

# Policy Brief on Jatropha

## A Short Description of Jatropha and its Potential Role as an Energy Crop in the Lao PDR

LIRE (Lao Institute for Renewable Energy) and LEAP (Lao Extension for Agriculture Project)

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### I. INTRODUCTION

The aim of this policy brief is to give a brief summary about current Jatropha development, in particular as it relates to the situation in Lao PDR. First, we will provide some background information about the country itself, followed by a brief introduction to the Jatropha Curcas species. Next, we will summarize some current claims of the biofuel industry and general media regarding Jatropha and its potential. These claims will be evaluated, taking into account the experiences of LIRE and other experts, following three years working with Jatropha in Laos. For this study, LIRE also carried out a dedicated field survey in Vientiane Province, to ensure the most up to date information could be including regarding the situation for smallholder farmers. Since Jatropha is under consideration for use in various business models, the study team will present three scenarios in which Jatropha can be utilized including:

- Jatropha as a cash crop
- Jatropha as a feedstock for biodiesel consumption
- Jatropha for rural electrification

The main advantages and disadvantages of each scenario will be reviewed, and expected requirements and timelines for adoption and market development shall be presented. Furthermore, since many project developers view Jatropha as a suitable cash crop for farmers in rural areas, we will also highlight the current challenges confronting farmers in Lao PDR. We will then outline some opportunities for the adoption and development of Jatropha in Lao PDR, before the policy brief will end up with a few conclusions.

### II. COUNTRY BACKGROUND

The Lao People's Democratic Republic (Lao PDR) is a landlocked country in the centre of Southeast Asia. The country benefits from a wealth of natural energy resources, in particular huge potential for hydro-power. Currently the Lao PDR is experiencing rapid economic growth that is bringing widespread change throughout much of the country. It is predicted that the Lao PDR will have the highest economic growth rate in 2009 in South East Asia at 7.5%<sup>1</sup>.

Central to the national agenda, the National Growth and Poverty Eradication Strategy (NGPES) aims to raise the Lao PDR out of the UN list of Least Developed Countries by 2020<sup>2</sup>. Within this timeframe, the government is dedicated to achieving 90% electrification coverage and to bringing clean drinking water to 100% of the population. Renewable energy (RE) technology receives special attention from the Government of Laos (GoL), since on the one hand RE is one of the most important export



Figure: Gasoline, Diesel and Kerosene filling station in remote area in Laos

products in the country<sup>3</sup> and on the other hand the expansion of RE is an important means to ensure energy security for the country. One of the main concerns of the GoL is the dependency on fossil fuel, 100% of which is imported from neighbouring countries. In November 2008 when oil prices reached new heights, the GoL organised a task force to find solutions for how the dependency on fossil fuels can be reduced by producing its own biofuels within the country<sup>4</sup>.

Until recently, the economy has mostly benefited from high foreign investment in hydropower, mining, and construction. Agriculture has joined this list as a new important investment sector. Traditional subsistence agriculture, predominantly rice cultivation with limited utilization of machinery, accounts for about 30% of GDP and provides 80% of total employment<sup>5</sup>. Since the recent global food crisis, investors identified huge potential in the Lao PDR for agribusiness. This includes agriculture and forestry products such as maize, cassava, teak, rubber, and others.

Energy crops, which can be used for biofuel production, are also in the focus of this investment. To date, investors from China, Thailand, Vietnam, Korea, Italy, France, and Japan have all tried to establish Jatropha plantations in the Lao PDR. At the time of writing this brief, almost all of these were either facing serious agronomical challenges or had aborted their activities due to (i) improper business models, (ii) lack of understanding of the local context, (iii) lack of experience with Jatropha cultivation, and (iv) overestimated expectations. A range of cultivation and business strategies (plantation models and contract farming) have all encountered difficulties resulting in an insufficient performance of seed yield.

### III. BACKGROUND ON JATROPHA CURCAS

Jatropha is a small shrub or tree which can reach a height up to 5-7 m tall with a soft wood and a life expectancy of up to 40 years<sup>6</sup>. Not a native plant to Southeast Asia, Jatropha originates in Central and South America, covering dry and semi arid areas such as Mexico as well as tropical sites like Paraguay. Portuguese traders were responsible for the spread of Jatropha to other parts of the

<sup>3</sup> [www.cia.gov/library/publications/the-world-factbook/geos/la.html](http://www.cia.gov/library/publications/the-world-factbook/geos/la.html)

<sup>4</sup> MEM

<sup>5</sup> <https://www.cia.gov/library/publications/the-world-factbook/geos/la.html>, Vientiane Times, 9 February, MEC.

