Northern Uplands
Core Coherent Programme

Economic and Financial Analysis

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EXECUTIVE SUMMARY

The financial and economic analysis of the Northern Uplands Core Coherent Programme assesses impact by comparing expected outcomes "with" the Project to conditions expected if the Project is not implemented (i.e. "without" the Project). Agricultural production in the villages of northern Lao PDR displays a large variety of approaches, though much of it can be characterized as low input and low output. Without a project's intervention, this situation is likely to continue into the future, although decreasing productivity and higher risks are expected due to changing farming systems and degradation of the soil resource base as fallows are reduced and mono-cropping increased. "With" the Project it can also be expected that households will take a variety of approaches to adopting improved technologies. However, a common shift towards diversified production, improved soil management, raising livestock as a productive resource and value-added post harvest processing is assumed.

Indicative agricultural production models have been developed to represent likely "with" and "without" Project scenarios. These include upland maize, upland rice, paddy, pig fattening, cattle fattening, tea processing and maize drying. The use of indicative models is not a denial of the variety of approaches that exist in the real world. Rather, such models provide a way of calculating representative increments to production values that may follow from Project implementation.

Calculations of financial and economic costs and benefits are expressed using the Lao PDR Kip in constant 2009 prices so as to exclude inflation. Economic valuations exclude transfers from one part of society to another (i.e. taxes and subsidies) and attempt to facilitate comparison of project benefits and real opportunity costs to the economy by translating all prices into a common, undistorted footing.

From the indicative models it is expected that households which adopt the improved upland maize technology will be able to attain LAK 1.85 million in annual incremental financial net revenue (when comparing "with" to "without" Project situations). For upland rice this figure is LAK 2.04 million, for paddy LAK 2.57 million, for pigs LAK 4.2 million, for cattle LAK 6.2 million, for tea processing LAK 990,000 and for maize drying LAK 290,000.

Project-wide, with all adopting households at full implementation, total annual incremental financial net revenue from upland maize is expected to be LAK 4.43 billion (€422,505) - with the comparable figure in economic terms being LAK 4.32 billion (€411,086). For upland rice this financial figure is LAK 4.89 billion (€465,897) and in economic terms LAK 4.05 billion (€385,963). For paddy the increment would be LAK 1.54 billion (€146,667) financially and LAK 1.5 billion (€142,857) in economic terms. For pigs the increment would be LAK 8.93 billion (€850,043) financially and LAK 7.87 billion (€749,669) in economic terms. For cattle the increment would be LAK13.5 billion (€1.27 million) financially and LAK 12.21 billion (€1.16 million) in economic terms. For tea processing the increment would be LAK 623.7 million (€59,500) financially and LAK 573.3 million (€54,600) in economic terms. Similarly for maize drying the financial figure is LAK 1.02 billion (€97,440) and the economic figure is LAK 1.13 billion (€107,520).

There are indications, though, that members of rural households are fully occupied each day. In the "without" Project indicative models, however, it can be noted that much of the time presently devoted to agricultural activities is not very productive. The adoption of "with" Project technologies can greatly increase the returns per labour-day.

Adoption rates have been assumed at 34% for cropping technologies and 30% for livestock technologies, representing 4,796 and 4,232 households respectively. A total of 600ha of paddy is planned for improvement to allow double cropping and it is expected at least 126 villages will undertake post harvest processing, adding value to their crops.

The resultant Project Economic Net Present Value (ENPV) is €2,425,863 assuming a discount rate of 10%. The Economic Internal Rate of Return (EIRR) is 14.45%, indicating the Project has strong potential.

Sensitivity tests regarding various risk factors were made on the calculation of economic returns. These risks included the attainment of expected levels of adoption rates and expected gross revenues. A 20% reduction in adoption rates reduces the EIRR to 8.1%, posing a high risk to viability, whilst a 20% reduction in gross revenue reduces the EIRR to 10.5%, posing a medium level of risk. Project management will need to monitor these variables and prepare mitigating measures as part of an overall risk management strategy.

A summary of financial and economic analysis is presented in Table 1.

INTRODUCTION

The Northern Uplands Core Coherent Programme is designed to secure and improve livelihoods of the rural poor in selected areas, based upon sustainable land and natural resource management and community driven development. To examine the possible financial and economic impacts of the Project a selection of indicative household agricultural enterprises are examined. A "without Project" situation for a given type of enterprise is compared to a "with Project" situation in order to calculate the increments of production and income that can be ascribed to the Project. These "with" versus "without" increments are then extrapolated based on anticipated adoption rates of the technologies introduced by the Project and on the number and size of villages that are expected to be reached.

In northern Lao PDR there exists a wide variety of approaches by farmers towards agricultural production. The average area cropped by a rural household in the northern uplands is estimated at 1.59ha[1]. Key issues in upland agriculture include the reduction of shifting cultivation in line with Government policy. Fallow periods have subsequently declined from 25 years, to three years, in some instances. Without the introduction of soil fertility management measures, yields will steadily decrease. Upland rice is commonly grown for home consumption but is gradually being replaced with cash crops, such as maize, in areas with access to markets. Mono-cropping of cash crops increases exposure to risk, not found in traditional diversified farming systems. Commodities, such as rubber and tea, are also being introduced but no, or very little, post harvest processing is carried out by the farmers. A general characteristic of livestock production is inadequate quality and quantity of feeds. Animals are often allowed to range free to find their own food or, if confined for a period of time, feed must be found in the forest and carried back to an animal enclosure. As a result, diet is generally unbalanced and animal health and growth rates tend to be poor.

The Project will present diversified cropping systems to maintain soil fertility and reduce risks associated with mono-cropping. Any areas suitable for intensive paddy production will be exploited through irrigation and the use of yield increasing inputs. Livestock activities will include forage technologies to improve animal diet and make it possible for farmers to adopt better livestock management techniques, including confinement and disease control measures. Value-adding post harvest technologies will be introduced on a village basis.

In addition to the wide variety found in present practice, it can be expected that households which choose to adopt Project technologies will do so in a variety of ways. The indicative models included in this financial and economic analysis are, therefore, abstractions from the wide variety of agricultural practices that presently exists and from the various ways in which households may actually choose to adopt Project technologies. Three cropping models are developed here: 1) upland maize intercropped with soybean, 2) a four year rotation of (i) upland rice with sesame followed by ginger, (ii) soybean, (iii) groundnut, and (iv) jobs tear, and 3) Intensive paddy production. Two livestock models are developed for pigs and cattle. Tea processing and grain drying are developed as examples of post harvest value-adding technologies.

[1] Laos PDR : Rural and Agriculture Sector Issues Paper, World Bank, 2006

METHODOLOGY

To develop the various agricultural enterprise models, certain assumptions are made regarding future practice (both "with" and "without" the Project) and about the valuation of inputs and outputs. These include:

- Project life is 12 years
- "Without" the Project, the present farming system is expected to continue for the life of the Project. However, crop yields for maize and upland rice will decline by a 10th of the first year yield for two years, before the farmer shifts to a new field, where the three year decline is repeated.
- "With" the Project, improved agricultural practices are also expected to continue for the life of the Project.
- Some agricultural outputs may be consumed within the household, but are valued as if sold.
- Some inputs may be purchased but many are valued simply on the amount of household labour involved.
- Values are expressed in constant 2009 prices so as to exclude inflation.
- The Lao PDR Kip is the unit of account. The exchange rate used is LAK 8,500 per U.S. dollar or LAK 10,500 per €uro.

Financial prices used in this analysis were identified during field work carried out by the consultant team.

In order to assess the Project's contributions to the economy of Lao PDR it is necessary to convert financial values into their economic equivalents. Economic valuations exclude transfers from one part of society to another (i.e. taxes and subsidies) and attempt to facilitate the comparison of project benefits and real opportunity costs to the economy by translating all prices into a common, undistorted footing. Basic assumptions, in addition to those above, used in the economic part of the analysis include:

- The use of a domestic price numeraire.
- In the case of major tradable commodities (food grains and fertilizers), economic values are based on border parity prices.
- For non-traded goods and services, a Standard Conversion Factor (SCF) of 0.9 is used. For rural labour, a Shadow Wage Rate Factor (SWRF) of 0.8 is used. The SWRF reflects the low productivity of rural labour in the area.
- Transfer payments such as taxes and subsidies are excluded in the calculation of economic values.

Tables can be found at the back of this document. **Table 1** provides a summary of the financial and economic analysis and **Table 2** lists farm-gate prices in financial and economic terms. As the development and use of forages is central to the livestock technologies, forage requirements and inputs are developed in **Table 3**. A model of upland maize is presented in **Tables 4 & 5**. Similar models are developed for upland rice in **Tables 6 & 7** and paddy cultivation in **Tables 8 & 9.** For pig fattening, "without" and "with" project scenarios are developed in **Tables 10 & 11** and the same are prepared for cattle fattening in **Tables 12 & 13.** Tea processing models are presented in **Tables 14 & 15** and maize drying in **Tables 16 & 17**. Project-wide impacts are provided in **Table 18,** presenting financial and economic internal rates of return and net present values.

INDICATIVE HOUSEHOLD AGRICULTURAL MODELS

- **Upland Maize**

Maize is the second largest crop, by area planted, in the three target districts. Hybrid seeds are being introduced by foreign and local traders to produce maize specifically for the animal feed processing industry, in Vietnam, for example. The maize is planted on sloping land for consecutive seasons as a mono crop. Reducing soil fertility and a reliance on the traders to market the maize, not suitable for human consumption, pose serious risks to the long-term sustainability of this production system.

"Without" Project Scenario

The "without" project situation is assumed to involve planting maize on an area of 0.59ha per household, with a yield of 2.5 t/ha. No other inputs are used and yields are expected to reduce to 2.25 t/ha in year 2 and 2 t/ha in year 3. However, inputs such as seed and labour remain constant, further reducing productivity. In year 4 the farmer shifts his maize crop to a new field where yields return to 2.5 t/ha.

"With" Project Situation

"With" the Project, one row of maize is intercropped with two rows of soybean within the 0.59ha area. Due to nitrogen fixation by the soybean, maize yields are expected to be maintained at 2.5 t/ha. The soybean has a higher value than the maize and produces significant additional income, in addition to maintaining soil fertility.

