Nonhumans in the Practice of Development: Material Agency and Friction in a Small-Scale Energy Program in Indonesia

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Nonhumans in the Practice of Development:

Material agency and friction in a small-scale energy program in Indonesia

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ABSTRACT

We develop the outlines of a new approach to study the role of nonhumans in constituting 'implementation' and calculative-discursive practices in development projects and programs. Developing a conceptual framework built on the concept of *friction* (material resistance or recalcitrance encountered in processes of transformation), we analyze an Energy Self-sufficient Village program in Indonesia. Focusing on specific projects and episodes within this program, we identify multiple distinctive instances of friction. These were driven by nonhumans' (and humans') resistance, as remolding of development beneficiaries' practices was attempted by project administrators, government officials, entrepreneurs and by the (scientific) calculations embedded inside their policies, strategies and models. In concluding, we distill four ways in which nonhumans shape development practices: a) by resisting representations and calculations produced by human actors, b) by re-directing planned/expected courses of action, c) through biophysical change to their weight or textures as they move in space and time, and d) by mediating competition for resources. Overall, nonhumans play a central role in making and unmaking asymmetric relations of power. Their diverse material and discursive agency, which manifests differently in different relational settings, also highlights the importance of broadening the range of spokespersons who speak on behalf of nonhumans and whose voices can be considered reliable and true. Our study thus provides support to calls for pluralizing and democratizing development 'expertise' beyond the usual suspects in science, government and civil society.

Keywords: actor-network theory, practices, relational agency, development policy, sustainable development, agrofuels, bioenergy, Indonesia

INTRODUCTION

In 2006, the Indonesian government introduced the Presidential Instruction No. 1/2006 about the utilization of biofuels where it mandated thirteen ministries, all provincial governors as well as mayors and district heads to support biofuel development. A year later, this instruction was followed by the launch of Energy Self-sufficient Village (ESV) program that aimed to cover at least 60% of the energy demand of 3000 remote villages using local resources. The program was undergirded by calculations of biofuel production potentials generated by scientists and demographic data about poor villages produced by the statistical bureau. The scientists highlighted the promise of new biofuel technology for increasing efficiency of agricultural production and for improving poor people's welfare. The statisticians pointed to the existence of 37.17 million (or 16.58% of the total population in 2006) poor people in Indonesia who lived in 'underdeveloped' villages. Building on these rationales, between 2007 and 2013, a number of ESV projects were initiated. But by 2014, most of these biofuel "self-sufficient village" projects based on energy crops such as Jatropha curcas and Calophyllum inophyllum had been discontinued (Afiff, 2014; Fatimah et al., 2015).

Despite these failures, new biofuel self-sufficient projects using different energy crops were continuously being promoted. For example, in March 2015, the provincial government of West Kalimantan issued a call for cultivating an energy crop named *Kemiri Sunan* (Reutealis trisperma) (Kompas, 9/3/15). This call was preceded by activities of planting 12,300 *Kemiri* seeds in 5,000 hectares area owned by local farmers. A month later, actors from the Ministry of Energy and Mineral Resources, the state oil company and Bogor Agricultural University held a workshop on using Kemiri Sunan to rehabilitate degraded land. In this workshop, these actors justified their support for Kemiri Sunan due to its potential of growing on marginal lands, carrying high oil content, a 100 year life-span and a possibility to work as a fertilizer (Antara, 16/04/15). These great expectations were strikingly similar to claims made by the previous Indonesian president Susilo Yudhoyono when opening the Jatropha-based self-sufficient village project in Grobogan in 2007,[1] and by Minister of Forestry when he inaugurated the Calophyllum-based self-sufficient village project in Purworejo on 2009.[2] Biofuel Self-sufficient Village projects were then, as now, expected to meet energy demand within the village while creating jobs and alleviating poverty. However, the biofuel crops and machines in the projects, by not performing the roles assigned to them, often despite the projects' human participants best efforts to make the projects succeed,

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[1] Transcript of dialog between the Sixth President and Grobogan farmers, February 21st, 2007.
[2] Masyhud, the Ministry of Forestry press release, December 4th, 2009.

were critical in constituting project practices and outcomes that were far removed from the governments' (and the scientists') expectations.

In this paper, we argue that practices in and outcomes of development projects can be better understood by appreciating the role played by nonhumans in transforming idealized expectations of project administrators, their expert advisors and funding bodies. Nonhumans, just as humans, do not always play roles that are assigned to them by other powerful actors, but rather they may display recalcitrance toward plans and expectations of the powerful. While we study projects that were not funded by international development aid, but rather by the Indonesian government, we believe that our analysis of the role of things in development practices has conceptual and methodological implications for studying practices in any development projects that involve technological or ecological elements.

In the last two decades, a significant body of literature in development studies has turned its attention to the actual practice of programs and projects during their implementation (see for example, Pigg 1995; Li 1999; Tsing 1999; Mosse, 2004; 2005; Lewis and Mosse, 2006a; Bebbington et al. 2007; Heeks & Stanforth, 2014; Ponte, 2014). Scholars have studied how, a) different subjectivities (e.g. as 'indigenous practitioner', 'community elder' or 'subsistence farmer') are re-constituted within development practices (Pigg 1995; Li 1999); b) practices are enacted through activities of convincing and enlisting heterogeneous actors as participants in a project (Tsing 1999; Mosse 2004); c) how different sets of practices ('social, discursive, and political') come to co-exist under different organizational cultures and under top-down and bottom-up strategies for project organization (Lewis and Mosse 2006a; Bebbington et al. 2007; Ponte, 2014); d) how a project's evaluation as success or failure depends on the interpretation and representation of actual project events through discursive practices informed by policy models (Mosse 2004; 2005; Rottenburg 2009; Heeks and Stanforth 2014).

Surprisingly, however, apart from development policies and the models undergirding them, this literature has given little attention to nonhumans as active constituent elements of development practices. Nonhuman action has been studied more extensively in science and technology studies (STS) (e.g. Callon, 1986; de Laet and Mol, 2000; Shepherd and Gibbs, 2006; Law & Mol, 2008), animal geography (e.g. Philo, 1995; Buller, 2014), and archaeology (e.g. Malafouris 2013; Witmore, 2014). This work has shown that nonhumans are not simply pliant objects, which human actors can willfully control (manipulate and measure), but rather they try to resist control by human actors, and have to be interested and manipulated in order to instead act as the humans' allies in action. In this article then, we conceptualise action as distributed across a range of associated humans and nonhumans. Such a distributed conceptualization of

action permits the possibility of nonhuman resisting the roles assigned to them by human actors at any time, even after they have been interested and aligned. It also allows us to extend the repertoire of pragmatic investigations into development, which becomes an effect of network of humans (with their dispositions, thoughts and bodies) and nonhumans (with their materiality in the form of weights, shapes and textures as well as the visions and knowledges inscribed into them). Introduction of a new entity into the network will, in general, require the adjustment of the network's other constituent entities (and the relations between them) to the new entity and vice versa. This multi-entity adjustment is unlikely to be smooth, and some entities may pose resistance to adjustments. We conceptualise this resistance and recalcitrance posed by nonhuman and human entities in a network as *friction*. Friction is emergent and its sources cannot be fully predicted. Such a conceptualisation allows us to avoid imposing any *a priori* coherence on development projects, despite the presence of 'coherent' policy models that ostentatiously govern these projects and their practices.