<sup>6</sup> Dr. Joachim Heller, Physik Nut, 1996, [www.bioversityinternational.org/publications/Pdf/161.pdf](http://www.bioversityinternational.org/publications/Pdf/161.pdf)

<sup>1</sup> [www.vientianetimes.org.la](http://www.vientianetimes.org.la)

<sup>2</sup> [www.undplao.org](http://www.undplao.org)

world in the 16th century<sup>7</sup>. The plant can be reproduced by sexual reproduction (seeds) but also by vegetative reproduction (cuttings). *Jatropha* develops one deep taproot and four shallow lateral roots. The taproot allows the plant to draw water and nutrients from deeper soil structures and may stabilize the soil against landslides; the shallow roots can prevent surface soil erosion, which could be caused by wind or water.

*Jatropha* is hermaphroditic (contains male and female flowers). The plant can flower and bear seeds between one and three times a year, depending on the rain fall conditions and temperatures. After pollination, the plant will bear clusters of fruit. The mature seeds of many provenances contain toxins, such as phorbol esters and curcin, at such a high content that the seeds, oil, and press cake are in general not fit for human or animal consumption without detoxification. Until now, the mechanization of the harvest process was still in its pilot phase and, particularly for small scale farmers, is not an option. The collection process of the seeds can be compared with the collection of other crops such as coffee and cotton. It is time- and labour-intensive since picking the fruit bunches and removing the fruit and seed shells must be done manually. *Jatropha* seeds contain between 30 – 40% oil which makes them interesting for oil production and as a feedstock for biofuel production. Seed yield per plant depends strongly on environmental conditions as well as genetics and plantation management.

The interest in *Jatropha* as a biofuel feedstock began to rise around 2005 when discussion about a suitable feedstock for the biofuel industry began and famous groups such as Daimler Benz or D1 Oils started promoting their activities on *Jatropha*.

*Jatropha* has been considered as a “wonder shrub”, suitable for cultivation on degraded land, and able to provide small scale farmers new opportunities for additional income by becoming a kind of “energy farmer”. The toxicity of *Jatropha* has also been regarded as an advantage: unsuitable as an edible oil, the price of *Jatropha* oil would be independent of the price of vegetable oil, and thus less variable. Concerns have also been raised regarding the use of vegetable oils (particularly palm and soya oil) for the biofuel industry since an increasing price of crude oil could lead to a rise in the cost of basic foods. Last but not least, investors hoped with *Jatropha* to have identified a morally acceptable feedstock for biofuel consumption. If the plant could be grown in areas unsuitable for food production, the cultivation of *Jatropha* *might* be environmentally friendly.

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#### IV. CLAIMS ABOUT JATROPHA

There are a number of claims and assumptions that the industry makes about *Jatropha* as a potential cash crop. While some of these claims and assumptions may turn out to be true, they are not necessarily proven, especially in the specific context of Lao PDR. In this section of the policy brief we will outline the current industry claims and highlight LIRE’s knowledge base and concerns regarding some of the claims.

##### **CLAIM: *Jatropha* species is a crop already domesticated and has clear value as a cash crop**

*Jatropha* is not a developed crop and the genetic potential for improvement via various origins has not been explored to any significant extent. For other important crops such as rice, maize and cassava, huge breeding efforts have been undertaken to improve the features and performance of the plants, and make them suitable for mass cultivation. At present, international plant breeding companies are trying to develop the features of

*Jatropha*, for example related to seed yield, pest resistance and growth. However, such breeding efforts are time consuming and the first generation of improved seed material is still some years away from being available for general distribution. Important breeding companies are D1 Plant Science and the University of Wageningen Netherland.

Regarding the Lao context, there is a low availability of knowledge concerning the extent of genetic variation. LIRE is conducting some studies on *Jatropha* plant breeding by establishing a test field with different accessions from different provinces. However these trials are for educational means rather than for the production of improved seed material. This task is time- and cost intensive.

##### **CLAIM: *Jatropha* can grow on marginal land**

*Jatropha* can grow on poor soil but, like other crops, the performance and the seed yield is strongly correlated to the level of nutrition in the soil. With a higher nutrient content in the soil, the yield of plants will be higher.

Regarding the Lao context, so far *Jatropha* is cultivated as a hedge (living fence) and only occasionally as a cash crop. Concerning cash crops, high yield is important to guarantee profit so farmers should use suitable land for *Jatropha* plantations. LIRE has started some trials on marginal soils and tests the impact of adding fertilizer on this land. Preliminary results of the trials showed already that *Jatropha* reacts to the supplementation of fertilizer significantly. Therefore if *Jatropha* is cultivated on marginal soils, additional input / treatment has to be done otherwise seed yields will be correspondingly marginal.