Incremental Results

The "without" Project scenario results in a household financial gross margin (net revenue less cash inputs) of LAK 826,500 per year and a return per labour day of only LAK 13,049. "With" the Project, however, gross margin for the year rises to LAK 3.12 million and the return per labour-day to LAK 26,264. Incremental household financial net revenue is LAK 1.85 million (€176) when comparing the "with" and "without" Project situations. In economic terms, incremental net revenue of this household enterprise is LAK 1.99 million (€190).

Project-wide, assuming that at full implementation 17% of the households in Project villages adopt the improved technology, financial incremental net revenue per year from maize and soybean is expected to be LAK 4.43 billion (€422,505). In economic terms, this annual increment would be LAK 4.32 billion (€411,086).

- **Upland Rice**

Upland rice is the largest crop, by area planted, in the northern uplands. The rice is planted on sloping land for consecutive seasons, sometimes intercropped with minor cash crops, such as sesame and jobs tear. Due to reducing fallow periods maintaining soil fertility is an issue for sustaining yields.

"Without" Project Scenario

The "without" project situation is assumed to involve planting upland rice intercropped with sesame on an area of 1ha per household. 9,000m² is planted to rice and 1,000 m² to sesame with yields of 1.8 t/ha and 0.9 t/ha, respectively. No other inputs are used and yields are expected to reduce to 1.62 t/ha and 0.81 t/ha in year 2 and 1.44 t/ha and 720 t/ha in year 3. However, inputs such as seed and labour remain constant, further reducing productivity. In year 4 the farmer shifts his upland rice crop to a new field where yields return to 1.8 t/ha and 0.9 t/ha respectively for upland rice and sesame.

"With" Project Situation

"With" the Project, is based on a four-year rotation. In year one the area is planted to upland rice and sesame as described in the 'without' project scenario. In year two the area is planted to soybean, year three to groundnut and year four to jobs tear. Due to nitrogen fixation by the soybean and groundnut, soil fertility is expected to be maintained. Diversifying crops grown also reduces the build up of pest and disease and lowers market risks associated with mono-cropping.

Incremental Results

The "without" Project scenario results in a household financial gross margin (net revenue less cash inputs) of LAK 3.83 million per year and a return per labour day of only LAK 12,354. "With" the Project, however, gross margin for the year rises to a four-year average of LAK 4.42 million and the return per labour-day to LAK 21,599. Incremental household financial net revenue is LAK 2.04 million (€194) when comparing the "with" and "without" Project situations. In economic terms, incremental net revenue of this household enterprise is LAK 1.69 million (€161).

Project-wide, assuming that at full implementation 17% of the households in Project villages adopt the improved technology, average financial incremental net revenue per year from the four-year rotation is expected to be LAK 4.89 billion (€465,897). In economic terms, this annual increment would be LAK 4.05 billion (€385,963).

- **Paddy**

Areas suitable for irrigated paddy production in the northern uplands are limited by topography. However, the potential yields and productivity arising from intensive paddy production require prioritising development of these areas for food security purposes. The consultant team estimates there are 600ha of rain-fed paddy in the Project area suitable for developing into irrigated double cropping.

"Without" Project Scenario

The "without" project situation is assumed to involve planting a single crop of rainfed paddy on a 1ha area. Improved seed and some fertilizers are used. Yields are estimated at 4.2 t/ha, in-line with the average for the three target provinces[2].

"With" Project Situation

"With" the Project, irrigation works are constructed allowing supplementary irrigation in the rainy season and an additional crop in the dry season. In addition to improved water management, other improved cultivation practices increase yields to 5 t/ha, similar to neighbouring Vietnam.

Incremental Results

The "without" Project scenario results in a per hectare financial gross margin (net revenue less cash inputs) of LAK 5.2 million per year and a return per labour day of LAK 24,998. "With" the Project, however, gross margin for the year increases to LAK 9.85 million, but the return per labour-day reduces to LAK 23,678, due to lower dry season yields. Incremental per hectare financial net revenue is LAK 2.57 million (€244) when comparing the "with" and "without" Project situations. In economic terms, incremental net revenue of this household enterprise is LAK 2.5 million (€238). Increases in income are largely attributed to doubling output, although there are also some increases in productivity.

Project-wide, assuming that at full implementation 600ha of paddy has been developed for double cropping, financial incremental net revenue per year is expected to be LAK 1.54 billion (€146,667). In economic terms, this annual increment would be LAK 1.50 billion (€142,857).

- **Pig Fattening[3]**

Pigs are raised by most rural households in northern Lao PDR. Approximately 77% of farmers in the Project's target districts own pigs. While the breeding of free range pigs is most common, pig fattening is a growing practice. Building on this situation, a model of "with" versus "without" Project pig fattening has been developed. One reason for this selection is that it can be accessible to the poorest farmers who are without the means to purchase animals. Such poor households can provide the labour and feed inputs for pig owners and share in the profits. For households preferring to breed (rather than fatten) pigs, improvements similar to those for pig fattening can also be expected from the use of Project-recommended forage technologies.

[2] Agricultural Statistics Year Book 2007, MAFF Department of Planning
[3] Source: PLDP Final Report

"Without" Project Scenario

The "without" project situation is assumed to involve four pigs, mostly confined except possibly during periods of extreme labour utilization (such as transplanting or harvest times). Food is composed of locally available forest vegetables boiled and mixed with rice bran. On this diet, pigs purchased at 20kg each can be expected to take a full year to reach a 70kg selling weight.[4] In **Table A10.8** it can be seen that collecting forest vegetables each day for the pigs consumes a great deal of labour, bringing total annual labour inputs to 109 days. In fact, it is this heavy labour input which makes it necessary to limit the number of pigs raised as additional pigs would require more labour to collect forest vegetables.

"With" Project Situation

"With" the Project it is assumed that the household pig enterprise will have adopted some of the changes put forward by the Project. These include a better diet for the pigs through the growing of legumes such as stylo to be mixed with the rice bran already being fed to the animals. The cultivation of such feeds not only provides for a better diet but also can save on labour inputs. Even though the raising of eight pigs has been assumed, total labour inputs are actually reduced to 71 days per year. (Details of forage requirements and inputs can be seen in **Table 3**). In addition, the better diet allows for the pigs to grow from 20kg to 70kg in only six months, allowing for two cycles (or batches of pigs) per year. The growing of forage feeds makes it possible to keep the pigs in pens all of the time, improving disease control. The removal of pig manure and its subsequent use as a fertilizer can also increase the revenue of the enterprise.

Incremental Results

The "without" Project scenario results in a household financial gross margin (net revenue less cash inputs) of LAK 0.4 million per year and a return per labour day of only LAK 3,729. If labour inputs are valued at their market price, net revenue is actually negative. "With" the Project, however, gross margin for the year (which includes two cycles of fattened pigs) rises to LAK 4.2 million and the return per labour-day to LAK 59,802. Net revenue becomes positive at LAK 3.5 million per year. Incremental household financial net revenue is LAK 4.2 million (€400) when comparing the "with" and "without" Project situations. In economic terms, incremental net revenue of this household enterprise is LAK 3.7 million (€352).

While most adopters of the improved technology are assumed to be households already raising pigs, it is also probable that some households previously not raising this animal will decide to start a pig fattening enterprise. Due to labour constraints it is assumed that such households will, as a result, cut back on some other economic activity. The representative activity chosen is that of growing one hectare of upland maize. When compared with this alternative "without" Project activity, "with" Project pig fattening results in annual incremental net revenue of LAK 3.4 million (€324)

Project-wide, assuming that at full implementation 15% of the households in Project villages adopt the improved technology, financial incremental net revenue per year from pigs is expected to be LAK 8.93 billion (€850,043). In economic terms, this annual increment would be LAK 7.87 billion (€749,669).

- **Cattle Fattening[5]**

Approximately 32% of households in the Project's target districts raise cattle.Typically the animals are allowed to range for their own feed, at times with some herding input. Growth is slow and animals are kept well beyond the time when they could best be sold. Cattle, even more than other livestock, are kept more as a store of wealth than as a productive enterprise. Some households,

[4] Mortality has been assumed to be zero even in the "without" Project situation so as to better concentrate on the effects of a forage-based pig management system. In reality, mortality might well be expected to be less in the "with" Project situation than under the "without" Project scenario - resulting in additional incremental benefits not included here.
[5] Source: PLDP Final Report

however, are now buying young cattle to hold until they are ready for sale. A model of cattle fattening is selected here for reasons similar to those used in the case of pigs. As with pigs, those households that prefer to breed cattle rather than fatten them should be able to experience similar improvements due to the adoption of the forage technologies and other livestock management technologies put forward by the Project.

"Without" Project Scenario

In the "without" project scenario it is assumed that a household fattens Three head of cattle from about the age of one year. On a free range diet it typically takes two years for the cattle to reach a selling weight. Inputs are minimal except for some herding, perhaps by children. Total labour inputs are assumed to be 90 days per year.

"With" Project Situation

In the "With" Project scenario it is assumed that the household fattens 5 head of cattle at a time. The better diet and livestock management afforded by the forage technology can fatten these cattle to a selling weight in one year, rather than the two years of the "without" Project situation. Growing both legumes and grass forages for cattle, however, does involve a significant labour input as well as a good deal of land, given the size of the animals and the amount that they eat. In total, fattening five head of cattle could entail 207 days of labour per year and almost a hectare of land. For this reason, it is assumed that some other economic activity will be reduced as cattle fattening is adopted. A representative activity to be reduced is the cultivation of one ha of upland maize. Such a reduction would free sufficient land and labour for the more lucrative livestock enterprise. In net labour terms, the "with" Project enterprise will entail the same amount of labour as the "without" Project situation.

Incremental Results

A household cattle fattening operation "without" the Project is likely to have a financial gross margin of LAK 3.6 million per year and a return per labour day of LAK 19,946. Net revenue (including labour costs) would be LAK 2.7 million. "With" the Project, gross margin and return per labour day would increase, respectively, to LAK 11.1 million and LAK 53,728. Net revenue would become LAK 9.1 million per year. Incremental household financial net revenue, when including one ha of maize as an additional "without" Project activity, is LAK 6.2 million (€590). In economic terms, incremental net revenue for this household cattle enterprise would be LAK 5.5 million (€524).