In the remainder of this article, we review relevant literature in development studies, focusing on accounts of practices and the role played by nonhumans in these accounts. This is followed by a theoretical section in which we develop our conceptual framework, following which we briefly discuss the methodology of our fieldwork in Indonesia (carried out by the first author between 2010 and 2012). An empirical section then recounts episodes of friction in four different hybrid collectives constituted at various times in the ESV project. Finally, a set of conclusions are drawn about the new insights offered by the inclusion of nonhumans into the analysis of development practices.

PRACTICES IN DEVELOPMENT

In the last two decades, the discipline of development studies has turned its attention to the study of practices. The first such studies of practices were carried out by critical scholars who argued that development policy was nothing but a passage for the exercise of asymmetrical power (see for example Escobar, 1995; Sachs, 1992; Ferguson, 1990). These critical scholars aimed to unmask unequal power relations and domination hidden underneath the rhetoric of rational policy-making and planning. But domination is anything but straightforward. Introducing an edited volume on the anthropology of policy, Shore and Wright (1997) argued that while policy may *attempt* to dominate and constitute subjectivities, its making and implementation entails contestation between heterogeneous actors. This argument foregrounds that, unlike the claims made by early critical scholars, development policy is not a homogeneous or absolute tool of domination, but rather its power is operationalized through a struggle

between different interests, identities and interpretations. Such a conceptualization is consistent with a focus on practices in which power to dominate is a contingent outcome of actors' relations with others but not a property of actors in themselves (Donovan, 2014; Ernston, 2013; cf. Callon & Law, 1995). Viewing power as negotiated and relationally distributed allows one to escape the critical assumption of development as a set of practices to objectify and homogenize the worlds of its 'beneficiaries'. In the following, we provide an overview of the literature on development practices, produced largely by anthropologists, focusing on how this literature has captured the role of nonhumans (living beings, technologies, models, concepts and statements) in practices.

Path-breaking critical work on development practices was carried out by Ferguson (1990), who discusses how the national government in Lesotho, by implementing a large international development aid project, expands the scope of its bureaucratic power over its citizens. Ferguson's detailed ethnographic work shows that the building of the road to connect Thaba-Tseka district with the capital city allowed the national government to exercise stronger administrative control over the region. This outcome was rather removed from the main rationale undergirding the project i.e., the development of a commercial livestock industry in the Thaba-Tseka region. By emphasizing this rationale, according to Ferguson, the central government of Lesotho was able to represent the project and their administrative apparatus as being situated outside the realm of politics, thereby 'depoliticizing development' (see also Bebbington 2005; Büscher, 2010). A substantial literature has provided evidence to support Ferguson's idea that development (aid), instead of generating the common good it rhetorically promises, ends up producing and furthering bureaucratic control and interference in the lives of its purported 'beneficiaries' (see e.g. Scott, 1998; Anders, 2005; Gould, 2005; Yarrow, 2011). While highly influential, and largely consistent with other critiques of development coming out of the so-called post-development literature (e.g. Rahnema and Bawtree 1997; Escobar 1995), this view has also been persuasively criticized for allowing little room for the (heterogeneity of) agency of development's 'beneficiaries' beyond that of resistance (Everett 1997; Fletcher 2001; Mosse 2004).

Ferguson's pioneering work also provided an impetus to the stream of scholarship on the relationship between development discourses and actual practices on the ground in specific projects and programmes. Ferguson had argued that development policy discourse, once it is materialized into actual practice, provides a passage for accumulating power in the hands of the powerful. Such an account inevitably ends up demonstrating the domination of one group over others (Mosse 2004; Jensen and Winthereik 2013). While asymmetry in inter-group relations may

be common, the production of domination needs to be demonstrated, as indeed Ferguson does. However, in his narrative the production of domination is a straightforward process where any development models (and other discursive and material entities such as roads and administrative centres) simply play the role that the powerful desire from them. Thus, nonhumans instrumentally help some human actors gain dominance over others *in practice*.

A more nuanced examination of how development may benefit, and how it may be appropriated by, elite organizations and local populations (in different ways) is carried out by Li (1999; 2007; also see Lewis & Mosse, 2006a; Simandjuntak, 2012). Li (2007) extends the work of Ferguson (1990) and Escobar (1995) by moving beyond the domination-exploitation framework, conceptualizing governance as a hybrid process in which acquiescence (of development's beneficiaries) plays a role alongside bureaucratic control (by national and provincial development administrators). By including this heterogeneity into her analysis of practices, she is able to show how different groups of actors mobilize resources to govern, to comply and to resist. While development administrators may benefit by extending their bureaucratic control, as Ferguson argued, this does not directly imply that the 'beneficiaries' are only exploited and that there is no room left for them to tactically 'consume' development in ways that were not intended or planned by the administrators (Mosse 2004: 645-46). Such a space for beneficiaries' agency is argued by Li and Mosse to be a product of the vulnerability and fragility of policy models or bureaucratic plans in practice, which are only 'secure on paper'. However, even in this understanding of development practices, which are only partially controlled by powerful humans, nonhumans such as development models and plans are considered too weak to shape actual practices.

Other nonhumans such as houses enter Li's (1999) accounts as passive entities that sustain some humans' interests and routines. In Li's narrative about a resettlement program of the Indonesian government, houses are represented as props that can be used to support the argument that the program has failed because "the houses are left to rot or are taken over by other villagers", which was not desired or expected of the program (1999: 301). Here, Li places houses only in *relation to the program's stated objective* of delivering 'ordered' housing to 'isolated [indigenous] communities', which is then considered to have failed in achieving this objective. Such an emphasis ends up situating things such as houses (Li, 1999), and identity cards in the study carried out by Simandjuntak (2012), as governmental devices deployed by administrators to develop human 'beneficiaries'. If things play the role ascribed to them by development administrators, they are deemed successful and they make a project or program successful. And

if they do not behave as expected, the things are argued to fail and so does the project/program they are part of.