Figure: Poor soil with underdeveloped *Jatropha* plants

##### **CLAIM: *Jatropha* can be cultivated on various types of soil / environments**

*Jatropha* can grow on many places however it is important to consider the features of the local environment otherwise the plant will develop poorly in terms of growth, seed yield and pest resistance. *Jatropha* is not frost resistant and prefers warm climates. Moreover, heavy and loamy soils are rather less suitable since this soil structure inhibits root development. Locations susceptible to water logging are not suitable for *Jatropha* cultivation at all. *Jatropha* develops well on sandy soils and soils which allow a sufficient contact between roots and air. In general it is good to consider whether native *Jatropha* plants perform well in the proposed planting area.

Another important issue related to suitable soils / environments is the cultivation method. As stated above, *Jatropha* can be cultivated by cuttings and seedlings. Cuttings do not develop a tap root and are thus unable to absorb water from deeper layers. Particularly in the dry season *Jatropha* propagated by cuttings

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<sup>7</sup> Claims and Facts on *Jatropha*, University of Wageningen [www.library.wur.nl/way/bestanden/clc/1858843.pdf](http://www.library.wur.nl/way/bestanden/clc/1858843.pdf)

might suffer from drought. In contrast, preliminary studies of soils with a high humidity suggest that *Jatropha* plants cultivated by cuttings can perform better than seedlings. However more rigorous scientific analysis is required to confirm these observations.

**CLAIM: *Jatropha* cultivation offers income to the farmers after the first year of cultivation**

*Jatropha* takes at least 2-3 years after planting to produce significant seed yields. In the first vegetative period only marginal yields can be achieved which brings negligible income. On the contrary farmers have to invest labour and financial resources for setting up the nursery, adding fertilizer, preparing land and establishing plantation management (weeding and pruning). Therefore financial benefits can be expected only 2-3 years after first cultivation.

**CLAIM: *Jatropha* can be grown with intercropping**

*Jatropha* is well suited for intercropping, in particular during the first years while the trees are small. Intercropping is generally not practiced in Laos, but there are already some promisingly trials with upland rice, vegetables and legumes.



Figure: Upland rice with intercropped *Jatropha*

The picture above gives an example where a farmer practised intercropping with upland rice and *Jatropha*. After the first year, the rice is harvested and *Jatropha* plants continue to grow. Additional intercropping seasons can follow if desired.

**CLAIM: *Jatropha* is tolerant against pest and diseases**

The claimed tolerance of *Jatropha* against pests and diseases are based on observations of singular mature trees, and can not be compared with *Jatropha* grown in plantations. Several diseases appeared on *Jatropha* plantations in Laos and in many cases no countermeasure could be taken by the farmers due to a lack of knowledge. Skills of organic pest management are available in the country but are generally not found on the village level. Particularly in the first year of planting, termites can destroy a whole plantation within a short period. Strategies and knowledge have to be developed to avoid negative impacts from diseases.



Figure: Weed occurrence, termites, rotten roots and other diseases

**CLAIM: *Jatropha* cultivation (harvesting) offers employment opportunities for local people**

It is claimed that *Jatropha* offers people in remote areas an opportunity to generate extra income and employment by cultivating *Jatropha*. As explained earlier, the harvesting process has to be done manually and is quite labour intensive. Again, little information is available regarding the quantity of seeds that can be harvested and processed (peeled from fruit and seed shell) by villagers in one day.

Problematic for the harvesting is the non-synchronous ripening of the fruits. Unlike other (domesticated) fruit trees, *Jatropha* seed production is a continuous process during the rainy season. The graphic below illustrates this problematic issue on several individual *Jatropha* plants observed during a single rainy season.

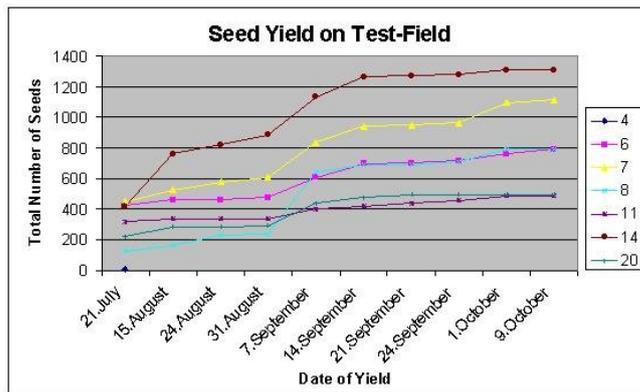


Figure: Seed development from single *Jatropha* plants. Individual plants were named with arbitrary numbers.

It can be seen that *Jatropha* plant number 14 has the best performance by producing about 1300 seeds during July and October. For the harvesting process it would be much more convenient if significant harvest peaks appear (e.g. like mangos).

