HUMAN-MEDIATED WORLD: UNDERSTANDING JATROPHA DEVELOPMENT IN INDONESIA

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ABSTRACT

This paper uses Actor-Network Theory (ANT) to understand the relation between farmers and nature by seeing how this shapes their participation in agricultural initiatives. Using Jatropha development in indonesia as focus, this paper show that actants' relation with nature is mediated through different. Sometimes conflicting, paths. In building the argument, this paper use a historical narrative started from Jatropha research in the laboratory in 2002 up to foreign investment after 2008. This paper identifies three period of Jatropha development in Indonesia in which its classification are based on its actors. Additionally, this paper identifies two type of substituation called *function-oriented* and *actant-oriented* determining the network durability.

Keywords: *actant, durability, function, Jatropha, nature*

Introduction

During the last couple of years, the trem of green innovation has become a buzzword attracted policy makers, scolars and entrepreneurs to invlove in the development. While the idea of living in harmony with nature was not being debated, it implementations created new controversies. Kyoto Protocol targets to reduce green house gassed (GHGs) for example , have stimulated many countries to put ambitious targets for biomass utilization (Faaij & Domac, 2006). Supported with various incentive mechanisms, world ethanol productions soared from 20 to 50 billion liters from 2001 to 2007, while world bio-diesel production increased from 0,8 to almost 4 billion liters (Bindraband *et al.*, 2009). The massive activities seems to be on the right track until recent researches show that biofuel development raise new environmental and social problesm i.e. danielsen *et al.* (2008) on rainforest conversion to energy crops, Martinelli & Filoso (2008) on soil degeradation from sugarcane plantation, and Bindraban *et al.* (2009) on food crisis.

The problems above stimulate the development of bio-fuel's second generation claimed as environmentally friendly, can be

planted in waste land, and have many derivative product (Naik *et al.*, 2010). As new invention, however, the research of the second generation was still under development especially in reducing the cost of conversion (Naik *et al.*, 2010). Achtent *et al.* (2007) highlighted the risk of the becoming interest on Jatropha. They argued that although the preliminary calculations of lifecycle energy and greenhouse gas (GHG) balances are positive; the GHG balance is highly determined by type of land, transportation cost, and vegetative stucture.

Both transitions, fossil fuel to bio-fuel and first generation to the second, were preceded by expectation of an ideal world. On the other hand, it creates dissppointment due to over-calculation on nature. Geels & Smit (2000) explained the over-calculation as part 'to attract attention from (financial) sponsors, to stimulate agenda-setting processes (both technical and political) and to build "protected spaces" (p.882)'. In Kyoto Protocol case, expectation to educe GHG succeeded in attracting various actors and stimulated bio-fuel development. The protected occurred in the from of various incentives so the new invention does not have to compete directy in the existing market. Similar pattern occurred in development of the second generation, especially which take Jatropha as energy source.

In India Vision 2020, the Planning Commission of India Government placed Jatropha as seeds which contain up to 35 per cent oil, can be blended in diesel motor fuels up to 15 per cent, cultivation of 10 million hectares could generate 7.5 million tons of fuel annualy, and generate year-round employment for 5 million people (India, 2002). Indonesia which visited India in 2005 for studying its experience in developing Jatropha also put high expectation on the crop. In Decleration on Poverty Alleviation and Solving Energy Crisis signed by various stakeholders, Jatropha plantation was expected to solve poverty and energy crisis. The declaration was followed by number of formal regulation and projects to develop Jatropha. Implementation of Jatropha's projects, however, show many failure stories (Amir *et al.*, 2008; Fatimah, 2010).

This paper thus aims to understand how actors' expectation shape man and nature relationship in the context of Jatropha development in Indonesia. In assessing the relationship, I built the analytical tool from actor-network theory (ANT) with elaboration from studies on expectation. The analytical framework is presented in Section 2. Section 3 presents the historical narrative of Jatropha development in Indonesia using the concept of translation. This section is divided into three part where the first foccuses on translation from the policy makers to intermediary agencies, and the last foccuses on the translation from intermediary agencies to farmers.

Section 4 applies the analytical framework to the case presented in section 3. In this section, I focus on the different trajectories amang related-actors and how it affects the durability of Jatropha development. In this section, I argue that nature capabilities are re-defined through different mediators. Section 5 is the concluding remarks where I make reflection on how transparency becomes the dominating concept in preserving nature.

Behind The Expectations

In this paper, I use expectation as an entry point to elaborate the case studies. Konrad (2006) described expectation as creating necessary momentum for coordinating heterogeneous actors, on one hand, and threat actors' credibility when hype-cycles turn into disappointment, on the other hand. This dilemma raises question on actors' motivation and risk calculation through thei involvement in the transition processes.

Calculation

In calculating risk, Van Lente (2000) saw expectations as the dynamic of promise and requirement (in Borup *et al.*, 2006). When actor Y said 'I will do X', then other actors can calculate thei reaction by taking into account 'Y relation to X'. Calculating others' reaction thus

can reduce unexpected result. Borup *et al.*, (2006), however, argued that 'pronouncing an expectation does not necessarily create accountability, but do prompt responses and the expectatyion that the enunciator should justify their future-oriented claim (p 289)'. Additionally, expectation's accountability can be increased through shared space involving legitimation and materual embodiment (Borup *et al.*, 2006).

