An Institutional Analysis of Biofuel Policies and their Social Implications

Lessons from Brazil, India and Indonesia

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United Nations
Research Institute
for Social Development

FRIEDRICH
EBERT
STIFTUNG

Occasional Paper Nine
Social Dimensions of Green Economy
and Sustainable Development
June 2012

This United Nations Research Institute for Social Development (UNRISD) Occasional Paper has been produced in collaboration with the Friedrich-Ebert-Stiftung (FES). UNRISD thanks the Norwegian Ministry of Foreign Affairs for supporting the conference, Green Economy and Sustainable Development: Bringing Back the Social Dimension, and the governments of Denmark, Finland, Mexico, South Africa, Sweden and the United Kingdom for their core funding.

Illustrations on front cover: Aine Cassidy.

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ISBN 978-9-90-85089-2

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Acronyms

NREGA	National Rural Employment Guarantee scheme (India)
OPEC	Organization of the Petroleum Exporting Countries
PNPB	National Programme on the Production and Use of Biodiesel (Brazil)
R$	Brazilian real

Summary

Biofuels production has quickly expanded worldwide as part of strategies to make energy economies "greener". Climate change mitigation and energy security have been frequent rationales behind biofuel policies, but developing countries have also emphasized the social dimensions of this new sector, flagging the inclusion of smallholder farmers in fuel production chains and the potential for poverty alleviation and rural development. However, most studies on biofuels remain focused only on the economic and ecological aspects of biofuel production and utilization, often leaving social and equity dimensions overlooked or understudied—and claims of "pro-poor" development largely unchecked. This paper therefore sets out to examine how different developing countries have attempted to promote rural development through biofuel production, what social outcomes those strategies have created, and what lessons can be learned, such as in terms of biofuel policy design. This is done through a comparative analysis of the contexts of Brazil, India and Indonesia; three countries with important agricultural sectors that have put large-scale biofuel programmes in place.

Brazil has built its biofuels policy primarily on a well-established sugarcane-ethanol industry and on an emerging biodiesel sector. As a way to stimulate those sectors, the government has put in place regulatory and economic incentives such as tax breaks, cheap credit through public banks and blending mandates[1] to secure captive markets. In the case of sugarcane-ethanol, despite its success from an economic and an emissions reduction perspective, its social implications are grim. A highly concentrated ownership pattern and an imbalanced allocation of burdens and benefits mean that the sugarcane agribusiness captures all value-addition while the rural poor participate only as seasonal migrants working under harsh and insecure conditions. In addition, its expansion over smallholder farms and indigenous peoples' lands has further tarnished the social profile of this sector. Brazil has attempted to compensate for these issues through a socially oriented biodiesel programme that promotes feedstock cultivation (primarily castor bean) among smallholders and the establishment of contract farming schemes with biodiesel industries. Initially, a design that made smallholders dependent on one crop and one buyer, plus poor implementation, led to broken contracts and abandoned smallholders who felt cheated and left with a crop they could not eat or sell. Only the mobilization of rural social movements and the government's commitment to a social agenda could force a revision of the biodiesel policy. This included the creation of the subsidiary Petrobras Biofuels to engage with smallholders, the distribution of higher quality seeds, and changes in the contract terms to give more leverage to smallholder farmers and guarantee their food security. As a result, the programme has met with increasing success in terms of income generation and number of affiliated smallholders.

India's biofuel policy has also relied on an established sugarcane agroindustry while promoting smallholder integration through new biodiesel value chains. On the one hand, India utilizes similar policy instruments such as tax breaks and blending mandates, but unlike Brazil it utilizes only sugarcane molasses (and not sugar juice) as a feedstock, due to tight sugar supplies. Besides, in India the chain has a much larger participation of smallholder farmers cultivating sugarcane. Nevertheless, all value-addition is captured by the industry, which now benefits from incentives to produce for a new market, while the conditions of poor sugarcane growers remain basically unchanged. Therefore, there is hardly a socially transformative element to the Indian ethanol policy. The biodiesel policy, on the other hand, has attempted to incorporate the rural poor through the promotion of non-food feedstock cultivation (mainly *Jatropha curcas*) on what the government regards as "marginal lands". However, disappointing yields, lack of agreement with customary land users for cultivating jatropha and lack of committed buyers to make the value chain viable led to a huge failure. In the end, most smallholders who had been persuaded into growing jatropha ended up being worse off.

[1] Blending mandates consist of policies that determine an obligatory mixing of a certain percentage of biofuels in liquid fossil fuels commercialized (ethanol in gasoline and biodiesel in mineral diesel).

