

ECONOMIC AND FINANCIAL ANALYSIS FOR IRRIGATION SUBPROJECT IN PREY VENG PROVINCE

A. INTRODUCTION

1. This economic and financial analysis (EFA) assess the economic and financial viability of a representative irrigation canal rehabilitation and agricultural development subproject under the Tonle Sap Poverty Reduction and Smallholder Development – Additional Financing (TSSD-AF) Project. The EFA consists of two main components. Firstly, the financial analysis is to validate the financial attractiveness of the subproject to the beneficiary households, the subproject's primary stakeholders. Only when these activities are financially attractive can the subproject's envisioned benefits be realized and sustained. Additional consideration is given to the extent of operation and maintenance required for the continuous functioning of the road. Finally, the economic analysis is to validate if the subproject's benefits, measured in economic terms, sufficiently outweigh its economic costs. The result of the economic and financial analysis is summarized by the internal rates of return or the net present value metrics.

2. The EFA is based on assessment of the difference in the without- and with-project scenarios. Data were collected by PPTA consultant from interviews with informant farmers in March-April 2017.¹ Following the assessment of these two scenarios in financial terms, economic costs and benefits were derived by applying standard conversion methodologies. Sensitivity tests were conducted to test the robustness of the analysis results.

B. MACROECONOMIC CONTEXT

3. Following the global economic downturn in 2008-2009, Cambodian economy has recovered quickly thanks to growth in the agricultural sector between 2009 and 2011. Since then, the agricultural sector's performance has been weak. Starting from 2012, the industry and service sectors have grown faster and significantly outpaced growth in the agricultural sector, squeezing the latter's share of gross domestic product from 33.5% in 2012 to 28.6% in 2015 (Table 1). Especially after 2012, its growth has abruptly declined and has been nearly negligible.

Table 1: Key Macro-Economic Indicators of Cambodia

Indicator	At constant 2000 Prices				
	2012	2013	2014	2015	2016
GDP (US\$ mil)	8,662	9,313	9,971	10,686	11,442
GDP per capita (US\$)	599	637	672	714	755
GDP growth (percent)	7.3	7.4	7.1	7.0	7.2
Sectoral growth (percent)					
- Agriculture	4.3	1.6	0.3	0.2	1.8
- Industry	9.3	10.7	10.1	11.7	11.5
- Services	8.1	8.7	8.7	7.1	7.3
Sectoral share					
- Agriculture	33.5	31.6	28.9	28.6	n/a

¹ About 150 farmers were interviewed, in addition to members of commune councils, commune extension workers and officers of provincial departments of agriculture, forestry and fisheries. Of the 150 informant farmers, 64 were female. Interviews were conducted in a group of 2 to 4 individuals at each session. The informants were from the subprojects' target communes, adjacent communes, and existing Tonle Sap Poverty Reduction and Smallholder Development Project (TSSD) communes. The last group is especially relevant for an assessment of the project's potential benefits, and the extent of farmers' adoption of new agricultural technologies that will be introduced by TSSD-AF. The range of data covers (i) the existing cultivation area of different crops and livestock; (ii) the existing crop or livestock budget which include production parameters farmgate prices, inputs quantity and prices, access to and costs of agricultural services and credits; (iii) adoption rates of new technologies, and (iv) assessment of benefits that can be achieved by the subproject activities.

Indicator	At constant 2000 Prices				
	2012	2013	2014	2015	2016
- Industry	23.0	24.1	25.6	29.7	n/a
- Services	37.8	38.5	39.7	41.7	n/a

GDP = gross domestic product; n/a = non-available.

Sources: National Bank of Cambodia 2016, Ministry of Economy and Finance 2017 and Ministry of Agriculture, Forestry and Fisheries 2017.²

4. Despite the sector's stagnant growth, agriculture remains the backbone of rural households, both for food security reason and as a significant source of livelihoods. The Cambodian Agricultural Census (2013), the very first agricultural census in Cambodian history, reports that 82% of the country's 2.6 million households are engaged in agricultural activities, including crops cultivation and poultry and livestock raising.³

5. Not only is agriculture important for Cambodian rural households, its development is an integral component of the economic diversification policy of the Royal Government of Cambodia (the government). The government's desire to promote the agricultural sector development is evidenced by its effort in planning and implementing, for examples, Paddy Rice Production and Milled Rice Export Policy (2010); Master Plan on the Promotion of Agricultural Investment in Cambodia (2013); Agricultural Sector Strategic Development Plan 2014-2018; a \$20 million Boosting Food Production Programme 2016-2018 which is fully funded with its own financial resources; and National Strategic Aquaculture Development Programme 2016-2030.