Focusing on practices of representation within development projects, Mosse (2004; 2005) argues that many actors play a role in maintaining coherent representations of a project's actual events/activities in accordance with its policy models, in terms of what the donors desire and expect to achieve, obscuring the disjuncture that exists between the representations (including policy documents and project reports) and project implementation practices (see Lewis and Mosse 2006b). The effects of donors' expectations and policy models are limited to this 'report generation' and may not influence the actual implementation of a project (Mosse, 2004; 2005).[3] The latter is instead driven by local social relations (including the patron-client type of relationships that may develop between administrators and 'beneficiaries'), by the routines of implementing organizations and by the beneficiaries' creative and tactical ways of using development. While foregrounding this local embeddedness of development practices and focusing on the production of representations, Mosse's detailed narrative does not illustrate how nonhuman material entities (such as lands and farm-inputs) play a role in shaping these representations and constituting actual implementation practices on the ground.

Mosse (2004; 2005) did emphasize the role of policy models such as participation that work as 'mobilizing metaphors', bringing not only actors with diverse interests under the umbrella of a development project but also secure the necessary development funds for implementation (also see Rottenburg 2009 on the similar role played by development plans and contracts which he calls inscriptions). Following Mosse's influential work, recent studies by Singh et al. (2014) and Pradhan and Ruysenaar (2014) have emphasized that (successful) policies work through their ability to include a heterogeneous group of actors as supporters but not necessarily by reaching their stated and desired objectives (including the desired 'best' practices). Similarly, focusing on irrigation management transfer in Mexico, Rap (2006) shows that a policy model becomes widely implemented and successful by aligning as many disparate social and material entities with it as possible. Yet, while documenting the model's promotion by powerful human actors and through the use of digital/visual means of representation (of the model's local successes), Rap does not document how materials such as irrigation canals and the water flowing through them act in affording the model to extend in space and time. Overall, in these studies as in Mosse's work, the only nonhumans endowed with the capacity to constitute (discursive) practices are policy models and statements, which are produced by authoritative human actors and whose goals and desires the models/statements instrumentally serve. Other nonhumans

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[3] It is also in this sense that the policy models are fragile in the practice of actual implementation of a project.

such as material biophysical and technological artefacts do not enter the picture as entities that actively constitute development practices.

Related work on the performativity of policy models is carried out by MacDonald and Corson (2012). They argue that a policy model or concept (in their case, 'natural capital') is true not because it represents reality accurately but rather because it contributes to the making of the reality it describes. Through their ethnographic work on The Economics of Ecosystems and Biodiversity (TEEB) project, they document how the policy ideal of natural capital formats arrangements for circulation of information about and for calculating the value of nature. However, despite promising to include material resources and technologies alongside discursive factors, their analysis falls short of documenting the material (technological or ecological) transformations produced by the policy model in question. Unlike Macdonald and Corson's study, Rottenburg's (2009) fictionalized ethnography, focusing on development practices in what he calls "interstitial spaces" that are neither the locations in which a theoretical or policy model of development originated nor places where it is implemented, documents how representations (reports, monitoring data) generated in development projects do not only describe the reality of the projects but play a (performative) role in producing a reality (see also Rottenburg 2014). This reality is created in development projects that attempt to alter the "cultural practices" of their beneficiaries in fields such as agriculture (often the landless or smallholders) and healthcare (Rottenburg 2009: xx). It is also obviously created in projects to build public infrastructures such as telecommunication networks, roads and bridges.

Other work on development policy-practice relationships has used the concept of translation from actor-network theory (ANT). Translation refers to the process of enrolling heterogeneous entities into a hybrid network in which one set of spokespersons can eventually speak on behalf of other associated entities (Callon 1986; Latour 1990; Latour 2005). Focusing on indigenous and environmentalist groups' resistance to and alliances with a multinational mining company in New Caledonia, Horowitz (2012) argues that different actors build alliances with others only to achieve their own individual goals. Although these goals may be adjusted over time, the different actors' interests may never become fully (and permanently) compatible with each other. This incompatibility may eventually result in the termination of alliances.

Veldwisch et al. (2009) and Heeks and Stanforth (2014) use the concept of translation to develop a model of power. In this model, power is defined as an outcome of a set of activities of enrolling, circulating and mobilizing other actors. Using this model of power, and viewing development projects as chains through which policy models and data are passed from 'global' to 'local' levels, they attempt to document a series of translations as political processes based not on

controlling other humans but on persuading them. However, while theoretically recognizing the importance of nonhuman action, these studies do not account for the active roles played by nonhuman materials (technological artefacts and natural entities) in the process of enrolling and persuading human actors. And while theoretically recognizing that actor-networks are collectives (that enact practices) constituted by things and humans, in their empirical narratives, these studies still only document how a network of human actors 'implements' things that themselves appear to exist outside of the network. Even in brief accounts of nonhuman action, for example in Heeks and Stanforth (2015: 45), nonhumans only work for the powerful among human actors.

Still other uses of actor-network theory focusing largely on techno-scientific practices within 'developing countries', yet largely published outside development studies, allow their bush-pumps (de Laet & Mol, 2000), mosquitoes and dams (Mitchell, 2002), cows on a dairy farm (Shepherd & Gibbs, 2006:683), roads (Dalakoglou, 2010), prepaid meters (von Schnitzler, 2008), water supplies (Anand, 2011), birds (Fearnley, 2013; Rodríguez-Giralt, 2015), cash/audit techniques (Maurer, 2012; Jensen & Winthereik, 2012; Donovan, 2013), to actively enter the frame of action as well as transform it. Here we provide a brief overview of some emblematic studies from this literature, which help us lay the foundations for our own theoretical discussion in the following section. De Laet and Mol (2000) emphasize the material flexibility of the Zimbabwe bush-pump type-B, which is easily re-designed to be adapted into different local settings. This fluidity is nurtured by the developer of the pump who abandons control over the pump's design (and use) in favour of allowing people in different settings to adjust the bush-pumps according to their needs, to the local tools at their disposal and to physical availability of water. In this process, users in different localities also develop the skills to maintain their pumps, giving rise not only to an unexpected multiplicity of Zimbabwe bush pumps but also users. In his illustration of how things may act, Mitchell (2002) studies how the project to dam the Aswan river enabled mosquitoes to jump from one region to the another. Designers (or engineers) of the project had not considered how the project might stimulate movement of mosquitoes and snails, which triggered the spread of malaria and *schistosomiasis* (a parasitic worm infection carried by an aquatic snail). In this way, Mitchell demonstrates the agency of mosquitoes and snails, alongside that of engineers and dams, and their effect on the actions of those who were affected by the diseases that spread.

