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An Institutional Analysis of Biofuel Policies and their Social Implications in Developing Countries

Lessons from Brazil, India and Indonesia

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Abstract

Despite some opposition, biofuels have experienced an explosive growth in production and policy making over the last years, becoming one of the most contentious debates in the sustainable development agenda. Countries have seen significant opportunities to shift energy systems in more environmentally, politically and economically favourable ways, as well as to insert the rural poor into such new systems. However, this allegedly inclusive development may still be a long way from tackling inequality. This paper analyzes the role of state policies in promoting biofuels in emerging economies, their associated "rural development" strategies, and why expectations have often been short-lived. To do that, it compares the biofuel policy frameworks of Brazil, India and Indonesia, where the author has conducted extensive field work and more than 100 key-informant interviews. The examination reveals substantial state steering through regulatory and economic incentives, but questionable equity and poverty-alleviation outcomes. Large agribusiness has remained the largest beneficiary of those policies. When included, the rural poor are most often bound to remain mere raw material suppliers without any perspective of ascension in the value chain. Worse, many of the contract-farming schemes being promoted offer disadvantageous terms and could arguably be characterized as adverse incorporation. Nevertheless, all three countries offer useful lessons for turning promises and hopes into reality.

The ‘green economy’ of biofuels and its social dimensions

The energy sector has been at the centre of the transformative effort towards a low-carbon economy. Being that sector the largest emitter of greenhouse gases that lead to climate change, it has become imperative that societies 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 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 of gasoline, and biodiesel can be produced from any vegetable oil, animal fat or waste oil and be used blended with or as a replacement of mineral diesel (Sagar and Kartha 2007; Koh and Ghazoul 2008). Their manufacturing technology is well-established, easily replicable using a number of different feedstocks (raw materials), and a transition requires only minor to no changes in vehicle engine technology or in the existing transportation infrastructure (Pacala and Socolow 2004; Matthews 2007).

Shifting energy sources naturally produces not only environmental but also geopolitical and socio-economic outcomes. Many countries have started pursuing biofuel programmes partly as a way to escape trade relations seen as unfavourable, such as those of net oil importers with the handful of petroleum 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 elastic demand. Developing countries, in particular, have identified in biofuel production a major opportunity to promote rural development, social inclusion and poverty reduction (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 other practical difficulties of extending a centralized grid (Kuik et al. 2011). Moreover, feedstock cultivation and biofuel production can create jobs in agriculture, provide smallholders with an income, and foster new “green” industries, eventually helping those countries leapfrog carbon-intensive energy development (von Braun and Pachauri 2006; FAO 2008; ODI 2009).

However, despite the potentials above, biofuels have come under massive criticism due to a weak social and environmental performance so far. Critics point to the risks of forest clearing and other land-use changes for feedstock cultivation, consequently to uncertainties over their actual climate benefits (Fargione et al. 2008; Searchinger et al. 2008), and to negative social impacts such as land-grabbing and competition with food production (Cotula et al. 2008; Eide 2008; Runge and Senauer 2007). Indeed, not only have major food producing countries begun to shift a substantial share of their crop outputs to biofuel manufacturing, but there has also been a strong and rapid move of biofuel-producing companies onto lands sometimes used in traditional farming systems and important to local food security (Eide 2008; FAO 2008; Vermeulen and Cotula, 2010). Given that those companies are often from rich industrialized countries seeking for “green” fuel while the environments and populations directly impacted are mostly in the developing world, this pattern has been perceived as a risky North-South imbalance that can aggravate inequalities instead of solve them (Bastos Lima 2009; Dauvergne and Neville 2009; Smith 2010).

Those risks and opportunities reveal the two-sided nature of biofuels and the need for careful assessment of how biofuel production takes place, how it relates to the rural poor, and ultimately why certain policy approaches and models of production have prevailed.