The relation between accountability and legitimination might be true if all actors not only know the others' expectation, but also know how the expectation may shape the actor's reaction. Cultural biases, beliefs, hopes, and fears are some pitfalls in calculating actors' expectation (Geels & Smit, 2000). Taking non-human actor as example, the whole calculation might collapse if newer research show an opposite result from the previous. In this case, other actor failed to calculate the culture of scientific actants. Knorr-Cetina (1999) described this dynamic as negative knowledge, 'knowledge of the limits of knowing, of the mistakes we make in trying to know , of the things that interfere our knowing, of what we are not interested in and do not really want to know (p.64)'. adding cultural and belief to the calculation, actor's accountability in doing something is not only resulted from her/his word or representation (for non-human actor) bt also from his/her/it culture and beliefs. These addition may increace the level of certainty in calculating and predicting other reaction. On the other hand, it might lead to incalculability since actors' preferenced overflowall the time.

Closure

In order to be framed and develop the space of calculability, Callon (1998) argued that the actant need to be identified and measured. The measuring process can be divided into three steps as follows (Callon & Muniesa, 2005:1231):

First, in order to be calculated, the entities taken into account have to be detached [...] *Second*, the entities considered (taken 'into account') are associated with one another and subjected to manipulations and transformations [...] A third step is necessary to obtain an accomplished calculation: a result has to be extracted (italics author; see Fig. 1).

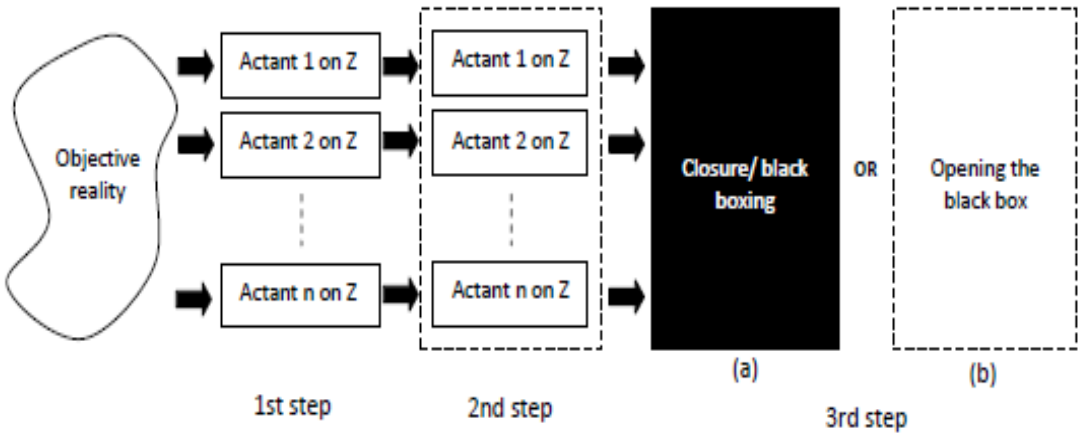

Figure 1. Three steps of (no) calculation process (author)

State where a result *can* be extracted is called closure (3 (a) in Fig. 1). Misa (1992) described this as condition where 'facts or artefacts in a provisional state characterized by controversy are moulded into a stable state characterized by consensus (p. 109)'.

In 'hot' situations, however, Callon (1998) argued that the actants cannot be calculated due to fluctuation of actors' identities (3 (b) in Fig.

1). Entanglement between facts and values lead to what Rip and Callon called 'hybrid forums' in which actants' overflows continuously (in Callon, 1998). Applying the argument above to bio-fuel development at the international level, Kyoto protocol targeted to reduce GHG emission can be seen as a way to *detach* certain actor with certain roles i.e. through protocol ratification (1st step).

The actants then are *associated with one another and become the subject of transformation* through translation from reducing GHG to biofuel development (2nd step). FAO (2008) noted that the second factor underlying biofuel policies, after securing energy supplies, is the increasing concern about 'human-induced climate change (p.26)'. In the second step, the actants are associated with biofuel market (Z in Fig. 1) which is constructed through list of possible states, hierarchy and rank of the possible states, and description of the required actions to reach each possible state (Callon, 1998).

Result of the transformation can be *extracted* through biofuel market (3rd step). However, when new controversies emerge i.e. food crisis, soil degradation, CO2 emission due to land conversion, the initial list of possible states and description of the required actions are no longer visible (non-calculable). This situation leads to transition state where the initial calculation is no longer valid, but still needed in certain degree as base to act. Beside practical issues, Levi (1997) highlighted (path) dependency that once an actant 'has started down a track, the costs of reversal are very high (in Rakhmanto, 2009:24)'. In explaining the reversal costs, Vergne and Durand (2010) saw path dependency as a property of stochastic process and causes lock-in in the absence of exogenous shock.

Actors and Intermediaries

Argument of an exogenous shock thus raise question on where does the shock come from? What is the shock relation with 'indigenous' actants? Borrowing vocabulary from economics, exogenous actants can be seen as *externality*, the absence of any incentive for actor who does the calculation (Callon, 1998). Drawing illustration from climate change discourse, (certain) companies' position to exclude GHG emission from the cost calculation may turn to create additional costs due to bad publication. In this sense, externality is not something disconnected with the companies' (or actors') network instead of something excluded by choice.

Capacities to include certain actants into the calculation and exclude the others lead to the concept of actors and intermediaries. Callon (1991) described actor as actant that put intermediary into circulation and intermediary as 'anything passing between actors which defines the relationship between them (p. 134)'. Actor can be seen as an author writing how the characters (intermediaries) should interact. Through the dynamic between actors and intermediaries, inclusion and exclusion are not only seen as an individual choice but also by taking into account the actor capabilities to circulate others.