More recently, Mitchell (2011) has studied how coal mines and cargo-boats, along with the miners and other workers, and technologies of oil extraction and movement from Saudi Arabia to the Mediterranean, afforded democratic struggle (strikes and revolts) in different ways due to the very materiality of their production and transportation chains. Shepherd and Gibbs

(2006) show that a model dairy farm (transferred from Australia to East Timor) is performed through elements such as lactose intolerance tests, cows, tractors, weeds, human workers and milking machines. These elements, if not adjusted to one another in specific settings, may resist acting together as a collective (Callon 2007). Furthermore, even after the elements of a collective have been adjusted to each other in one setting (e.g. an Australian rural area), its move to another spatial setting will entail newer adjustments, not only among the entities that are being moved but also with/in the local milieu that is receiving the entities. Thus the transfer of a technology is not simply an undisturbed movement from one setting to another, but rather a process involving resistance by and transformation of the entities that move and of the host entities that receive. As Shepherd and Gibbs (2006:684) document, "seeds, weeds, and cows resisted the control of humans, just as humans resisted the control of nonhumans." Obviously Shepherd and Gibbs do not claim that seeds, weeds, cows and humans resist in the same way. Instead, the nonhumans and humans contribute to acts of resistance, and any other acts for that matter, differently. In the following, rather than attempting to theoretically categorize the difference between actions of humans and nonhumans as if they belong to distinct "ontological regions" (Vandenberghe 2002: 53), we will attempt to empirically map the differences between the actions of different humans and nonhumans. Thus, our theoretical discussion below is limited to the conceptualization of distributed action, between humans and nonhumans who form hybrid collectives that act, and frictions encountered in the process of assembling the collectives that act.

CAPTURING NONHUMAN ACTION

To conceptualize the active role of things in development, following some of the studies reviewed above, we develop a relational approach to the agency of humans and nonhumans. Characterizing agency broadly as action that makes "some difference to a state of affairs" (Latour 2005: 52), we argue that it is an outcome of relations between differently-placed humans and nonhumans. Any act then is an emergent effect of relations between humans and nonhumans, and (non)human actors' "competence is deduced from their performances," (Latour 2004: 237), rather than being solely an effect of humans' intentions or their own inherent capacities (Latour, 1994). In fact, an individual human's capacity to act, and her/his intentions, are not her/his own essential attributes (as claimed for example by Vandenberghe 2002), but rather are constituted through relations with other humans and nonhumans. The latter make individual capacities and intentions possible. For example, a farmworker is only able to act, or function on the farm, with help from associated humans and nonhumans including her tools, the employment contract with the farmer, the crops she may be harvesting or the weeds she may be

removing. She, who is apparently an individual, acts as a collective and each of the entities involved in this collective (including the human worker, the tools, and the crops or weeds) participates in the action of the collective. Thus, even when it appears to be centered on an individual (e.g. a farmer, a policy-maker or even a policy model), agency is instead *distributed* across a range of human and nonhuman entities that together form hybrid collectives (Callon and Law, 1995; Callon, 2008).[4]

Action then, including the making of a development policy, is performed by a hybrid collective (Callon 2008; 2007). Policy-design hybrid collectives are often composed of calculative agencies of economists and their models as well as of other technoscientific experts and their equipment (cf. Callon and Muniesa 2005). In actual development projects where a policy is 'implemented', the hybrid collective that designed the policy may need to be moved into the location of the project. Often, however, such a transportation of entire collectives is not possible, nor may it be considered desirable (as in some community-driven development where local decision-making and control of projects is key: Mansuri and Rao 2004). Fortunately, things such as policies and models 'last longer than the interactions that formed them', and can be (partially) detached from the hybrid collectives that constituted them (Callon & Latour 1981 in Sayes 2014:137; Callon 2007). Even after detachment however, the calculative agencies that constitute an individual policy model will remain embedded in it.

In most development settings then, a policy as an entity is *translated* into a place of implementation. In our relational approach, any place of implementation is composed of hybrid collectives that are already present in 'beneficiary' communities and practices. Translation of a policy into the 'beneficiary' hybrid collectives entails adjustments of the policy (model) for it to work and to be put to work. It also entails a reconfiguration of the 'beneficiary' collectives, through a transformation of their constituent entities and the relationships between these entities (Arora et al. 2013). This reconfiguration may take place differently in different collectives that then enact a multiplicity of practices within a single project (or 'beneficiary' community), undergirded by a single policy model such as participation or self-sufficiency. Thus practices are performed differently in different beneficiary collectives (e.g. on farms, shops, and households), depending on the collectives' human and nonhuman composition.

Translation, as the reconfiguration of 'beneficiary' collectives and the parallel adjustment of policy models into them, is never a straightforward process. It is perfused with *frictions* (cf.

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[4] Recently, in an important intervention, Appadurai (2015) has conceptualized these entities as 'mediants' which are not 'whole individuals' but rather 'dividual beings'. Mediants, in interaction with each other, then constitute practices of mediation of which materiality and human subjectivities are emergent effects.

Tsing 2005), which are a result of (material) resistance by human and nonhuman entities to the courses of actions attempted, according to others' proposals, plans and expectations (cf. Latour 1988). Resistance (or recalcitrance) as a term can be replaced by a "whole collection of verbs and adjectives, tools and instruments, which together define the ways of being real. We could equally well say "curdle", "fold", "obscure", "sharpen", "slide"." (Latour 1988: 159). Resistance is then a force (of varying strengths and shapes) that changes the course of action to different degrees, depending on the entity in question and the collective in which it resists. Like all action, resistance by an entity is an emergent effect of its relations with other humans and nonhumans. In general, resistance as friction slows things down, forces changes in direction, and may eventually lead to 'failed' projects if little resemblance is achieved between the projects' stated objectives and the practices (and outcomes) that are actualized on the ground. However, as demonstrated by Mosse (2004), classification of a project as a success or a failure also depends on how the actual material practices are represented in project reports and evaluations. The production of these representations may entail their own resistances, negotiations, and thus frictions (e.g. when a beneficiary's precarious situation resists claims of purported gains delivered by a livelihoods project). Similarly, friction may also be encountered in the process of designing policies by calculative collectives, as outlined above. Thus, friction refers not only to the material resistances that govern the process of policy 'implementation', but also to the resistance encountered by project administrators in producing official representations of actual development practices in line with the policy models.

Following from above, the focus in our empirical analysis is on social-material frictions experienced in translation of policies into four different 'beneficiary' hybrid collectives involving energy crops in Indonesia.

ON THE FIELD

The narratives we present below, informed by the above framework on the role of 'things in development', is based on formal policy documents, newspaper articles and ethnographic fieldwork in Indonesia where the first author studied a government program called the Energy Self-sufficient Village (ESV) from October 2010 to May 2012. At the beginning of the fieldwork, the aim was to investigate a Jatropha biofuels ESV pilot project in Grobogan district. However, by the time of the field visit, the village cooperative running the ESV pilot project had shifted their energy crop from Jatropha to Calophyllum. In June 2011, this cooperative stopped producing biofuels altogether and chose to focus on corn for food rather than Calophyllum for biofuel. This situation left us with two options: to stay in Grobogan and investigate why they

stopped producing biofuels or to switch fieldwork location to investigate biofuel activities in Purworejo. Since our primary focus was on biofuel practices, we chose the second option.