Considering the Lao context, the harvest timing can be problematic since the rainy season is already a busy time for farmers, who tend to their rice fields. According to LIRE's experience, farmers will rarely neglect rice fields for another crop.

Last but not least the harvest of mature fruits has to be done quickly after maturation, otherwise seeds will start to germinate which will make them useless for the oil production.

**CLAIM: *Jatropha* can produce 4 tons of seeds per ha after three years**

It is a common problem that due to the lack of experience and information, currently it is not possible to estimate and predict seed yield. Too many unknown parameters can influence plantation performance such as:

- Local climatic condition
- Local soil condition
- Cultivation method (cuttings vs. seedlings)
- Plantation management including: pruning, weeding, watering, fertilization and harvesting

Currently there is a lack of verified data about seed yield in Laos. Moreover these figures have to be combined with an exact description of the properties of the plantation (date and kind of cultivation, local environmental features, maintenance efforts...). LIRE conducted a monitoring project of a *Jatropha* plantation on a fertile soil. In the second year of cultivation the average seed yield per tree was about 300 grams which means approximately 600 kg per ha. More data from mature plantations but also hedges is required from qualified persons/institutions.

**RECOMMENDATION:** More efforts have to be conducted in order to gain validated data and information about existing plantations in Laos. Universities and private companies are encouraged to share their resources and experience.

**CLAIM: Farmers can generate their own biofuel for local consumption by planting Jatropha**

In the Lao context, currently Jatropha companies which promote Jatropha cultivation set a clear target to produce for export and hardly consider local biofuel production and consumption. In principle it is technically possible to operate community scale Jatropha processing facilities which can be operated by farmers' associations in order to generate their own biofuel for use in tractors, water pumps, and diesel generators etc. However these facilities are still cost intensive and require operators with technical skills. Therefore decentralized biofuel facilities require technical training and financial support in order to produce a standardized biofuel which does not harm the engine.

**RECOMMENDATION:** Support from NGO's, the private- and public-sectors is needed in order to stimulate decentralised solutions. Otherwise there will be minimal opportunities and benefits for small scale farmers in order to make themselves independent from the regular diesel.

**CLAIM: Jatropha production does not harm food security**

High seed yield expectations and aggressive promotion of Jatropha may result in a doubtful incentive for farmers to change from traditional food production to Jatropha production. In that case, farmers may risk their food security or income stability. An option would be to integrate Jatropha production in traditional farming systems, such as intercropping or hedge production. There is a clear demand for extension materials which assist farmers. If the experience about a sustainable Jatropha production is considerably explored, farmers may choose to dedicate their land, labour and investment in Jatropha production.

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## **V. POTENTIAL SCENARIOS OF USE AND ADOPTION OF JATROPHA IN LAO PDR**

In this section, we will discuss three key potential scenarios for the use of Jatropha in the Lao PDR. We will highlight advantages and disadvantages of each scenario as well as discuss the projected requirements and timelines for adoption and market development (for example maturation of the supply chain, relative labour intensity, economic viability, etc.). The potential scenarios for Jatropha include a) Jatropha as a cash crop, in particular when compared to alternatives like cotton, maize, cassava, coffee, fruit trees, b) Jatropha as feedstock for biodiesel to offset diesel consumption, and c) Jatropha for rural electrification.

### **V.I. JATROPHA AS A CASH CROP**

Jatropha has potential to be a valuable cash crop for small scale farmers of the Lao PDR if the following are accomplished: i) a suitable and proper cultivation method is practised, ii) extension services and follow-ups are provided, iii) companies provide the initial investment, (iv) sufficient labour is available, v) a suitable integration in the current agricultural system is secured, and vi) a fair price and access to markets are ensured.

#### **Suitable and sustainable cultivation practice**

There are two main cultivation approaches for Jatropha: cultivation as a common plantation and the cultivation as a hedge. The main advantage of Jatropha cultivation as a plantation is the outlook to a long lasting commercial plantation which has to be

planted only once and with decreasing amounts of efforts for maintenance. Already after 2 to 3 years, Jatropha provides reasonable seed yields which is faster compared to rubber which is also a perennial crop where first tapping can be conducted after 5 to 8 years. However the amount of work required for weeding and harvesting should not be overlooked, as it is of a comparable level to other cash crops such as cotton or coffee. A shortcoming of the plantation model might be the use of arable land which can cause competition to other food crops.

The Plantation model is suitable if a lot of land is available. This requires a medium amount of labour force compared to other common cash crops in the Lao PDR.