This paper aims to shed light onto these questions through a comparative analysis of three developing-country contexts: Brazil, India and Indonesia, all of which have put large biofuel policy programmes in place. The analytical framework draws from Young et al. (2008) and their foci on institutional *causality* (how and to what extent the institutions in place are indeed a cause of the processes being assessed), *performance* (how they perform according to a set of parameters) and *design* (how institutions could be redesigned to better meet the expected performance) (see Young et al. 2008). That implies that there is a necessary normative dimension to the analysis of performance (Mitchel 2008). In this case, the norms utilized follow the broad rural development literature that emphasizes the need for livelihood security, empowerment, and reduction of poverty and income inequality (UNRISD 2010; IFAD 2011). The case study analyses rely on extensive field work in each one of the countries, including more than 100 key-stakeholder interviews in total.

The next section discusses the social and rural development outcomes of the biofuel programmes in place in Brazil, India and Indonesia, and examines the links between such outcomes and the particular biofuel policy approaches and policy instruments utilized. The subsequent section draws general lessons on the limitations, pitfalls and opportunities of rural development through biofuel production, drawing from the experiences of those three countries. Finally, a conclusion section summarizes the key lessons from this institutional analysis and reflects upon possibilities for policy change.

Institutions and rural development outcomes of biofuel production in Brazil, India and Indonesia

Biofuel production has spread worldwide at a very fast pace, mainly due to ambitious governmental policy programmes (FAO, 2008; Searchinger, 2009; Sorda et al. 2010). In other words, the literature points to a strong link of *institutional causality*, i.e. it points to public policy frameworks as being major drivers of biofuel expansion (see Underdal 2008). As argued by Pilgrim and Harvey (2010), biofuels have largely been politically-instituted markets created under different rationales such as climate change mitigation, energy security and/or rural development. Developing countries have picked particularly on the latter one, as mentioned previously, and often charged biofuel policies with a strong social character by framing them along the lines of job creation, social inclusion, poverty reduction, and overall rural development.

However, it is imperative to thread beyond both the official “sustainable development” discourse framing those policies, as well as beyond wholesale criticism based on localized experiences. Rather, what seems necessary is an examination of how various biofuel policy frameworks have made a difference in terms of distributional outcomes and of positive and negative impacts on the rural poor. The rest of this section attempts to that by taking an in-depth look at the policies and rural development contexts of Brazil, India and Indonesia.

Brazil

Brazil has had one of the longest experiences with commercial biofuel production and utilization, one that dates back to the 1930s when the first ethanol blending mandates were put in place (Hira and Oliveira 2009). The country scaled-up those early initiatives and adopted a major ethanol programme 1970s, aiming at replacing expensive and volatile foreign oil as well as providing its sugarcane sector with an additional market during a time of sugar-price crisis. These decades of experience have built knowledge, infrastructure and institutional capacity for a leading position that Brazil holds in the biofuel sector nowadays, and even though the ethanol programme was dismantled in the early 1990s as oil prices receded, it came vigorously back to life as climate change climbed up on the international agenda and oil prices again increased. This time, now framing under a sustainable development agenda, Brazil widened its biofuel policy to include also biodiesel programme, one charged with a strong social-inclusion orientation (Garcez and Vianna 2009). As the ethanol and biodiesel programmes involve different production chains and contexts of feedstock cultivation, it is useful to analyze them individually.

Ethanol production in Brazil, which accounts for about 95 per cent of the country's biofuels, is produced from a well-established sugarcane sector dominated by large-scale producers (Hall et al. 2009). Large-scale farms account for 75 per cent of the ethanol production in São Paulo state, the heart of Brazil's biofuel agroindustry and responsible for about three-quarters of the country's ethanol output (Goldemberg et al. 2008). The proportion of large-scale enterprises is even larger in the Northeast, where sugarcane cultivation has a long history of large landlord ownership that dates back to slavery in colonial times (Hall et al. 2009). As such, the participation of smallholders in the Brazilian ethanol programme is very limited. Although there are pilot experiments with small-scale distilleries and local ethanol utilization, these usually face limitations in terms of financial resources, technology, infrastructure, organizational capacity and access to markets, since biofuels cannot be distributed in Brazil without verification of technical standards (Ortiz 2007; personal interviews). These, in turn, incur in technological requirements and transaction costs that small-scale producers may be ill-prepared 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 groups 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, capturing all value-adding stages of production.