In the context of expectation, however, the authorship becomes problematic. Brown and Kraft (2006) highlighted multi-authorship, agency's complexity, and absence of 'first causes' as elements that make expectation path to future-oriented action hard to be traced. In explaining the last point, they saw the causes as 'long and complex prefiguring of expectations through events, practices, statements and promises stretching through time (p. 324).'

Cycles of Accumulation

Latour (1987) systemized the long and complex prefiguring of expectations through the concept called cycles of accumulation. This concept has the closest meaning with what non-ANT scholars called structure or institutions. The construction of cycles of accumulation started when an actant starts to circulate her expectation to others. If she is able to attract other to meet her expectation, than the cycles of accumulation become stronger. Stability of the cycles of accumulation thus is determined by the relation among actors. In this sense, expectations' embodiment, whether in the form

of sound, text, machines, skill, and number of intermediaries involved become matter.

Callon (1991) argued that there are two things determined the irreversibility degree of cycles of accumulation[1] (p. 150): (i) the extent to which it is subsequently impossible to go back to a point where the translation was only one amongst others; and (ii) the extent to which it shapes and determines subsequent translations.

To increase the degree of impossibility to go back, Latour (1987) offered to harden the fact through accommodation, incorporation, negotiation, and adoption. Those translations aim to strengthening the rhetoric and attract more and more actors. However, since it involves non humans' actor, the translation may have limitations such as negotiation on CO2 versus the fact of CO2 emission, land availability for food versus fuel. Through more negotiations it is possible to reach agreement among countries. Meanwhile, the earth has to wait. For biofuel development, fact on non human actors called soil, energy crops, and chemicals are being negotiated through intensive researches to 'manipulate' the existing performance of the nature. This type of negotiation, however, is time consuming and has no predicted result.

[1] Callon used the word translation

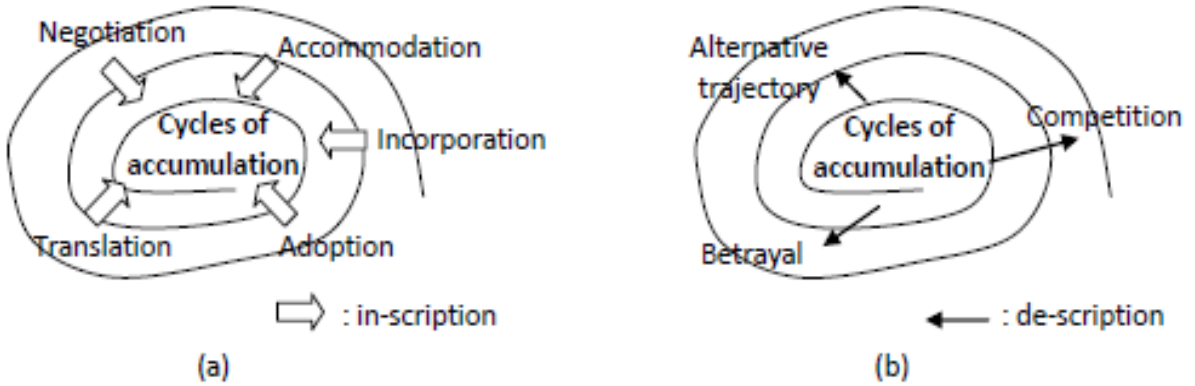

Figure 2. (a) Hardening the facts; (b) Softening the facts

In creating network consisted of human and non human actor, Callon (2009) offered three stages of translation. The first is reduction of the big world (macrocosm) to the small world. In this stage, actor defines the nature of the problem. The second stage is the formation and setting of a restricted group, 'relying on a strong concentration of instruments and abilities, devises and explores simplified objects (p. 48)'. In this stage, the actor construct some scenarios on how the problem can be solved with involvement of other actors i.e. through simulations, models, calculations, road map. The third stage is returning to the big world. In the last stage, the models and calculation is being materialized through more actors' involvement.

Jatropha Development in Indonesia

To provide adequate materials to see how the concepts above can be applied, this section presents a narration of Jatropha development in Indonesia. In constructing the narration, I follow what Latour (2005) called *in medias res*, begin in the middle of things. The entry point is thus everywhere although each tracing may lead to a different narration. To reduce the serendipity effect of this approach, I use different data sources such as direct observation, in-depth interviews, documentations and archival records.

From Scientists to Policy Makers

Jatropha's scientists' intersections with the policy makers had been started since 2002. At that moment, scientists from universities, government research agencies, private companies, non- government organizations (NGOs), and automotive association formed Indonesian Biodiesel Forum (IBF). In IBF's fifth meeting on August 2002, representative from National Atomic Energy Agency (BATAN), a non departmental government institution which coordinated under the Ministry for Research and Technology, presented BATAN's research on the improvement of Jatropha genetic through nuclear radiation. He was hoping that the policy makers can establish a standard for Jatropha oil as base for the genetic engineering.

In the same meeting, representative from Forestry Agency expressed his support to develop Jatropha. He argued that the crop was non-edible so it won't compete with food crops, can be cultivated in dry area and marginal land, supported forest conservation, and gave economic activities to the local communities. This argument was followed by action plan to plant 10,000 Jatropha's stem in Forestry Agency's area in Rumpin sub-district, Bogor district, West Java province. To get proper seeds, National Estate Agency through Local Estate Agency in West Nusa Tenggara province developed a nursery garden up to one hectare.