6. The proposed AF will contribute to the Government's Rectangular Strategy on Growth, Employment, Equity and Efficiency 2014–2018, especially on enhancement of the agriculture sector (diversification, value addition, and productivity); and infrastructure development, and the Agricultural Sector Strategic Development Plan 2014-2018 which focuses on increase of value addition and development of transport infrastructure and irrigated lands. It is also aligned with the Asian Development Bank (ADB) Cambodia Country Partnership Strategy,⁴ Country Operations Business Plan (2017–2019),⁵ and ADB's assessment, strategy, and road map (ASR) for the agriculture, natural resources, and rural development sector.⁶

C. LESSON LEARNT FROM TSSD EXPERIENCE

7. TSSD's major outputs include road rehabilitation, irrigation scheme rehabilitation, and poverty-targeting livelihood improvement groups (LIGs) support. Under the TSSD, the poorest households were first organized into LIGs. The range of LIGs support include sponsoring regular meetings to facilitate knowledge sharing and technology transfer; training on basic record management and business planning; agricultural extension service; training and demonstration on chicken raising, fish and frog farming, and vegetables cultivation; group-based revolving fund for working capital loan. A rapid assessment of TSSD indicates that it has performed well economically, yielding an economic internal rate of return (EIRR) above 20%.

8. TSSD-AF covers the same outputs as TSSD, and has additional elements. Despite TSSD's overall success, not all TSSD subprojects were successful. The major lessons learned

² Government of Cambodia. 2016. *Economic and Monetary Statistics*. Phnom Penh; Government of Cambodia, Secretary of State of MEF. 2017. *Cambodia: Past, Present and Future*. Phnom Penh; Government of Cambodia. 2017. *Annual Report of Ministry of Agriculture, Forestry and Fisheries*. Phnom Penh.

³ Government of Cambodia. 2015. *Census of Agriculture of the Kingdom of Cambodia 2013*. Phnom Penh.

⁴ ADB. 2014. *Country Partnership Strategy: Cambodia, 2014–2018*. Manila.

⁵ ADB. 2016. *Country Operations Business Plan: Cambodia, 2017–2019*. Manila.

⁶ Sector Assessment Summary (accessible from the list of linked documents in Appendix 2 of the report and recommendation of the President [RRP]).

are as follows:

- (i) Rebuilt or rehabilitated irrigation schemes for wet season supplementary irrigation improved food security, but yield limited benefits during dry season due to a dearth of water. When their investment costs were considered, these schemes were not economically viable;
- (ii) Rebuilt or rehabilitated village roads under the TSSD do not help lift the economic wellbeing of communities unless they are connected to a wider road network;
- (iii) Demonstration farms did not encourage adoption of new farming practices or technologies unless they were linked with organized farmer groups, such as LIGs, to help draw visitors and propagate knowledge; and
- (iv) Specific assistance targeting the poor and female-headed households through LIGs had a significant positive impact, and the LIGs knowledge and information sharing function was important. In view of TSSD's success, other donor-funded projects, for example, the World Bank's Local Economic Association of the Poor Project, Land Allocation for Social and Economic Development Project have adopted the TSSD approach, specifically the LIG support model.

9. Lessons from TSSD informed TSSD-AF's design project. Particularly, TSSD-AF will only finance irrigation schemes with sufficient water resources to support a second or even a third crop, or subproject roads that connect the beneficiary communities to a wider network. In addition, TSSD-AF will no longer support new demonstration farms.

D. RATIONALE

10. Development problems in the agriculture sector in Cambodia include: (i) low agricultural productivity; (ii) under-developed value chains; and (iii) deteriorating natural capital stock and high vulnerability to climate threats. For the poor in particular, inefficient use of resources, poor productive infrastructure and limited access to rural financial services are major constraints. Since 1998, ADB has invested in rural infrastructure, agricultural productivity, and natural resources management in the Tonle Sap Basin. These investments have lifted millions out of poverty. However, the number of vulnerable people remains high; the loss of only \$0.3 per day would bring Cambodia's poverty rate back to 40%.⁷

11. Furthermore, disasters including extreme climate events such as floods and droughts have aggravated adverse impacts on agriculture and other sectors. Cambodia is consistently ranked among the top 10 countries most vulnerable to extreme climate events.⁸ With climate change, these impacts may worsen over time. Vulnerability of the poor, compounded by the expected adverse climate change impacts, and disasters triggered by natural hazards, makes it essential to continue to build on the successes achieved in the current TSSD.

12. The subproject will rehabilitate an existing irrigation system and support poor and female-headed households to improve their agricultural livelihoods in Lvea commune in Preah Sdach district of Prey Veng province. Totally, there are 1,828 rural households living in 11 villages of the commune. 94% of these households depend on farming. Their main source of income is from rice cultivation, one wet season rice crop and one or two dry season rice crops and some other minor crops, including lotus and sugar cane.

⁷ World Bank Group. 2015. *Cambodian Agriculture in Transition: Opportunities and Risks*. Washington, D.C.

⁸ Germanwatch. 2014. *Global Climate Risk Index 2015: Who Suffers Most from Extreme Weather Events? Weather-related Loss Events in 2013 and 1994 to 2013*. Bonn; and United Nations University. 2012. *World Risk Report 2012*. Berlin.

13. Wet season occurs from May to October. A dry spell always breaks the wet season in July. In certain years, the dry spell – known as small dry season can be prolonged and adversely affect wet season rice production, which can threaten local community food security. For the dry season rice farmers do not have enough water for the dry season rice production as they depend on the existing irrigation system, which is already dilapidated. They currently grow two crops of dry-season rice, but on very small area using pumps.