Finally, in Indonesia there have again been incentives to cultivate feedstock on "marginal lands" and for established agroindustries to start producing biofuels. These incentives have included: subsidies and tax cuts for the sugarcane industry to produce ethanol and for the palm oil industry to produce biodiesel, facilitated legal conditions for long-term corporate investments on land and blending mandates to guarantee markets. Despite these efforts, other end-markets remain more attractive to the sugarcane industry and so fuel-ethanol is not being commercialized. In turn, the cultivation of "marginal lands" with jatropha faced the same problems as in India; the lack of a viable and established market chain and the problem of smallholders being abandoned without a buyer and without a use for those seeds. Only palm oil biodiesel has been viable, but with very mixed social implications. On the one hand, the sector counts on the large participation of smallholders and creates an income that alleviates rural poverty, but there are important limitations when it comes to: no ascension in the value-chain (farmers remain only at the least valuable stage of the chain, selling palm fruit bunches to private mills); little bargaining power in the face of the industries and no voice in decision-making; and loss of control over the land in the long term, for which only a small compensation is given. In this, as in the other cases of already established crops such as sugarcane in Brazil and India, biofuel policies may not create additional social issues but they can still be perceived as socially neglectful, failing to improve the inequitable structures and outcomes of the sectors they build upon.

The comparative analysis indicates a mismatch between the social discourse and the biofuel policy instruments usually adopted. In reality, benefits to the rural poor have been very limited, and far too often they have been left worse off after being incorporated into biofuel production chains under disadvantageous conditions. The examined experiences show that better outcomes depend crucially on: (i) building upon traditional livelihoods, rather than attempting to replace them; (ii) paying heed to the views, needs and interests of the rural poor in the making of such rural development strategies; and (iii) inserting policy provisions that allow smallholders to climb up the value-chain, thus addressing the inequality structures that keep the poor poor.

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Introduction: "Green Economy" of Biofuels

The concept of green economy has emerged in recent years and gained large usage in the lexicon of sustainable development, not replacing this other, previously established concept, but rather emphasizing in it the need for an *economic* transition toward more resource efficient, low-carbon and socially inclusive patterns of production and consumption (UNEP 2011). In this context, the energy sector plays a crucial role, as it is the largest emitter of greenhouse gases that lead to climate change; therefore, it has become imperative for societies to undertake a (fast) transition from fossil fuels to renewable energies (IPCC 2007). However, while many alternative energy options exist to replace sources of *power*, there are few renewable alternatives to *liquid* fossil fuels such as the petroleum products used in transportation. It is in this context that biofuels appear as an attractive option at hand. Ethanol can be easily produced from any starch or sugar crop and be blended with or used as a replacement for gasoline, and biodiesel can be produced from any vegetable oil, animal fat or waste oil and be used blended with or as a replacement for mineral diesel (Sagar and Kartha 2007; Koh and Ghazoul 2008). Their manufacturing technology is well-established, it is easily replicable using a number of different feedstocks (raw materials), and a transition would require minor to no changes in vehicle engine technology or in the existing transportation infrastructure (Pacala and Socolow 2004; Matthews 2007).

However, the environmental rationale is only part of the biofuels story. Shifting energy sources naturally creates not only ecological but also socioeconomic and geopolitical outcomes. Many countries have started pursuing biofuel programmes partly as a way to avoid trade relations seen as unfavourable, such as those of net oil importers with the handful of oil-exporting countries (Farrell et al. 2006; Hira and Oliveira 2009). This comes along with the possibility of creating jobs domestically and providing the agricultural sector with a new market—one of large and elastic demand. Developing countries, in particular, have identified in biofuel production a major opportunity to promote social inclusion, poverty reduction and rural development (Biswas et al. 2009; Garcez and Vianna 2009). Power generation from indigenous biomass sources can overcome many of the obstacles impairing access to modern energy for two billion of the world's poorest, such as the costs and frequent logistical difficulties of extending a centralized grid (Kuik et al. 2011). In addition, feedstock cultivation and biofuel production can create jobs in agriculture, provide an income to smallholders and foster new "green" industries, eventually helping those countries leapfrog carbon-intensive energy development.[2]

But while these opportunities have been praised by advocates of biofuels, critics have warned against important social and environmental risks. For instance, the actual environmental benefits of biofuels have been recently brought into question due to the energy and water inputs needed for their production, or to eventual emissions from land use changes that could negate any climate benefits (Fargione et al. 2008; Searchinger et al. 2008). In addition, unfettered expansion of feedstock cultivation can seriously threaten traditional rural livelihoods, smallholder farming and local food security, particularly where land tenure is not ensured (Cotula et al. 2008; Eide 2008). And finally, the large-scale diversion of crop usage from food to fuel production can have severe impacts on global food prices and accessibility (Runge and Senauer 2007).

These risks and opportunities reveal the two-sided nature of biofuels and the need for careful assessment of how their production takes place, what its social implications are and particularly how vulnerable groups such as the rural poor are affected by it. This article addresses these questions through a comparative analysis of three developing country contexts: Brazil, India and Indonesia, all of which have put ambitious biofuel policy programmes in place. While much work has been done on the economic and biophysical aspects of biofuels, relatively little

[2] von Braun and Pachauri 2006; FAO 2008; ODI 2009.

research has assessed the social and equity dimensions of this transition.[3] Therefore, this paper focuses on the different biofuel policy strategies these countries have adopted and their social implications, analyzing not only the consequences of biofuel production for the poor, but also how there may have been complementarities between environmental and social goals and to what extent these biofuel strategies have represented an authentic transformative effort toward an equitable and socially inclusive green economy.