As with pigs, while most adopters of the forage technology (and other Project livestock management methods) are assumed to be households already raising cattle, it is likely that some households not previously raising cattle will also decide to start cattle fattening. Due to labour constraints at this scale of operation, it is likely that such adopting households will cut back on some other economic activity. As before, the cultivation of one ha of maize is used here as the representative activity that would be cut back[6]. When compared with this alternative "without" Project activity, "with" Project cattle fattening results in annual incremental net revenue of LAK 8.8 million (€838).

For the entire Project, assuming that at full implementation 15% of the households in Project villages adopt the improved technology, financial incremental net revenue per year from cattle fattening is expected to be LAK 13.5 billion (€1.27 million). In economic terms, this annual increment would be LAK 12.21 billion (€1.16 million).

- **Tea Processing**

In Phongsaly province up to 2,300ha of tea is estimated to have been planted over the past ten years. All tea is bought from the tea growers fresh, by tea processing factories, where it is processed and packaged for sale in Laos or for export to neighbouring countries. Tea yields in Laos are low, not exceeding 2 t/ha, and it takes approximately 4t of fresh tea to produce 1t of dry

[6] For such households this assumption would mean that a total of two ha of maize would be decreased. It should be remembered, though, that maize cultivation is used here merely as a representative activity that might be cut back. Households would, in reality, cut back on a variety of prior activities rather than only maize cultivation.

tea. Nonetheless, the price for dry tea is five times more than for fresh tea, so considerable potential exists for tea growers to process their own tea and capture additional income.

"Without" Project Scenario

Tea growers harvest approximately 2t/ha of fresh tea and sell to local processing factories for LAK 3,000/kg.

"With" Project Situation

Simple processing equipment is managed by a village based tea growers association. The 2 t/ha of fresh tea produces 0.5 t/ha of dry tea with a wholesale price of LAK 16,000/kg. The tea growers association would also need to consider quality control and marketing and distribution networks if they were no longer supplying the commercial tea processing factories.

Incremental Results

The "without" Project scenario results in a financial gross margin (net revenue less cash inputs) for 1ha of fresh tea of LAK 6 million per year. "With" the Project, however, gross margin for the year rises to LAK 7.59 million. The return per labour-day just for the additional processing is LAK 26,500. Incremental financial net revenue per ha is LAK 990,000 (€94) when comparing the "with" and "without" Project situations. In economic terms, incremental net revenue per ha is LAK 910,000 (€87).

Project-wide, assuming that at full implementation 25% of Project villages adopt a processing technology on 10ha of crop, average financial incremental net revenue per year is expected to be LAK 623.7 million (€59,400). In economic terms, this annual increment would be LAK 573.3 million (€54,600).

- **Maize Drying**

Another example of a post harvest processing activity is maize drying. Typically farmers sell fresh maize to intermediaries who clean, dry, grade and sell on maize to secondary wholesalers or export to neighbouring countries. Therefore there exists some potential for village based maize growers association to capture additional income through maize drying services. However, margins are thin on a per kg basis, so sufficient volumes of maize needs to be dried to provide a worthwhile income.

"Without" Project Scenario

Fresh maize is sold to local traders for LAK 800/kg.

"With" Project Situation

A multipurpose dryer is managed by a village based association for the purpose of drying grains, including maize. Cleaned, dried and graded maize can then be sold to secondary wholesalers or exporters for LAK 1,500/kg.

Incremental Results

The "without" Project scenario results in a financial gross margin (net revenue less cash inputs) for 1t of fresh maize of LAK 800,000. "With" the Project, however, gross margin for the year rises to LAK 1.37 million. Incremental financial net revenue per tonne is LAK 290,000 (€28) when comparing the "with" and "without" Project situations. In economic terms, incremental net revenue per tonne is LAK 320,000 (€30).

Project-wide, assuming that at full implementation 25% of Project villages adopt a grain drying technology on 56t of crop/year, average financial incremental net revenue per year is expected to be LAK 1.02 billion (€97,440). In economic terms, this annual increment would be LAK 1.13 billion (€107,520).

ECONOMIC ANALYSIS

- **Adoption of Project Interventions**

It is assumed the resultant full population adoption for at least one improved upland cropping technology is 34% of households in the target villages. It is also assumed the resultant full population adoption for at least one improved livestock raising technology is 30% of households in the target villages. This reflects a comparatively high adoption rate to other similar on-going projects in Laos. However, considering the low village population, distance to reach the villages and the amount allocated in the project budget for field services, high adoption rates are necessary to ensure efficient utilisation of funds.

Other targets are not based upon household adoption rates. The Project-wide target for paddy improvement is 600ha. It is also expected 50% of villages will undertake some form of post harvest value-adding activity, such as grain drying. A summary of full population adoption, for the examples provided in the economic models used in this analysis, is provided in the table below.

Technology	Adoption
Upland maize	2,398 HH on 0.59ha
Upland rice	2,398 HH on 1ha
Paddy	600ha double cropped
Pig	2,116 HH fattening 8 pigs twice a year
Cattle	2,116 HH fattening 5 cattle in one year
Processing	63 villages processing 10ha tea each
Drying	63 villages drying 56t of maize each

- **Project Benefits**

The Project-wide incremental economic benefits of the household adopters of the improved technologies can be aggregated and extrapolated through the years of expected Project life to create a benefit cash flow (**Table 18)**. These incremental benefits will grow over the first three years as more and more villages are reached by the Project and as households within those villages gradually adopt the new technology. In addition, full benefits for individual adopting households will take up to three years to attain, for some activities.

- **Project Costs**

In financial terms, Project costs total €21,883,900, a figure that includes taxes, price contingencies and other factors which do not reflect economic values in 2009 currency terms. After adjusting for these factors, this total cost becomes €17,971,059, spread over the four years of implementation.

- **Economic Project Returns**

The Project's net economic revenue cash flow can be calculated from the benefit and cost cash flows. Given the increments calculated in the various indicative agricultural enterprise models and the assumed adoption rates of the improved Project technology, the Economic Net Present Value (ENPV) of the Project is €2.43 million assuming a discount rate of 10%. The Economic Internal Rate of Return (EIRR) for the Project is 14.45%, indicating that the Project has the potential to be a good investment for Lao PDR.

- **Sensitivity of Project Returns to Various Risks**

While the EIRR for this Project seems to be adequately above the cut-off level of 12%, there are various risks associated with the validity of the information and assumptions that have gone into the indicative production models. While little or nothing is known about the probability distribution of these risks, sensitivity analyses can be performed to indicate how much the economic returns may change with certain levels of change in the risk factors.

  - **Decrease in Adoption Rate:** If adoption rates were to be lower than those assumed in the analysis, economic returns could be expected to decrease. A 20% decrease in adoption

rates would cause the EIRR to fall to 8.1%. This poses a high risk to the economic viability of the project.

- **Decrease in Gross Revenues:** If gross revenues decreased by 20%, the EIRR to fall to 10.5%, a medium level of risk.

Whilst the economic internal rate of return would appear to be fairly robust, sensitivity analysis has exposed a high level of risk if rates of adoption were to decrease and a medium level of risk if gross revenues, i.e. prices received, were to fall. Project management will need to monitor these variables and prepare mitigating measures as part of an overall risk management strategy.

Table 1: Summary of Financial and Economic Analysis

Summary of Financial and Economic Analysis

Village Statistics

Number of villages expected to be included in the project	252
Average number of HHs per village	56
HHs with opportunity to participate in project	14,104

Assumed Adoption Rates

Target 34% of HH to adopt one improved upland cropping technique	4,796
Target 30% of HH to adopt one improved livestock technique	4,232
Total area (ha) of irrigated paddy developed for double cropping	600
Target 50% of villages to adopt one post harvest processing technology	126

Parameters used to develop model farm household (Average 1.59ha cropping area)

Area planted to upland rice = 1ha
Area planted to upland maize = 0.59ha
Number of cattle raised per HH increased from 3 to 5 head
Number of pigs raised per HH increased from 4 to 8 head
Area of crop per village for value-added processing = 10ha
Volume of crop per village for drying = 56MT

Financial Incremental Returns per Household for Indicative Activities (Kip)

	Upland Maize (0.59ha)	Upland Rice (1ha)	Paddy (1ha)	Cattle (5 head)	Pigs (8 head)	Tea processing (2MT)	Maize drying (1MT)
Incremental Net Revenue per year	1,845,750	1,645,300	2,570,500	6,378,450	3,536,659	990,000	287,500
Incremental Gross Margin per year	2,325,750	592,800	4,650,500	7,552,345	4,246,796	1,590,000	565,500
Incremental Return per Labor Day	13,215	9,245	(1,320)	33,782	56,073	26,500	

Economic Incremental Returns per Household for Indicative Activities (Kip)

	Upland Maize (0.59ha)	Upland Rice (1ha)	Paddy (1ha)	Cattle (5 head)	Pigs (8 head)	Tea processing (2MT)	Maize drying (1MT)
Incremental Net Revenue per year	1,683,976	1,309,442	2,501,000	5,767,227	3,177,515	910,000	314,550
Incremental Gross Margin per year	2,067,976	467,442	4,165,000	6,706,343	3,745,625	1,390,000	536,950
Incremental Return per Labor Day	12,252	8,385	(1,342)	29,966	49,691	23,167	

Economic Returns for the Project

ENPV @ 10%	**€ 2,425,853**
EIRR	**14.5%**

Sensitivity Tests	Change in Risk Variable	EIRR
Decrease in adoption rate	-20%	8.1%
Decrease in gross revenue	-20%	10.5%