14. Given the precarious conditions for their livelihood source, many households remain poor and female-headed households are the most vulnerable ones. Poor and female-headed households consist of 29% and 17%, respectively, of the entire household population in the commune. Poverty level in the target commune is above provincial average and higher than that recorded in the majority of former TSSD-targeted provinces.

15. The subproject investment aims at improving farm productivity and diversification of 320 beneficiary households in four villages of the 11 villages in the target commune. Potential land area that will be served by the rehabilitated irrigation scheme was estimated to be 305 hectares (ha). The scheme will provide supplementary irrigation to wet season crop, especially the 305 ha of wet season paddy rice, during the monsoon season (May-October), and full irrigation for a second and a third non-photosensitive, short-maturity crop during the dry season (November-April). The subproject will improve yield and diversify agricultural produce.

16. In addition to rebuilding the irrigation scheme for the 320 households in the four villages, the subproject will extend support on agricultural and value chain development (in rice, vegetables, chickens, and aquaculture) as well as on the establishment of LIGs along with revolving funds, which will benefit farmers in other seven villages of the communes.

E. SELECTION OF ALTERNATIVE SUBPROJECTS

17. All subprojects must meet the following primary criteria:⁹ (i) community support which may include preparing a commune plan to contribute to infrastructure operation and maintenance (O&M); (ii) the infrastructure investment cost not to exceed \$200,000; (iii) the economic internal rate of return (EIRR) exceeds 12%; (iv) construction be completed within 2 years; (v) no major resettlement or environmental issues; (vi) at least 40% of beneficiaries be female.

18. In addition, priority will be given to subprojects that (i) have high poverty ratios; (ii) reduce disaster risks; (iii) involve rehabilitation which is likely to be less costly; (iii) have strong community participation and support, particularly for O&M; (iv) have suitable soil or topographic conditions suitable for agriculture; and (iv) improve production and market access.

19. During a national consultative workshop held in Kampong Thom province on 28 March 2017, the Lvea irrigation system was discussed and agreed upon by the relevant government agencies as a representative subproject. It meets all the aforementioned criteria and was selected in part because it meets a least cost per beneficiary household criterion as recommended in the TSSD Technical Audit Report.¹⁰

⁹ Appendix 3 of TSSD-AF Project Administration Manual.

¹⁰ The technical audit report recommended that an irrigation subproject capable of providing supplementary wet season irrigation should be selected if it costs less than \$50/household. Any subproject that costs more than \$50/household but less than \$100/household are subject to more eligibility criteria. Any potential subproject that costs more than \$100/household is ineligible. The number of beneficiary is defined by beneficiary of the infrastructure. The least-cost-per household criteria was adopted during consultation but was subsequently replaced by the economics criteria (EIRR to exceed 12%).

F. MAJOR ASSUMPTIONS AND METHODOLOGY

20. The economic analysis has been conducted using the Asian Development Bank's (ADB's) *Guidelines for the Economic Analysis of Projects*,¹¹ and *Key Areas of Economic Analysis of Investment Projects: An Overview*.¹² The major assumptions include:

- (i) The economic analysis is carried out over 20 years, coinciding with the subproject's expected economic life, starting in 2018 and including a 5-year subproject implementation period;
- (ii) The EFA uses the world price (US dollars, \$) numeraire. Local currency, in Cambodian riel (KR), are converted to \$ using an exchange rate of KR4,023.0 = \$1;
- (iii) Financial investment costs were provided by the PPTA consultants. They were already in \$;
- (iv) Financial farm gate prices including farm wages were based on field works that were carried out during March-April 2017. Vehicle operating costs, time costs and crop and livestock budgets were first collected in KR and then converted to \$ using the stated exchange rate;
- (v) To convert the items' financial values into economic values, taxes and subsidies are net out from the gross financial values. Appropriate conversion factors were then applied on the local and unskilled labor components of each item to derive the final economic values;
- (vi) When data is available, for the main tradable agricultural inputs and outputs, their economic values are estimated based on the World Bank's Commodity Price Forecasts of January 2017 after adjusting border prices to farm gate prices. Estimation of economic prices of these commodities was over the period 2017 to 2030;
- (vii) The standard conversion factor (SCF) of 0.92 was applied to local component and local labour (both skilled and unskilled); in addition, local unskilled labor was further adjusted by a shadow wage rate factor (SWRF) of 0.90;
- (viii) The EFA used an economic internal rate of return (EIRR) threshold of 12.0%.