For that examination, this paper pays particular attention to the specific policies and policy instruments adopted by each of the three countries, analyzing their design vis-à-vis the different social outcomes in order to extract lessons from those experiences. This research relies on extensive literature review, policy analysis and on altogether more than 100 semi-structured interviews conducted with key informants in Brazil, India and Indonesia. These informants included farmers and grassroots organizations, business and industry officials, government policy makers, as well as NGOs and academics. The results of the interviews were then triangulated with the literature in order to extract the inferences presented here.

The next section provides an overview of the biofuel production strategies of the three case study countries and discusses what implications they have had on social equity and rural development. The subsequent section then draws from those experiences to identify patterns and extract lessons on the limitations, pitfalls and opportunities for rural development through biofuel production. Finally, a conclusion section summarizes the key arguments of the paper and its major policy recommendations.

The Social Dimensions of Biofuel Production in Brazil, India and Indonesia

Biofuel production has spread worldwide at a very fast pace following rationales that vary from climate change mitigation to energy security and rural development.[4] Developing countries, in particular, have often emphasized the socioeconomic potential of biofuel production and charged their biofuel policies with a strong "pro-poor" character, framing them along the lines of social inclusion, job creation, poverty reduction and rural development. However, it is imperative to thread beyond both the official sustainable development discourse of those policies as well as wholesale criticism. Rather, what seems necessary is a careful assessment of how various biofuel production systems have affected different social groups (particularly the most vulnerable, such as the rural poor), succeeded or not in creating co-socioenvironmental benefits and engaged with an actual transformation that addresses the structural causes of poverty and inequality (see UNEP 2011; UNRISD 2010). The rest of this section does that by taking an in-depth look at the biofuel policies and at the social implications of biofuel production in Brazil, India and Indonesia.

Brazil

Brazil has a very long experience with biofuel policies and commercial production, dating back to the 1930s when the first ethanol blending mandates were put in place (Hira and Oliveira 2009). The country later scaled up those early initiatives and adopted a major ethanol programme in the 1970s to replace expensive and volatile foreign oil and at the same time provide domestic sugarcane producers with an additional market during a time of sugar-price crisis. With the reduction of international oil prices and consumer dissatisfaction with ethanol-dependent vehicles in Brazil, the programme was largely dismantled in the early 1990s, but it came vigorously back to life in the 2000s as flex-fuel cars (which can run on any combination of ethanol and/or gasoline) were introduced in the country, oil prices began to rise again and climate change climbed up on the international political agenda. This time, now framing it in a

[3] An exception to that is a double special issue of *The Journal of Peasant Studies on the Politics of Biofuels, Land and Agrarian Change* (Vol. 37, No. 4, October 2010).

[4] FAO 2008; Searchinger 2009; Sorda et al. 2010

sustainable development agenda, Brazil has widened its biofuel policy to include a biodiesel programme, charged with a strong social inclusion orientation (Garcez and Vianna 2009). As the ethanol and biodiesel programmes involve very different production chains and contexts of feedstock cultivation, it is useful to analyze them separately.

About 95 per cent of Brazil's biofuel production consists of sugarcane-ethanol, which is where the country's long experience with biofuels is based (Goldemberg et al. 2008). This is a highly consolidated sector which has its origins in the large sugarcane plantations worked by African slaves during the Brazilian colonial period (Hall et al. 2009). For instance, large-scale farms account for 75 per cent of all ethanol production in Sao Paulo state, the centre of Brazil's biofuel agroindustry (Goldemberg et al. 2008). The proportion of large-scale enterprises is even larger in the Northeast Region, where the traditional structures of large landlord ownership over sugarcane cultivation are even more prevalent (Hall et al. 2009). As such, the participation of smallholders in the Brazilian ethanol programme is considerably limited. Rather, smallholders at sugarcane expansion frontiers more frequently end up selling their lands and moving to a city, thus leading to increased consolidation of land ownership in Brazil.[5] There are experiences demonstrating the feasibility of small-scale distilleries and pilot examples of local ethanol utilization in some parts of the country, but these usually face limitations in terms of financial resources, technology, infrastructure, organizational capacity and access to markets (Ortiz 2007; personal interviews). Biofuels cannot be sold in Brazil without verification of technical standards, but meeting these standards incurs technology and transaction costs that small-scale producers may be unable to afford (personal interviews). As a consequence, sugarcane growers of small and medium size are normally bound to sell their production to processing mills controlled by large landowners or agribusiness companies who possess the resources and capacities above (see Hall et al. 2009; Gomes et al. 2010a). These industries will, in turn, sell ethanol abroad or to domestic fuel distributors and capture all value-adding stages of production.