Table 2: Financial and Economic Farm-Gate Prices

	Unit	Financial Prices	Conversion Factor	Economic Prices
Crops				
Rice	T	1,500,000	0.00	-
Rice bran				
Wet season	kg	350	0.00	-
Dry season	kg	200	0.00	-
Seasonal average[b]	kg	263	0.0	-
Maize	T	860,000	0.00	-
Maize seed	kg	19,000	0.00	-
Urea	kg	1,900	0.00	-
DAP	kg	2,600	0.00	-
Pesticide chemicals (for maize)	lumpsum	100,000	1.0	100,000
Other maize inputs	lumpsum	100,000	1.0	100,000
Stylo seed	kg	15,000	1.0	15,000
Animals				
Pigs	20 kg	250,000	0.9	225,000
	50 kg	400,000	0.9	360,000
	70 kg	630,000	0.9	567,000
Vaccine/medicines	pig/yr	10,000	1.0	10,000
Pen materials cost (4 yrs)	3-4 pig size	100,000	0.9	90,000
Pig manure	T	60,000	0.9	54,000
Goats	20 kg	260,000	0.9	234,000
	30 kg	400,000	0.9	360,000
Deworming	goat/year	2,000	1.0	2,000
Shelter/enclosure materials	lumpsum	600,000	0.9	540,000
Cattle				
1 yr old wet season	each	1,000,000	0.9	900,000
1 yr old dry season	each	800,000	0.9	720,000
1 yr old seasonal ave.[b]	each	883,333	0.9	795,000
2 yr old wet season	each	2,500,000	0.9	2,250,000
2 yr old dry season	each	2,250,000	0.9	2,025,000
2 yr old seasonal ave.[b]	each	2,354,167	0.9	2,118,750
post-fattened	each	3,250,000	0.9	2,925,000
Vaccine/medicines	animal/yr	2,000	1.0	2,000
Cattle manure	T	40,000	0.9	36,000
Poultry				
Pullets	each	15,500	0.9	13,950
Cockerels	each	20,600	0.9	18,540
Hens	each	20,600	0.9	18,540
Cocks	each	27,800	0.9	25,020
Newcastle Disease vacc.	10 hen flock	113,800	1.0	113,800
Fowl Cholera vaccine	10 hen flock	200,700	1.0	200,700
Pen improvement materials	lumpsum	50,000	0.9	45,000
Fencing				
Barbed Wire	M	1,125	1.0	1,125
Labor	Day	10,000	0.8	8,000

Tradable crop conversion factors SCF: 0.9 SWRF: 0.8

[b] Seasonal average price is the weighted average over the 5 month wet season and 7 month dry season.

Source: PLDP Final Report

Table 3: Annual Forage Requirements and Cultivation

			Pigs	Cattle
Annual Feed Requirments		**unit**		
Assumed average body weight (BW)		kg	50	200
Feed requirement as % of BW/day in Dry Matter (DM)		%	4%	3%
Daily Dry Matter feed requirement		kg	2.00	6.00
Legumes as % of feed		%	10%	20%
Grasses as % of feed		%	NA	80%
For pigs, bran as % of feed		%	90%	NA
rice bran's % DM		%	85%	NA
amount of rice bran/day/animal		kg	2.1	NA
Legumes/day/animal (DM)		kg	0.2	1.2
Grasses/day/animal (DM)		kg	NA	4.8
Legumes/day/animal (fresh)[a]		kg	1.0	6.0
Grasses/day/animal (fresh)[a]		kg	NA	19.2
Legumes/year/animal (fresh)		kg	365	2,190
Grasses/year/animal (fresh)		kg	NA	7,008
Area of Forage Cultivation				
Area of legume cultivation needed/animal		M^2	146	876
Area of grasses cultivation needed/animal		M^2	NA	1,001
Inputs for forage cultivation				
Grasses cultivation inputs/year/animal[b]				
Urea		kg	NA	20.0
First year planting of cuttings		days	NA	6.3
Wet season weeding/cutting/drying		days	NA	6.3
Legume cultivation inputs/year/animal[b]				
Seed		kg	0.09	0.53
Prepare land and plant seed		days	0.65	3.89
Weeding (over entire season)		days	1.62	9.73
Wet season cutting/drying/carrying		days	1.62	9.73
Fencing needs for forage plots[c]				
Plot size depends on the number of animals	**No. Animals**			
	1	M	48	173
	2	M	68	245
	3	M	84	300
	4	M	97	347
	5	M	108	388
	6	M	118	425
	7	M	128	459
	8	M	137	490
	9	M	145	520
	10	M	153	548
	15	M	187	671
	18	M	205	735
	20	M	216	775

[a] **Yield assumptions**		**Fresh**	**Dry Matter as % Fresh**	**Dry Matter (DM)**
Legumes	$kg/yr/100M^2$	250	20%	50
Grasses (ave.)	$kg/yr/100M^2$	700	25%	175

[b] **Cultivation Needs**			
Grasses: Calculation for a 40x40M plot		**40 M^2 Plot**	**Per M^2**
Plot size	M^2	1,600	1
Labor			
First year plant cuttings	days	10	0.0063
Wet season weeding/cutting/drying/etc.	days	10	0.0063
Urea	kg	32	0.02
Legumes: Calculation for a 30x30M plot		**30 M^2 Plot**	**Per M^2**
Plot size	M^2	900	1
Labor			
Plant seed	days	4	0.0044
Weeding (over entire season)	days	10	0.0111
Wet season cutting/drying/carrying	days	10	0.0111
Seed	kg	0.54	0.0006

[c] **Fencing labor for local materials & construction**		**Pigs**	**Cattle**
1 animal	days	2.4	8.7
2 animals	days	3.4	12.3
3 animals	days	4.2	15.0
4 animals	days	4.8	17.3
5 animal	days	5.4	19.4
6 animals	days	5.9	21.2
7 animals	days	6.4	22.9
8 animals	days	6.8	24.5
9 animals	days	7.2	26.0
10 animals	days	7.6	27.4
15 animals	days	9.4	33.6
18 animals	days	10.3	36.8
20 animals	days	10.8	38.8

Source: PLDP Final Report

Table 4: Upland Maize Cultivation

Upland Maize (0.59ha)

Without Project Production Costs

Item		Quantity Unit	Quant.	Financial Cost Price (kip)	Financial Cost Cost (kip)	Economic Cost Price (kip)	Economic Cost Cost (kip)
Seeds		kg	18.0	19,000	342,000	17,916	322,490
Labor		p-day	71.0	10,000	710,000	8,000	568,000
Total cost					1,052,000		890,490

Without Project --- Financial Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Financial Price (Kip/t)	Gross Financial Revenue (Kip)	Financial Production Cost/ha (Kip/ha)	Gross Financial Cost (Kip)	Financial Net Crop Income (Kip)	Gross Margin (Kip)
Upland Maize	0.6	2.5	1.5	860,000	1,268,500	1,052,000	1,052,000	216,500	926,500
Return per labour day									13,049

Without Project --- Economic Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Economic Price (Kip/t)	Gross Economic Revenue (Kip)	Economic Production Cost/ha (Kip/ha)	Gross Economic Cost (Kip)	Economic Net Crop Income (Kip)	Economic Gross Margin (Kip)
Upland Maize	0.6	2.5	1.5	808,400	1,192,390	890,490	890,490	301,900	869,900
Return per labour day									12,252

Upland Maize intercropped with Soybean (0.59ha)

With Project Production Costs

Item		Quantity Unit	Quant.	Financial Cost Price (kip)	Financial Cost Cost (kip)	Economic Cost Price (kip)	Economic Cost Cost (kip)
Seeds	Maize	kg	9.0	19,000	171,000	17,860	160,740
	Soybean	kg	20.0	12,000	240,000	11,280	225,600
Labor		p-day	119.0	10,000	1,190,000	8,000	952,000
Total cost					1,601,000		1,338,340

With Project --- Financial Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Financial Price (Kip/t)	Gross Financial Revenue (Kip)	Financial Production Cost/ha (Kip/ha)	Gross Financial Cost (Kip)	Financial Net Crop Income (Kip)	Gross Margin (Kip)
Upland Maize	0.6	0.8	0.5	860,000	421,400				
Soybean	0.6	1.5	0.9	3,500,000	3,115,000				
Total					3,536,400	1,601,000	1,601,000	1,935,400	3,125,400
Return per labour day									26,264

With Project --- Economic Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Economic Price (Kip/t)	Gross Economic Revenue (Kip)	Economic Production Cost/ha (Kip/ha)	Gross Economic Cost (Kip)	Economic Net Crop Income (Kip)	Economic Gross Margin (Kip)
Upland Maize	0.6	0.8	0.5	808,400	396,116				
Soybean	0.6	1.5	0.9	3,290,000	2,928,100				
Total					3,324,216	1,338,340	1,338,340	1,985,876	2,937,876
Return per labour day									24,688

Table 5: Incremental Returns of Upland Maize Production (0.59 ha)

Upland Maize - financial

(Unit = '0,000 LAK)

	Without Project			With Project			Increments		
Year	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day
1	93	22	1.0	313	194	3.0	220	172	2.0
2	83	9	1.0	313	194	3.0	230	185	2.0
3	74	-4	1.0	313	194	3.0	239	198	2.0
4	93	22	1.0	313	194	3.0	220	172	2.0
5	83	9	1.0	313	194	3.0	230	185	2.0
6	74	-4	1.0	313	194	3.0	239	198	2.0
7	93	22	1.0	313	194	3.0	220	172	2.0
8	83	9	1.0	313	194	3.0	230	185	2.0
9	74	-4	1.0	313	194	3.0	239	198	2.0
10	93	22	1.0	313	194	3.0	220	172	2.0
11	83	9	1.0	313	194	3.0	230	185	2.0
12	74	-4	1.0	313	194	3.0	239	198	2.0
Annual ave	83	9	1				230	185	2

Upland Maize - economic

(Unit = '0,000 LAK)

	Without Project			With Project			Increments		
Year	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day
1	87	31	1.0	294	199	2.0	207	168	1.0
2	79	19	1.0	294	199	2.0	215	180	1.0
3	70	7	1.0	294	199	2.0	224	192	1.0
4	87	31	1.0	294	199	2.0	207	168	1.0
5	79	19	1.0	294	199	2.0	215	180	1.0
6	70	7	1.0	294	199	2.0	224	192	1.0
7	87	31	1.0	294	199	2.0	207	168	1.0
8	79	19	1.0	294	199	2.0	215	180	1.0
9	70	7	1.0	294	199	2.0	224	192	1.0
10	87	31	1.0	294	199	2.0	207	168	1.0
11	79	19	1.0	294	199	2.0	215	180	1.0
12	70	7	1.0	294	199	2.0	224	192	1.0
Annual ave	79	19	1				215	180	1

Table 6: Upland Rice Cultivation

Upland Rice (0.9ha) and Sesame (0.1ha)

Without Project Production Costs

Item		Quantity Unit	Quant.	Financial Cost Price (kip)	Financial Cost Cost (kip)	Economic Cost Price (kip)	Economic Cost Cost (kip)
Seeds	Rice	kg	60.0	1,500	90,000	1,410	84,600
	Sesame	kg	3.0	10,000	30,000	9,400	28,200
Labor		p-day	310.0	10,000	3,100,000	8,000	2,480,000
Total cost/ha					3,220,000		2,592,800

