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Article

Engineering the Jatropha Hype in Indonesia

Suraya A. Afiff

Department of Anthropology, Faculty of Social and Political Sciences, University of Indonesia, Building B 1st floor, Depok 16424, Indonesia; E-Mail: saa60@ui.ac.id; Tel.: +62-21-788-49022; Fax: +62-21-788-81032

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Abstract: This paper explores the actors, social networks, and narratives at national and global levels that have been contributing to creating a hype about Jatropha as a biofuel crop in Indonesia. Widespread concerns about climate change and the 2005–2006 rise of world crude oil prices had created the important momentum for promoting Jatropha based biofuel around the world. What have been the drivers behind this hype and which narratives have been spread? The paper discusses the difference between hypes and boom-and-bust patterns, and argues that the latter is not applicable to Jatropha, because a market for Jatropha products has not been developed yet. In terms of the actors' contributions to this hype, the paper highlights the important role of engineers in mobilizing public support for Jatropha activities. Drawing on the results from interviews and secondary analysis, the paper reports how they have spread the news and claims through the Internet, creating public expectations about the potentials of the crop. Those narratives include one specifically Indonesian argument for supporting Jatropha cultivation appealing to the collective memory about Jatropha during the Japanese occupation period in Indonesia.

Keywords: *Jatropha curcas*; Indonesia; hype; global-local linkages; actor networks

1. Introduction

In the mid-2000s, especially during the year 2007/2008, there was widespread interest in developing biodiesel based on a little-known crop species, *Jatropha curcas* Linnaeus. Jatropha was promoted as "Green Gold" [1], a perfect solution for biofuel. The crop was claimed suitable for marginal lands, could create income for poor farmers, and because it is a non-edible crop, it was believed that it would not undermine food security [2]. In 2008, GEXI, a market consultant report

funded by World Wildlife Fund, claimed at least 242 Jatropha projects had been identified around the world, with a total coverage of approximately 900,000 hectares [3]. The report predicted that total global coverage of Jatropha plantations would increase to 5 million hectares by 2010 and approximately 13 million hectares in 2015. The report indicated that 80% of global Jatropha production was located in Asia, with rapid development in several countries, including Indonesia. The report estimated Jatropha plantations in Indonesia would grow rapidly from approximately 75,000 hectares in 2008 to approximately 5.2 million hectares in 2015. A more recent evaluation of Jatropha initiatives indicated that very few projects had survived in Indonesia, with similar a situation in other places around the world. Unproven claims about seeds' high productivity, low costs to set up the plantation, and no farming treatment needed to maintain the crop are among the main reasons for Jatropha plantations' failure. Jatropha plantations have turned out to be unprofitable [4]. Many farmers have also discontinued their involvement with Jatropha, with a study in 2010 reporting about 85 percent of farmers in India having stopped the cultivation of Jatropha [5]. Since the land area covered under Jatropha cultivation is considerably low, far below the GEXI expectation[6], there is some debate about the extraordinary global collapse of Jatropha initiatives [7,8].

The main objective of this paper is to understand the driving force behind this widespread support for Jatropha activities. In particular, it investigates the narratives and social, political, and economic contexts that were important in contributing to the emergence of the Jatropha hype: Which key actors advocated the crop, and what role did they play in the emergence of the Jatropha hype? The geographical focus in addressing such questions will be on the Indonesian national experience. However, since Jatropha initiatives are a global phenomenon, the study also pays close attention to the ways in which global discourses and projects shaped the promotion of Jatropha in Indonesia. Study about Jatropha hype such as this one might enhance our understanding about the complex social and political processes that shaped the development of the national innovation strategies.

Although the term hype has already been used here, it would be valuable to first review how previous studies of technology innovation conceptualize the cycle of excitement and disappointment related to the expectations of innovation. A number of studies use different terms and definitions in attempting to explain the up-and-down cycle of innovation. Besides the term hype [9,10], other terms within the literature include "social bubble" [11], "hyperbolic expectation" [9], and "exuberant innovation" [12]. Very few of the recent publications analyzing the cyclical nature of technology innovation used the term "boom and bust," perhaps because that concept is more often associated with the economic investment side of technology innovation [13] and the tendency to associate it with the negative effects of commodity price fluctuations [14]. Some scholars suggest that hype in technology innovation is not inherently always negative [15], and that it also has a positive side due to sometimes "providing an essential catalyzing element in the formation of major projects, which may lead to great innovations" ([11], p. 1413); some scholars prefer a term and definition that could accommodate a more nuanced picture of this dynamic.

In the present study, hype or hyperbolic expectation is defined as "a phase characterized by an upsurge of public attention and high rising expectations about the potential of the innovation" ([9], p. 317). Because of the important role of expectation and vision "defined as the state of looking forward" ([15], p. 286) in analyzing technological innovations, some scholars propose the concept of "the sociology of expectations" [15]. It is suggested that expectations:

> "… frequently serve to bridge or mediate across different boundaries and otherwise distinct (though overlapping) dimensions and levels. Expectations are foundational in the coordination of different actor communities and groups (horizontal co-ordination) and also mediate between different scales or levels of organization (micro, meso, and macro-vertical co-ordination). They also change over time in response and adaptation to new conditions or emergent problems (temporal coordination). Likewise, expectations link technical and social issues, because expectations and visions refer to images of the future, where technical and social aspects are tightly intertwined. Finally, expectations constitute 'the missing link' between the inner and outer worlds of techno-scientific knowledge communities and fields. At the same time, expectations and visions are often developed and reconstructed in material scientific activities and disseminated in obdurate and durable forms. In a sense, expectations are both the cause and consequence of material scientific and technological activity (p.286)."