Advocates of the Brazilian sugarcane-ethanol sector argue that there are substantial social benefits in terms of job creation, by employing hundreds of thousands of sugarcane cutters for manual harvesting every year (Goldemberg et al. 2008). However, it is important to examine the quality of those jobs. It is well documented that work conditions are often degrading and overexploitation of labour and occupational health problems are far too common.[6] In addition, the sugarcane sector employs primarily seasonal migrant workers, incurring further social problems associated with the disintegration of household and family structures[7] (Hall et al. 2009; Gomes et al. 2010a).

The Brazilian ethanol policy does little to shift that situation of uneven allocation of benefits and burdens. Its policy instruments consist primarily of regulatory and economic incentives to the sugarcane agroindustry, such as tax exemptions, offer of facilitated credit through public banks and a mandate of 18–25 per cent of ethanol blending in all gasoline sold in the country (Hall et al. 2009; Hira and Oliveira 2009). Arguably, Brazil's ethanol policy framework thus does not contain any transformative element that would lead to the empowerment of the rural poor or to the reduction of income inequality. Instead, it just provides state support to an established agroindustry which may well contribute to economic growth and to the increase of renewable energy supplies, but which perpetuates the daunting land ownership and income disparities of the country (see Ferreira et al. 2008). It would probably be exaggerated to say that the ethanol policies *cause* those problems – the Brazilian sugarcane sector and its inequalities pre-date any biofuel policy. Yet, for giving public support to the sector while not envisaging any structural change toward equity, Brazil's ethanol programme could be seen as socially neglectful at least. In addition, the rapid expansion it has experienced in recent years, sometimes aggressively and

[5] See Monteiro Novo et al. (2010) for the case of small dairy farmers in São Paulo state.

[6] Novaes 2007; Sawyer 2008; Gomes et al. 2010a.

[7] Such seasonal migrants normally stay away for the largest part of the year. In Brazil, the wives left behind become known as "widows of living husbands" (Biondi et al. 2009).

violently over smallholders and indigenous peoples' lands (for example the Guarani-Kaiowá in Mato Grosso do Sul state) has further compromised the social profile of the sugarcane sector (Gomes et al. 2010a).

Brazil has tried to fill that social gap through its biodiesel policy, which is much more tuned toward rural development. In 2004 the Brazilian government launched the National Programme on the Production and Use of Biodiesel (PNPB) to gradually replace diesel. It set for 2008 the start of 1 per cent mandatory blending, aiming at reaching 5 per cent by 2013.[8] The crucial feature of this policy, however, is its attempt to incorporate smallholders in the production chain. The policy determines that those biodiesel industries that direct at least 30 per cent (10 per cent in some regions) of their annual feedstock-purchasing expenditure to smallholders be rewarded with a social fuel seal, a social labelling initiative from the government (MDA 2012). The label is a condition for receiving a number of additional incentives such as further tax reductions and more favourable credit terms at public banks. As a consequence, biodiesel industries started establishing a large number of contract farming schemes with smallholders who were willing to undertake feedstock cultivation (see de Andrade and Miccolis 2011).

In its first few years, the social outcomes of that biodiesel programme were rather negative, due to three major shortcomings. First, castor bean, a non-edible oilseed that had been cultivated traditionally by some of the rural poor in Brazil's semi-arid region, was chosen as a "smallholder-friendly" feedstock as it grows on marginal soils and without external chemical inputs; however, the utilization of low-quality seeds under suboptimal conditions resulted in very low yields (see César and Batalha 2010). Second, lack of organizational capacity meant that smallholders had to be approached individually, and incorporating subsistence farmers with little or no previous experience with cash-cropping under contract terms revealed to be a major challenge (Gomes et al. 2009; personal interviews). Finally, although the policy determines that companies must provide technical assistance, the assistance offered often proved inadequate or insufficient to improve yields or to build smallholders' capacity (Zapata et al. 2010). As a consequence, both sides—farmers and biodiesel industries—were found breaching the contracts. Contracted prices were often below market prices, in an attempt by the industry to make feedstock-purchasing economical, but this meant that some farmers with access to other buyers would sell the seeds elsewhere. Once the industries saw the arrangement was economically unviable, smallholders were abandoned and those with least market access (the most vulnerable) were left with seeds that they had been asked to grow but which had no subsistence use and which could not be sold anywhere (Gomes et al. 2009; Gomes et al. 2010b; personal interviews). This clearly showed that policies aiming at social inclusion may well backfire when their designs are flawed.