G. SUBPROJECT COSTS AND BENEFITS

1. Subproject Costs

21. Major costs of the subproject investment were estimated by the PPTA's engineers and financial and cost expert. Main cost components of the subproject comprise:

- (i) Disaster risk reduction (DRR) irrigation scheme rehabilitation and related irrigation system design and supervision support;
- (ii) Operation and maintenance (O&M) of the irrigation system in the initial years (Year 3-5). The fund can be used for physical maintenance or capacity building of beneficiary communes; after project completion, the routine O&M funding will be provided by the government or beneficiaries;
- (iii) Establishment of and support to 11 LIGs (in 11 villages), and agricultural value chain development, specifically for rice, vegetables, native breed chicken raising, and aquaculture (fish, frog, and freshwater prawn farming);

¹¹ ADB. 2017. *Guidelines for Economic Analysis of Projects*. Manila, Philippines.

¹² ADB. 2014 *Key Areas of Economic Analysis of Investment Projects: An Overview*. Manila, Philippines.

- (iv) Other support and recurrent costs including agriculture information and communication technology (ICT), DRR training, and multi-stakeholder value chain platforms; and
- (v) Project management cost.

22. Total estimated cost of the subproject is \$379,232 (Table 2). The amount is in financial terms and is later converted to economic values in the economic analysis.

23. The economic life of the subproject depends on the useful life of the rehabilitated irrigation system, to a limited extent, the continued relevance of introduced/new agricultural and marketing practices.

24. Irrigation system rehabilitation will use locally available construction materials, such as earth, laterite, crushed rocks and gravels, and incorporate DRR design. Many TSSD-funded canals, which were visited by the consultant during the course of the PPTA, have remained in good conditions after years of building without O&M, although they were not based on DRR-design and used DRR-resistant materials. A DRR-resilient irrigation system will require limited or no maintenance. To further extend the economic life of the physical assets, TSSD-AF will provide financial resources to support O&M in the initial years (Year 3 to 5). For the representative subprojects, the O&M budget allocation is estimated at 2% per annum of the total irrigation system's rehabilitation cost, and will keep the system in usable conditions for at least 12 to 15 years after the project completion.

25. The economic life of the subproject depends on the useful life of the rehabilitated irrigation scheme and, to a limited extent, the continued relevance of introduced agricultural and marketing practices. In the EFA, it is assumed that it will have a useful life of 20 years with limited or no maintenance after the subproject implementation period.

Table 2: Irrigation Subproject Financial Costs

Components	Financial cost (\$) ^a	Composition				Economic cost (\$) ^b
		Local (%)	Foreign (%)	Unskilled (%)	Skilled (%)	
1. Civil works	197,200	50%	20%	20%	10%	182,528
2. Design	12,615	38%	0%	0%	62%	11,185
3. Civil works O&M ^c	11,832	50%	20%	20%	10%	10,952
4. Commune/Community	100,822	8%	2%	6%	35%	91,962
5. Other support ^d	39,862	165%	5%	0%	54%	35,658
6. Project management	16,901	55%	0%	0%	45%	15,203
Total	379,232					347,488

O&M = operation and maintenance

^a Inclusive of taxes and physical contingency. Total values are not discounted.

^b Derived from financial value by first netting out taxes, and applying the standard conversion factor (SCF) of 0.92 on local component, and a conversion factor of 0.83 (Shadow wage rate factor (SWRF) of 0.90 multiplied by SCF) on unskilled labor.

^c 2% of construction costs per year, between Year 3 and 5.

^d Include agriculture information and communication technology, DRR training, and multi-stakeholder value chain platforms. Benefits were not captured in the EFA.

Source: PPTA consultants.

2. Subproject Benefits

26. The design assumed that the subproject implementation will begin in 2018, taken as year 1 in the EFA. The implementation period of the subproject will coincide with the ADB's financing term, which will be between 2018 and 2023 (Year 1-6). Responsibilities for the subproject will be

handed over to the beneficiary communities, the concerned commune councils and the government by 2024.

27. The subproject will help farmers to (i) improve, to a certain extent, wet season rice yield due to application of new practices and availability of water for supplementary irrigation, specifically in the command area, during the monsoon season if and when prolonged dry spell would occur; (ii) diversified dry season crops (including lotus, water melon, vegetables) with availability of water for irrigation; and (iii) diversification into high-value farm enterprises (especially improved practice of native-breed chicken keeping, fish, frog, and freshwater giant prawn farming). The irrigation system will benefit 320 households; but support to and development of agricultural extension, value chain and LIGs will benefit other farming households in the entire commune.

28. From experience, increased yield and production would depress local farm-gate prices. As such, some slight reduction in farm-gate prices is expected in the with-project scenario as compared with the without-project scenario, unless well-coordinated and market-demand-driven planning of agricultural production could be instituted among the beneficiary households. In the EFA, it is assumed that there will be no such coordination, and farm-gate prices are slightly lower in the with-project scenario. The downward adjustments are based on interviewed farmers' price estimates for bountiful harvests.

29. While farm-gate prices of agricultural produce will decline, the beneficiary households will increase productivity and cut farm production costs by optimizing and rationalizing the use of agro-chemicals and inputs. Farming is highly mechanized in the subproject area, which is experiencing labor shortage due to rural to urban migration of the workforce and attractiveness of factory jobs. The rehabilitated road would allow for efficient mobility of agricultural machines (such as walking tractors, tractors, and harvesters). This would reduce costs for O&M of agricultural machines and service fees, as rental are charged at hourly rates. The cost for produce transportation will likewise be lowered. The reduction in farm-gate prices of agricultural produce will thus be offset by increased productivity and reduced farm production and transportation costs.

