price. It further asserts that one way for the agrofuel companies to get out of this quagmire is for such companies to control the production and supply of their own feedstock. GRAIN also points out that the agribusiness corporations, with their already well established global commodity chains, generate a 'double bonus' from agrofuels: they make money not only in the production and sale of agrofuels, but also through the global commodities boom that new sources of demand help to generate (GRAIN 2007).

GRAIN draws attention to the pattern of investments in agrofuels, where money is increasingly being spent on the construction of fully integrated agrofuel networks, including production, shipping, processing, and distribution. They point out that almost all new agrofuel projects come with 'plans for high-tech plantations or contract growing arrangements, often managed by local agribusiness, and often on lands used for food production or communal pastures and forest' (*ibid.*).

Another economic factor to consider is that blending requirements and standards may shift the cost to consumers. In addition, higher prices from exports may impact on opportunities for local energy needs, since it may be more viable for suppliers to export biofuels. In the southern African region alone, many countries rely extensively on biomass, especially wood for fuel – chiefly for residential use and in rural areas – with more than 80 per cent of the population relying on solid fuels (Wakeford 2006). Thus African governments wanting to explore the potential of biofuels need to put in place incentives for local producers, particularly prioritising support measures for small-scale farmers and rural development.

Furthermore, externalised environmental and health costs are not being taken into account. These costs should include the negative impacts of ethanol or bio-diesel, such as the cost of restoring the damage to the environment, water, air, plants and animals. For ethanol production in the US, in 2004 these external costs were estimated to be US$2 billion (Santa Barbara 2007).

Santa Barbara (2007) advocates that real environmental and social costs must be accounted for in the production of agrofuels. In the US, the large subsidies for agrofuels provide a disincentive for exploring other renewable energy sources like solar and wind. Also, the use of biofuels as an additive to petroleum and diesel maintains dependence on the oil economy, postponing the need for technological change away from the internal combustion engine towards more sustainable and climate-friendly forms of transportation.

Biodiversity and environmental implications

The impact of energy-intensive commercial agriculture on climate change and biodiversity is a major concern. Firstly, it takes energy to make energy. For example, energy-intensive farming methods include mechanised farming equipment, transporting inputs and outputs, and direct farming inputs such as fertilisers and pesticides, which are all petroleum-based. Climate Action indicates the 'contribution of the food chain as a whole to climate changing greenhouse gas (GHG) emissions has been estimated to be as high as 20-22 percent' (http://www.climateactionprogramme.org/industry). According to Santa Barbara (2007), using maize products in combustible fuel releases carbon back into the air so there is no net benefit in terms of greenhouse gas emissions. Therefore, even if biofuels are more feasible at a local level, the carbon emitted in growing the feedstock must be taken into account in order to assess whether different biofuels are energy efficient or not.

Santa Barbara (2007) points out that a US Energy Information Agency report maintains that maize-based ethanol results in almost as much carbon dioxide generated by petrol as a result of more methane and nitrous oxide, and considerably more water vapour. All of these contribute to climate change; at the same time, climate change itself will have an impact on total crop production as droughts and flooding affect output.

Secondly, the proliferation of genetically modified organisms (GMOs) is a serious concern. Genetically modified crops are controversial and not enough research has been done on their impact on human and animal health and the environment. A United Nations Commission on Trade and Development (UNCTAD) XII Civil Society biofuels workshop in Accra in April 2008 raised concerns that Ethiopian farmers are being asked to switch to monocropping for producing biofuel crops. It is feared that this push for biofuels will also lead to an increase in the use of GMOs.

Another related concern is centralised control and ownership of this technology by a few large companies, particularly over seed and plant varieties. Caution is required by farmers and governments of developing countries regarding multinational companies' interest in securing monopolies of patents over promising seeds and genes in next-generation crops. Governments need to be aware that while the GMO lobby may

try and find a foothold for the use of these crops for biofuels instead of human consumption, Knauf *et al* (2008) emphasise the fact that GMOs are primarily dangerous 'because of what they do to the natural environment while growing'.

Thirdly, the clearing of indigenous forest has huge social and environmental implications. In Malaysia and Indonesia, for example, enormous tracts of rainforest have been cleared for the palm oil industry. In addition, clearing is often done by burning, which releases large amounts of CO2 into the atmosphere. Forests are ecosystems, and act as life support systems, not only for animals and plants but also people (*ibid)*. Rainforests, in particular, play an important role in regulating the earth's climate and they are under threat in many parts of the world.

Pressure from civil society with regard to the ecological impact, particularly the production of biodiesel from palm oil, has influenced governments and stakeholders to consider sustainability issues. Plans for certification systems at both national and community levels are being developed (World Ethanol and Biofuels Report 2008), which may have a strong influence on the feedstock portfolio.