A revision of policies in 2008–2009 reformed the biodiesel programme, and many of the shortcomings have been addressed since then. A major change was the creation of Petrobrás Biofuels in 2008 as a subsidiary of Brazil's state-controlled oil company and its entrance into the sector as a new major player establishing contracts with smallholders. The imminent failure of the biodiesel programme was a serious threat to the government's social agenda and to much of its political base (partly grounded on mass social movements, including those acting on rural development issues). Therefore, rescuing the programme was the order of the day. The government then delegated its former minister of agrarian development—and one of the mentors of the biodiesel policy—Miguel Rossetto, to become president of the newly-created Petrobrás Biofuels (personal interviews). The government also released a new "normative instruction" for biodiesel production in 2009, thus revising the policy (MDA 2012). This has since led to substantial changes in the approach toward smallholders and therefore in the social outcomes of biodiesel production. Five key differences are worth noting: (i) Petrobrás has supplied seeds of higher quality and explored possibilities with alternatives to castor bean, such as sunflower; (ii) it has improved the technical assistance and fostered the creation of smallholder cooperatives to build organizational capacity; (iii) it has purchased feedstock at

[8] This latter goal was reached by 2010, and the blending mandate was then anticipated.

above market prices and with the flexibility to increase it in case market prices go up; (iv) it has more strongly promoted mixed food and feedstock cultivation rather than feedstock monocultures, to reduce smallholder vulnerability and safeguard food security; and, finally, (v) the policy now requires that a representative social movement sign the contract along with the smallholders in order to increase bargaining power and verify the fairness of the terms. Although some limitations remain (see next section), rural development outcomes have improved significantly, along with smallholder satisfaction.[9] The number of smallholder households involved in the programme quadrupled between 2008 and 2010 to more than 100,000, and the value spent by biodiesel industries on feedstock acquisitions from smallholders increased five-fold in the same period, to about R$ 1.2 billion (~US$ 635 million) in 2010 (Gomes et al. 2010b).[10] This has been possible thanks to pressure from social movements, to their capacity to organize smallholder farmers and negotiate terms that represent their interests, as well as to their political leverage and policy advocacy, coupled with the clear determination of the Brazilian government to pursue a social agenda through the biodiesel policy.

India

As another major agricultural country that has experienced growing energy demands, India too has initiated a large-scale biofuel production and consumption programme. As in Brazil, India's policy also has social contours and aims expressly at job creation and rural poverty reduction (MNRE 2009). However, its possibilities for biofuel production are comparatively more limited, for three main reasons. First, although India is the world's second largest producer of sugarcane (after Brazil), its sugar supplies are matched by an equally large demand, and therefore it cannot afford to divert sugarcane for other purposes; as such, its ethanol production is only from molasses, a by-product of sugar (Ravindranath et al. 2011). Second, India is a net importer of edible oil, therefore it cannot afford to divert its supplies into biodiesel manufacturing, either. India has thus tried to avoid any biofuel policies that could aggravate the country's already dire situation of food insecurity, which affects more than 220 million Indians (FAO 2011). Finally, India is also constrained in terms of arable land availability, a challenge for the ambitions of expanding feedstock cultivation. Given these conditions, India's programme has focused on sugar by-products (sugarcane molasses) and on cultivating non-food crops on what the government perceives as "marginal lands", that is, lands of suboptimal soil and water conditions that are not used by intensive agriculture (see Kumar et al. 2009).

Like Brazil, India's fuel-ethanol programme builds upon an existing agroindustrial sector that already produced ethanol for purposes other than fuel (industrial, medical, beverages and so on). The Indian ethanol policy counts on a 5 per cent blending mandate and on a number of tax incentives to sugarcane mills (MNRE 2009). The industry argues that by receiving additional governmental support it can transfer such gains to the more than five million sugarcane growers in India, mostly smallholders in the states of Uttar Pradesh, Maharashtra and Orissa (personal interviews). However, it is debatable to what extent this policy serves rural development purposes. While it is clear that an industry with higher revenues might transfer some of those gains upstream the production chain, there is no perspective of reducing income inequality in this system. As in Brazil, it is the industry that continues to capture all value-addition and which now benefits from additional incentives and from the opportunity to sell sugarcane products to a new market.

Meanwhile, India launched a very ambitious National Biodiesel Mission in 2003 aiming at replacing 20 per cent of the country's total diesel consumption by 2012. In contrast to the ethanol policy, this one has attempted to build entire new production chains centred on the cultivation of non-food crops on "marginal lands" (Kumar et al. 2009; MNRE 2009). The policy

[9] Gomes et al. 2010b; Zapata et al. 2010; personal interviews.

[10] It may be worth noting that even though Petrobrás Biofuels is purchasing castor bean from smallholders under the biodiesel policy, that feedstock is not being used for biodiesel manufacturing but instead sold at more profitable markets, such as oleochemical industries. In turn, Petrobrás Biofuels purchases (cheaper) soybean oil for biodiesel production. That said, regardless of whether or not the feedstock is being converted into biofuel, this integration of smallholders with Petrobrás remains an outcome of the Brazilian biodiesel policy.

rests on the estimate that there are 13.4 million hectares of such lands available for feedstock cultivation in India (Rajagopal 2008) and provides a package of economic and regulatory incentives (for example, tax reductions, credit provision through national banks, facilitated access to land) to private companies willing to develop industrial plantations or to engage in contract farming schemes with smallholders (MNRE 2009). The government has also made such feedstock cultivation eligible for its National Rural Employment Guarantee scheme (NREGA), which provides up to 100 government-paid days of manual rural labour per year. The main crop of choice for that endeavour has been *Jatropha curcas*, a crop known to some parts of India (for example, Rajasthan) and which has received immense praise in the scientific and grey literatures for its alleged capacity to resist pests and to yield well even on degraded soils, under water stress and without fertilizer inputs (Jain and Sharma 2010; Silitonga et al. 2011).