Without Project --- Financial Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Financial Price (Kip/t)	Gross Financial Revenue (Kip)	Financial Production Cost/ha (Kip/ha)	Gross Financial Cost (Kip)	Financial Net Crop Income (Kip)	Gross Margin (Kip)
Upland Rice	0.9	1.8	1.6	1,900,000	3,009,600				
Sesame	0.1	0.9	0.1	10,000,000	940,000				
Total/ha					3,949,600	3,220,000	3,220,000	729,600	3,829,600
Return per labour day									12,354

Without Project --- Economic Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Economic Price (Kip/t)	Gross Economic Revenue (Kip)	Economic Production Cost/ha (Kip/ha)	Gross Economic Cost (Kip)	Economic Net Crop Income (Kip)	Economic Gross Margin (Kip)
Upland Rice	0.9	1.8	1.6	1,767,000	2,862,540				
Sesame	0.1	0.9	0.1	9,300,000	930,000				
Total/ha					3,792,540	2,592,800	2,592,800	1,199,740	3,679,740
Return per labour day									11,870

Upland Rice in rotation 1ha (Yr 1 Rice/sesame, Yrs 2 & 3 soybean and groundnut, Yr 4 Jobs tear)

With Project Production Costs

Item		Quantity Unit	Quant.	Financial Cost Price (kip)	Financial Cost Cost (kip)	Economic Cost Price (kip)	Economic Cost Cost (kip)
Seeds	Rice	kg	60.0	1,500	90,000	1,410	84,600
	Sesame	kg	3.0	10,000	30,000	9,400	28,200
	Soybean	kg	45.0	12,000	540,000	11,280	507,600
	Groundnut	kg	45.0	12,000	540,000	11,280	507,600
	Jobs tear	kg	55.0	2,000	110,000	1,880	103,400
Labour	Rice	p-day					
	Sesame	p-day	310.0	10,000	3,100,000	8,000	2,480,000
	Soybean	p-day	169.0	10,000	1,690,000	8,000	1,352,000
	Groundnut	p-day	169.0	10,000	1,690,000	8,000	1,352,000
	Jobs tear	p-day	171.0	10,000	1,710,000	8,000	1,368,000
	Sub-total		*819.0*		*8,190,000*		*6,552,000*
Total cost over 4 years					9,500,000		7,783,400
Average for 1 year			204.75		2,375,000		1,945,850

With Project --- Financial Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Financial Price (Kip/t)	Gross Financial Revenue (Kip)	Financial Production Cost/ha (Kip/ha)	Gross Financial Cost (Kip)	Financial Net Crop Income (Kip)	Gross Margin (Kip)
Rice	0.9	1.8	1.6	1,900,000	3,009,600				
Sesame	0.1	0.9	0.1	10,000,000	940,000				
Soybean	1.0	1.3	1.3	3,500,000	4,550,000				
Groundnut	1.0	1.5	1.5	5,000,000	7,500,000				
Jobs tear	1.0	2.0	2.0	1,500,000	3,000,000				
Total return for 4 years					18,999,600	9,500,000	9,500,000	9,499,600	17,689,600
Average for 1 year					4,749,900	2,375,000	2,375,000	2,374,900	4,422,400
Return per labour day									21,599

With Project --- Economic Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Economic Price (Kip/t)	Gross Economic Revenue (Kip)	Economic Production Cost/ha (Kip/ha)	Gross Economic Cost (Kip)	Economic Net Crop Income (Kip)	Economic Gross Margin (Kip)
Rice	0.9	1.8	1.6	1,767,000	2,798,928				
Sesame	0.1	0.9	0.1	9,300,000	874,200				
Soybean	1.0	1.3	1.3	3,290,000	4,277,000				
Groundnut	1.0	1.5	1.5	4,700,000	7,050,000				
Jobs tear	1.0	2.0	2.0	1,410,000	2,820,000				
Total return for 4 years					17,820,128	7,783,400	7,783,400	10,036,728	16,588,728
Average for 1 year					4,455,032	1,945,850	1,945,850	2,509,182	4,147,182
Return per labour day									20,255

Table 7: Incremental Returns of Upland Rice Production (1 ha)

Upland Rice - financial

(Unit = '0,000 LAK)

	Without Project			With Project			Increments		
Year	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day
1	383	73	1.0	442	237	2.0	59	164	1.0
2	343	33	1.0	442	237	2.0	99	204	1.0
3	304	-6	1.0	442	237	2.0	138	243	1.0
4	383	73	1.0	442	237	2.0	59	164	1.0
5	343	33	1.0	442	237	2.0	99	204	1.0
6	304	-6	1.0	442	237	2.0	138	243	1.0
7	383	73	1.0	442	237	2.0	59	164	1.0
8	343	33	1.0	442	237	2.0	99	204	1.0
9	304	-6	1.0	442	237	2.0	138	243	1.0
10	383	73	1.0	442	237	2.0	59	164	1.0
11	343	33	1.0	442	237	2.0	99	204	1.0
12	304	-6	1.0	442	237	2.0	138	243	1.0
Annual ave	343	33	1				99	204	1

Upland Rice - economic

(Unit = '0,000 LAK)

	Without Project			With Project			Increments		
Year	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day
1	368	120	1.0	415	251	2.0	47	131	1.0
2	330	82	1.0	415	251	2.0	85	169	1.0
3	292	44	0.9	415	251	2.0	123	207	1.1
4	368	120	1.0	415	251	2.0	47	131	1.0
5	330	82	1.0	415	251	2.0	85	169	1.0
6	292	44	0.9	415	251	2.0	123	207	1.1
7	368	120	1.0	415	251	2.0	47	131	1.0
8	330	82	1.0	415	251	2.0	85	169	1.0
9	292	44	0.9	415	251	2.0	123	207	1.1
10	368	120	1.0	415	251	2.0	47	131	1.0
11	330	82	1.0	415	251	2.0	85	169	1.0
12	292	44	0.9	415	251	2.0	123	207	1.1
Annual ave	330	82	1				85	169	1

Table 8: Paddy Cultivation

Paddy (Rainfed single crop) 1ha

Without Project Production Costs

Item		Quantity Unit	Quant.	Financial Cost Price (kip)	Financial Cost Cost (kip)	Economic Cost Price (kip)	Economic Cost Cost (kip)
Seeds		kg	60.0	2,500	150,000	2,325	139,500
Fertiliser	Urea	kg	100.0	8,000	800,000	8,640	864,000
	TSP	kg	50.0	2,500	125,000	2,650	132,500
Labor		p-day	208.0	10,000	2,080,000	8,000	1,664,000
Total cost/ha					3,155,000		2,800,000

Without Project --- Financial Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Financial Price (Kip/t)	Gross Financial Revenue (Kip)	Financial Production Cost/ha (Kip/ha)	Gross Financial Cost (Kip)	Financial Net Crop Income (Kip)	Gross Margin (Kip)
Paddy	1.0	4.2	4.2	1,500,000	6,274,500	3,155,000	3,155,000	3,119,500	5,199,500
Return per labour day									24,998

Without Project --- Economic Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Economic Price (Kip/t)	Gross Economic Revenue (Kip)	Economic Production Cost/ha (Kip/ha)	Gross Economic Cost (Kip)	Economic Net Crop Income (Kip)	Economic Gross Margin (Kip)
Paddy	1.0	4.2	4.2	1,395,000	5,859,000	2,800,000	2,800,000	3,059,000	4,723,000
Return per labour day									22,707

Paddy (Irrigated double crop) 1ha

With Project Production Costs

Item		Quantity Unit	Quant.	Financial Cost Price (kip)	Financial Cost Cost (kip)	Economic Cost Price (kip)	Economic Cost Cost (kip)
Seeds		kg	120.0	2,500	300,000	2,325	279,000
Fertiliser	Urea	kg	200.0	8,000	1,600,000	8,640	1,728,000
	TSP	kg	100.0	2,500	250,000	2,650	265,000
Labor		p-day	416.0	10,000	4,160,000	8,000	3,328,000
Total cost/ha					6,310,000		5,600,000

Note: Irrigation costs included in project implementation costs

With Project --- Financial Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Financial Price (Kip/t)	Gross Financial Revenue (Kip)	Financial Production Cost/ha (Kip/ha)	Gross Financial Cost (Kip)	Financial Net Crop Income (Kip)	Gross Margin (Kip)
Paddy	1.0	4.0	8.0	1,500,000	12,000,000	6,310,000	6,310,000	5,690,000	9,850,000
Return per labour day									23,678

With Project --- Economic Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Economic Price (Kip/t)	Gross Economic Revenue (Kip)	Economic Production Cost/ha (Kip/ha)	Gross Economic Cost (Kip)	Economic Net Crop Income (Kip)	Economic Gross Margin (Kip)
Paddy	1.0	4.0	8.0	1,395,000	11,160,000	5,600,000	5,600,000	5,560,000	8,888,000
Return per labour day									21,365

Table 9: Incremental Returns of Paddy Production (1 ha)

Paddy - financial

(Unit = '0,000 LAK)

Year	Without Project			With Project			Increments		
	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day
1	520	312	2.0	985	569	2.0	465	257	-
2	520	312	2.0	985	569	2.0	465	257	-
3	520	312	2.0	985	569	2.0	465	257	-
4	520	312	2.0	985	569	2.0	465	257	-
5	520	312	2.0	985	569	2.0	465	257	-
6	520	312	2.0	985	569	2.0	465	257	-
7	520	312	2.0	985	569	2.0	465	257	-
8	520	312	2.0	985	569	2.0	465	257	-
9	520	312	2.0	985	569	2.0	465	257	-
10	520	312	2.0	985	569	2.0	465	257	-
11	520	312	2.0	985	569	2.0	465	257	-
12	520	312	2.0	985	569	2.0	465	257	-

Paddy - economic

(Unit = '0,000 LAK)