Regarding cultivation as a hedge, there would not be any competition to other food crops because no arable land is used. An additional advantage is the much lower amount of labour force that is necessary compared to Jatropha plantations or any other cash crops. Additional Jatropha hedges have positive environmental effects, as they protect the soil from wind erosion and other plants from damage due to animals. However it has to be mentioned that the yield of Jatropha hedges is lower compared to plantations because spaces between traditional hedges are quite small and due to that less nutrients are available per plant. It is possible to plant 400 metres of Jatropha hedge around a field with the size of one hectare.

**RECOMMENDATION:** Hedge cultivation is suitable if no additional land is available. Moreover if farmers aren't sure about their commitment to Jatropha, planting hedges requires fewer efforts than establishing plantations.

#### **Extension service and follow-up provided**

The use of Jatropha is widespread in the Lao PDR, but the wild species grow with minimal input from villagers. Farmers gained basic cultivation skills but have no profound experiences on any further activities like pest control, fertilisation, intercropping, harvesting, peeling and proper storage techniques. At this point the Provincial and District Agriculture and Forestry Office (PAFO and DAFO) play a crucial role in providing extension services and following-ups. However first of all PAFO / DAFO need access to extension material as well as the opportunity to receive training about cultivation practices.

**RECOMMENDATION:** Basic cultivation skills are available but there is a huge need for further training courses and a deeper cooperation between DAFO and small scale farmers. A follow-up by extension staff of DAFO is important for a sustainable and successful cultivation. Furthermore, a broader cooperation among farmers is necessary, and this can be achieved through comprehensive village meetings.

#### **Financial support from the promoter**

The establishment of a Jatropha plantation/hedge is linked with expenses and work efforts. Jatropha promoters have different strategies for encouraging farmers to cultivate Jatropha. Almost all of them overstate expected seed yields and fewer efforts for the cultivation. However some companies are providing initial investment (e.g. 30 US\$ per cultivated ha) as an incentive to the farmers which is also practised with other cash crops such as tobacco. The farmer however has to guarantee that he only sell the produced seeds to the company. In general it is important that the farmer does not carry completely the risk of cultivation. Some funds have to be reserved in order to reimburse the farmer if the Jatropha plantation doesn't work out.

#### **Enough labour force available**

In the Lao context the availability of an accurate amount of labour forces during the rainy season is problematic. Jatropha cultivation -as plantation or hedge- is not as labour intensive as other cash crops regarding to the information given by villagers involved in Jatropha cultivation. One of the main reasons is that Jatropha is an annual crop. However, it should be noted that harvesting is very labour-intensive and may jeopardise the economic viability of Jatropha cultivation, particularly when compared against other cash crops.

**RECOMMENDATION:** The labour-intensive maintenance of Jatropha plantations in a mature stage is less than for other food and cash crops, and could be seen as an advantage regarding the low amount of labour force in the Lao PDR. However, regarding harvest efforts, Jatropha has to be compared with cotton and coffee, common cash crops in Laos.

#### **Suitable integration in the current agricultural system secured**

Regarding the low availability of labour force, it is important not to increase workload during seasonal labour peaks connected to the cultivation of main food crops. For a sustainable cultivation of both practices, the integration of food crops is important. If there is an overlap between the tasks regarding Jatropha cultivation and the tasks regarding the cultivation of other food or cash crops, the cultivation of Jatropha is not sustainable and would only increase peak workloads for farmers.

**RECOMMENDATION:** The local cropping calendar (which crop will be cultivated/harvested at what time) has to be considered seriously. Otherwise overlaps with the maintenance and particularly the harvest time of Jatropha will be the result.

#### **Fair price and secured market**

There is a continuous and high demand of Jatropha seeds in the Lao PDR. However the main problems are miscommunication or no communication at all between company and farmer. Not all companies are offering a fair price, nor do they promise to purchase the seeds. Contract farming is not often taken seriously and farmers in rural areas are mostly in a weak bargaining position.

**RECOMMENDATION:** The price for Jatropha seeds has to be evaluated and arranged by the company and the farmer. If it transpires that farmers can not gain a benefit out of this price Jatropha should not be promoted at all.

#### **V.II JATROPHA AS FEEDSTOCK FOR BIODIESEL TO OFFSET DIESEL CONSUMPTION**

The GoL has set the target that 5% of the fossil fuel consumption should be covered by biofuels by 2015. The diesel consumption for 2015 is predicted to reach 393 million litres per year<sup>8</sup>. This means that about 19.7 million litres of biodiesel has to be produced annually in order to reach that target. Since estimates of Jatropha seed yields are still vague it is not yet possible to determine the demanded area for the Jatropha cultivation. However if this biodiesel will be produced by Jatropha oil, approximately 78,000 tons of Jatropha seeds / year would be required. As a comparison, in 2006 about 12,000 tons of soy beans and 500,000 tons of maize were produced in the Lao PDR<sup>9</sup>. At the

<sup>8</sup> Survey on Fossil Fuel Consumption for Energy Efficiency Conservation to Promote the New Technology of Biofuel in Lao PDR, May 2008, [www.lao-ire.org/documents/reports/0805-LIRE-report\\_Biofuel-NEDO.pdf](http://www.lao-ire.org/documents/reports/0805-LIRE-report_Biofuel-NEDO.pdf)

<sup>9</sup> Agriculture Statistic Center MAF, Vientiane Capital 2006

current stage, this demand can not be filled by Jatropha within the next 5-10 years.