Reality, however, has proven to be starkly different from what the government foresaw. First, jatropha's ability to obtain satisfactory yields under suboptimal growing conditions showed to have been highly overestimated by the academic and policy-making circles. Indian farmers who traditionally grew jatropha as a fence crop knew of its growth limitations without inputs but were not consulted in the decision making (personal interviews). Additionally, the establishment of jatropha monocultures was often unwelcome, primarily because what official statistics regard as "marginal lands" are often under some form of traditional use by rural populations, be it shifting cultivation, pastoralism, or use for other resources such as fuelwood and medicinal plants (Rajagopal 2008; personal interviews). However, fuzzy land ownership patterns, conflicts between customary and legal rights and lack of land tenure security have made it possible for the government to claim large tracts of such lands (or to hand them over to private companies) and put jatropha monocultures in place, in what has been perceived as massive land grabbing by some civil society organizations (GRAIN 2008; personal interviews). This reportedly led to a policy boycott on the part of some farmers who would join the programme in order to benefit from NREGA payments but then sabotage the plantations by removing the roots of jatropha saplings before "planting" them, or return to the field and uproot them all a few weeks later (personal interviews). Meanwhile, farmers who were persuaded into jatropha cultivation—mainly those who were unfamiliar with it—entered buy-back contracts and most were abandoned when yields proved disappointing. This resulted in the reduction of local food production (for example, groundnut in the state of Tamil Nadu), larger exposure to food insecurity and a number of social and economic costs that the rural poor were already ill-suited to bear (see Lahiri 2009; Ariza-Montobbio and Lele 2010).

Once the difficulties above became visible, the Indian government lowered its expectation and adopted, instead, the goal of replacing 20 per cent of the total liquid fuel consumption with biofuels by 2017 (MNRE 2009). However, even this has been largely frustrated so far. In addition, its promises of delivering rural development through biofuels have remained far from reality. Rather, while India's ethanol policy shows to have little to do with poverty and inequality reduction, its biodiesel programme has exploited the vulnerability of customary land users, threatened the livelihoods and food security of rural populations and incorporated smallholders under insecure contract farming terms that left many of them worse off.

Indonesia

Indonesia is an ex-Organization of the Petroleum Exporting Countries (OPEC) member turned net oil importer and another major agricultural country that has adopted policies for large-scale biofuel production. Its official goals are primarily the improvement of national energy security and the promotion of rural development (Government of Indonesia 2006; Legowo et al. 2007). Its 2006 National Energy Policy thus aimed at replacing 10 per cent of Indonesia's diesel and 5 per cent of its gasoline consumption by domestically produced biofuels by 2010 and increase that gradually afterward (Legowo et al. 2007). The approach used is similar to that of Brazil and India: it has put in place blending mandates to create a captive market for biofuels and given a number of economic and regulatory incentives to private agribusiness, aiming for the creation of employment at feedstock plantation and the establishment of contract farming schemes

between industry and smallholders (Dillon et al. 2008; Caroko et al. 2011). Those incentives have included tax exemptions, direct subsidies to fuel-ethanol and biodiesel producers, and facilitated conditions for investment, such as faster acquisition of land use permits for feedstock cultivation and longer duration for land concessions (Caroko et al. 2011). In this context, the major crops have been sugarcane (for ethanol), oil palm and jatropha (for biodiesel).

Although some utilization of cassava was envisaged, sugarcane has remained the main crop targeted for ethanol production in Indonesia (Legowo et al. 2007; Slette and Wiyono 2010). Like India, Indonesia has experienced tight domestic sugar supplies and thus targets only molasses as a feedstock. However, the Indonesian sugarcane sector is far smaller than those of India or Brazil, and despite the incentives provided, it has remained reluctant to produce fuel-ethanol with the molasses supplies available; instead, it has chosen to produce for more profitable markets such as that of industrial ethanol (Slette and Wiyono 2011). As a result, Indonesia currently has no commercial fuel-ethanol production, despite the policies in place.

The biodiesel sector, on the other hand, has met with more success, building on the huge palm oil agroindustry of Indonesia. Indonesia has since 2010 adopted the format of "food and energy estates", adding a biofuel rationale to industrial plantations of multi-purpose crops such as oil palm (Ginting and Pye 2011). As the world's largest producer of palm oil, Indonesia is well endowed with a large supply of feedstock and availability of edible oil is not a concern. Currently, three-quarters of all Indonesian palm oil production is exported, and from what is consumed domestically 80 per cent goes for food, with only 20 per cent reaching other markets such as that of biofuels (Slette and Meylinah 2011). Therefore, there is much room for expansion, and the industry has welcomed the incentives offered by the governmental policy and the possibilities of aiming at biofuel markets (see Caroko et al. 2011).