In explaining the dynamics of Jatropha promotion in Indonesia from the perspective of expectation, we need to understand the future-oriented visions that guide actors' activities and the way this vision can be used to draw the interest of other actors and to mobilize their support for new innovation [16]. One example from the study of innovation is to focus on the process behind the decision to develop Palapa, Indonesia's first satellite: multiple actors who played key roles in this idea (engineers from Bandung Institute of Technology ITB, government and military officials, and the late President Suharto himself) had their own personal and broader collective meaning attached to the (satellite) technology [17]. From this example, therefore, the main questions explored in this paper are what were the narratives used by the national actors who advocated Jatropha; and what was the meaning attached to that crop, which made a significant contribution to growing public expectation of the potential benefits from investing in planting the Jatropha plantations and developing the Jatropha-based biodiesel industry.

The rest of this paper is organized as follows. First, I will explain the timeframe and the context of Jatropha hype at the national level in Indonesia. Using media reports, I show the dynamic of how the hype/disappointment cycle related to the promotion of Jatropha at the national level. In the next section, I analyze the promotion of Jatropha prior to the hype. Here, I argue that although a substantial number of people in Indonesia retained a collective memory that associated the term *Jarak pagar* (Jatropha in Indonesian) with the Japanese war-time occupation, very few Indonesians actually had useful knowledge about the tree. I then discuss how the hype emerged, focusing on the key actors and the critical role played by their social network. I also explore the narrative that such actors used to draw the interest of others within the government in order to provide support for Jatropha initiatives. The discussion then briefly describes what happened following the disappointment stage of the cycle. The study concludes with a discussion of the lessons learned from the promotion of Jatropha in Indonesia in terms of hype and innovation.

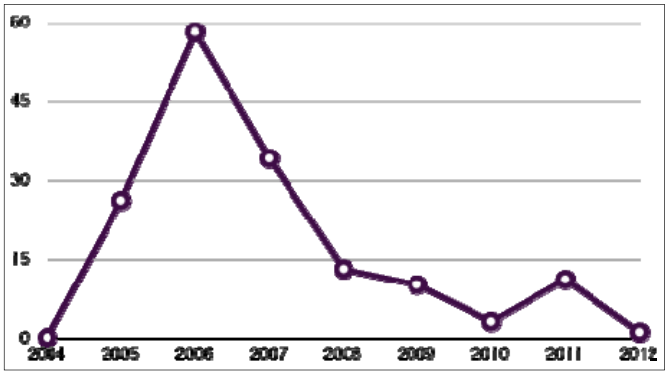
2. The Timeframe and Context of the National Jatropha Hype

In this section, I will describe the pattern of the Jatropha hype in Indonesia. Since "hype can be understood as 'excessive publicity' due to the attention a subject receives for example in the mass media" ([9], p. 319), I searched the frequency of reporting of the Jatropha in the prominent newspaper as a proxy for measuring the national hype pattern [9].

On March 15, 2005, *Kompas* (one of the most respected national newspapers in Indonesia) ran a front-page story about the potential of *Jatropha curcas* oil for diesel fuel [18]. This article is important for two reasons: firstly, because it was the first full-coverage story about Jatropha oil and its potential for fuel that appeared at the national level; secondly, because the timing of the article coincided with the middle of an important energy crisis in Indonesia triggered by a sharp increase in global oil prices, which had almost doubled from $31 per barrel in 2003 to $70 per barrel in mid-2005. Intensive debates immediately emerged in Indonesia, about whether the government should keep the domestic fuel price unchanged at less than the market price. The government's eventual decision was to increase the price in an attempt to cut the oil subsidy, which led to popular protests against the policy.

The news about the potential use of Jatropha for biodiesel immediately brought hope and public euphoria about the possibility of a quick fix to resolve the energy crisis. Subsequently, the number of articles in *Kompas* that mentioned Jatropha increased quite rapidly since 2005, as shown in Figure 1: the number of reports about Jatropha published in *Kompas* increased from zero in 2004 to 26 articles in 2005, and peaked at 58 articles in 2006. However, since 2007, the reverse cycle has occurred: the number of articles consistently declined until by 2012 when almost no articles on Jatropha were found. This cycle of media reporting is a good indicator of public attention for the introduction of a new technological innovation [19].

Figure 1. Number of articles mentioning "Jatropha" (or "jarak pagar") in *Kompas* newspaper (2004–2012).



This graph visualizes the pattern of the Jatropha hype in Indonesia.

3. Jatropha Promotion before 2005

This section focuses on the Jatropha promotion before the emergence of national hype. I divided the section into two historical periods—Jatropha activities during the colonial era and as a modern biofuel—because of the importance of this history in our understanding about the social, political and economic contexts that had shaped Jatropha hype in Indonesia.