**RECOMMENDATION:** Alternative oil crops such as soy beans, pumpkin, canola, sunflower, camellia, sesame and others should also be considered as potential feedstock for the biodiesel production.

#### **V.III JATROPHA FOR RURAL ELECTRIFICATION**

Rural electrification by using Jatropha oil is a means to increase the value chain inside the village where Jatropha is produced. However, since the oil-pressing equipment and required modifications to engines is still expensive, it is unlikely to be economically feasible. Moreover due to limited energy consumption in remote villages, meagre revenues can be generated from the sold electricity<sup>10</sup>.

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#### **VI. CHALLENGES FOR SMALL SCALE FARMERS**

Given the above potential scenarios of use, this section addresses specific barriers to the adoption and development of Jatropha as a cash crop for small scale farmers in Lao PDR. In general, the key issues in the adoption and development of Jatropha as a cash crop for small scale farmers in other countries include a lack of knowledge transfer and capacity building of local farmers, unviable business plans for both companies and farmers, a lack of market understanding and presence, and finally the incapacity of legal systems to enforce contracts for both farmers and companies.

The first set of general challenges is that in other countries, companies, and other stakeholders (NGOs and local institutions and associations), often fail to provide adequate information or technical assistance to farmers, including frequent follow ups. Furthermore, companies usually made unrealistic promises in terms of productivity, net profit, and the timing of the first harvest, which led to distrust between the local farmers involved, and subsequently a decline or abandonment of the plantation. A similar pattern is seen with other actors who were involved, as they often used input data for their project related to large scale plantations, which do not correspond to small scale cultivation. Without adequate planning, including detailed business plans adapted to the local context, it has not been possible to evaluate the real opportunities in term of profit for all the actors involved, and market development has therefore been disappointing.

Another challenge seen in other countries is the lack of institution-building, which could bring about the establishment of a viable, competitive market. A lack of support from government agencies and the legal system to enforce contracts are also responsible. Traders may buy seeds from farmers at prices much lower than market value, or at less than the agreed fixed price, without respecting the contract between the



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<sup>10</sup> FONDEM, Study on the use of biofuels for rural electrification in high environmental quality condition in Luang Prabang province, 2009

companies and the traders and the farmers. In the sections below, the key challenges to the adoption and development of Jatropha as a cash crop are detailed for the case of the Lao PDR.

#### **VI.I. GAPS IN COMMUNICATION BETWEEN STAKEHOLDERS**

The first challenge for small scale farmers in Lao PDR are the gaps in communication between stakeholders. These gaps in communication are not just between farmers themselves, but also between farmers and companies, between companies and the government, and between farmers and the government.

According to a recent LIRE field survey, there is miscommunication between the local farmers already involved in jatropha cultivation. It seems that important information such as market prices and the details of farming contracts are not shared at the village level. One contributing factor is that farmers are not organized and thus do not have a strong bargaining position.

Similarly, the communication between farmers and companies is lacking, in particular regarding technical assistance and expectations for productivity and profits as seen in other countries. Communication and cooperation between companies and government institutions is also weak, and in general each party is unaware of the terms and responsibilities of the arrangements made between the other party and farmers. Lastly, despite ongoing efforts, the information flow between governmental institutions and farmers should also be improved, in part because of the challenges of distributing information and gaining access to remote villages in the rough terrain of the Lao PDR. In summary, there is miscommunication or lack of communication between all the actors involved, leading to mistrust and poor cultivation and market practices.

#### **VI.II. LACK OF MARKET, MONOPOLISTIC PRACTICES, AND WEAK CONTRACT ENFORCEMENT**

Since the market is underdeveloped and there is no support for farmers' associations, farmers are unorganized and do not have a strong bargaining position. The incapacity of the legal system, and the lack of competitive market forces, means that farmers are often taken advantage of. There are currently monopolistic practices regarding Jatropha as a cash crop, with only one trader or company available for each district and village. Farmers are forced to accept the price paid by the company or the trader in their vicinity; this price may be lower than the fixed price initially agreed upon or significantly lower than a fair one. Since the culture of respecting and enforcing contracts between farmers and companies is weak, it may be to the responsibility of the government to provide services which enforce contracts.