Half of all Indonesian oil palm plantations are owned by private companies, 10 per cent by the government and 40 per cent by smallholders (Sheil et al. 2009). However, it is difficult for independent smallholders to afford the high start-up costs of oil palm cultivation and to bear four years without income before the plant becomes mature; therefore, most smallholders in the oil palm sector work under contract farming schemes where a company provides for the start-up costs (Feintrenie et al. 2010). Typically, most cultivation takes place under the so-called nucleus-plasma schemes negotiated between rural communities and a private company, once the latter has obtained the necessary land use licenses from the government. In this scheme, the land is normally divided between industry and smallholders in the following way: about 70 per cent of it (the "nucleus") is rented by the company, who then sets up its own plantation and processing mill; the remaining 30 per cent (the "plasma") is retained by the smallholders, who are then integrated through a feedstock-supplying scheme with the company (Rist et al. 2010; Feintrenie et al. 2010). This is thought to be advantageous to smallholders because oil palm cultivation requires relatively little labour and provides them with a regular income that is superior to what could be obtained from other crops (Feintrenie et al. 2010; Rist et al. 2010). On the other hand, there remains an income inequality between smallholders growing oil palm and the industries capturing the value-adding stages of palm oil processing. In addition, the smallholders tend to have little to no say in the set up of the process, indicating a power imbalance and a failure in participatory governance.

Consultation with local stakeholders also reveals a number of other drawbacks. First, the financial compensation offered by the companies for acquiring 70 per cent of the land is frequently perceived as too low; in a sense, farmers agree to concede it for lower than they would due to an eagerness to earn an income and escape poverty – a situation of powerlessness and vulnerability (Feintrenie et al. 2010; personal interviews). Second, farmers frequently assume that the "nucleus" will come back to them after the contract, when in reality it becomes government property (personal interviews). Third, smallholders' lack of bargaining power sometimes becomes an issue and exposes their vulnerability to the company's terms and demands, especially in remote areas where farmers have less experience with such contracts and only one mill is available (Feintrenie et al. 2010; personal interviews). Fourth, oil palm

expansion has in some regions (for example, Jambi province, Sumatra) replaced rice cultivation (Indonesia's main staple crop), making smallholders—and the country as a whole—more vulnerable to food price volatility that could compromise their food security.

Finally, Indonesia too has attempted to expand feedstock cultivation on what it regards as "unused", "available" lands, incorporating smallholder farmers in biodiesel production chains (see Legowo et al. 2007; Dillon et al. 2008). Like in India, the government distributed jatropha seeds and stimulated smallholders to grow it as a marginal crop, encouraging contract farming schemes with the private sector. But, as elsewhere, yields have been disappointing, biodiesel industries have opted for purchasing (cheaper) palm oil as a feedstock[11] and smallholders growing jatropha have been left with no markets to absorb their production (personal interviews). As a result, neither the creation of larger biofuel supplies from jatropha nor the generation of income and expected reduction of rural poverty have been realized.

Limitations, Risks and Opportunities of Biofuel Policies for Rural Development

Rural development has been sought as a major goal of biofuel policies in Brazil, India and Indonesia, as in other developing countries. However, this comparative assessment indicates that there are a number of limitations and pitfalls—but also opportunities—for socially oriented biofuel policy in these contexts. It identifies a pattern in how biofuel production has been generally structured and in the types of policy instruments utilized, leading to systematic—and therefore to an extent predictable—social outcomes.

All three countries have adopted a two-tiered approach to biofuel policy where they have, on the one hand, relied upon established agricultural sectors (endowed with enough production capacity to offer sufficient feedstock supplies in a short time) and, on the other hand, attempted to promote non-food crop cultivation on "marginal lands", trying to incorporate those lands and the rural poor thereon into an integrated formal economy. For that, governments have assigned a protagonist role to the private sector. New regulations have largely facilitated conditions for investment, fiscal incentives and abundant offers of public credit have provided economic incentives to sway agroindustries into feedstock cultivation and biofuel production, and blending mandates have been put in place to ensure that there will be a market for biofuels despite oil price fluctuations that could compromise their economic competitiveness.

A first important limitation of this approach is trying to promote rural development by simply expanding corporate-owned industrial plantations and the jobs they create. While employment is essential, one must look at: (i) the quality and in particular the work conditions in those jobs; (ii) the self-employment and traditional forms of subsistence that might be eliminated as those plantations expand; and (iii) their inherent limitations when it comes to creating structural change and reducing inequality. While those jobs might indeed *alleviate* poverty, inequality structures are maintained, not only in terms of income but also of land ownership, power, decisions and control over production.