3.1. Jatropha during the Colonial Era

Jatropha curcas L., which is called *jarak pagar* in Indonesia, is not native to the country. Portuguese traders helped to spread the plant from its native range in Central America to Africa, then

later to Asia including Indonesia around the 17th and 18th centuries [20]. Currently, *Jatropha curcas* has spread across Indonesia as a wild plant, particularly in the lowland areas of the islands in the eastern region [21]. The traditional uses of the plant are medicinal and as fence material, the seeds are used for illumination [22]. In Indonesia, *Jatropha curcas* has often been confused with castor, which is also called *jarak* in Indonesia's official language [23,24]. There is no specific record indicating that there has been extensive trade of *Jatropha curcas* seeds exported from Indonesia.

Before 2005, *Jatropha curcas* was an underutilized species in Indonesia. Although very few Indonesians knew about the Jatropha tree, many people retain a strong collective memory of the name *Jarak*, which was associated with the Japanese occupation of Indonesia between 1942 and 1945 [23,25–27]. Many Indonesians still remember how the Japanese rulers forced the native people to grow *Jarak* and collect the seed [28]. *Jarak* was actually a combination of both castor and Jatropha seeds [23,26,29]; Jatropha was planted to form fences; school children and their teachers had to collect seeds and hand them over to the Japanese authorities, who exported the seeds to their home country as a raw material for making lubricants for military equipment [28]. However, this activity was immediately discontinued with the ending of Japanese occupation in 1945. Nevertheless, this colonial history of utilizing Jatropha seeds for industrial purposes during the Japanese era later helped to convince people of the crop's potential as a feedstock for alternative fuel.

3.2. Developing Jatropha as a Modern Biofuel

The early national promotion of Jatropha for biodiesel was strongly associated with Bandung Institute of Technology (ITB). The key figure in this promotion was Dr. Tatang Soerawijaya, a professor of chemical engineering technology who graduated from Delft University of Technology, the Netherlands in 1985, who headed the Center for Research on Energy at ITB. Within this center, Dr. Soerawijaya and his colleagues, in particular Dr. Tirto P. Brodjonegoro (Ph.D. in chemical engineering from Keio University, Japan in 2001) and Dr. Iman Reksowardjojo (a mechanical engineer who graduated from Hokkaido University, Japan), formed a specific research team that focused on biodiesel. Since the 1990s, they explored the potential of biomass for fuel, and identified about 50 crops in Indonesia for potential use as biofuel feedstock [30].

In the early 2000s, there was an increasing interest within government and the private sector to develop a biodiesel program in Indonesia. At first, the original motivation behind this emerging interest in biodiesel was partly related to the effort to secure the Indonesian palm oil sector. During the 2000s, the price of crude palm oil (CPO) plummeted on the world market. It was believed that renewed demand for CPO would prevent the industry from huge losses resulting from the volatile market price. In 2001, Medan hosted the International Biodiesel Conference on the possibility of utilizing palm oil for biodiesel. Meanwhile, the Ministry of Research and Technology began to develop laboratory-scale trials of palm oil-based biodiesel [31].

The emergence in Indonesia of the discourse on biofuel inspired ITB researchers from the Center for Research on Energy to advocate for a biofuel policy and program in Indonesia. They were active in conducting a number of presentations to lobby policy makers within parliament, the national planning board, and the government institutions (particularly within the energy and agriculture sectors) to secure government support for a more systematic program on biofuel development [32]. It was in one of these

meetings organized by the Coordination Agency for National Energy under the Ministry of Mining and Energy held in 2001, that Dr. Soerawijaya mentioned the potential of *Jatropha curcas*. In his presentation, which was titled "*To make Biodiesel part of the Liquid Fuel Mix in Indonesia*," he particularly promoted *Jatropha curcas* and palm oil as the two crops with potential uses as raw material to produce biodiesel in Indonesia. The presentation contrasted Jatropha with palm oil on the basis that Jatropha is non-edible, and so conversion of Jatropha seeds to biofuel would not disrupt food security. In addition, the presentation specifically mentioned that since Jatropha grows well on marginal land (*lahan kritis*), it has the potential to address the problem of erosion on approximately 20 million hectares of degraded land in Indonesia. The presentation emphasized a pilot project in Nicaragua that began to develop Jatropha in 1995. The presentation concluded by proposing a five-year plan toward biodiesel commercialization, *i.e.*, to develop a biodiesel pilot industry for palm oil and Jatropha, to organize road tests of vehicles using palm oil and Jatropha-based biodiesel, to intensify the research and development (R&D) program on the potential of various crops for feedstock and the biodiesel production chain, and to develop a mandate for biodiesel mix, certification, and a distribution system [30,33].

The presentation by Dr. Soerawijaya convinced some government officials and those within the private sector of the need to form the Indonesia Biodiesel Forum (IBF). After a number of meetings organized by the Ministry of Environment, the IBF was formed in 2002, headed by Dr. Soerawijaya. IBF members consisted of government officials, academics, journalists, entrepreneurs, and other stakeholders interested in biodiesel issues. Its main focus was to develop a road map for the commercialization of biodiesel [32]. As early as 2003, the IBF actively lobbied members of parliament on the need for Indonesia to develop biofuel policy [33]. One of the IBF instrumental works was in the development of government regulation pertaining to the standard for industrial biodiesel product. This regulation, which was passed in 2006, adopted IBF proposal for technical standard for industrial biodiesel product in Indonesia. To follow up this regulation, in 2007 IBF formed a new institution in charge of the certifying process for industry planning to sell biodiesel product in the Indonesian market to ensure it meets the quality standard as stated in the regulation [32].