Researchers' local initiatives to develop Jatropha were continued by presentation in front of the House of Representatives (DPR) on February 2003. In their presentation, IBF highlighted Indonesian biodiversity on energy crops source, in particular palm oil and Jatropha. The last crop received additional attention since it supports Forestry Agency program on forest conservation. Responding IBF's presentation,

one of the House of Representative members expressed hissurprise on Jatropha ability to produce oil. The other mentioned his support to bring Jatropha issue to national level especially to solve energy problems in remote areas.

IBF's chair emphasized government role in supporting the new initiatives. In building his argument, he took examples from Europe and United States speeded up their biodiesel commercialization processes through tax mechanism. For Indonesia, the chairman suggested fossil fuel subsidy to be allocated for biofuel development. Representation from Indonesia's state-oil company, Pertamina, stated Indonesian capability in developing biodiesel through their experience in testing palm oil and Jatropha performance in a road test from Jakarta to Cianjur regency, West Java province (> 100 km) in 1995. As a follow up from this meeting, the House of Representatives promised to bring this issue to their meeting with Ministry of Research and Technology which held three days later.

During 2003 – 2005 many Jatropha's researches had been conducted. The players included universities, government research agencies, foreign agencies, state-owned enterprises, and local government. In 2005, on the same year with the increase of world oil price and Indonesian government decision to reduce fossil fuel subsidy, number of Jatropha initiatives at the national level increased. On May 2005, scientists from Institute of Technology Bandung (ITB) incorporation with Indonesian Farmers' Association (HKTI), Indonesia's Moslem mass organization, Nahdatul Ulama, and Institute of Agricultural Bogor (IPB) declared their commitment to support Jatropha development. Three months after, government apparatus from different departments formed Indonesian Green Energy Community (MEHI). The first program of this new body was a comparative study on Jatropha to India.

A bigger event appeared on October 12-13, 2005, several days after Indonesian President increased the national oil price for the second time in that year up to 107%. Eight ministers and representatives from local governments, Indonesia's electricity company, universities, HKTI, MEHI, and funding agencies was signed a declaration on poverty alleviation and solving fossil fuel crisis through Jatropha plantation. The declaration stated the stakeholders' commitment to create Jatropha market and arrange its mechanism.

From Policy Makers to Intermediary Agencies

Indonesian government commitment to develop Jatropha and biofuel in general was formalized through number of regulations in 2006. As legal framework for energy planning, Indonesian government launched National Energy Policy (Presidential Regulation No. 5/2006) on January 2006. The policy targeted that by 2010 bio-energy should meet 3.7 per cent of total household and commercial needs (Dillon *et al.*, 2008). To obtain commitments from stakeholders, Indonesian President convened a special cabinet meeting in Losari sub-district, Brebes regency, Central Java province. The meeting resulted target to create 3.6 million new jobs, reduce the poverty rate by 16 per cent and lower oil imports by US$ 5 billion a year through energy plantation from cassava, sugarcane, palm oil and castor oil (Dillon *et al.*, 2008).

As coordinator to modulate the various stakeholders, Indonesian President formed a national team for biofuels development (Presidential Decree No. 10/2006). The team consisted of selected cabinet members as steering committee and representatives from government's departments, research agencies, state-owned enterprises (SOE), funding agencies, and private companies as executor. The team was mandated to formulate a blueprint for biofuel development programmes. In December 2006, they launched blue print on biofuel development for poverty and unemployment acceleration. At the national level, the blue print targeted to reach 2% of energy mix (5.29 million kL) in 2005-2010, 3% (9.84 million kL) in 2011-2015, and 5% (22.26 million kL) in 2016-2025.

In reaching its target, the team strategies for developing biofuel were (i) developing

investment and finance scheme to support biofuel program; (ii) developing price mechanism, starting from feedstock up to biofuel product; (iii) increasing local potential; (iv) increasing availability of feedstock and production needs; (v) stipulating biofuel trading system; (vi) accelerate land availability; (vii) developing special biofuel zone and *Self-Sufficient Energy Village* (SEV); and (viii) improving local government and community participation in biofuel business (Yusgiantoro, 2007). Generally, the strategies can be divided into two groups: one was focused on the national level under biofuel utilization mandatory (Minister of Energy and Mineral Resources Regulation No. 32/2008) i.e. transportation, industry, and power generator sector; and the other was SEV. The latter was executed by several government departments which used various energy crops such as Jatropha curcas, coconut, palm oil, and cassava (see Table 1).

Tabel 1 National Government Plan for Self-Sufficient Energy Villages Program

No	Coordinator	Crop
1	Ministry for Acceleration of Development in Underdeveloped Regions	Palm oil (3 provinces), coconut (5 provinces), Jatropha curcas (14 provinces)
2	Department of Maritime Affairs and Fisheries	Cassava (5 provinces), Jatropha curcas (5 provinces), palm oil (1 province)
3	Department of Labor and Transmigration	Palm oil (1 province), Jatropha curcas (2 provinces)
4	Department of Home Affairs	Jatropha curcas (5 provinces)
5	Department of Agriculture	Jatropha curcas (25 provinces)
6	RNI Company (SOE)	Jatropha curcas (3 provinces)
7	Rekind Company (SOE)	Jatropha curcas (1 provinces)

Source : National Team of Biofuel, 2007

The table above shows that Jatropha was the main preference for SEV. In developing the market, the national team proposed plasma-core model. One SEV consist of 6 plasmas, where each covers an area of 50 ha and produces CJO (Crude Jatropha Oil) with the capacity of 25 liter per day. The core then processed the CJO to become PJO (Purified Jatropha Oil) in a factory with 250 liter per day capacity. The last step is selling PJO to PLN (National Electricity Company) or biodiesel factories (GFA, 2008). In this model, the Jatropha seeds' price was assumed 800 Rupiah per kilogram (National Team, 2007). This price was cheaper than most of food crops, especially corn and cashew.