A strong and fair market will be difficult to develop unless there is coordination and respect between all the actors involved. While currently who the market players are is unknown, a good first step in resolving this issue will be to identify the main actors and the role they should play in the future. Once the market players are identified, it will be possible to support coordination between players and to ensure fair practice.

#### **VI.III. LACK OF EXTENSION SERVICES AND INFORMATION**

The third specific challenge in Lao PDR is the lack of extension services and information for small scale farmers which would help them achieve market success. The services which are lacking include basic services related to infrastructure, market and financial information and services, and technical assistance.

Because villagers are often located in remote areas and the infrastructure connecting villages to markets is unreliable in the

Lao PDR, transport costs and ease of delivery of seeds are a real financial and logistic burden for the farmers. It is difficult to link farmers with markets which could become a critical issue in the scenario of Jatropha as a cash crop.

Another barrier farmers must overcome is access to market information. The farmers who were interviewed in the most recent LIRE field surveys said that they have little or no information about the Jatropha market, especially in terms of prices and market trends. Farmers receive all the information related to Jatropha from the companies that provided them the seeds and from other villagers. Farmers' access to market information should improve quickly through the work of government institutions such as DAFO (as happens for other cash crops) and as a result of the rapidly increasing media presence. According to LIRE observations, television is the medium preferred by farmers for receiving market information. In addition to basic market information, farmers also do not have access to basic formal financial services which would help them to manage their Jatropha businesses competently.

The final and critical shortcoming in support for farmers in Lao PDR is a lack of access to useful and reliable technical assistance and best practices for growing and harvesting Jatropha. Jatropha as a cash crop is still an innovation in the Lao context. According to the most recent LIRE field investigation, farmers have a low level of knowledge about cultivation techniques. Compounding this lack of technical assistance and knowledge of best practices is a current uncertainty over which institution or organization would be best suited to provide farmers with this critical information.

In summary, in review of the current situation, small scale farmers in Lao PDR are being expected to invest manpower, land, and money in a new cash crop without having access to market, technical, or legal assistance. Understandably, farmers are unwilling to cover all the required cost to engage in Jatropha cultivation as a cash crop without having a secure demand for their seeds at a known and fair price, and moreover without reliable information about the crop itself. It is generally accepted in literature that small farmers with a low income are risk-averse; this is definitely the case in Lao PDR where Jatropha as a cash crop is perceived by farmers as a risk instead of an opportunity. To be successful with small scale farmers, the responsible issues must be addressed.

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### **VII. OPPORTUNITIES**

With a solid understanding of the barriers to adoption and the specific challenges for small-scale farmers of Jatropha in Lao PDR, it is possible to outline opportunities for addressing the main issues. In the text below, the opportunity areas suggested as starting points for the implementation of meaningful and actionable initiatives. A more detailed prescription of actions to address these challenges would need to be developed after a more rigorous consultation.

#### **Utilization of existing resources for improving the quality of the extension service**

Agriculture extension agencies which are part of governmental bodies have already gained invaluable experience with other types of extension work for different agriculture products such as rubber, organic coffee, sustainable forest/wood production etc. If these resources can be redirected to assist and train DAFO staff and farmers in terms of the Jatropha market chain, the situation of remote farmers can be substantially strengthened. In order to achieve this, extension staff require immediate access to technical

information such as best practises or decision tools. Here stronger collaborations with the private sector might also be advantageous.

#### **Strengthen farmers' position by founding farmers' associations for Jatropha**

As the study team experienced during the field trip, there is a general lack of communication between farmers and other Jatropha stakeholders which makes a closer collaboration and discussion between Jatropha stakeholders desirable. The funding of farmers' associations which are considering Jatropha as a cash crop could be an interesting option to strengthen farmers' position in terms of Jatropha cultivation and marketing

#### **Capacity building by the establishment of demonstration sites**

The purpose of demonstration sites is both to learn more about the technical aspects (research) and to evaluate the social, economical and environmental impact of Jatropha cultivation. In order to develop demonstration sites successfully, financial and organisational support is essential. After the first period of protection and according to the results obtained, it is necessary to evaluate whether the project can survive in realistic conditions.

Additionally, the goal of demonstration sites is to support the capacity building process by employing and training local farmers and DAFO staff. The increase of local capacity is one of the key goals in the transition towards successful Jatropha cultivation. In addition, results gained from Jatropha demonstration projects are good indicators for further activities, and the assessment of the potential of Jatropha as a cash crop can be made by increased research efforts.



Figure: Well maintained research and demonstration plantation at the Lao State Fuel Company test site close to Vientiane

#### **Identify market opportunities before promoting Jatropha**

If Jatropha is considered as a cash crop, the local infrastructure deserves special attention. The transport costs of seeds are a relevant part of the final cost, and Jatropha production as a cash crop in remote areas might be economically unviable<sup>11</sup>. They found out that transport costs are more twice the price than in Thailand. The high transport cost is a barrier to market access, as has been the case for other crops, increasing the final cost and reducing the crop competitiveness.