While the early work on biofuel was more focused on oil palm, starting in 2002, Dr. Soerawijaya and his team increased their research on Jatropha. Initially, they collaborated with Mr. Ibrahim, a former ITB student from an area of West Nusa Tenggara (NTB) where Jatropha trees occur in the wild. To obtain Jatropha seed for laboratory research at ITB, Mr. Ibrahim mobilized people to collect the seed from the wild and purchased the seed from them [24,33]. Starting in 2003, the team received additional institutional support and expanded the collaboration with other stakeholders. In 2003, they collaborated with PT Rekayasa Industri (PT Rekind), a state-owned company, to start a pilot project to produce biodiesel at laboratory scale [34]. Dr. Seorawijaya's link with the company was through the ITB graduates who served in the top management positions in the company. In the same year, the New Energy and Industrial Technology Development Organization (NEDO) of Japan sponsored a trial project to plant 2 hectares of Jatropha in the West Nusa Tenggara. From 2004–2005, NEDO also provided financial support for research to test engines using pure Jatropha oil in an attempt to develop a small-scale distributed energy plan for rural areas utilizing Jatropha-based biodiesel. This research was conducted by ITB researchers lead by Dr. Reksowardjojo in collaboration with

the Mitsubishi Research Institute, Kyushu Electric Power Co., Inc., and West Japan Engineering Consultants, Inc. [32,35,36].

However, starting in 2004 and in particularly in 2005, there was significant interest in promoting biofuel policy in Indonesia, with palm oil and Jatropha as two main feedstocks. Within the Ministry of Energy and Mineral Resources, for example, a Ministerial Decree on Renewable and Conservation Energy was passed (no 2/2004). The growing interest in biofuel had pushed researchers beyond the focus on laboratory research and small-scale projects; instead, some had become interested in activities to develop a large-scale Jatropha plantation despite the limited research on the crop. As explained in the previous section, the media coverage of Jatropha emerged at a time of significantly increased global crude oil prices. This affected domestic oil prices, since Indonesia's energy supply is increasingly dependent on imported fossil fuels; therefore, the discussion of Jatropha had raised expectations of national energy independence. In the Indonesian context, where nationalist sentiment is still deeply embedded in public discourse, Jatropha became a symbol of national self sufficiency in energy. This vision was facilitated by the fact there was already a collective memory about Jatropha during the Japanese era, in addition to a strongly misleading claim, not only in Indonesia but also elsewhere, that Jatropha can grow easily in harsh conditions with limited care and input [37]. Nevertheless, in the following years, particularly after 2005, the elevated expectations of Jatropha encouraged more actors to join the bandwagon.

4. The Emergence of National Hype (2005–2006)

In the years 2005 and 2006, the national promotion of Jatropha intensified. Looking at the actors who were instrumental in the implementation of Jatropha initiatives during this period leads to three important ITB graduates: (a) Dr. Robert Manurung, a senior ITB lecturer in chemical engineering; (b) Mr. Alhilal Hamdi, who was the head of the National Team on Biofuel Development; and (c) Dr. Kusmayanto Kadiman, former rector of ITB who served as the Minister for Research and Technology between 2004 and 2006. The present paper focuses on these three who, I argue, played a significant role in shaping the adoption of Jatropha crop within policy circles. In addition, due to their strategic positions, their opinions were highly influential in persuading the president and other governmental actors to support the adoption of Jatropha-based biodiesel within the national policy framework. In the following section, I will discuss their role in promoting Jatropha.

4.1. ITB-Groningen Collaboration

Dr. Robert Manurung received his PhD in chemical engineering from the University of Groningen, the Netherlands, in 1994. He understood that global developments in biofuels would provide business opportunities, because legal blending mandates in Europe and elsewhere would create a strong market for biofuel. While some ITB engineers focused on the conversion of Jatropha plant oil into biodiesel for blending purposes, Dr. Manurung's interest was to explore easier ways to extract Jatropha oil from the seed and to use it directly as an alternative fuel without the requirement for complex treatments during production. In the newspaper *Kompas*, he stated that "(Jatropha oil) can replace diesel fuel for power generators. Since Jatropha can grow in almost all parts of Indonesia, this crop could help to

generate electricity in the remote areas and this oil can be produced by the community who needs the electricity" [18].

In 2005, Dr. Manurung created a new center, the Center for Biotechnology, and served as the head of that institution in order to promote his proposal to use pure plant oil (PPO) and byproducts extracted from the seeds of *Jatropha curcas* [18,27]. He actively advocated this idea to multiple actors in civil society, government institutions, and the business sector both nationally and internationally. For example, Dr. Manurung developed a Jatropha initiative with the Indonesia Farmer's Association (HKTI); with Nahdatul Ulama (NU), one of the largest Muslim organizations in Indonesia; the Bogor Agriculture Institute (IPB) [38]; the agriculture vocational school [39]; and with PT RNI (Rajawali Nusantara Indonesia), a state-owned company [40]. His involvement in Jatropha activity in Indonesia made him a leading international expert on this subject. He was the only representative from Indonesia among biofuel experts from around the world who were invited to the "Expert Group Meeting on Small-scale Production and Use of Liquid Biofuels in Sub-Sahara Africa" organized by UNICEF in 2007. He assisted a number of Jatropha- and bio-based industries in their activities in Sudan, Surinam, and Ethiopia [41], and was invited to speak at numerous meetings and seminars organized by national and international organizations.