The ethnographic work was multi-sited because we followed our informants and associated things as they moved from one place to another. For example, the Calophyllum seeds moved from the forest to the pickers' houses to a biofuel processing factory in Purworejo area, while a local entrepreneur often moved from Bantul district to Purworejo district to Jakarta (e.g. to attend a meeting with central government officials). In moving from one place to another, the aim was not simply to be as close to the informants as possible, but rather to map our informants' relations with others beyond any spatial boundaries (cf. Marcus, 1995, 1999; Hine, 2007).

The ethnographic field notes were combined with our readings of policy documents and newspaper articles to compose a narrative of multiple hybrid collectives (of humans and nonhumans) that were formed at different times, in different places. We present the formation of these collectives by narrating four different episodes of friction (encountered during translations in the reconfiguration of the collectives).

FRICTIONS IN PRACTICES

The first of the four episodes focuses on frictions between calculations led by the Ministry of Forestry to develop a non-forest crop for energy and attempts to promote non-forest crops in the field by the Ministry of Agriculture. The second episode focuses on changes in policy models of energy crop development due to resistances posed by materials or things constituting existing practices in the field. The third episode focuses on frictions due to disagreements in deciding the course of proposed and future changes in the collective calculative agency embedded in the policy models. Out of the latter, different human actors tried to strengthen their rhetoric by framing things (such as energy crops) as supportive of their own interests. The fourth episode focuses on friction between the distributed agencies of the pickers and the crop buyer due to weight change in the crop as it moved in time and space, and in deciding which scale should be used to measure the crop's weight.

Friction #1: Crop or Tree?

In preparation to meet the Parliament in February 2003, researchers affiliated to the working group of Natural Resources of the Indonesian Biodiesel Forum prepared an argumentative document. The document highlighted the Ministry of Forestry's interest on Jatropha curcas development due to the following reasons: i) the plant can be planted in marginal lands with nutrient-poor soils; ii) the plant is suitable for conservation purposes and for use as an energy

crop; iii) it is suitable for industrial forestry; and iv) its cultivation can create a multiplier effect for farmers' welfare because it has many potential by-products (e.g. inputs for making fertilizer and soap).[5] It was expected that the Ministry of Forestry will be able to take the lead in Jatropha development, providing Jatropha seeds to various stakeholders including farmers. It was also expected to develop technology to process Jatropha seeds into biodiesel. Thus, in early 2003, Jatropha was predominantly considered to fall under the jurisdiction of the Ministry of Forestry. This was agreed upon by a representative of the Indonesian Association of Forestry Businesses at the February 2003 meeting with the parliament. Jatropha was argued to belong to the realm of trees by the forestry industry.

However, once the Jatropha promotion work gained some momentum in 2006, most Jatropha-related research and pilot projects in villages on Jatropha curcas were undertaken by the Ministry of Agriculture. In that year, the President issues his Instruction Number 1/2006 that mandated the Ministry of Agriculture to support the provision of seeds and seedlings of energy crops (to farmers). The Ministry of Forestry was to only manage the permissions to use non-productive forest lands for biofuel plantations. The Ministry of Agriculture translated the mandate by planting Jatropha nurseries in 14 provinces and by introducing a new variety of Jatropha. Further, they promoted Jatropha as a plantation crop that could be cultivated together with rubber, vanilla, cacao, coffee and pepper (BPTP Lampung, 2009). Meanwhile, Ministry of Forestry shifted its research to a new energy crop that was classified as a tree, called Calophyllum inophyllum. The Ministry's association with the tree had started in the 1950s when they planted Calophyllum along the southern part of coastal Java as a windbreaker (Bustomi et al., 2010). This association put the Ministry of Forestry in a stronger position than the Ministry of Agriculture, in relation to Calophyllum.

Thus the Presidential Instruction (1/2006) led the Ministry of Forestry to dissociate from Jatropha and, at the same time, associate with Calophyllum. The Instruction thus helped constitute two different hybrid collectives, in which materiality of the biofuel feedstock played an important role: Jatropha's material characteristic of a bush that can be cultivated as a plantation crop allowed it to join the Ministry of Agriculture's collective, while Calophyllum's as a tree that grows in forested areas allowed it to become a part of the Ministry of Forestry's collective. These two collectives were supported by the Ministry of Energy and Mineral Resources and the Coordinating Ministry of Economic Affairs, which cooperated with the Ministry of Agriculture to develop Jatropha in 24 provinces in the Energy Self-sufficient Village (ESV) program and

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[5] Document of the preparation materials for hearing with the Parliament (Indonesian Biodiesel Forum, 2003).

with the Ministry of Forestry to develop Calophyllum inophyllum in two provinces. The Ministry of Forestry collective was joined by Trakon, a manufacturing company, to develop a biofuel processing unit.

In this episode, friction in the process of formation of the Ministry of Forestry's hybrid collective around Jatropha was driven by the plant's materiality as a 'bush'. This 'bush' resisted its classification by the forestry industry as a type of tree, and thus reshaped the direction of the expected course of action for the Ministry of Forestry. This Ministry eventually did not develop a Jatropha programme. Instead it focused on Calophyllum. On the other hand, Jatropha's materiality as a 'bush' and a suitable plantation crop afforded the formation of a hybrid collective centered around the Ministry of Agriculture. This hybrid collective (composed of Jatropha plants, local government departments, farmers, firms and processing machinery etc.) was also co-constituted by a Presidential Instruction and by various other Ministries, allowing the Ministry of Agriculture to mobilize a wide range of support to develop Jatropha. The development of the Ministry of Agriculture's hybrid collective forced the Ministry of Forestry to search for and develop their collective around an alternative crop that is publicly categorized as a forest tree. Thus, in this episode, frictions manifested not just in the formation/continuation of this latter collective but also in the form of competition for resources, such as Presidential endorsement and wider governmental support, between two different collectives that were assembling at the same time.

Friction #2: National versus Local Calculations

In 2008, the Ministry of Forestry published a book titled 'Calophyllum as biofuel source' in which it argued that Calophyllum was suitable for biofuel production because it: a) is widely available in Indonesia; b) is easily planted; c) has a higher yield (20 ton per hectare per year) than Jatropha (five ton per hectare per year) and oil palm (six ton per hectare per year); d) does not compete with food. In addition, most parts of the Calophyllum tree have economic value and the trees can simultaneously serve other functions such as wind breaker in coastal areas. This book transformed the materiality of Calophyllum into numbers (e.g. based on yield calculations), and then into a business model for pilot projects in three villages, one each in Kebumen, Banyuwangi, and Purworejo districts. These districts were selected by the government due to existing Calophyllum vegetation in the areas. The business model posited that four kilograms of Calophyllum fruit can produce one liter of biofuel and that Calophyllum fruit can be harvested three times per year and sold at 1100 IDR per kilogram (FORDA, 2008). Based on these calculations, each ESV pilot project aimed to provide additional income to the rural poor through the collection and sale of wet Calophyllum fruit.