From Intermediary Agencies to Farmers

The plasma-core model implementation, however, did not run as smooth as it expected. A mechanics in one of Jatropha factories built by funding from the national budget in Cilacap regency, Central Java province only worked for three months before the factory closed due to lack of Jatropha seeds supply[2]. Disappointment also came from South Kalimantan farmer who was one of 374 farmers received Jatropha training in Cibubur area, West Java province in May 2005. After planting 10,000 Jatropha stem in South Kalimantan province, he did not know where to sell the seeds. A Jatropha buyer ever came, but the price offered, 500 Rupiah per kilogram compared to the capital he spent with total amount 10 million Rupiah was too low[3].

Beside activities emerged through government apparatus interventions i.e. funding, mandatory, factories, initiatives also came through farmers' 'great' expectation seeing Jatropha as planting gold. Commenting the last point, head of Kreatif Energi Indonesia—one of the private companies which mainly focused on meeting the demand from governmental institutions to supply seed material, technology know-how, and processing technology for oil

[2] See *Kompas* (16/06/07), 'Biji Jarak: Mimpi Nelayan Padam'

[3] See Tempo (21/04/08), 'Tanam Dulu, Bingung Kemudian'.

extraction, purification and bio-diesel production—said that farmers' expectation were built upon wrong assumptions. Conceptually, Jatropha plantation was designed as additional crop and not to replace the existing crop(s).

To see the dynamics between government interventions, farmers' expectation, and intermediary agencies in connecting the whole actors, this sub-section presents two Jatropha plantation cases. One was initiated by a local NGO and the other by a multi-national company (MNC). The first case relies heavily on Nurlaila (2007) who used literature and field study as data sources.

Local NGO Initiatives in Garut district, West Java province

Jatropha plantation in Garut district was started in 2006 from a village named Mandalasari. The village was dominated by Muslim with strong religion tradition. This relationship led certain people received higher position due to his knowledge in religious matters. Mandalasari's Islamic tradition was acculturated with Sundanese tradition acknowledges kinship from male and female. The villagers called this relation as *sadulur* where everyone is brother or sister to others (Nurlaila, 2007; Amir *et al.*, 2008).

It was the head of Pager Warna, a farmers' organization who stimulated Jatropha plantation among its members in Mandalasari, a village in Kadungora sub-district, Garut district. Besides being the head of Pager Warna, he was also a member of DPKLTS, an organization formed by Sundanese elites in Bandung, capital of West Java to aid local farmers. His involvement in DPKLTS gave him additional information which he used to promote Pager Warna through Jatropha plantation. The first harvesting succeeded in producing 300 kilograms seeds which partly used for the next plantation and the other was bought by *Gerakan Waqaf Pohon*[4](GWP), a local NGO which engaged in forestry issues. Apart from buying seeds, GWP also played a role as a mediator connecting Pager Warna with funding and technology sources such as University of Syarif Hidayatullah, government environment agency, and Ministry for Cooperatives and Small and Medium Enterprises (Nurlaila, 2007).

Commenting SEV program, Suryadharma Ali, Minister for Cooperatives and Small and Medium Enterprises said that to get funding the village has to meet several requirements such as receive local government support in providing land and Minister of Agriculture endorsement in supplying Jatropha seeds. GWP encouraged Pager Warna to fulfil this requirement through involving more farmers' groups resulting incorporation with farmers in Pakenjeng and Cikajang sub-district, Garut district. In addition to energy reason, Nurlaila (2007) argued that mass mobilization from one farmer group to another was coloured by political interest from the local NGO aimed to receive recognition from the elite in Garut.

Taking *sadulur* as basis in building trust, Jatropha initiatives spread from mouth to mouth with no formal agreement as expressed in several statements from Mandalasari villagers as follows, "Currently, I am taking care for the seeds, later, when the fruit can be harvested, I can get additional money, *as my friends said* ..." and "Honestly, jobs availability is very limited. If Jatropha factory available *which according to others* are not bad, it would be better than being jobless". The Jatropha initiator did the same thing in early 2006 when he heard government plan to develop Jatropha from Mubiar's friend (Nurlaila, 2007).

Jatropha initiatives in Mandalasari, however, faced difficulties in maintaining its durability. Amir *et al.* (2008) noted that one of the major issues hindering Mandalasari farmers from becoming commercially and socially viable is continuity of buyers. As a non-profit environment organization, GWP capacity to purchase Jatropha seeds was very limited. Its

[4] Literally means tree-donation movement. The word *waqaf*, however, has an additional meaning since it was taken from Arabic/Islamic religion which connect charitable action in the world with good position afterlife.

activities in purchasing Jatropha seeds on the first harvesting and connect Mandalasari's farmers with funding and technology suppliers was intended as a catalyst. Unfortunately, after the Jatropha activities were widely accepted, the private companies expected to purchase the seeds were not available.