30. Membership of Cambodia in the World Trade Organization and Association of Southeast Asian Nations has allowed Cambodia to expand export markets for its agricultural produce and products, but also has required that it opens its domestic markets for the same. Given the openness of Cambodia to globalization, markets for agricultural outputs and inputs have been very competitive nationwide. Agricultural inputs (including fertilizers, seeds, propagative materials, breeds, and agricultural machines) and agricultural mechanization services are readily available through local markets and are of reasonable quality. Agricultural inputs have not been taxed. No taxes have been imposed on agricultural land, farm outputs and farm incomes.

31. The subproject's beneficiary households will not export their products directly. Additionally, movement of goods within and outside the subproject's area is free and in response to market signals, generally unhindered. There have been no official trade barriers. In reality, of course, there are hidden and unexplained costs due to rent seeking activities.

32. As mentioned earlier, the subproject will enable farmers to improve rice yield and diversify agricultural produce. The without-project scenario was based on information collected during field visits. The range of data gathered include (i) farm budgets for the most commonly grown crops and chicken raising; and (ii) cultivation area by farming seasons.

33. Altogether 14 crops and livestock budgets were incorporated in the EFA. These include ones that local farmers are already practicing or can practice, and that the subproject will promote. These include production of: (i) wet season paddy rice; (ii) dry season paddy rice; (iii) lotus; (iv) sugar cane; (v) watermelon; (vi) yard long bean; (vii) cucumber; (viii) morning glory; (ix) bitter

gourd; (x) musk melon; (xi) native-breed chickens; (xii) fish; (xiii) frog; and (xiv) freshwater giant prawn. Data for these farm enterprise budgets were gathered from several key farmers and key informants in the subproject areas and nearby communes. Average statistics (e.g., mean yields, mean costs of inputs) were used in the EFA model.

34. Tables 3 summarizes estimates on the number of wet season rice area that will be converted to improved practices introduced by the subproject. For the with-project scenario, parameterization on the adoption rates of various crop and livestock improved practices was based on the TSSD experience.

35. Historically, beneficiary farming households rarely converted all their farmland to new practices. Their willingness to convert farmland to new practices is always constrained by financial resources that are needed for high-priced inputs; risk-aversion; lack of markets; weak value chains; lack of storage facility or processing center; and attractive off-farm alternative livelihoods; and preference for leisure and rural-urban migration/rural exodus.

36. For the without-project scenario, farmers are assumed to continue with existing practices. For the with-project scenario, farmer's adoption rate varies by crop and livestock. Although the subproject will be effectively started in year 1, partial, incremental benefits will begin to flow in only in year 2 as the agricultural extension service and value chain support activities would take effect. Full benefits of the subproject's interventions in agriculture and value chain development will only occur from year 5. The gradual transition is shown in Column B of Table 3. In the case of wet season rice, only 28% (217.6 ha) of the existing wet season rice area will be cultivated using improved practices. This 217.6 ha is the basis for the computation of incremental benefits of wet season rice cultivation.

Table 3: Wet Season Rice Cultivation Area Under New Practices

	Without project	With project		
	Existing practice (ha) (A)	Adoption rate (%) (B)	Existing practice (ha) (C=A*(1-B))	Improved practice (ha) (D=A*B)
Year 1	777.0	0%	777.0	0.0
Year 2	777.0	7%	722.6	54.4
Year 3	777.0	14%	668.2	108.8
Year 4	777.0	21%	613.8	163.2
Year 5 - 20	777.0	28%	559.4	217.6

ha = hectare.

Source: PPTA consultant, based on TSSD experience and Agro-Ecosystem Analyses of both communes by the General Department of Agriculture of the Ministry of Agriculture, Forestry and Fisheries.

37. Table 4 presents the per-hectare budgets for wet season rice, in the without- and with-project scenarios. The data were collected during the March-April 2017 field works, in KR but converted to \$. Other crop and livestock budgets are presented in Annex 1.

Table 4: Wet Season Rice Crop Budget (Per Hectare, \$)

	Unit	Financial			Economic		
		W/O	W/	Dif.	W/O	W/	Dif.
Wet season rice	ha	1.0	1.0	0.0	1.0	1.0	0.0
Cycle	month	4.5	3.5	-1.0	4.5	3.5	-1.0
Revenue							
Produce	kg	2,001.6	2,400.0	398.4	2,001.6	2,400.0	398.4
Produce price	US\$/kg	0.199	0.194	0.0	0.225	0.225	0.0
Total revenue	US\$	398.0	465.3	67.3	450.1	539.7	89.6
Costs							
Planting material	US\$	74.6	74.6	0.0	68.6	68.6	0.0
Land preparation	US\$	65.6	54.7	-10.9	60.4	50.3	-10.1
Insecticide	US\$	0.0	0.0	0.0	0.0	0.0	0.0