To understand the business model's translation into actual (material) practices, we focus on the pilot project in Purworejo district (Patutrejo village). According to a local farmer, this process began in earnest when the firm Trakon entered the village in 2008 to install biofuel processing machines, approaching her (and other villagers) to collect Calophyllum fruit. This installation of biofuel processing machine, together with preparation of seedbeds and planting of Calophyllum, as well as the provision of technical training to farmers so they can operate the machine, was funded by the national budget of the Ministry of Energy and Mineral Resources.

The Minister of Forestry Zulkifli Hasan visited Purworejo in 2009 to formally open the biofuel processing unit and to legally hand over the ownership of the unit to a village cooperative. During the opening ceremony, Hasan said that success or failure of these pilot projects, in Purworejo, Kebumen and Banyuwangi would be used to decide whether the same business model should be replicated in other villages or not. He said that his ministry would assess whether this project is economically profitable for farmers. However, he also made it clear that "economic calculations" aside, his government wanted "to introduce energy crops due to the limited availability of fossil fuels."[6]

In a national ESV meeting held on May 5th (2010) in Makassar, the head of Agricultural and Forestry Office of Purworejo described their involvement in Calophyllum ESV project since 2009 when, together with *Wana Lestari*, a village forestry cooperative, they planted 2000 Calophyllum trunks on common land (*tanah bengkok*) and on an area of around fifty hectares that was used for mining in the past. When they evaluated the state of these trees in March 2010, they found that 90.92 per cent of the trees had grown as expected (Sumarno, 2010). However, instead of producing 1 liter of biodiesel from 4 kilograms of Calophyllum fruit, as the national calculations (and their business model) had predicted, they only managed to produce 60 liters of biodiesel from 750 kilograms Calophyllum fruits in Purworejo i.e., 1 liter from 12.5 kilograms of the fruit. Due to this resistance by Calophyllum fruits against national calculations (and the course of action planned on the basis of these calculations), and perhaps by biofuel production machinery and chemicals which also did not work as expected, the ESV program in Purworejo ended up abandoning biofuel production for a year. Despite these frictions, the ESV project was still considered as a *success* by the national government: "the project had met its physical target by installing machines, planting Calophyllum and implementing in the training." (Uripno, 2015:51).

The disjuncture between the national government's assessment (as a success) and the frictions experienced at the local level (and the one-year hiatus) in the project led to calls for

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[6] Kompas, December 9th, 2009. "Mencoba Nyamplung di Tiga Desa."

renewal. A senior official in Purworejo's Forestry and Agriculture Office tried to revive the biofuel production unit by seeking help from an entrepreneur from Yogyakarta. The senior official's cooperation with the entrepreneur stimulated the emergence of a new hybrid collective that was successful in mobilizing political support from local organizations including a Watershed Management Center, the State Owned Forestry Enterprise (Perhutani) and the NGO Relung. In December 2011, a working group for Non-Timber Forest Products was established, involving the actors mentioned above, which formed the basis for the assembly of a new collective for local Calophyllum development in Purworejo.

While the original ESV collective under village cooperative's (*Wana Lestari*) management focused on implementing the national Ministry of Forestry's business model, the new collective around the entrepreneur envisaged a future for Calophyllum oil in the non-energy market. The entrepreneur brought in new machines and two of his trusted workers from Yogyakarta to Purworejo. He reorganized the management structure of the ESV cooperative by making *Sinar Bhineka*, the entrepreneur's firm, a shareholder. As an active shareholder, *Sinar Bhineka* became responsible for funding biofuel activities in Purworejo. According to the entrepreneur and a worker of the ESV cooperative, regular demand was expected from *batik* producers who used Calophyllum oil to dye their fabrics. This demand, however, turned out to be insufficient for maintaining the continuity of the ESV cooperative since the *batik* producers needed only about 75 liters per month while the ESV's production capacity was 100 liters per day. Here the friction encountered by the entrepreneur's planned course of action does not appear to be generated by resistance from a human or nonhuman entity (or even from the practice of *batik* production) but rather it may be argued to be an outcome of miscalculation (overestimate) of market demand by the entrepreneur's hybrid collective. To extend this point beyond this particular case, one may argue that many, if not all, instances of material resistance/friction are simply a consequence of wrong calculations, bad business models, and misguided plans. We address this important caveat concerning the validity of our frictional narratives in subsequent sections of the article.

To utilize their production capacity of 100 liters per day, the ESV cooperative, through *Sinar Bhineka*, tried to expand the Calophyllum market. In March 2012, they conducted a Road Test where they used Calophyllum diesel to fuel three cars for a 730 kilometer journey through Purworejo, Kebumen, Cilacap, Semarang and Yogyakarta. In Purworejo, Kebumen and Cilacap districts, large ceremonies (attended by high-ranking district officials) were organized to welcome the Calophyllum Road Test team. This Road Test was financially supported by State-owned Perhutani. Support for the Road Test from local governments and mass media publicity definitely played in a role in the forestry research and development agency's decision to buy all

Calophyllum oil produced by the ESV cooperative for three months. The agency also then demanded Calophyllum seeds from other areas in Java.[7]

In this episode, the first friction was encountered when, by yielding less than a third of the oil promised by the central government's calculations, Calophyllum fruits resisted the calculative agency and the course of action planned by the government and its advisory experts. This friction encountered at the local level, in combination with the pressure to implement a 'successful' project, led to the mobilization of a new hybrid collective centered around an entrepreneur from Yogyakarta, who in turn added his own machines and operators to the biofuel processing machines provided by the government. While this addition succeeded in increasing the productivity of the biofuel processing unit, the demand for the Calophyllum from the newly included non-energy buyers remained low at about 75 liters per month, posing a significant challenge to the designed 100 liters per day production capacity of the ESV. Was this a case of friction by non-energy buyers or simply the result of a miscalculation by the entrepreneur's hybrid collective? In any case, attempts were made to address the issue of low demand by organizing the material spectacle of a high-profile Road Test.

Friction #3: Resistance in Representing Things

Calophyllum trees were first planted by the Purworejo forestry department in 1950 along the coastal line of the district, covering an area of 10.6 hectares. By breaking sea winds, these trees enabled local farmers to plant corn, chili, papaya and wet paddy at around 100 meters from the sea, which was initially impossible due to the high wind speed. This program continued until 1980 by when Calophyllum trees had spread to an area of more than 135 hectares (Bustomi et al., 2010).