Advocates of the Brazilian 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 (Goldemberg et al. 2008). However, it is well documented how those are degrading work conditions, with overexploitation of labour and a number of associated health problems (Novaes 2007; Sawyer 2008; Gomes et al. 2010a). In addition, it employs primarily seasonal migrant workers, incurring into further social problems associated to the disintegration of household and family structures[1] (Hall et al. 2009; Gomes et al. 2010a).

Brazilian ethanol policies do little to shift that situation; its policy instruments consist primarily of regulatory and economic support to the sugarcane agroindustry, such as tax

[1] 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).

exemptions, abundant availability of credit from 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 social inclusion 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 be probably exaggerated to say that the ethanol policies *cause* these 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 towards equity, Brazil's ethanol programme could be seen as socially neglectful at least.

Brazil has tried to fill that gap through its biodiesel policy, much more tuned towards rural development. This policy originates in 2004 with the National Program on Production and Use of Biodiesel, aimed at creating biodiesel production chains that incorporate smallholders. The policy determines that those biodiesel industries which direct at least 30 per cent (10 per cent in some regions) of their annual feedstock-purchasing expenditures on smallholders are rewarded with a "social fuel seal", a social labelling initiative (MDA 2011). The label is a condition for receiving a number of governmental incentives such as further tax reductions and more favourable credit terms at public banks. As a consequence, biodiesel industries have started establishing a large number of contract farming schemes with smallholders willing to undertake feedstock cultivation (castor bean, sunflower, oil palm, etc) (see de Andrade and Miccolis 2011).

While the institutional causality link is clear in this case, its performance with respect to rural development is more nuanced. In its first few years of the biodiesel programme had rather negative social impacts, associated 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 those suboptimal conditions resulted in low yields, which made this business unattractive for the biodiesel industry (César and Batalha 2010). Second, lack of organizational capacity meant that farmers had to be approached individually, and incorporating smallholders with 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 the smallholders with technical assistance, it often proved insufficient to improve yields or build smallholders' capacity (Zapata et al. 2010). As a consequence both sides, farmers and biodiesel industries, were found breeching 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 industries saw it 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).

A revision of policies in 2008/2009 reformed the programme, and many of the shortcomings have been addressed since then. A major change has been the entrance of *Petrobrás Biofuels* (Pbio), a subsidiary of Brazil's state-owned oil company, as a new industry actor establishing contracts with the smallholders. Five key differences in the

new approach have led to substantial improvements: (1) Pbio has supplied seeds of higher quality and explored possibilities with other crops, such as sunflower; (2) it has improved the technical assistance and fostered the creation of smallholder cooperatives to build organizational capacity; (3) it has purchased feedstock at above market prices and with flexibility to increase it in case market prices go up; (4) it has promoted consociated food-and-feedstock cultivation rather than feedstock monocultures, to reduce smallholder vulnerability and safeguard food security; and, finally, (5) it has required that a local 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 with the programme (Gomes et al. 2010b; Zapata et al., 2010). 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 of two years, to about R$ 1.2 billion (~US$ 635 million) in 2010 (Gomes et al. 2010).