	Unit	Financial			Economic		
		W/O	W/	Dif.	W/O	W/	Dif.
Herbicide	US\$	11.4	10.4	-1.0	10.5	9.6	-0.9
Fertilizer	US\$	67.3	122.3	55.0	61.9	112.5	50.6
Watering	US\$	0.0	30.5	30.5	0.0	28.1	28.1
Hired labor	US\$	43.3	22.7	-20.5	35.8	18.8	-17.0
Harvesting (machine)	US\$	89.5	74.6	-14.9	82.3	68.6	-13.7
Produce transport	US\$	17.9	17.9	0.0	16.5	16.5	0.0
Total costs (excl. interest payment)	US\$	369.5	407.7	38.2	336.0	373.0	37.0
Net (excl. interest payment)	US\$	28.5	57.6	29.1	114.1	166.6	52.6

W/O = without-project; W/ = with-project; Dif. = difference

Source: PPTA consultant, based on TSSD experience and Agro-Ecosystem Analyses of both communes by the General Department of Agriculture of the Ministry of Agriculture, Forestry and Fisheries.

38. In the financial analysis, the total incremental farm income from wet season rice cultivation is computed by multiplying the incremental area under new practices (217.6 ha, Column D of Table 3) by the per-hectare incremental net income of \$29.1/ha, the difference between the without-project and with-project income (last line in Table 4). The total incremental income from wet season rice cultivation is thus \$6,332. The incremental farm incomes for other crops and livestock are computed similarly. The summation of the incremental represents the total incremental farm income brought about by the project.

39. The incremental farm incomes for other crops, chickens and aquaculture are computed similarly. The summation of the incremental represents the total incremental farm income brought about by the project. All line items in the left panel of Table 4 are in financial terms. In the economic analysis, all items are converted to economic values by applying appropriate conversion factors. The without- and with-project resources flows are computed following the steps outlined above except that the costs and benefits are now expressed in economic values. The difference represents the project's incremental benefits. The analysis results are presented in the next section.

E. Analysis Results

1. Financial Analysis of Benefits

40. Table 5 summarizes the subproject's incremental farm income accrued to the beneficiary households, based on the above given assumptions. In the economic analysis, these benefit streams, which are in financial terms, are converted to economic values, and are compared against the subproject's investment costs, also expressed in economic values.

Table 5: Irrigation Subproject Incremental Farm Income^a (Financial Value, \$ '000)

Project year	Crop						Livestock				Total Incremental
	WS rice	DS rice	Lotus	Sugar cane	Water melon	Other vegetables ^b	Chicken	Fish	Frog	Tiger prawn	
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	1.58	0.90	2.18	0.54	0.00	0.00	0.00	0.37	0.38	0.00	5.97
3	3.16	1.81	4.37	1.08	0.14	1.82	9.02	0.74	0.77	0.26	23.17
4	4.75	2.71	6.55	1.63	0.27	2.59	18.04	1.11	1.15	0.52	39.32
5	6.33	3.62	8.74	2.17	0.41	3.36	27.06	1.47	1.54	0.77	55.47
6	6.33	3.62	10.92	2.71	0.54	3.36	36.08	1.47	1.54	1.03	67.61
7	6.33	3.62	10.92	2.71	0.68	3.36	36.08	1.47	1.54	1.03	67.75
8	6.33	3.62	10.92	2.71	0.68	3.36	36.08	1.47	1.54	1.03	67.75
9	6.33	3.62	10.92	2.71	0.68	3.36	36.08	1.47	1.54	1.03	67.75
10	6.33	3.62	10.92	2.71	0.68	3.36	36.08	1.47	1.54	1.03	67.75
11	6.33	3.62	10.92	2.71	0.68	3.36	36.08	1.47	1.54	1.03	67.75
12	6.33	3.62	10.92	2.71	0.68	3.36	36.08	1.47	1.54	1.03	67.75

Project year	Crop						Livestock				Total Incremental
	WS rice	DS rice	Lotus	Sugar cane	Water melon	Other vegetables ^b	Chicken	Fish	Frog	Tiger prawn	
13	6.33	3.62	10.92	2.71	0.68	3.36	36.08	1.47	1.54	1.03	67.75
14	6.33	3.62	10.92	2.71	0.68	3.36	36.08	1.47	1.54	1.03	67.75
15	6.33	3.62	10.92	2.71	0.68	3.36	36.08	1.47	1.54	1.03	67.75
16	6.33	3.62	10.92	2.71	0.68	3.36	36.08	1.47	1.54	1.03	67.75
17	6.33	3.62	10.92	2.71	0.68	3.36	36.08	1.47	1.54	1.03	67.75
18	6.33	3.62	10.92	2.71	0.68	3.36	36.08	1.47	1.54	1.03	67.75
19	6.33	3.62	10.92	2.71	0.68	3.36	36.08	1.47	1.54	1.03	67.75
20	6.33	3.62	10.92	2.71	0.68	3.36	36.08	1.47	1.54	1.03	67.75

^a Include yard long bean, cucumber, morning glory, bitter gourd, and muskmelon, all grown in households' garden plots.