Multiple-Actors Initiatives in Grobogan district, Central Java Province

Jatropha plantation in Grobogan district was started before 2007 through appearance of Energi Hijau Lestari (Enhil) Company in Tanjungharjo village, Ngaringan sub-district. As most other districts in Java, Islam is the dominant religion with significant presence of Protestant, Catholic, Hindu, and Buddhism. Along with Grobogan villagers' attachment to religion rituals, their activities were also driven by Javanese culture and economic calculation. Economy activities in the villages were mainly agriculture and public sectors. This situation leads to farmers' vulnerability due to climate change and annually problem for areas with low rainfall. To overcome the economic problem, there had been a significant increasing of female migrant workers (TKW), especially from dry areas, in the last decade. While females go abroad, male workers usually choose to become seasonal workers in Indonesian big cities so they can keep maintaining their crops.

Jatropha program for poverty alleviation and job creation thus seems to be the perfect solution for the problems above. The claims stated that the crop can be planted in marginal land (dry areas). Additionally, the program was designed to integrate on and off-farming which lead to job creation. The plan, however, did not run as smooth as it expected, if not totally failed. Enhil, a biodiesel company which co-operated with RNI, a SOE, only operated for a year. Representative from Enhil said that this situation was resulted from government inconsistency and RNI which bail out from their initial role as Jatropha oil off-taker[5]. One of the farmers who initially involved in supplying Jatropha for the company mentioned that he wanted to involve since it was the Indonesian President who opened the factory[6]. Another farmer who lived near the factory said that farmers' enthusiasm was driven by the Indonesian President promised to give 10 billion Rupiah to develop Jatropha in the area[7].

The amount of grant promised by the President in Enhil's opening ceremony came from Pertamina, RNI, and PGN, a national oil gas company fund. The fund was managed by Pertamina under a new local body named DME Dian Grobogan cooperation with distribution as follows, 4.7 billion Rupiah was used for building biodiesel plant in Bandungharjo village, Torroh sub-district, 3.7 billion for buying Jatropha seeds, and 2.1 billion for training the farmers. Since 2010, however, the biodiesel plant has stoped using Jatropha and shifts their energy crops source to *nyamplung* (Calophyllum inophyllum L.). Representative from DME Dian Grobogan argued that this decision was made by considering Jatropha continuity supplies from farmers which were irregular and price. Grobogan's farmers were expecting 1500 Rupiah per kilogram causing the biodiesel price became not competitive with fossil fuel price, while DME Dian Grobogan can get *nyamplung* for 1200 Rupiah per kilogram[8].

Other player who entered the area was Waterland Asia Bio Ventures (WABV), a multi-national company (MNC) established with investment from 32 Dutch companies. Their activities in Grobogan started in 2007 through WABV cooperation with Perhutani and farmers. This cooperation was formalized by three-partite agreement where WABV plays as investor, Perhutani as land-owner, and farmers' as workers (Fatimah, 2011). In building the argument about WABV's choice on Java, especially Grobogan, WABV saw Java as the effect of the extreme population growth and

[5] See Kompas, 18 March 2011, "Desa Mandiri Energu Bohong-bohongan?"

[6] See Kompas, 7 March 2011, "Minyak Jarak Terlantar".

[7] Interview, 9 August 2010.

[8] Interview, 16 October 2011.

density[9]. By taking Java as laboratory to start solving environmental and social problems, WABV hoped that the model can be used in a other areas.

The first trial used 522.1 hectares for Jatropha plantation and 326 hectares for seed breeding. Success of the first trial led WABV built Jatropha processing plant in Danyang village, Purwodadi sub-district on November 2008. Parallels with plant construction, WABV organized various events to attract different stakeholders. One of WABV's field officers said that to entangle with farmers' interest, WABV invited *kyai*, an influential person based on his expertise in Islam, to promote Jatropha. Additionally, farmers received Jatropha seeds, fertilizer, stove (in co-operation with BSH), and other crops which can be planted together with Jatropha (inter-cropping) (Fatimah, 2011). To attract investors and stabilize their position in the business, WABV involved local government apparatus, ambassadors, farmers, and their business partners in ceremonial events documented in their website. The website also gave investors access to see what was happening in the field through what WABV's promoted as real-time video broadcast.

Translating Jatropha 'Facts'

Jatropha's translation from one actant to another, whether in the form of numbers, papers with words 'Jatropha for solving poverty issues and energy crisis' on it, seeds, or biodiesel shows that Jatropha is able to connect various actants. Its ability to connect, however, does not placed Jatropha as an actor by it self. To understand how Jatropha can affect others, being affected, and on the same, being internalized in actants' world, this section analyses cases in Section 3 using concepts presented in Section 2.

Actants' Translation

Translation from one actant to other raises a question on actants' closure. Does consensus appear at the individual, organisation, national or even at the inter-national level? Narration in Section 3 shows that consensuses appear in different levels of aggregation and with various types of durability. Relation between the two can be understood by following three stages of translation. Applying the stages to the narration of scientists (Section 3.1), reduction of big world to the small world can be found when scientists from various backgrounds chose several crops as energy source. In this stage, actants isolate nature of the energy problem through several assumptions. Various scientists start to converge to certain crops as energy source. The second stage is formation of several scenarios where scientists speak on behalf of the energy crops (taking problem definition in stage 1 as assumption). The third stage is returning to the big world where various scientists can be seen as an actant in their relationship with policy makers. In the third stage, the result can be extracted from assumption in stage 1 and scenarios in stage 2.