Year	Without Project			With Project			Increments		
	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day
1	472	306	2.0	889	556	2.0	417	250	-
2	472	306	2.0	889	556	2.0	417	250	-
3	472	306	2.0	889	556	2.0	417	250	-
4	472	306	2.0	889	556	2.0	417	250	-
5	472	306	2.0	889	556	2.0	417	250	-
6	472	306	2.0	889	556	2.0	417	250	-
7	472	306	2.0	889	556	2.0	417	250	-
8	472	306	2.0	889	556	2.0	417	250	-
9	472	306	2.0	889	556	2.0	417	250	-
10	472	306	2.0	889	556	2.0	417	250	-
11	472	306	2.0	889	556	2.0	417	250	-
12	472	306	2.0	889	556	2.0	417	250	-

Table 10: Pig Fattening Model

Without Project Pig Fattening Enterprise

Duration: months 12

			Financial		Economic	
	unit	Q	Price	Cost	Price	Cost
Cash (or saleable) inputs						
Young pigs (20 kg)	each	4	250,000	1,000,000	225,000	900,000
Pen materials/year[a]	each	0.25	100,000	25,000	90,000	22,500
Vaccine/Medicine[b]	per pig	4	10,000	40,000	10,000	40,000
Bran[c]	kg	4,320	263	1,134,000	243	1,049,632
Sub-total cash costs				2,199,000		2,012,132
Labor inputs						
Pen labor/year[a]	days	1.25	10,000	12,500	8,000	10,000
Veg feed[d]	days	72.00	10,000	720,000	8,000	576,000
Feed cooking fuel[e]	days	36.00	10,000	360,000	8,000	288,000
Sub-total labor costs		109.25		1,092,500		874,000
Total Cost				3,291,500		2,886,132
Revenue						
Sale of pigs (70 kg)	each	4	630,000	2,520,000	567,000	2,268,000
Value of manure	T	1	60,000	86,400	54,000	77,760
Total Revenue				2,606,400		2,345,760
Net Revenue for one production cycle				(685,100)		(540,372)
Gross Margin (net revenue less cash costs)				*407,400*		*333,628*
Return per labor day				*3,729*		*3,054*
Net Revenue per year				(685,100)		(540,372)
Gross Margin per year				*407,400*		*333,628*
Return per labor day				3,729		3,054
Labor costs per year	days	109.25		1,092,500		874,000

a) Pen: A pen for 3 or 4 pigs takes 5 person days to build and uses 100,000 kip worth of poles, etc. It is expected to last 4 years.
b) Vaccine costing 2,000 kip administered to each pig twice a year --- plus 1,000 kip of medicine per pig/year.
c) Price is seasonally weighted.
d) Each pig gets vegetables per day gathered in the forest taking about 2 hour per day's feed for 4 pigs.
e) Fuel for cooking the bran and vegetables for the pigs takes 1 hour per day to collect.

With Project Pig Fattening Enterprise

Duration: months 6

			Financial		Economic	
	unit	Q	Price	Cost	Price	Cost
Cash (or saleable) inputs						
Young pigs (20 kg)	each	8	250,000	2,000,000	225,000	1,800,000
Pen materials/cycle	each	0.25	100,000	25,000	90,000	22,500
Fence materials/cycle (forage)[f]	M	82.0	1,125	92,275	1,125	92,275
Vaccine/Medicine	per pig	8	10,000	80,000	10,000	80,000
Stylo seed	kg	0.35	15,000	5,256	15,000	5,256
Bran[g]	kg	3,049	263	800,471	243	740,916
Sub-total cash costs				3,003,002		2,740,948
Labor inputs						
Pen labor/cycle	days	1.25	10,000	12,500	8,000	10,000
Fence labor/cycle (forage area)[h]	days	0.7	10,000	6,835	8,000	5,468
Stylo[h]	days	15.6	10,000	155,733	8,000	124,587
Feed cooking fuel	days	18	10,000	180,000	8,000	144,000
Sub-total labor costs	days	35.5		355,069		284,055
Total Cost				3,358,070		3,025,003
Revenue						
Sale of fattened pigs	each	8	630,000	5,040,000	567,000	4,536,000
Value of manure	T	1.4	60,000	86,400	54,000	77,760
Total Revenue				5,126,400		4,613,760
Net Revenue for one production cycle				1,768,330		1,588,757
Gross Margin (net revenue less cash costs)				*2,123,398*		*1,872,812*
Return per labor day				*59,802*		*52,745*
Net Revenue per year				3,536,659		3,177,515
Gross Margin per year				*4,246,796*		*3,745,625*
Return per labor day				*59,802*		*52,745*
Labor cost per year	days	71		*710,137*		*568,110*

f) Unit is meters of barbed wire. Fencing is assumed to include 6 strands of barbed wire and to last for 5 years. Figure is the amount attributable to one cyle of cattle fattening.

Table 11: Project-Wide Incremental Returns of Pig Fattening Enterprises

Incremental Financial Returns of Pig Fattening Enterprises

Pig Fattening Household Enterprise

(in 10,000 kip units)

Year	Without Project			Phasing of adoption benefits	With Project			Increments		
	Gross Margin	Net Revenue	Return to Labor/day		Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day
1	41	(69)	0.4	0.25	106	88	1.5	65	157	1.1
2	41	(69)	0.4	0.60	255	212	3.6	214	281	3.2
3	41	(69)	0.4	0.80	340	283	4.8	299	351	4.4
4	41	(69)	0.4	1.00	425	354	6.0	384	422	5.6
5	41	(69)	0.4	1.00	425	354	6.0	384	422	5.6
6	41	(69)	0.4	1.00	425	354	6.0	384	422	5.6
7	41	(69)	0.4	1.00	425	354	6.0	384	422	5.6
8	41	(69)	0.4	1.00	425	354	6.0	384	422	5.6
9	41	(69)	0.4	1.00	425	354	6.0	384	422	5.6
10	41	(69)	0.4	1.00	425	354	6.0	384	422	5.6
11	41	(69)	0.4	1.00	425	354	6.0	384	422	5.6
12	41	(69)	0.4	1.00	425	354	6.0	384	422	5.6

Incremental Economic Returns of Pig Fattening Enterprises

Pig Fattening Household Enterprise

(in 10,000 kip units)

Year	Without Project			Phasing of adoption benefits	With Project			Increments		
	Gross Margin	Net Revenue	Return to Labor/day		Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day
1	33	(54)	0.3	0.25	94	79	1.3	60	133	1.0
2	33	(54)	0.3	0.60	225	191	3.2	191	245	2.9
3	33	(54)	0.3	0.80	300	254	4.2	266	308	3.9
4	33	(54)	0.3	1.00	375	318	5.3	341	372	5.0
5	33	(54)	0.3	1.00	375	318	5.3	341	372	5.0
6	33	(54)	0.3	1.00	375	318	5.3	341	372	5.0
7	33	(54)	0.3	1.00	375	318	5.3	341	372	5.0
8	33	(54)	0.3	1.00	375	318	5.3	341	372	5.0
9	33	(54)	0.3	1.00	375	318	5.3	341	372	5.0
10	33	(54)	0.3	1.00	375	318	5.3	341	372	5.0
11	33	(54)	0.3	1.00	375	318	5.3	341	372	5.0
12	33	(54)	0.3	1.00	375	318	5.3	341	372	5.0

Source: PLDP Final Report

Table 12: Cattle Fattening Model

Without Project Cattle Fattening Enterprise

Duration: months 24

			Financial		Economic	
	unit	Q	Price	Cost	Price	Cost
Cash (or saleable) inputs						
Young cattle (1 year old)	each	3	883,333	2,650,000	795,000	2,385,000
Vaccine/Medicine	per animal	3	2,000	6,000	2,000	6,000
Sub-total cash costs				2,656,000		2,391,000
Labor inputs						
Herding (full year)and other labor	days	180.00	10,000	1,800,000	8,000	1,440,000
Sub-total labor costs		180.00		1,800,000		1,440,000
Total Cost				4,456,000		3,831,000
Revenue						
Sale of fattened cattle	each	3	3,250,000	9,750,000	2,925,000	8,775,000
Value of manure	T	2	40,000	86,400	36,000	77,760
Total Revenue				9,836,400		8,852,760
Net Revenue for one production cycle				5,380,400		5,021,760
Gross Margin (net revenue less cash costs)				*7,180,400*		*6,461,760*
Return per labor day				*39,891*		*35,899*
Net Revenue per year				2,690,200		2,510,880
Gross Margin per year				*3,590,200*		*3,230,880*
Return per labor day				19,946		17,949
Labor costs per year	days	90		900,000		720,000

With Project Cattle Fattening Enterprise

Duration: months 12

			Financial		Economic	
	unit	Q	Price	Cost	Price	Cost
Cash (or saleable) inputs						
Young cattle (about 120 kg)	each	5	883,333	4,416,667	795,000	3,975,000
Fence materials/cycle (forage)[a]	M	465.0	1,125	523,151	1,125	523,151
Vaccine/Medicine	per animal	5	2,000	10,000	2,000	10,000
Stylo seed	kg	2.63	15,000	39,420	15,000	39,420
Urea for grass forage	kg	100.1	1,900	190,217	2,048	205,006
Sub-total cash costs				5,179,455		4,752,577
Labor inputs						
Fence labor/cycle (forage area)	days	3.9	10,000	38,752	8,000	31,002
Stylo[b]	days	116.8	10,000	1,168,000	8,000	934,400
Grasses	days	41.7	10,000	417,143	8,000	333,714
Herding (1/2 year) and other labor	days	45.0	10,000	450,000	8,000	360,000
Sub-total labor costs	days	207.4		2,073,895		1,659,116
Total Cost				7,253,350		6,411,693
Revenue						
Sale of fattened cattle	each	5	3,250,000	16,250,000	2,925,000	14,625,000
Value of manure	T	1.8	40,000	72,000	36,000	64,800
Total Revenue				16,322,000		14,689,800
Net Revenue for one production cycle				9,068,650		8,278,107
Gross Margin (net revenue less cash costs)				*11,142,545*		*9,937,223*
Return per labor day				*53,728*		*47,916*
Net Revenue per year				9,068,650		8,278,107
Gross Margin per year				*11,142,545*		*9,937,223*
Return per labor day				*53,728*		*47,916*
Labor cost per year	days	207		*2,073,895*		*1,659,116*

a) Unit is meters of barbed wire. Fencing is assumed to include 6 strands of barbed wire and to last for 5 years. Figure is the amount attributable to one cyle of cattle fattening.

b) A legume (stylo assumed) is all grown in the wet season, with sufficient amounts grown to dry a supply for dry season use.