India

As another major agricultural country that has experienced growing energy demands while facing persistent poverty and inequality, India too has initiated a large-scale biofuel production and consumption programme. However, its possibilities for biofuel production are much more limited than those of Brazil, 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 use sugarcane for other purposes; as such, its ethanol production is limited to *molasses*, a co-product of sugar (Ravindranath et al. 2010). Second, India is net importer of edible oil; therefore it cannot afford to divert its supplies into biodiesel manufacturing, either. And third, India is constrained in terms of arable land availability, a challenge for any ambitions of expanding feedstock cultivation. Given these conditions, India's programme has focused to an extent on sugarcane molasses and largely on cultivating non-food crops on what the government perceives as "marginal lands", i.e. lands of suboptimal soil and water conditions and which are not used by intensive agriculture (see Kumar et al. 2009).

In many ways India's ethanol programme does not introduce any structural novelty. Like that of Brazil, it largely builds upon an existing agroindustrial sector that already produced ethanol for other than fuel purposes (industrial, medical, beverages, etc.). Therefore, the causality link between fuel-ethanol policies and the social conditions of this sector is very weak. 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, most smallholders (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 these 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 the opportunity of selling sugarcane products to a new market.

India's biodiesel programme, in contrast, has attempted to build entire new production chains centred on feedstock cultivation on "marginal lands" (Kumar et al. 2009; MNRE

2009). The policy rests on the estimate that there are 13.4Mha of such lands available for feedstock cultivation in India (Rajagopal 2008) and provides a package of economic and regulatory incentives (e.g. 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 crop of choice for that endeavour has been *Jatropha curcas*, a crop which has received immense praise in the scientific and grey literatures for its alleged capacity to resist pests and 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, what official statistics regard as "marginal lands" are largely under some form of traditional use by rural populations, be it shifting cultivation, pastoralism, or use of other resources such as fuelwood or medicinal plants (Rajagopal 2008; personal interviews). Fuzzy land ownership patterns, conflicts between customary and legal rights, and lack of 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 civil society movements (GRAIN 2008; personal interviews). And second, jatropha's ability to obtain satisfactory yields under suboptimal growing conditions showed to have been highly overestimated. As a consequence, just like with castor in Brazil, many feedstock-purchasing contracts were abandoned by the industry, incurring in both economic and social costs to the smallholder farmers who had been incorporated (see Ariza-Montobbio and Lele 2010).

As such, India's goal to replace 20 per cent of its liquid fuel consumption by biofuels by 2017 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 them worse off.

Indonesia

Indonesia is an ex-OPEC member turned into net oil importer and another major agricultural country pervaded by rural poverty, As the others, it has adopted policies for large-scale biofuel production as a way of improving national energy security and promoting socio-economic development (Government of Indonesia 2006; Legowo et al. 2007). The approach is similar to that of Brazil and India: it has put in place blending mandates to create a captive market for biofuels and a number of incentives to private agribusiness, aiming for the creation of employment at feedstock plantation and the establishment of contract farming schemes with 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 sugar supplies and targeted

only molasses as a feedstock. But 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 oil palm sector, in contrast, is the biggest of Indonesian agriculture and has welcomed biodiesel markets and the incentives offered by biofuel policy (see Caroko et al. 2011). 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 2010). 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 of 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).

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 work under contract farming schemes where the company provides for the start-up costs (Feintrenie et al. 2010). Typically, most cultivation takes place under 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 company sets its own plantation and processing mill on a larger part of the land (normally 70 per cent of it, the "nucleus") and incorporates smallholders under contract farming schemes on the surrounding area (the "plasma", normally 30 per cent) (Rist et al. 2010; Feintrenie et al. 2010). This is felt as advantageous to smallholders because oil palm cultivation requires 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, the income inequality between oil palm growers and the industries which capture the value-adding stages of palm oil processing remain.

Consultation with smallholders also reveals a number of other drawbacks. First, the compensation offered by the companies for acquiring those 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 for earning an income and escaping poverty – a situation of powerlessness and vulnerability (Feintrenie et al. 2010; personal interviews). Second, farmers frequently misunderstand that the "nucleus" will come back to them after the contract, when it in reality becomes government property (personal interviews). And third, smallholders' little 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 and only one mill is available (Feintrenie et al. 2010; personal interviews).