The second closure appears in convergence between scientists and policy makers. Taking alleviating poverty, creating job, and solving energy crisis as rhetoric to cover broad expectation, Jatropha activities were being attached to economic calculation. In this second closure, three stages of translation appear. The first is when different actants, scientists, members of the House of Representative, and national government apparatus start to define national problem from energy crisis in 2002 to poverty in mid-2005. The second stage of translation appears when scientists and policy makers create new alliance through national energy road map and blue print for biofuel development. In the third stage, the results are being returned to the big world through number of formal regulations and funding from the national budget.

The third closure appears variously in the farmers' world. This situation can be understood by tracing farmers' intersection with Jatropha. As presented above, information about Jatropha circulate through different forms. There is no single source for Jatropha information or

[9] Presentation by WABV on PT Waterland Agro Food: Were food, energy and biodiversity are in balance.

funding source. In certain areas, Jatropha cultivation has been started in 2003 for research purpose while others started in 2005 and 2007 whether as government project or for commercial practices. Different initiators lead to different Jatropha's model. In areas where Jatropha was used for research purpose, the seeds' price reached 8,000 Rupiah per kilogram while in the model from the government apparatus, the seeds were only appreciated 800 Rupiah per kilogram. These situations were worsening by farmers' expectation see Jatropha as planting gold.

Beside price, mediators connecting farmers with Jatropha also determine the actant-network's durability. For project-based mediators, Jatropha continuity is determined by the next term budget. Their involvement in Jatropha activities is thus influenced by a longer network i.e. whether the donators are still interested on the issue, government policy direction, etc. While for commercial mediators, decision whether they want to stay in the business or not is determined by benefit calculations. Both of them can withdraw their involvement in Jatropha activities although through different requirements.

Callon (1991) identified two basic possible configurations: *complementary* or *substitute*. In the first possibility, Jatropha is the necessary and sufficient requirements for the next step. This situation may appear if an actant invests a huge amount of money in a specific Jatropha research. The more specific the research is, the harder it becomes to break away from Jatropha. To overcome this situation, an actant has to shift Jatropha from a *complementary* to a *substitute*function i.e. through entering non-energy market (Clean Development Mechanism, derivative product of Jatropha, diversification of Jatropha land or virtual market). In this type of shifting, lost due to wrong prediction might be covered through subsidiary market which built upon different financial scheme. However, when the subsidiary market collapse, the whole investment might be gone as well. For the national government, collapse might mean loss of legitimacy, while for entrepreneurs it might mean loss of money or being bankrupt.

In practice, relation between material performance and loss was non-linier. In 2005 and 2006 for example, Jatropha was not only emerged in the context of energy crisis but also as part of the rhetoric to stabilize the political situation in Indonesia due to the oil price increase. This situation shows that in certain aspects, Jatropha has succeeded. The same situation may also valid for companies which can smoothly shift Jatropha as energy source to other purposes. Non-linearity between (Jatropha's) material performance and reward is even more complicated in the scientific domain. Opposite to government and businessmen who rhetorically placed Jatropha as energy source, its emergence in the scientific domain was part of bigger research on alternative energy. Jatropha's performance is thus not determined solely by its ability to produce oil, but also as a comparison with the other second generation crops, possibility to produce derivative products, and lastly, if all of the experiments show bad results, the scientific actants still produce new knowledge on how bad the crop is. More over, scientific actants received their funding from the national budget, international agencies, and minor entrepreneurial activities which are not being affected with Jatropha's result. In this case, Jatropha can be easily be *substituted* with other crops if the research is no longer interesting.

For other actants with shorter network, however, *substitution* from economics benefit to political or scientific benefits might not possible. Taking the farmers case in Mandalasari and Grobogan (Section 3.3) for example, the farmers options to gain benefit from Jatropha were bounded to Jatropha price offered by the buyers and their availability. On the other hand, farmers might receive more money if they cultivate other crops. There are two options to change this relation: (i) increase the Jatropha price (or give additional reward) or (ii) remove the farmers access to alternative crops. In Grobogan, WABV applied both options through their co-operation with BSH (first option) and Perhutani (second option). The second option is possible for

farmers who do not have any land and work in Perhutani's areas.

Cycle of Accumulation

The situation above shows that there are two type of substitutions: (i) *functions* as appear in the case of national government rhetoric on Jatropha during 2005-2008 and WABV in Grobogan; and (ii) *actants* as appear in the case of scientists and DME Dian Grobogan. Actants' ability to substitute one function or actant to another raise a question on lock-in: to what extent the actants or functions can be replaced? Reflecting this question to the cases above, biofuel development was still not able to substitute fossil fuel. At the village level, especially from the farmers' perspective, Jatropha was not being framed in biofuel context or energy security issue rather been placed as an economic commodity. Its function is thus how the crops can give the greatest profit.

Actants' tend to conserve function i.e. energy, income rather than actants. In the context of calculation, however, this tendency may leads to non-calculability which might cause more loss due to instability. In Jatropha development in Indonesia, both actant-oriented and function-oriented appear in different moments. From 2005 to 2008, Jatropha activities can be classified as actant-oriented. This tendency can be observed through Jatropha business model, graphics, and tables placing Jatropha as subject of experiment. During those years, most of the farmers involved in Jatropha activities were being circulated by government apparatus.