Dr. Manurung's first institutionalized research tract related to Jatropha was his involvement in a collaborative research project with Prof. Erik Heeres, a professor in green chemical reaction engineering at the University of Groningen. Prof. Heeres knew Dr. Manurung since they both were graduate students at the University of Groningen. In approximately 2004/2005, Dr. Manurung introduced the information about *Jatropha curcas* for renewable energy to Prof. Heeres. Their collaborative research proposal was awarded funding by the Royal Netherlands Academy of Arts and Sciences (KNAW) in 2005 [42].

International publications and events were quite influential in shaping the initial knowledge and interests of both Prof. Heeres and Dr. Manurung. Several early international Jatropha projects are important. First were the findings from the first large-scale Jatropha plantation in Nicaragua, established in 1990, that was sponsored by the Austrian Government. In 1997, this project organized the first Jatropha conference and published the conference proceedings [3,43]. The second source of information was the Jatropha initiatives established in India. In 2003, the Indian Government adopted a policy to establish 11 million hectares of Jatropha cultivation in the state forest and other public land across the country [44]. The Indian project received particular international attention in 2004, when the Western media became excited about an initiative by DaimlerChrysler India, an Indian branch of the German car company, which announced successful tests of a Mercedes-Benz C-Class car using 100% Jatropha oil [45,46]. Moreover, at about the same time D1 Oils, an investment firm registered in London, also reported an ambitious plan to establish Jatropha plantations and refining facilities in various countries (South Africa, India, Ghana, Tanzania, Burkina Faso, Philippines, Thailand, Saudi Arabian, Central America, and Madagascar) [47]. A company spokesperson told reporters that in India alone D1 Oils was planning to develop 5 million hectares of Jatropha plantation between 2004 and 2009 [47]. Publications by experts from Germany and Austria, two leading countries in Europe with a strong history of biofuel development, convinced Prof. Heeres of the need to conduct research on Jatropha [48]. This decision was also shaped by the political situation in Europe. Around the same time, European governments began discussing mandatory biofuel blending in the context of reducing

carbon emissions from fossil fuel in order to address climate change, and also to address widespread concerns about the rapid global increase in fossil fuel prices. All of this information was used by researchers at ITB and the University of Groningen as the basis for their proposal seeking Dutch research funding in 2005.

The academic collaboration between Dr. Manurung and Prof. Heeres targeted the valorization process as a means of maximizing the value of *Jatropha curcas* as a source of renewable energy and bio-based products, contributing to further developing the bio-refinery concept. In the bio-refinery concept, "…biomass is used as the input and converted in an integrated and energy- and material-efficient manner to bio-based chemicals, biofuels, and bio-energy" ([49], p. v). The research grant from the KNAW enabled them to conduct research on Jatropha from 2006–2011, involving the University of Wageningen in the Netherlands, and eight Indonesian researchers from ITB and the Agency for the Assessment and Application of Technology (BPPT) [50]. Based on this joint research, Prof. Heeres became one of the key advocates of Jatropha oil in the Netherlands particularly, and within Europe in general.

Dr. Manurung and Prof. Heeres were also involved in an important event that significantly influenced public opinion about Jatropha, and which contributed to the hype in Indonesia: the *Jatropha Expedition*, which was held from July 12–20, 2006. In this expedition, three cars fueled with Jatropha oil drove from Atambua in the East Nusa Tenggara (NTT) to the Indonesian capital of Jakarta, a total distance of 3200 kilometers. As a main sponsor of this expedition, the journal National Geographic Indonesia provided impressive media coverage, while PT BioChem Prima International, a company interested in investing in Jatropha seed production, provided some financial support. The ITB provided technical expertise to the venture. The expedition was a great way to widely publicize the idea of this alternative fuel, while the participation of Prof. Heeres during the test drive emphasized the international character of this technological innovation.

In each of the major cities that the expedition passed through, local officials and organizations had organized a variety of promotional activities, such as involving local government representatives in planting Jatropha trees. When the expedition arrived at its final destination, the presidential palace in Jakarta, President Susilo Bambang Yudhoyono delivered a supportive speech to the crowd of journalists, officials, scientists, and others in attendance. The *Jatropha Expedition* had triggered widespread public enthusiasm about Jatropha. It also proved to be quite instrumental in convincing the Indonesian Government to issue legislation in support of biofuel production, and to allocate funds to support cultivation, processing, and scientific research on Jatropha. Some companies and international aid organizations also joined the government in funding Jatropha projects.

Dr. Manurung's national and international Jatropha networks expanded greatly due to his involvement in these activities. As a result of the many media stories in print newspapers and on the Internet since 2005, Dr. Manurung became renowned as "the inventor of Jatropha-based biodiesel", at least in Indonesia [51].