Although biofuel policies may have boosted the oil palm sector by providing it with further incentives and an additional market, those policies have not created this structure of production. Therefore, the causality link between biofuel institutions and the social (or environmental) implications of Indonesian oil palm production is weak. Still, it can

be argued that biofuel policies maintain and reinforce the rather unequal structure of this sector.

Finally, Indonesian too has attempted to expand feedstock cultivation onto "unused" available lands by promoting jatropha among smallholders – an initiative entirely attributable to the biofuel policy (see Legowo et al. 2007; Dillon et al. 2008). Like in India, the government has 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[2], 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, pitfalls and opportunities of biofuel policies for rural development

Rural development has been sought 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 those contexts. It suggests that there is a pattern in how biofuel production has been structured and in the policy instruments utilized, leading to systematic – and therefore to an extent predictable – social outcomes.

All three countries have adopted a two-tiered approach where they rely upon established agricultural sectors (endowed of production capacity to offer sufficient feedstock supplies in a short time) and attempt 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 offer of public credit have seduced agroindustries into feedstock cultivation and biofuel production, and blending mandates have been put in place to ensure that there will be a market despite of oil price fluctuations that could compromise biofuels' 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 (a) the work conditions in those jobs, (b) the self-employment and traditional forms of subsistence that might be eliminated as those plantations expand, and (c) 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 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 inequality, for the contracting industries systematically retain most or all value-adding

[2] For a comparison, while acquiring the equivalent of one liter of jatropha oil costs in average 8,000 Indonesian Rupiah (~US$ 0.90), raw material for one liter of palm oil costs in average 5,000 Rupiah (~US$ 0.56) (Slette and Wiyono 2011).

while leaving smallholders perpetually as mere raw material suppliers. Moreover, those are often conditions of monopsony (i.e. only one buyer available) where bargaining power is little and smallholders usually have to bend to the conditions and terms determined by the company. Finally, there are pitfalls and risks associated to establishing contract farming on feedstock crops, particularly when these crops take years to mature and have little other use – such as the cases of both jatropha and castor. The fact that in all three countries smallholders contracted to plant those crops were abandoned and left to bear the consequences should not be overlooked. These have arguably been cases of 'adverse incorporation', i.e. 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 on something that was based on hype. And 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 bankrupt or move away. In other words, smallholder resilience was undermined instead of strengthened.

Better policies can avoid many of those 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; consociated 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 and lack of structural change remain. Addressing that would require that the poor climb up the biofuel value-chain and start lifting themselves out of a condition of raw material suppliers. In other words, some degree of locally-owned rural industrialization is necessary (see Ploeg 2008). This has been attempted in some cases in Brazil where smallholder communities growing castor under contracts have started negotiating for having 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. 2010). This, of course, requires additional technical support as well as financial resources and organizational capacity, but it seems to be the natural 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' of 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 focused much more on building (renewable) energy supplies quickly and have paid insufficient attention to rural development needs. Biofuel policy frameworks have been marked by ambitious fossil

fuel replacement targets, blending mandates and incentives to established 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 showed 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 to the rural poor. Three elements appear to be crucial: (1) the consociation of feedstock with food production, to safeguard food security, reduce vulnerability and strengthen existing livelihoods rather than replace them; (2) the empowering of smallholders by including social movements at the negotiation phase when setting contract farming terms; and (3) provisions for having smallholders 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 those recommendations, elaborating policy designs adapted to local realities may pose challenges, 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, reducing profits and spending more on purchases from smallholders, or to have (tougher) bargains with social movements. Therefore, there is active role to be played by those movements themselves in improving smallholder collective organization and making a strong articulation of their position. It has been clear that the biofuel policy improvements achieved in Brazil would not have been possible without social movement pressure, smallholder organization, and policy advocacy (see Ortiz 2007; Gomes et al. 2010b). Still, 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 of rural poor, not only for the sake of equitable development, but also a matter of effective democracy.

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