The process of closure (or creating cycles of accumulation) starts when scientists made some observation, conducted experiment, made some calculation, and came out with certain formulas. The 'fact' then was being translated to businessmen, government research agencies, NGOs, and professional association. Those translations succeeded in forming an inter-institution named IBF with consensus to support biofuel development in Indonesia. This cycle became stronger when IBF was being invited by the House of Representation to present their work in 2002. At that moment, Jatropha was being promoted as an alternative crop for energy.

In 2005, the options started to converge to Jatropha, especially because it claimed to be cultivated in waste or marginal land. A year after, Indonesian executive government issued several formal regulations to support Jatropha development. Reflecting this situation with the concept of calculation, period 2005-2008 follows three requirements of measuring proposed by Callon and Muniesa (2005). *To be calculated*, Jatropha was being isolated from reality through assumptions. The assumptions then were being used to create a model *associating* Jatropha with other actants. Results of this association were being *extracted* through funding from the national budget for Jatropha projects. Generally, this situation last until 2008 when National team of Biofuel had finished their contract and therefore, being dismissed.

From 2008-2010, Jatropha development in Indonesia started to shift to function-oriented. There was no dominant actant during this period. Cycle of accumulation was being constructed through claim about Jatropha and number of actions in 2005 – 2008. However, in 2008, the cycle started to de-stabilize due to new facts contradicting the initial assumptions, absence of biofuel coordinator, and the government interest's change. Players who survive in the last round were actants with multi-functions so they can gain profit through different markets.

Summary of the whole dynamic can be seen in Fig. 3 where the actors (in distinction with intermediary) affect rule of the games in each period. Number 1, 2, 3 in the figure represents Callon and Muniesa's measurement requirement. The black colour in the second period shows that the actants are convergence with their functions so it can be calculated. On the next period, this situation is no longer valid. Consequently, the actants start to re-calculate their involvement with Jatropha.

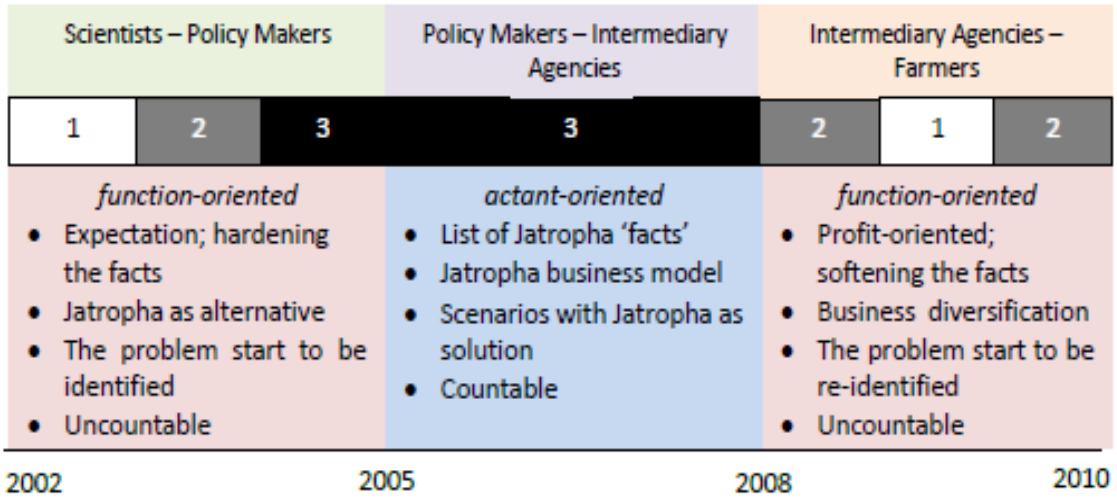

Figure 3. Translation of Jatropha actants

Concluding Remarks

Throughout this paper I have shown that actor's expectation translate through complex network. Those translations create detour where initial expectation may no longer valid in the moment it comes true. Man and nature relationship thus cannot be seen as something natural since it involve mediators such as scientists, policy makers, and businessmen each of which translate Jatropha into their own world. Translation from one actant to another as presented in Section 4 lead the following conclusion. First, ANT was useful to understand the possibility of calculation and planning. The focus on calculation, closure, and cycle of accumulation were helpful in understanding who are the actor and intermediaries.

Second, this paper identifies three period of Jatropha development in Indonesia which classified based on its actors (in contrast with intermediary). The actors determine rule of the game for each period in their relation with Jatropha. Third, this paper identified variation in substitution called *function-oriented* and *actant-oriented* which can be used to understand the transition process from one period to another. Distinction between function and actant can also be used to understand network durability. If an actant convergence to certain functions, then the network will durable. This paper shows that one reason why the black box in the second period started to collapse, especially when government started to decrease the subsidiary mechanism, was because Jatropha 'fact' was built upon wrong assumptions.

Fourth, this paper shows that there were incompatibility between actants' expectation and Jatropha trajectories. For scientists, Jatropha is subject of research, for government, Jatropha is solution for the national problem, for farmers, Jatropha is economic goods, and for the businessmen, Jatropha is profit. In translating Jatropha for one actant to another, however, this expectation may threat other interests as seen in the Jatropha price assumption designed by the government. Fifth, this paper identifies actants' strategies to distribute risk raised by the new crops. These strategies, however, can lead to economic bubble where Jatropha inflation was covered through certain translation.

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