4.2. Promotion through Technical University Alumni Networks

Some ITB graduates have prominent positions within government. As some of them also became interested in biofuel generally and Jatropha in particular, they helped further the promotion of Jatropha

within government circles, and their work contributed to the process of developing biofuel policies and programs in Indonesia. In the context of promoting Jatropha, at least two individuals were quite influential in the adoption of Jatropha within government. Dr. Manurung was well connected with Dr. Kusmayanto Kadiman, who served as the Minister for Research and Technology from 2004–2006. Dr. Kadiman was previously a lecturer at ITB, and between 2001 and 2004 also served as rector of this prominent Indonesian university. Researchers from BPPT, the institution under the leadership of Dr. Kadiman, were also involved in the KNAW-sponsored Jatropha research led by Prof. Heeres and Dr. Manurung.

Dr. Kadiman's interest was to promote the increased funding for applied research and technology related to biofuel in general, including Jatropha biodiesel. Under his leadership, the Ministry particularly supported the Agency for the Assessment and Application of Technology (BPPT) in expanding their work on Jatropha projects. Moreover, his position as a government minister gave him direct access to the president and other ministers in the national government, and the strategic position to persuade members of parliament and the president to support biofuel policy.

The other key individual was Mr. Alhilal Hamdi. He and Mr. Kadiman had been colleagues since they were students at ITB. Upon graduating from ITB with a degree in petroleum engineering, Mr. Hamdi began his career in the petroleum sector. After the *Reformasi* era in 1998, he decided to become a politician. Initially, he joined the National Mandate Party (Partai Amanah Nasional) before switching to the Justice Party (PKS) and becoming the Secretary General of the PKS from 2001–2007. During the presidency of Abdurrahman Wahid, he served as the Minister for Manpower and Transmigration from 1999–2001. When Susilo Bambang Yudhoyono (SBY) was elected as president, Mr. Hamdi served as Special Staff of the Coordinating Minister for Community Welfare from 2004–2005; then, from 2006–2008 he became the head of the National Biofuel Team.

Mr. Hamdi's support for Jatropha can be partly attributed to his belief that it was a good strategy to alleviate poverty, reduce unemployment, and to support the rural economy. There is clear evidence to support this claim within the objective of the SBY Presidential Decree of June 26, 2006, concerning the formation of the National Biofuel Team for the acceleration of poverty and unemployment reduction. The following section discusses some of Mr. Hamdi's key activities to promote biofuel in general and Jatropha in particular.

On August 1, 2005, Mr. Hamdi with Mr. Julius Bobo (Special Staff of the State Minister for the Acceleration Development of Backward Regions), and Dr. Faizul Ishom from the BPPT formed the Indonesia Green Energy Society (IGES) [52]. The importance of IGES within the national campaign to promote Jatropha was that IGES obtained information about Jatropha development in other countries. For example, IGES organized a field trip to India to gain direct information about the implementation of Jatropha projects and the associated industry.

Another part of Mr. Hamdi's work was to mobilize the participation of the state-owned enterprises. He was able to secure the support of Dr. Agus Pakpahan, one of the deputies at the Ministry of State-owned Enterprises, who is Mr. Hamdi's colleague from the ICMI (Indonesian Muslim Intellectual Association) network. On August 25, 2005, with a number of the directors of state-owned enterprises, they all signed a declaration on the commitment of the state-owned company to support the establishment of Jatropha plantations and industry [52].

Within the Coordinating Ministry for Community Welfare, Mr. Hamdi initiated the Working Group on Renewable Energy, which aimed at coordinating communication among multiple stakeholders such as ITB, BPPT, the Ministry of State-owned Enterprises, the State Minister for the Acceleration Development of Backward Regions, state-owned enterprises, and other individual potential investors [52]. Mr. Hamdi and Dr. Kadiman were also active supporters of the declaration of the "National Movement to Reduce Poverty and Fuel Crisis through the Rehabilitation and Reforestation Program of 10 million Hectares of Degraded Land with Plants for Renewable Energy." This declaration was signed on October 12, 2005 by eight ministries and nine organizations, including civil society organizations.

Mr. Hamdi's efforts to promote biofuel became easier as more individuals in the government became interested in Jatropha investment. For example, when at the end of 2005 President SBY decided to reshuffle the cabinet, Mr. Aburizal Bakrie (also an ITB graduate) was appointed as the Coordinator Minister for Community Welfare and became Mr. Hamdi's supervisor. Mr. Bakrie began his career as a businessman before joining GOLKAR, one of the main political parties. Although his role in Jatropha promotion was less obvious, his personal view was quite supportive of Jatropha initiatives, since his business conglomerate also involved a Jatropha plantation project [53]. In fact, personal involvement in Jatropha investments is not unique to Mr. Bakrie alone: around this time of increased public focus on Jatropha, a number of high-ranking individuals within universities and the government in Indonesia held personal investments in Jatropha. Some of them established plantations on their own private land, whereas others gained personal economic benefit from various activities related to Jatropha. Thus, the Jatropha program was not just a national goal but was also deeply embedded in their own personal economic interests. This example shows there is often a fuzzy separation between public goals and private interests, particularly in economic terms. One should not assume that this case is unique to Indonesia.