Increments for Cattle Fattening Alone

Incremental Net Revenue per year			6,378,450	5,767,227
Incremental Gross Margin per year			7,552,345	6,706,343
Incremental return per labor day	days	117	33,782	29,966

Increments when including 1 ha maize as an additional Without Project activity

Incremental Net Revenue per year			6,229,450	5,479,221

Table 13: Incremental Returns of Cattle Fattening Enterprises

Incremental Financial Returns of Cattle Fattening Enterprises

Cattle Fattening Household Enterprise

(in 10,000 kip units)

Year	Without Project				With Project			Increments		
	Gross Margin	Net Revenue	Return to Labor/day	of adoption benefits	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day
1	359	269	2.0	0.25	279	227	1.3	(80)	(42)	(0.7)
2	359	269	2.0	0.60	669	544	3.2	310	275	1.2
3	359	269	2.0	0.80	891	725	4.3	532	456	2.3
4	359	269	2.0	1.00	1,114	907	5.4	755	638	3.4
5	359	269	2.0	1.00	1,114	907	5.4	755	638	3.4
6	359	269	2.0	1.00	1,114	907	5.4	755	638	3.4
7	359	269	2.0	1.00	1,114	907	5.4	755	638	3.4
8	359	269	2.0	1.00	1,114	907	5.4	755	638	3.4
9	359	269	2.0	1.00	1,114	907	5.4	755	638	3.4
10	359	269	2.0	1.00	1,114	907	5.4	755	638	3.4
11	359	269	2.0	1.00	1,114	907	5.4	755	638	3.4
12	359	269	2.0	1.00	1,114	907	5.4	755	638	3.4

Incremental Economic Returns of Cattle Fattening Enterprises

Cattle Fattening Household Enterprise

(in 10,000 kip units)

Year	Without Project				With Project			Increments		
	Gross Margin	Net Revenue	Return to Labor/day	of adoption benefits	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day
1	323	251	1.8	0.25	248	207	1.2	(75)	(44)	(0.6)
2	323	251	1.8	0.60	596	497	2.9	273	246	1.1
3	323	251	1.8	0.80	795	662	3.8	472	411	2.0
4	323	251	1.8	1.00	994	828	4.8	671	577	3.0
5	323	251	1.8	1.00	994	828	4.8	671	577	3.0
6	323	251	1.8	1.00	994	828	4.8	671	577	3.0
7	323	251	1.8	1.00	994	828	4.8	671	577	3.0
8	323	251	1.8	1.00	994	828	4.8	671	577	3.0
9	323	251	1.8	1.00	994	828	4.8	671	577	3.0
10	323	251	1.8	1.00	994	828	4.8	671	577	3.0
11	323	251	1.8	1.00	994	828	4.8	671	577	3.0
12	323	251	1.8	1.00	994	828	4.8	671	577	3.0

Source: PLDP Final Report

Table 14: Tea Processing Model

Fresh tea

Without Project Processing Costs

Item	Quantity Unit	Quant.	Financial Cost Price (kip)	Financial Cost Cost (kip)	Economic Cost Price (kip)	Economic Cost Cost (kip)
Total cost				0		0

Without Project --- Financial Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Financial Price (Kip/t)	Gross Financial Revenue (Kip)	Financial Processing Cost/ha (Kip/ha)	Gross Financial Cost (Kip)	Financial Net Crop Income (Kip)	Gross Margin (Kip)
Fresh tea	1.0	2.0	2.0	3,000,000	6,000,000	0	0	6,000,000	6,000,000

Without Project --- Economic Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Economic Price (Kip/t)	Gross Economic Revenue (Kip)	Economic Processing Cost/ha (Kip/ha)	Gross Economic Cost (Kip)	Economic Net Crop Income (Kip)	Economic Gross Margin (Kip)
Fresh tea	1.0	2.0	2.0	2,700,000	5,400,000	0	0	5,400,000	5,400,000

Processed tea (1ha)

With Project Processing Costs

Item	Quantity Unit	Quant.	Financial Cost Price (kip)	Financial Cost Cost (kip)	Economic Cost Price (kip)	Economic Cost Cost (kip)
Firewood	m²	2	50,000	100,000	50,000	100,000
Shed dep'tn	lump sum	1	50,000	50,000	50,000	50,000
Machinery dep'tn	lump sum	1	235,000	235,000	235,000	235,000
Maintenance	lump sum	1	25,000	25,000	25,000	25,000
Labor	p-day	60.0	10,000	600,000	8,000	480,000
Total cost				1,010,000		890,000

With Project --- Financial Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Financial Price (Kip/t)	Gross Financial Revenue (Kip)	Financial Processing Cost/ha (Kip/ha)	Gross Financial Cost (Kip)	Financial Net Crop Income (Kip)	Gross Margin (Kip)
Processed	1.0	2.0	0.5	16,000,000	8,000,000	1,010,000	1,010,000	6,990,000	7,590,000
Return per labour day									26,500

With Project --- Economic Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Economic Price (Kip/t)	Gross Economic Revenue (Kip)	Economic Processing Cost/ha (Kip/ha)	Gross Economic Cost (Kip)	Economic Net Crop Income (Kip)	Economic Gross Margin (Kip)
Processed	1.0	2.0	0.5	14,400,000	7,200,000	890,000	890,000	6,310,000	6,790,000
Return per labour day									23,167

Table 15: Incremental Returns of Tea Processing Enterprises

Tea processing - financial

(Unit = '0,000 LAK)

Year	Without Project			With Project			Increments		
	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day
1	600	600		759	699		159	99	3.0
2	600	600		759	699		159	99	3.0
3	600	600		759	699		159	99	3.0
4	600	600		759	699		159	99	3.0
5	600	600		759	699		159	99	3.0
6	600	600		759	699		159	99	3.0
7	600	600		759	699		159	99	3.0
8	600	600		759	699		159	99	3.0
9	600	600		759	699		159	99	3.0
10	600	600		759	699		159	99	3.0
11	600	600		759	699		159	99	3.0
12	600	600		759	699		159	99	3.0

Tea processing - economic

(Unit = '0,000 LAK)

Year	Without Project			With Project			Increments		
	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day
1	540	540		679	631		139	91	2.0
2	540	540		679	631		139	91	2.0
3	540	540		679	631		139	91	2.0
4	540	540		679	631		139	91	2.0
5	540	540		679	631		139	91	2.0
6	540	540		679	631		139	91	2.0
7	540	540		679	631		139	91	2.0
8	540	540		679	631		139	91	2.0
9	540	540		679	631		139	91	2.0
10	540	540		679	631		139	91	2.0
11	540	540		679	631		139	91	2.0
12	540	540		679	631		139	91	2.0

Table 16: Maize Drying Model

Maize dryer

Without Project Processing Costs

Item	Quantity Unit	Quant.	Financial Cost Price (kip)	Financial Cost Cost (kip)	Economic Cost Price (kip)	Economic Cost Cost (kip)
Total cost				0		0

Without Project --- Financial Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Financial Price (Kip/t)	Gross Financial Revenue (Kip)	Financial Processing Cost/ha (Kip/ha)	Gross Financial Cost (Kip)	Financial Net Crop Income (Kip)	Gross Margin (Kip)
Fresh maize			1.0	800,000	800,000	0	0	800,000	800,000

Without Project --- Economic Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Economic Price (Kip/t)	Gross Economic Revenue (Kip)	Economic Processing Cost/ha (Kip/ha)	Gross Economic Cost (Kip)	Economic Net Crop Income (Kip)	Economic Gross Margin (Kip)
Fresh maize			1.0	752,000	752,000	0	0	752,000	752,000

Dried maize

With Project Processing Costs

Item	Quantity Unit	Quant.	Financial Cost Price (kip)	Financial Cost Cost (kip)	Economic Cost Price (kip)	Economic Cost Cost (kip)
Machinery dep'tn	MT	1.0	6,500	6,500	5,850	5,850
Labour	MT	1.0	278,000	278,000	222,400	222,400
Power/fuel	MT	1.0	14,000	14,000	12,600	12,600
Transport	MT	1.0	100,000	100,000	90,000	90,000
Maintenance	MT	1.0	14,000	14,000	12,600	12,600
Total cost				412,500		343,450

With Project --- Financial Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Financial Price (Kip/t)	Gross Financial Revenue (Kip)	Financial Processing Cost/ha (Kip/ha)	Gross Financial Cost (Kip)	Financial Net Crop Income (Kip)	Gross Margin (Kip)
Dried maize			1.0	1,500,000	1,500,000	412,500	412,500	1,087,500	1,365,500

With Project --- Economic Returns

Crop	Area (ha)	Yield (t/ha)	Physical Production (t)	Economic Price (Kip/t)	Gross Economic Revenue (Kip)	Economic Processing Cost/ha (Kip/ha)	Gross Economic Cost (Kip)	Economic Net Crop Income (Kip)	Economic Gross Margin (Kip)
Dried maize			1.0	1,410,000	1,410,000	343,450	343,450	1,066,550	1,288,950

Table 17: Incremental Returns of Maize Drying Enterprises

Maize drier - financial

(Unit = '0,000 LAK)

Year	Without Project			With Project			Increments		
	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day
1	80	80		137	109		57	29	
2	80	80		137	109		57	29	
3	80	80		137	109		57	29	
4	80	80		137	109		57	29	
5	80	80		137	109		57	29	
6	80	80		137	109		57	29	
7	80	80		137	109		57	29	
8	80	80		137	109		57	29	
9	80	80		137	109		57	29	
10	80	80		137	109		57	29	
11	80	80		137	109		57	29	
12	80	80		137	109		57	29	

Maize drier - economic

(Unit = '0,000 LAK)

Year	Without Project			With Project			Increments		
	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day	Gross Margin	Net Revenue	Return to Labor/day
1	75	75		129	107		54	32	
2	75	75		129	107		54	32	
3	75	75		129	107		54	32	
4	75	75		129	107		54	32	
5	75	75		129	107		54	32	
6	75	75		129	107		54	32	
7	75	75		129	107		54	32	
8	75	75		129	107		54	32	
9	75	75		129	107		54	32	
10	75	75		129	107		54	32	
11	75	75		129	107		54	32	
12	75	75		129	107		54	32	