Source: PPTA consultant.

41. Table 6 presents the financial analysis for the overall project.

Table 6: Irrigation Subproject Economic Analysis (\$'000)

Project year	Capital cost	O&M	LIGs support	Other support	Project Management	Total Costs	Farm Benefits	Net Benefit
1	(111.2)	0.0	(13.1)	(9.9)	(2.6)	(136.9)	0.0	(136.9)
2	(98.6)	0.0	(30.9)	(7.8)	(3.5)	(140.8)	6.0	(134.8)
3	0.0	(3.0)	(31.2)	(7.4)	(3.8)	(45.3)	23.2	(22.1)
4	0.0	(3.0)	(18.4)	(7.2)	(3.4)	(31.9)	39.3	7.4
5	0.0	(3.0)	(7.0)	(6.8)	(3.3)	(20.1)	55.5	35.4
6	0.0	(3.0)	(0.2)	(0.7)	(0.4)	(4.3)	67.6	63.3
7	0.0	(3.0)	0.0	0.0	0.0	(3.0)	67.7	64.8
8	0.0	(3.0)	0.0	0.0	0.0	(3.0)	67.7	64.8
9	0.0	(3.0)	0.0	0.0	0.0	(3.0)	67.7	64.8
10	0.0	(3.0)	0.0	0.0	0.0	(3.0)	67.7	64.8
11	0.0	(3.0)	0.0	0.0	0.0	(3.0)	67.7	64.8
12	0.0	(3.0)	0.0	0.0	0.0	(3.0)	67.7	64.8
13	0.0	(3.0)	0.0	0.0	0.0	(3.0)	67.7	64.8
14	0.0	(3.0)	0.0	0.0	0.0	(3.0)	67.7	64.8
15	0.0	(3.0)	0.0	0.0	0.0	(3.0)	67.7	64.8
16	0.0	(3.0)	0.0	0.0	0.0	(3.0)	67.7	64.8
17	0.0	(3.0)	0.0	0.0	0.0	(3.0)	67.7	64.8
18	0.0	(3.0)	0.0	0.0	0.0	(3.0)	67.7	64.8
19	0.0	(3.0)	0.0	0.0	0.0	(3.0)	67.7	64.8
20.0	0.0	(3.0)	0.0	0.0	0.0	(3.0)	67.7	64.8
ENPV =	(177.9)	(17.1)	(74.3)	(29.2)	(12.0)	(310.5)	339.5	29.0
EIRR =								13.4%

FIRR = Financial internal rate of return; FNPV = financial net present value; O&M = operation and maintenance. Source: PPTA consultant.

2. Economic Analysis Results

42. Economic analysis demonstrates that the subproject is feasible at the cut-off discount rate (or cost of capital) of 12% (Table 7). At the 12% economic discount rate the base-case economic net present value (ENPV) is \$140,300, and the base-case EIRR is 19.1%.

Table 7: Irrigation Subproject Economic Analysis (\$'000)

Project year	Capital cost	O&M	LIGs support	Other support	Project Management	Total Costs	Farm Benefits	Net Benefit
1	(102.4)	0.0	(12.0)	(9.0)	(2.4)	(125.8)	0.0	(125.8)
2	(91.3)	0.0	(28.2)	(7.0)	(3.1)	(129.6)	10.5	(119.1)
3	0.0	(2.7)	(28.5)	(6.6)	(3.4)	(41.2)	31.6	(9.6)
4	0.0	(2.7)	(16.8)	(6.4)	(3.0)	(28.9)	51.5	22.6

Project year	Capital cost	O&M	LIGs support	Other support	Project Management	Total Costs	Farm Benefits	Net Benefit
5	0.0	(2.7)	(6.3)	(6.1)	(3.0)	(18.1)	71.5	53.4
6	0.0	(2.7)	(0.2)	(0.7)	(0.4)	(3.9)	82.9	79.0
7	0.0	(2.7)	0.0	0.0	0.0	(2.7)	83.1	80.3
8	0.0	(2.7)	0.0	0.0	0.0	(2.7)	83.1	80.3
9	0.0	(2.7)	0.0	0.0	0.0	(2.7)	83.1	80.3
10	0.0	(2.7)	0.0	0.0	0.0	(2.7)	83.1	80.3
11	0.0	(2.7)	0.0	0.0	0.0	(2.7)	83.1	80.3
12	0.0	(2.7)	0.0	0.0	0.0	(2.7)	83.1	80.3
13	0.0	(2.7)	0.0	0.0	0.0	(2.7)	83.1	80.3
14	0.0	(2.7)	0.0	0.0	0.0	(2.7)	83.1	80.3
15	0.0	(2.7)	0.0	0.0	0.0	(2.7)	83.1	80.3
16	0.0	(2.7)	0.0	0.0	0.0	(2.7)	83.1	80.3
17	0.0	(2.7)	0.0	0.0	0.0	(2.7)	83.1	80.3
18	0.0	(2.7)	0.0	0.0	0.0	(2.7)	83.1	80.3
19	0.0	(2.7)	0.0	0.0	0.0	(2.7)	83.1	80.3
20.0	0.0	(2.7)	0.0	0.0	0.0	(2.7)	83.1	80.3
ENPV =	(164.2)	(15.8)	(67.8)	(26.1)	(10.8)	(284.7)	425.0	140.3
EIRR =								19.1%

O&M = operation and maintenance; EIRR = economic internal rate of return; ENPV = economic net present value.
Source: PPTA consultant.