In 2006, Presidential Decree No. 5 concerning the National Energy Policy was passed. Following this policy, the Ministry of Energy and Mineral Resources passed the National Blueprint on National Energy Plan from 2006–2025 [54]. The Presidential Decree mandated that biofuel should account for approximately 5% of the total national energy supply. The total government investment for biodiesel alone in 2009 was predicted to reach approximately $244 million. Another policy, Presidential Instruction No. 1/2006, instructed 13 ministries and all governors to support the establishment of the biofuel program [55]. There was no specific mention of Jatropha in these policies. Each government ministry decided their own strategies for implementing this policy, based on the guidance of this presidential instruction and decree.

5. The Emergence of Disappointment

In Indonesia, signs of disappointment can been recognized from not only the decline in media reporting but also the tone of such reporting, in addition to the attitude of the public, particularly those who played a crucial role in the implementation of the Jatropha sector. As explained in the previous section, since 2006, the number of national media articles about Jatropha have significantly declined. However, the declined of media reporting does not always correspond with the end of investments or activities, because the activities related with the technology innovation can still continue after the hype

with a change in expectations [9]. Therefore, to complement the analysis of the emergence of disappointment, I use interviews with key actors as well as content analysis of written documents (newspapers, official and other reports) about actors' attitudes toward Jatropha.

As early as mid-2006, *Kompas* newspaper reported that some farmers had expressed doubts about Jatropha's promotion and had claimed that newspaper reports sometimes contained misleading information. These farmers blamed the government for failing to provide sufficient assistance for planting Jatropha. Moreover, farmers complained about the current limited agriculture extension service, which had been declining after Indonesia's *Reformasi* era. Without the agriculture extension service, farmers said they could not verify which news items to believe. They told *Kompas* about a previous disappointing experience in which they were misinformed by media promotion of another agriculture commodity. As a result, famers who invested in the commodity had suffered substantial financial losses, because it turned out they could not sell the produce. They told the reporter that they hoped the same problem would not happen with Jatropha. The *Kompas* article on 22 August 2006 also reported doubts raised by some government officials. The Ministry of Agriculture told a *Kompas* reporter, for example, that it was reluctant to promote Jatropha if the crop productivity was only 1–2 tons per hectare [56]. However, the impact of this article was unclear, since there was no sign that Jatropha promotion was affected. For example, *Kompas* reported that from 2007 the Indonesian government would distribute funding to support the Jatropha program [57].

Post-2007 *Kompas* articles revealed a mix of stories about Jatropha activities and the attitudes of those involved. On the one hand, in 2007, government funding for Jatropha activities had been increased: to establish plantations, carry out socialization activities, build a number of factories, and purchase processing machines, including Jatropha-based stoves for villagers. Moreover, *Kompas* reported increasing claims of private-sector interest in Jatropha projects. However, the problem with such media-published reports is that verifying whether these projects actually materialized or were just claims is a difficult task.

On the other hand, since 2008 onward, in particular, *Kompas* also reported a growing number of project failures and people's disappointment with Jatropha projects. These reports highlighted farmers complaining that no one bought their produce and the low price of seed. As a result, many farmers cut their Jatropha plants, since they saw them as unprofitable. Furthermore, newspaper reports also indicated that Jatropha industries failed to operate because of an insufficient supply of Jatropha seeds, lack of government coordination during the implementation stage, and a lack of support via government assistance for famers. Some also pointed out the issue of low government subsidies for biofuel development and the possibility of misused funds on the part of government officials.

Only in March 2011 did *Kompas* articles begin to publish statements from the Surfactant and Bioenergy Research Centre at the Bogor Agriculture Institute: Dr. Erliza Hambali, for example, pointed out the problem of Jatropha's low seed yield, arguing for the need for a government-supported research fund to improve Jatropha's genetic performance. Researchers would need 5–15 years of continuous funding to develop a Jatropha crop variety with a high yield [58]. Thus, the early doubt about Jatropha productivity—expressed by the Ministry of Agriculture in mid-2006—was one of the main reasons for the program's failure. A recent report that evaluated Jatropha investment in Africa and elsewhere also reported a similar situation [4,5,17,59].

Initially, it was farmers who expressed their disappointment with Jatropha projects. Later on, more government officials also expressed doubt and withdrew their support. At present, no additional Jatropha projects have been supported by government funds. In fact, based on my interviews with donors that support biomass programs for energy, selection committee officials were reluctant to even approve a proposal to test a small-scale Jatropha pilot project. After the hype was over, the government biomass program has become more focused on oil palm-based biodiesel, utilizing waste from palm oil for energy; most importantly, at the community level, focus has been shifted towards biogas programs for electricity and cooking.

6. Conclusions

This paper has discussed the actors and narratives that contributed to the emergence of Jatropha biofuel activities in Indonesia, in addition to explaining the political and economic contexts that allowed this underutilized species to gain extraordinary national awareness. This paper also highlights the network of key actors who graduated from a prominent technical university in Indonesia that promoted the idea of Jatropha-based energy solutions. The narratives framing Jatropha as a super crop (*i.e.*, perfect for marginal lands, requiring a very low input for planting and cultivation) were able to attract the interest of multiple government actors whose objective is to find solutions for poverty, unemployment, and energy dependency. Some of these key actors also had personal interest due to their dream of gaining significant economic benefit from their involvement in Jatropha activities. Moreover, the collective memory related to Jatropha during the Japanese occupation of the 1940s played a crucial role in influencing people's excitement. Thus, the emergence of Jatropha hype in Indonesia can be explained via the image that had been created about this crop, which, at a moment of energy crisis, mediated different actors' interests and expectations at the national and personal levels.