Similar structural limitations are present in the contract farming schemes being promoted. Although they may provide smallholders with an income, they do not address equity issues, for the contracting industries systematically retain most or all added value while leaving smallholders perpetually as mere raw material suppliers. Moreover, these are often conditions of monopsony (that is, only one buyer available) where there is limited bargaining power and smallholders usually have to bend to the conditions and terms determined by the company. Finally, there are pitfalls and risks associated with establishing contract farming on non-edible feedstock crops, particularly when these crops take years to mature and have little other use, as

[11] The equivalent of one litre of jatropha oil costs on average 8,000 Indonesian Rupiah (~US$ 0.90), while the raw material for one litre of palm oil costs in average 5,000 Rupiah (~US$ 0.56) (Slette and Wiyono 2011).

in the cases of both jatropha and castor. The fact that in all three countries smallholders contracted to plant these crops were abandoned and left to bear the consequences should not be overlooked.

These have arguably been cases of "adverse incorporation", that is, instances of inclusion under disadvantageous conditions (Hickey and Du Toit 2007; McCarthy 2010). This reinforces the point that rural development policies, when misconceived, may easily leave the rural poor worse off. In this case, two key factors seem to have been crucial. First, contracts were established with little knowledge or transparency about the actual performance of those crops under suboptimal growing conditions—smallholders were simply persuaded by government agencies and private industries to participate in something that was based on hype. Second, the design of this strategy left smallholders even more vulnerable from the beginning—to market fluctuations on a single cash-crop that cannot be used for food or fodder and to a single buyer that could respond negatively to such market volatility and either become bankrupt or move away. In other words, the strategy design undermined smallholders' resilience instead of strengthening it.

Better policies can avoid many of these pitfalls and improve rural development outcomes significantly, as the case of Brazil demonstrates. Support for organizational capacity and creation of cooperatives; participation of social movements at contract negotiation to improve bargaining power; mixed production with food crops rather than as feedstock monocultures; flexibility to adjust prices according to market signals—all these policies seem to have contributed to better outcomes in terms of smallholder empowerment, food security and stable income generation.

Still, the issues of persistent inequality, power imbalance and lack of structural change remain. Addressing these would require that the poor climb up the biofuel value-chain and start to lift themselves out of a condition of mere raw material suppliers. In other words, some degree of locally owned rural industrialization seems necessary (see Ploeg 2008). This has been attempted in some cases in Brazil where smallholder communities growing castor under contracts have started negotiating to have local, community-owned vegetable oil extraction, meaning that they would start selling castor oil instead of seeds, obtain higher revenues and keep the seed-cake for other uses (Gomes et al. 2010b). This, of course, requires further political will and appropriate policies, such as additional technical support, financial resources and organizational capacity, and it seems to be the necessary step forward if rural development goals are to be taken seriously.

Conclusions

Developing countries characteristically emphasize the social aspects of sustainability, and that has not been different in their attempt to promote a "green energy economy" through biofuels. The biofuel policies of Brazil, India and Indonesia have allegedly aimed as much at domestic renewable energy production as at rural development co-benefits in the form of employment creation and poverty reduction. However, a more careful analysis reveals that in practice they seem to have most often focused much more on building (renewable) energy supplies quickly and paid insufficient attention to rural development needs. Biofuel policy frameworks have been marked by ambitious fossil fuel replacement targets, blending mandates and incentives to establish agribusiness, but they have seldom taken the complexity of rural poverty into account or included instruments to promote structural change. As such, the jobs created hardly tackle inequality, and the rushed top-down experimentation of jatropha and castor on smallholders under risky contract terms led to many instances of adverse incorporation that ended up increasing vulnerability and aggravating their plight.

This analysis has shown that the design of biofuel policies matters significantly to the outcomes of biofuel production on rural development, and the example of policy revision in Brazil is

illustrative of how they can lead to tangible benefits for the rural poor. Three elements appear to be crucial: (i) the mixing of feedstock with food production, to safeguard food security, reduce vulnerability and strengthen existing livelihoods rather than replace them; (ii) the empowering of smallholders by including social movements at the negotiation phase when setting contract farming terms; and (iii) provisions for having smallholders gradually ascend in the biofuel value-chain, with capacity building for developing locally owned seed-oil extraction and eventually other steps down the chain.

Despite the apparent straightforwardness of these recommendations, elaborating policy designs adapted to local realities may pose challenges, and the role of power politics and advocacy coalitions should not be underestimated. Private agribusinesses and even state-owned companies are seldom willing to let go of value-addition, lowering their profits and spending more on purchases from smallholders, or to have (tougher) bargains with social movements. Therefore, there is an active role to be played by those social movements in improving smallholder collective organization and making a strong articulation of their position at the political level, as happened in Brazil. Governments putting forth biofuel policies, in turn, should avoid hasty and top-down grand plans such as the Indian National Biodiesel Mission and instead develop such strategies in more participatory ways, that is, in partnership with those who are to be helped, the rural poor. Given that biofuel programmes have been initiated and conducted largely by governments and public policies, they are accountable and should be even more responsive to the needs of the masses, not only for the sake of equitable development, but also as a matter of effective democracy.

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Printed in France
GE.12-01028-June 2012-400

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