Under the ESV program to develop biofuels between 2008 and 2012, the humans constituting Purworejo's local Calophyllum collective were primarily local farmers and the forestry agencies (Perhutani and Forestry Research and Development Agency or FORDA). In 2012, when *Sinar Bhineka* (the Yogyakarta entrepreneur's firm) joined this collective, it started monitoring Calophyllum pickers by hiring a supervisor whose function was to ensure that the pickers sell Calophyllum fruits only to the ESV cooperative (even if the price offered was low). The entrepreneur deployed the argument that since the fruits came from the government's forest, these fruits should be used exclusively to support the government's ESV program. This argument was resisted by Perhutani (the state-owned forestry corporation), which was supporting Calophyllum for biofuels as part of its corporate social responsibility program.

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[7]http://regional.kompas.com/read/2012/03/05/21221878/Purworejo.Produksi.6.000.Liter.Biodiesel.Nyamplung (accessed 10/25/2013)

According to Perhutani, the pickers should be allowed to sell the fruits to any buyer who offers them a high price, and enables them to make a good profit. Villagers expressed a similar expectation and thus intensified the friction between Perhutani and the entrepreneur.

As scientists became involved in testing Calophyllum, they turned the materiality of Calophyllum into numerical measures of its density, viscosity, fogging point, acid number, phosphorus content and others. The scientists' practice (their method and the materials used in their laboratories) created Calophyllum numbers that were translated out of the laboratories and into policy documents. This translation obviously did not carry over the scientists' entire hybrid collective (including their controlled laboratory conditions and testing materials) into government offices. Yet through the travelling numbers, as they became embedded in public policies and business models, and as the policies and models were implemented, the scientists' calculations were confronted with other entities in the field. These entities such as trees, farmers and fruits resisted or were not able to confirm the validity (or accuracy) of the numbers presented by the scientists' calculation. In other words, the scientists' representations of the Calophyllum trees and the farmers' labour, as producers of harvestable fruits 3 times a year, were effectively resisted: harvests were never done more than twice a year and even that was heavily dependent on the length of the rainy season. As one operator of a local biofuel processing unit explained, "in rainy season, Calophyllum fruit does not ripen, falling from the tree without becoming ripe. Only in the dry season do we get good Calophyllum fruits. Additionally, to get good oil, we still have to filter the dry season fruit by putting it in water, picking the ones that sink."

The scientists' calculations on the oil content of Calophyllum, as discussed in the previous section, which underlie the national government's ESV project, were performed by isolating causality between the Calophyllum fruit and the oil yielded in a controlled environment. Obviously the calculations confront a differently (and perhaps less effectively) controlled environment during actual projects in the field. In this sense then, the reality of actual projects is underdetermined by the scientists' calculations (or any other calculations for that matter which may undergird policies and business models). Thus, it is not that the scientists' calculations were wrong, but rather they were a valid product of their controlled (laboratory) environment, or their hybrid collective, within the bounds of which reality could be effectively tamed and accurately represented (cf. Stengers 2010). Their truth in this sense was true only in its own hybrid collective.

Inside actual projects, during implementation in local hybrid collectives, one may argue that other entities such as rains and fruits play more diverse roles (as demonstrated by the

explanation of the biofuel processing unit operator above) than they are permitted inside the scientists' laboratory. Even though this qualitative diversity of entities' actions is subject to attempted control or management by the projects' administrators, the entities often manage to resist this control in practice and produce what we are documenting here as frictions.

Friction #4: The Weight Change Problem

The manufacturing firm Trakon's entry into Purworejo's ESV project in 2007-8 afforded the emergence of a hybrid collective involving Trakon and the local farmer-pickers of Calophyllum. We narrate the frictions in this episode by following Lasiyah, a farmer-picker. In joining this new collective, Lasiyah cycled around 10 kilometers every day during harvest time of Calophyllum from her house to the forest to pick fruits. She picked the fruits that had fallen to the ground between tall grass, bushes and trees. During the harvest season, she could collect up to 100 kilograms per day (in seven hours), leading to a daily income of about 100000 IDR. This activity of picking Calophyllum and receiving sporadic income from selling it lasted for two years until the end of 2009 when Trakon decided to end its operations in Purworejo and the Ministry of Forestry handed the biofuel processing unit to *Wana Lestari* (the local village cooperative). Until Trakon's departure, which may be viewed as the first friction encountered by the course of action for Lasiyah's Calophyllum activities, she had sold 15 tons of Calophyllum fruits for 1000 to 1200 IDR per kilogram.

A reconfigured collective for Lasiyah's work emerged in early 2010 when the Yogyakarta entrepreneur started to buy Calophyllum fruits from her. When not collecting Calophyllum, Lasiyah often worked as a labourer on others' farms. Her primary job was working in the paddy fields where she led a group of seven labourers, most of whom were male. By working in the paddy field, she would receive 90000 IDR per day. Even though collecting Calophyllum fruit was more profitable than working in the paddy field, she considered working in paddy field easier since it was finished in the field and she did not need to bring work home. For Calophyllum, she had to collect the fruits, put them in sacks, bring them home and wait until the fruits were picked up by the buyer. Fortunately, between 2010 and 2011, the entrepreneur gave her money in advance for the Calophyllum and agreed to take the fruits even when they were wet. The main reason why she became involved in picking Calophyllum was the gap in the paddy cultivation cycle during which she had to look for alternative jobs.

In early 2012, the entrepreneur reduced his involvement in the ESV cooperative by handing the responsibility of buying Calophyllum fruit to Agus, the operator of the local biofuel processing unit. This change produced another friction for Lasiyah because Agus had to reduce the price for Calophyllum fruit from 1000 IDR to 700 IDR. He also decided to buy fruit that

was dry rather than wet. In March 2012, Lasiyah told us that picking and collecting Calophyllum was no longer attractive for her and her colleagues. In her most recent transaction, she had lost 800000 IDR due to weight loss of Calophyllum fruits during post-harvest storage stage. In addition to collecting fruit herself, she had also bought some wet Calophyllum fruit from her neighbors for 500 IDR per kilogram and sold it as dry fruit for 700 IDR. She had expected to make a small profit from her work of storing and drying the wet fruit, but the dried fruit weighed only about half of its wet counterpart. In addition, the issue of weight became a source of conflict between her and Agus because they were using different weighing scales. Lasiyah's loss was made worse when Agus asked her to bring the fruits to the site of the biofuel processing unit rather than picking up the fruits from her home. These re-arrangements made her profit much smaller than the one she used to get from Trakon and from the entrepreneur, and forced her to re-evaluate her involvement in the ESV project.

Another local picker, Barman (an adult male) had also stopped collecting Calophyllum after Agus took over the Calophyllum ESV management. In fact, during the last fieldwork trip in March 2012, we observed that most people who still picked Calophyllum were either women or children. According to Lasiyah, this composition was a result of a division of labor between women and men, according to which women mostly dealt with small or unused land and men mostly worked in paddy fields. Lasiyah was an exception to this since she had lost her husband.