Comparing Jatropha projects with other innovation projects could be valuable in expanding our understanding. To some extent, the story of Jatropha promotion has a strikingly similar correlation with the Barker story of national satellite promotion in the 1970s [60]. In both cases, engineers at ITB play a significant role in the national promotion to adopt these new technologies. It has a similar network pattern consisting of technocrats, politicians, and entrepreneurs, which further confirmed Barker's argument about the central roles of engineers and their networks as human mediators in the national decision to develop a new technology in Indonesia. The engineers' promotion of the technology in terms of what it means for achieving the government's national agenda was an important narrative for attracting other key actors' interests to support the idea. In the satellite story, the satellite project served the interest of president Soeharto and his military allies for achieving the government political ambition to unite the country and to modernize Indonesia. Meanwhile, in the Jatropha case, the project has been viewed as important for Indonesia independent of energy sources and for achieving the national development agenda. Moreover, in both cases too, each key individual who was involved and supported the innovation also have their own personal interest attached to the technology. Since in the two cases there is a similar pattern in which the two types of interests—the broader national agenda and the specific personal gain—have overlap, this might tell us that it is probably more common to find this kind of pattern in public decisions for technology change, at least in Indonesia.

The significant difference between the two stories—promotion of satellite and Jatropha—however, is in the characteristics of the technology, the role of global discourse, and in the involvement of other actors in technology innovation. In the satellite case, Indonesian engineers actually did not become involved in the making of the satellite but only in the strategic decision of whether Indonesia should have its own satellite system. On the contrary, Jatropha-based biodiesel is a technology in the making. In fact, since Jatropha is an underutilized plant, the knowledge about the crop and many aspects of its cultivation system are still unclear [61]. The important lesson learned here is that national strategy to promote an infant technology such as Jatropha-based biodiesel would be significantly different than when backing a robust technology that has been well developed. In terms of the effect of global discourse, in the Jatropha story, global discourse about climate change and biofuel has shaped the promotion of Jatropha-based biodiesel in Indonesia. The influence of global discourse was not significant in the context of the satellite promotion. Furthermore, the satellite is a "high technology". This means the key to innovation success depends on the engineers' knowledge and assessment about the technology. Jatropha, on the other hand, is a crop; it is a living organism. Engineers rely on the involvement of other key actors in the process to assess the success of implementation of Jatropha for energy. For example, they must learn from farmers how they perceive the proposed technology. The knowledge of other experts such as agronomists and plant scientists is also crucial in the decision to determine what the best strategy for implementing the idea is. With Jatropha, to a large extent, engineers did not have all the necessary information to assess the success of the implementation of Jatropha-based biodiesel. Thus, a technology that might find success in the lab environment would not necessarily have the same rate of success when it is implemented outside the laboratory. Sometimes, engineers need to seriously consult other qualified experts to further assess the applicability of the technology in society and incorporate the concern of the users itself for the proposed technology. It is high risk to promote a new innovation strategy without adequately assessing all the considerable factors related to the development of the technology.

At the conceptual level, this paper also highlights the use of the terms "hype-disappointment" rather than "boom and bust" on the grounds that the later term "bust" is associated with the market price, which was not the case with Jatropha, since there was not yet a market for this crop, at least in Indonesia [62]. The Jatropha story also contributes to the analysis about the role of expectation in the emergence of hype. The emergence of hype in Indonesia was mediated by the Jatropha advocates who framed the expectation using a vision based on memory about the past (the Jatropha story during the Japanese colonial era), a story about the ability of Jatropha to solve immediate present problems (for example, as an alternative of fuel and to generate additional income for the rural poor), and a story about Jatropha's future hope (*i.e.*, to mitigate climate change and to reduce the country's dependency on fossil fuel). This finding also reaffirms that "[the] interplay between past, present, and future [expectation]" often are the common themes in the formulation of expectation ([15], p. 288).

A disappointment stage occurred following the hype, which was triggered by the unexpected promise about the economic return from Jatropha cultivation. This caused a serious backlash to Jatropha promotion in Indonesia. Meanwhile, at the global level, the formulation of expectation toward Jatropha has evolved from other issues. For example, there is an emerging discourse about the potential role of Jatropha for climate change mitigation [63] and other advocates still insist that under certain circumstances, Jatropha cultivation might be justifiable for local development projects, in

particular, in some African countries [64]. What the future direction will be for Jatropha promotion after the hype is over is difficult to predict. The cost from the inability of the technology to live up to expectations might not be shared evenly among actors. Although, it is beyond the scope of this paper to provide detailed estimations about the cost of Jatropha promotion in Indonesia, it is sufficient to say that this cost is not necessarily monetary. This cost might include the loss of credibility, trust, time, as well as money.

The last lesson we can draw from this study pertains to the importance of identifying the way in which Jatropha had been hyped: this case points to a pattern that can easily reoccur at any time with new technology interventions or ideas that correspond with global or national problems. The important lesson we could draw from this experience is to avoid instant innovation: government officials should give due diligence in evaluating new technologies before making any decision to support investment.

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Conflicts of Interest

The author declares no conflict of interest.

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