Table 18 : Northern Uplands CCP Project Economic Cash Flow

Financial Internal Rate of Return and Net Present Value

Year	Activity	Adopters	Incremental Gross Margin (LAK 0'000)	Incremental Net Revenue (LAK 0'000)	Total Project Inc GM (LAK 0'000)	Total Project Inc NR (LAK 0'000)	Project Implementation Costs (€)	Total Project Inc NR minus PIC
1	Maize (HH)	800	230	185	184,000	148,000		
	Upland rice (HH)	800	99	204	79,200	163,200		
	Paddy (ha)	200	465	257	93,000	51,400		
	Pig (HH)	705	65	157	45,825	110,685		
	Cattle (HH)	705	- 80	- 42	- 56,400	- 29,610		
10ha/villag	Processing (village)	21	159	99	33,390	20,790		
56T/village	Drying (village)	21	57	29	67,032	34,104		
	Sub-total (LAK)				*446,047*	*498,569*		
	Sub-total (€)				*424,807*	*474,828*	*5,708,800*	*- 5,233,972*
2	Maize (HH)	1,998	230	185	459,540	369,630		
	Upland rice (HH)	1,998	99	204	197,802	407,592		
	Paddy (ha)	500	465	257	232,500	128,500		
	Pig (HH)	1,763	214	281	377,282	495,403		
	Cattle (HH)	1,763	310	275	546,530	484,825		
10ha/villag	Processing (village)	53	159	99	84,270	52,470		
56T/village	Drying (village)	53	57	29	30,210	15,370		
	Sub-total (LAK)				*1,928,134*	*1,953,790*		
	Sub-total (€)				*1,836,318*	*1,860,752*	*6,665,100*	*- 4,804,348*
3	Maize (HH)	2,398	230	185	551,540	443,630		
	Upland rice (HH)	2,398	99	204	237,402	489,192		
	Paddy (ha)	600	465	257	279,000	154,200		
	Pig (HH)	2,116	299	351	632,684	742,716		
	Cattle (HH)	2,116	532	456	1,125,712	964,896		
10ha/villag	Processing (village)	63	159	99	100,170	62,370		
56T/village	Drying (village)	63	57	29	201,096	102,312		
	Sub-total (LAK)				*3,127,604*	*2,959,316*		
	Sub-total (€)				*2,978,670*	*2,818,396*	*5,379,300*	*- 2,560,904*
4	Maize (HH)	2,398	230	185	551,540	443,630		
	Upland rice (HH)	2,398	99	204	237,402	489,192		
	Paddy (ha)	600	465	257	279,000	154,200		
	Pig (HH)	2,116	384	422	812,544	892,952		
	Cattle (HH)	2,116	755	638	1,597,580	1,350,008		
10ha/villag	Processing (village)	63	159	99	100,170	62,370		
56T/village	Drying (village)	63	57	29	201,096	102,312		
	Sub-total (LAK)				*3,779,332*	*3,494,664*		
	Sub-total (€)				*3,599,364*	*3,328,251*	*4,130,700*	*- 802,449*
5 to 12	Maize (HH)	2,398	230	185	551,540	443,630		
	Upland rice (HH)	2,398	99	204	237,402	489,192		
	Paddy (ha)	600	465	257	279,000	154,200		
	Pig (HH)	2,116	384	422	812,544	892,952		
	Cattle (HH)	2,116	755	638	1,597,580	1,350,008		
10ha/villag	Processing (village)	63	159	99	100,170	62,370		
56T/village	Drying (village)	63	57	29	201,096	102,312		
	Sub-total (LAK)				*3,779,332*	*3,494,664*		
	Sub-total (€)				*3,599,364*	*3,328,251*	-	*3,328,251*
TOTAL							***21,883,900***	***13,736,367***

Year	Project Investment Costs	Total project Incremental Net revenue	Discount factor 12%	Present worth 12%	Discount factor 14%	Present worth 14%	*Discount factor 10%*	*NPV @ 10%*
1	5,708,800	- 5,233,972	0.893	- 4,673,937	0.877	- 4,590,193	0.909	***- 4,757,681***
2	6,665,100	- 4,804,348	0.797	- 3,829,065	0.769	- 3,694,544	0.826	***- 3,968,391***
3	5,379,300	- 2,560,904	0.712	- 1,823,364	0.675	- 1,728,610	0.751	***- 1,923,239***
4	4,130,700	802,449	0.636	510,358	0.592	475,050	0.683	***548,073***
5		3,328,251	0.567	1,887,118	0.519	1,727,362	0.621	***2,066,844***
6		3,328,251	0.507	1,687,423	0.456	1,517,682	0.564	***1,877,134***
7		3,328,251	0.452	1,504,369	0.4	1,331,300	0.531	***1,767,301***
8		3,328,251	0.404	1,344,613	0.351	1,168,216	0.467	***1,554,293***
9		3,328,251	0.361	1,201,499	0.308	1,025,101	0.424	***1,411,178***
10		3,328,251	0.322	1,071,697	0.27	898,628	0.386	***1,284,705***
11		3,328,251	0.287	955,208	0.237	788,795	0.35	***1,164,888***
12		3,328,251	0.257	855,361	0.208	692,276	0.319	***1,061,712***
Total	21,883,900	14,829,233		691,280		- 388,935		***2,086,817***

Interpolation = 13.29%

Economic Internal Rate of Return and Net Present Value

Year	Activity	Adopters	Incremental Gross Margin (LAK)	Incremental net revenue (LAK)	Total Project Inc GM (LAK)	Total Project Inc NR	Project Implementation Costs (€)	Total Project Inc NR minus PIC
1	Maize (HH)	800	215	180	172,000	144,000		
	Upland rice (HH)	800	85	169	68,000	135,200		
	Paddy (ha)	200	417	250	83,400	50,000		
	Pig (HH)	705	60	133	42,300	93,765		
	Cattle (HH)	705	- 75	- 44	- 52,875	- 31,020		
10ha/villag	Processing (village)	21	139	91	29,190	19,110		
56T/village	Drying (village)	21	54	32	63,504	37,632		
	Sub-total (LAK)				*405,519*	*448,687*		
	Sub-total (€)				*386,209*	*427,321*	*4,688,067*	*- 4,260,746*
2	Maize (HH)	1,998	215	180	429,570	359,640		
	Upland rice (HH)	1,998	85	169	169,830	337,662		
	Paddy (ha)	500	417	250	208,500	125,000		
	Pig (HH)	1,763	191	245	336,733	431,935		
	Cattle (HH)	1,763	273	246	481,299	433,698		
10ha/villag	Processing (village)	53	139	91	73,670	48,230		
56T/village	Drying (village)	53	54	32	160,272	94,976		
	Sub-total (LAK)				*1,859,874*	*1,831,141*		
	Sub-total (€)				*1,771,309*	*1,743,944*	*5,473,380*	*- 3,729,436*
3	Maize (HH)	2,398	215	180	515,570	431,640		
	Upland rice (HH)	2,398	85	169	203,830	405,262		
	Paddy (ha)	600	417	250	250,200	150,000		
	Pig (HH)	2,116	266	308	562,856	651,728		
	Cattle (HH)	2,116	472	411	998,752	869,676		
10ha/villag	Processing (village)	63	139	91	87,570	57,330		
56T/village	Drying (village)	63	54	32	190,512	112,896		
	Sub-total (LAK)				*2,809,290*	*2,678,532*		
	Sub-total (€)				*2,675,514*	*2,550,983*	*4,417,481*	*- 1,866,498*
4	Maize (HH)	2,398	215	180	515,570	431,640		
	Upland rice (HH)	2,398	85	169	203,830	405,262		
	Paddy (ha)	600	417	250	250,200	150,000		
	Pig (HH)	2,116	341	372	721,556	787,152		
	Cattle (HH)	2,116	671	577	1,419,836	1,220,932		
10ha/villag	Processing (village)	63	139	91	87,570	57,330		
56T/village	Drying (village)	63	54	32	190,512	112,896		
	Sub-total (LAK)				*3,389,074*	*3,165,212*		
	Sub-total (€)				*3,227,690*	*3,014,488*	*3,392,131*	*- 377,643*
5 to 12	Maize (HH)	2,398	215	180	515,570	431,640		
	Upland rice (HH)	2,398	85	169	203,830	405,262		
	Paddy (ha)	600	417	250	250,200	150,000		
	Pig (HH)	2,116	341	372	721,556	787,152		
	Cattle (HH)	2,116	671	577	1,419,836	1,220,932		
10ha/villag	Processing (village)	63	139	91	87,570	57,330		
56T/village	Drying (village)	63	54	32	190,512	112,896		
	Sub-total (LAK)				*3,389,074*	*3,165,212*		
	Sub-total (€)				*3,227,690*	*3,014,488*	*-*	*3,014,488*
TOTAL							**17,971,059**	**13,868,951**

Year	Project Investment Costs	Total project Incremental Net revenue	Discount factor 15%	Present worth 15%	Discount factor 14%	Present worth 14%	Discount factor 10%	NPV @ 10%
1	4,688,067	- 4,260,746	0.87	- 3,706,849	0.877	- 3,736,674	0.909	- 3,873,018.11
2	5,473,380	- 3,729,436	0.756	- 2,819,454	0.769	- 2,867,936	0.826	- 3,080,514.14
3	4,417,481	- 1,866,498	0.658	- 1,228,156	0.675	- 1,259,886	0.751	- 1,401,740.00
4	3,392,131	- 377,643	0.572	- 216,012	0.592	- 223,565	0.683	- 257,930.17
5		3,014,488	0.497	1,498,201	0.519	1,564,519	0.621	1,871,997.05
6		3,014,488	0.432	1,302,259	0.456	1,374,607	0.564	1,700,171.23
7		3,014,488	0.376	1,133,447	0.4	1,205,795	0.531	1,600,693.13
8		3,014,488	0.327	985,738	0.351	1,058,085	0.467	1,407,765.90
9		3,014,488	0.284	856,115	0.308	928,462	0.424	1,278,142.91
10		3,014,488	0.247	744,579	0.27	813,912	0.386	1,163,592.37
11		3,014,488	0.215	648,115	0.237	714,434	0.35	1,055,070.80
12		3,014,488	0.187	563,709	0.208	627,014	0.319	961,621.67
Total	17,971,059	13,881,581		- 238,308		198,766		2,425,852.64

Interpolation = 14.45%