In this episode, frictions emerged due to the departure of human actors, changes in 'weight' of Calophyllum fruits in storage as the fruits were drying, and the use of different weighing scales. The pickers and the buyers/operators of the biofuel processing unit had not predicted the extent of weight loss during storage and had not standardized the weighing scales. Thus the relationships between pickers and buyers were mediated through nonhumans such as the weighing scale and through methods for deciding the right time and the right product (wet or dried Calophyllum fruit) for the transaction.

CONCLUSIONS

The aim of this article was to identify useful ways to account for how nonhuman (material) entities actively shape development practices. In order to realize this goal, we proposed to revise the notion of agency by viewing it not as the capacity of a human being to change a state of affairs, but rather as an effect of actors' relations with each other. Thus, the agency of a human being or of a nonhuman is distributed across a hybrid collective. A hybrid collective is (re)configured through translation, a process through which any new (calculative) entity such as a policy/model is adjusted into an existing collective, trans-forming existing practices. Adapting

the concept of friction from Tsing (2005) we argued, and attempted to demonstrate using four empirical episodes of transforming hybrid collectives, that translation processes encounter resistances posed by human and nonhuman entities.

From the episodes of friction, we can identify four ways in which nonhuman entities resist, always afforded by their relations with significant others, and (re)shape development practices. Our listing of the four ways is not exhaustive and other ways could definitely be identified through further research on the role of nonhumans in development practices. Additionally, while we do not discriminate between nonhumans' distinctive agency (resistance/friction) according to their general classification as plants, animals, models, tools or technologies (preferring not to classify diverse nonhuman agency according to these prior categories), such an examination may be a productive avenue for future research.

A. *Nonhumans resist representations (e.g. calculations embedded in policies and models)*. In the second episode narrated above, Calophyllum fruits and biofuel processing machines (by yielding less than a third of the predicted oil output) resisted the calculations embedded inside the national government's policy and the Energy Self-sufficient Village (ESV) business model. Through this resistance, they forced a one-year hiatus in oil production in Purworejo and eventually led to new local calculations by an emerging constellation of actors involving an entrepreneur (and his workers and machines) and forestry agencies, which gave rise to new local business models for the ESV.

B. *Nonhumans redirect action*. Nonhumans did not only resist their representation in official calculations and categories, they also redirected action by affording a hiatus in oil production and by forcing new local calculations. Similarly, in the first episode about the friction between two Indonesian Ministries, materiality of vegetation shaping their categorization as plants or trees played a role in redirecting development practices. Thus, this entanglement between material entities, their classification (that may be treated as a nonhuman entity in itself), and rules for division of labor between Indonesian ministries led to a redirection of action by the Ministry of Forestry (toward a focus on Calophyllum inophyllum instead of Jatropha curcas).

C. *Nonhumans change (as they travel) over time and space*. In the final episode, Calophyllum fruits' material texture reacted to the passage of time and to movement between two different weighing scales, creating a disagreement between the pickers and the Calophyllum buyers. Some pickers stopped engaging in Calophyllum collection practices as a result of this disagreement. This illustration highlights the significance of changes in nonhumans as they move in time and/or space for re-directing practices. This is consistent with our conceptual framework on

translation, according to which the arrival of a new or changed entity reconfigures existing collectives and transforms the practices enacted by these collectives.

D. *Nonhumans mediate competition for resources.* In episode 1, we documented how the materiality of biodiesel feedstock as a short bush or tall tree influenced the flow of resources to different Ministries, mediating competition between them for the national government's biofuel development resources. The Ministry of Forestry had to abandon its Jatropha curcas activities, which were taken over by the Ministry of Agriculture. The latter Ministry ended up gaining more resources than the former, for biodiesel development from various other national ministries. Thus Jatropha curcas, due to its very materiality as a plant rather than a tree, no doubt afforded by a range of other actors including designers and enactors of botanical classification systems, mediated the competition between the two Ministries.

Returning to the caveat discussed in episodes 2 and 3, we must ask if the cases of friction based on resistance afforded by nonhumans (and humans) are simply consequences of prior miscalculation by actors who misrepresented nonhumans and devised badly planned courses of actions (for others and themselves). Taking the issue of categorization, for instance, by treating a short bush or plantation crop to fall under its jurisdiction, did the Ministry of Forestry not simply make a mistake? Obviously, in hindsight, it is easy to conclude that the Ministry backed the wrong horse and, in this sense, it made a mistake (even some Ministry officials might accept this), but this would be an oversimplification even if the responsibility of such a 'mistake' is distributed among all the actors that constituted the Ministry's policy. More importantly, however, perhaps the 'mistake' was not based on miscalculations by scientists, policymakers or project administrators. Instead, the calculations may have been *true*, not in all situations and under all conditions, but only in the hybrid collectives that constructed them. These hybrid collectives may be found in the form of social and material relations that constitute scientific facts, economists' calculations, policymakers' proposals, entrepreneurs' strategies or farmers' plans. And each collective may be a maker of its own distinctive and partial truth that may no longer be true outside the collective in question, even when universal validity of the truth is proclaimed. In fact, due to this bounded validity, the truth's entry into other collectives, and the resultant course(s) of action, may be resisted by entities populating the other collectives. And this resistance may continue until the quest for applying the truth is abandoned in the other collectives, or the truth is adjusted (as are the collectives themselves) for achieving new validity.

Overall, the four episodes of friction demonstrate that *nonhumans make and unmake domination in practice*. The various frictions also demonstrate how the Calophyllum Energy Self-Sufficient Village (ESV) project of the national government failed to meet its stated objective.

Many different human and nonhuman actors (machines, chemicals, oil-bearing fruits, weighing scales etc.) in the field, introduced by the central government to support its biofuel policy and business model, failed to act as pliant objects that act in collaboration with the government's plans and expectations. Instead the objects resisted, their resistance always afforded by relations with other nonhumans and humans, working to unmake the government's domination and control over local actors. Yet the same nonhumans (alongside new ones ushered in from Yogyakarta) later enrolled by the entrepreneur (and his company), and therefore afforded by a different set of relations than in the government's hybrid collective, facilitated his temporary domination of Purworejo district's ESV.

In drawing attention to this relationally-situated activity of nonhumans, in addition to calling for future research into the effects of relations between humans and nonhumans, we hope to draw the attention to the politics of spokespersons who (can) speak the truth on behalf of nonhumans. We aim to raise the question: how do we proliferate these voices beyond the monopoly held by scientists, engineers and other experts (as the 'traditional' spokespersons of things: cf. Sayes 2014). Broadening the ambit of reliable spokespersons to include actors such as small farmers, entrepreneurs, NGO representatives and other ordinary people may be crucial for democratizing and pluralizing development discourses and practices. And this democratic pluralism of 'expert' yet ordinary voices may be essential for articulating and enacting genuinely empowering transformations.

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