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### **VIII. BEST KNOWN PRACTICES**

Despite the general lack of established best practices, there is some existing directional information on how best to select sites to grow Jatropha. Moreover LIRE is currently working on decision tools and a manual that will equip farmers with some of the relevant knowledge they require. The quality of these tools could be greatly improved through knowledge sharing with locally acting companies.

The study team has outlined these understandings in the following section with the hope of establishing a solid knowledge base for future initiatives. One of the aims of the policy brief is to stimulate knowledge exchange within the concerned stakeholders.

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### **IX. CONCLUSIONS**

#### **Contract farming with small scale farmers**

The idea that farmers in developing countries like the Lao PDR can become some kind of "energy farmer" contributing to the national energy security has to be considered carefully. One of the major burdens of Jatropha is the fact that this plant is still far away from being domesticated like other crops. Moreover basic knowledge about Jatropha is still lacking. Aggressive promotion of this crop combined with weak extension services for farmers will not result in a sustainable production of Jatropha but will instead increase the risk of neglect of important field work. So far the plant is still unproven as an alternative cash crop for farmers in remote areas. Further research is vital before Jatropha can be considered as an alternative. An increased demand for energy crops (oil, starch, and sugar) in Lao PDR can be expected since the country fully depends upon fossil imports which are likely to become and increasing burden without investigations for alternatives such as biofuels or energy saving initiatives.

However, instead of transferring this burden to farmers in rural areas – the weakest group of the chain –, central resources should be mobilised to avoid further disappointments for small scale farmers. Furthermore companies intending to use contract farming as a business model have to consider the local context for each district, village and family.

#### **Involvement of Jatropha companies**

Jatropha companies with sufficient financial resources need to invest in human resources and train local technicians. Moreover the establishment of test and demonstration sites is highly recommended. Instead of investing huge efforts and resources for the establishment of medium scale Jatropha plantations, small test fields will provide invaluable experiences in terms of seed yield expectations, costs for maintenance and harvesting and many others.

The private sector should increase their efforts in networking and knowledge sharing with other organizations and companies. Even organizations which are not directly linked with the biofuel industry such the WWF or SNV are able to contribute and assist in terms of sustainability and others.

The focus on Jatropha as being the most promising biofuel crop in the Lao PDR has to be reconsidered. Efforts for identifying other oil crops have to be started instead of ignoring them completely. Besides intelligent crop selection, a suitable business model and site selection also has to be developed. Furthermore, an

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<sup>11</sup> Smits, LIRE, Feasibility study on Biomass gasification 2008

appropriate Biofuel policy is not yet in place and hopefully the GoL will present new guidelines very soon.

The hype concerning Jatropha, mainly caused by skillful advertising experts from huge oil and automobile groups, will not last forever. Jatropha which has been called the wonder shrub is currently under fire and needs immediate support to avoid its effective disappearance from the Lao PDR. The demanded agronomic research will take some years before the heightened expectations are justified.

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## X. ABOUT LIRE

The Lao Institute for Renewable Energy (LIRE) was founded in October of 2006 by Lao companies, organizations, and agencies with the common vision to establish a platform for renewable energy research in Lao PDR. LIRE is a government-authorized Non Profit Association (NPA) operating under the Lao Union of Science and Engineering Associations (LUSEA), the umbrella organisation set up by the Lao National Science Council (NSC) in 2001.

The principal founding member of LIRE was Sunlabob Renewable Energy Ltd., a successful Lao company specialised in providing off-grid rural electricity solutions. Other founding members include the National University of Laos (Faculty of Engineering and Architecture); XAO BAN Group; Lao Association of Organic Products Promotion (LAOPP); Geo - Systems International Ltd; Technology Research Institute (TRI); and the Lao Renewable Energy Services Development Association (RESDA Lao). The institute offers agronomical, technological and socio-economic research services, and works to provide free public resources. LIRE strives to support the development of the country by exploring commercially viable means to establish long term alternatives to conventional practices.

LIRE recognises that, in order for renewable energy technologies to offer a long-term solution for Lao PDR, it is essential to establish local expertise for the operation and maintenance of systems. The institute develops training and resources for the end user, and promotes renewable energy technologies as alternatives to traditional practices through educational initiatives.

Much of the research undertaken at LIRE is performed by Lao nationals, with the support of visiting researchers from overseas. In addition to facilitating the transfer of expertise to permanent staff, projects also benefit from first-hand insight into the Lao context, which is especially advantageous for field research.

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