Holistic approach

Present experience indicates that export-led interest in biofuels can increase social, economic, and environmental problems. The initial benign claims that biofuels will prevent climate change or lessen foreign dependence on oil appear to be hijacked by large industrial agri-business corporations seeking new ways to make maximum profits. GRAIN (2007) notes: 'The bottom line is that agrofuels are a new way for corporations, speculators and powerful agro-barons to make more money, sell their commodities and consolidate control over the earth. African governments may find themselves trapped in another 'resource curse' as they sell or lease large tracts of land to multinationals, with few benefits accruing for local people, and little positive development in individual countries in terms of control over capital flows, reinvesting profits, and encouraging forward and backward linkages to stimulate local economic development'.

Studies show that foreign investment has not translated into spillover effects from transferring technology and skills. In addition, ensuring labour rights and social and environmental responsibility, as well as transparent accounting systems, are major issues in Africa.

Those governments seeking to venture into biofuels must develop strategies that incorporate a holistic approach, which supports sustainable development objectives. Despite the negative implications, biofuels as part of a bioenergy mix can potentially play a positive role in development, particularly in African countries, by improving rural development. These include support for small-scale farmers to provide feedstock, introducing innovative and sustainable cultivation systems and technology, and decentralising local electricity generation. However, this must be developed in the wider context of changing unsustainable production and consumption patterns to sustainable agricultural practice; it must support local energy needs and give access to the energy-poor, rather than quick-fix market-driven opportunities with dire consequences.

Policy priorities towards sustainable biofuels

Sustainable development criteria

It is recommended that a lifecycle approach is used to ensure that sustainable criteria are adhered to from the outset of production. This approach will include equitable land ownership, innovative and sustainable cultivation methods, with minimal use of fertilisers and pesticides, and the use of low-energy farming methods. It should also include barring the use of GMOs, but using plant and animal waste, promoting local consumption, and ensuring that value is added. Knauf *et al (*2007) propose that 'ideally, each level (international, regional, national and local) should introduce sustainability standards for bioenergy by means of regulation that are consistent with other levels'.

A number of initiatives are under way to develop sustainability criteria. One international initiative is the Roundtable on Sustainable Biofuels (RSB), launched by the Swiss Federal Institute of Technology (EPFL) in Lausanne. It brings together farmers, companies, non-governmental organisations, experts, governments, and inter-governmental agencies, with the aim of achieving global, multi-stakeholder consensus on the principles and criteria of sustainable biofuels production (http://EnergyCenter.epfl.ch/biofuels).

Another initiative, by the German Agency for Technical Cooperation (GTZ), which is known as the Programme for Basic Energy and Conservation (ProBEC), aims to ensure access to energy by low-income populations in Africa by using bioenergy in a socially and environmentally sustainable manner (www.proBEC.org).

Supports for rural development and local access to energy

It is vital that all interested and affected parties participate in decision-making on biofuels projects. The support and protection of small-scale farmers and their structures through, for example, co-operatives and communal systems, are essential. Also, increased biofuel production should not contribute to the further concentration of land ownership and access in fewer hands.

Preference must be given to local production to meet local consumption and energy needs. Biofuels should not undermine other bioenergy options, such as developing biogas plants in rural areas. Rather, biofuel production should be placed in the context of broader biomass use for energy. Options for very low GHG emissions, such as using organic waste and residues from agriculture, forestry, industry and households, must also be considered.

Using appropriate crops

Food production is a priority, particularly in the African region. Therefore, non-food crops such as jatropha, the moringa tree, and the indigenous plum tree – which may be more suitable for marginal and degraded land and do not compete with food production – should be considered. (It is worth noting that Jatropha is toxic and its cultivation could therefore pose a threat to animal life).

The energy balance also needs to be considered. (This is the amount of energy input required to produce the energy output). Maize, for example, has an energy balance of between 1:1.1 and 1:1.7, which means that maize produces a very low energy output. This may be compared to the energy balance of sugar cane of 1:8, which appears to be more energy efficient. Since maize is a staple food for many people around the world, maize should be phased out from biofuel production because it is not the most energy-efficient.

Regional co-operation and collaboration

Effective regional development requires cooperation, coordination and harmonisation of policies, rules and standards. Governments have an important role to play in negotiating regional arrangements and agreements to support regional development. Keet (2007) argues that regionally orientated production is an important strategy for ensuring development. This is particularly relevant to agriculture and bioenergy development. For example, in the southern African sub-region, some countries are more water-scarce than others. Therefore, those countries that have more water resources or land may be better at producing certain crops for food and energy use.

One of Keet's proposals is encouraging new areas of specialisation or divisions of labour among the countries in the region, taking account of local resources and skills, but not confined to their current 'comparative advantage'. Knauf *et al* recommend using biomass directly for domestic energy needs, and prioritising the development of regional value-added chains, mostly in developing countries. These approaches can lead to biofuels assisting Africa's development, instead of Africa just being a source of land and feedstock for EU, US, and Asian markets.

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