3. Sensitivity Analysis

43. Sensitivity tests of the economic analysis were performed on five variables that could potentially affect the economic performance of the subproject. The five variables are:

- (i) 10% increase in capital cost;
- (ii) 10% increase in recurrent cost;
- (iii) 10% decrease in benefits;
- (iv) 20% decrease in benefits; and
- (v) one-year delay in benefits.

44. The sensitivity tests show that the most sensitive variables are the 20% reduction in benefits, followed by the one-year delay in benefits (Table 8). While the one-year delay in benefits will reduce the ENPV to \$36,000, the reduction in benefits by 20% will result in the decline of the ENPV to \$45,400. Accordingly, the subproject's EIRR will be down to 13.7% when the benefits were delayed by 1 year, and to 15.5% as the benefits were reduced by 20%. The subproject is highly sensitive to these two variables.

Table 8: Sensitivity Analysis

Case	ENPV (\$'000)	EIRR	SI (ENPV)	SV (ENPV)
0. Base case	140.30	19.1%		
1. Capital costs + 10%	123.87	18.0%	2.0	49%
2. Recurrent costs + 10%	129.32	18.4%	2.0	49%
3. Benefits decrease - 10%	97.79	17.1%	3.0	33%
4. Benefits decrease - 20%	55.29	15.0%	3.0	33%
5. Benefits delay - 1 year	87.07	16.1%	3.0	38%

EIRR = economic internal rate of return; ENPV = economic net present value; SI = sensitivity indicator (the ratio that compares percentage change in ENPV with percentage change in a variable); SV = switching value (the percentage change in a variable sufficient to reduce ENPV to zero)

Source: PPTA consultant.

4. Distribution Analysis

45. Table 9 presents the distribution analysis. Based on a poverty household ratio of 28.9% in the subproject communes, the poverty impact ratio is 27.8%, that is, at least 27.8% of the

projects' benefits accrues to the poorest and poor households (ID1 and ID2 categories). The subproject is likely to have a greater impact on poverty reduction since the LIGs and agricultural value chain development support are targeting poor households.

Table 9: Irrigation Subproject Distribution Analysis

	Financial	Economic	Externality	Allocation of Benefits and Costs			Total
				Gov	Labor	Farming HHs	
Project Benefits							
Farm benefits	29.0	425.0	396.0	396.0	0.0	29.0	425.0
Total Benefits	29.0	425.0	396.0	396.0	396.0	0.0	29.0
Project Costs							
Investment Costs							
Local	98.8	91.2	-7.6	91.2	0.0	0.0	91.2
Foreign	39.5	36.5	-3.0	36.5	0.0	0.0	36.5
Unskilled	39.5	36.5	-3.0	39.5	-3.0	0.0	36.5
O&M Costs							
Local	17.1	15.8	-1.3	15.8	0.0	0.0	15.8
Foreign	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unskilled	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Others (LIG support, project management, etc.)							
Local	66.9	60.6	-6.2	60.6	0.0	0.0	60.6
Foreign	21.0	19.1	-1.9	19.1	0.0	0.0	19.1
Unskilled	27.6	25.0	-2.6	27.6	-2.6	0.0	25.0
Total Project Costs	310,470	310.5	284.7	-25.7	290.4	-5.7	0.0
Net Benefits	-281,476	-281.5	140.3	421.8	105.7	5.7	29.0
Poverty Impact Analysis							
Proportion of the poor ^a				28.9%	0.0%	28.9%	
Net Benefits for the Poor				30.6	0.0	8.4	39.0
Poverty impact ratio							27.8%

^a Include the poorest and poor households (ID1 and ID2 category).

Source: PPTA consultant.

F. Sustainability Analysis

46. With DRR-design and the use of DRR-resilient materials, TSSD-AF rural infrastructure are likely to have a longer economic life than the ones built using conventional standards.¹³ To further extend their economic life, TSSD-AF will finance O&M in the initial years (Year 3 to 5). The routine O&M provision is equivalent to 10% of the total budget for civil works.

47. TSSD-AF will construct tertiary irrigation schemes that will cover 6,000 ha of command area. Management of the primary and secondary canals is the responsibility of Ministry of Water Resources and Meteorology (MOWRAM), while management of the tertiary canals is the responsibility of beneficiary communes.

48. The O&M requirement for the representative tertiary irrigation subproject is about \$2,958 (in financial terms) per year. This is equivalent to 10.8% of the incremental financial income of \$27,480 from crop cultivation (Table 5, excluding income from livestock) that could be generated by the irrigation subproject. Currently, the commune in the representative subproject collects a seasonal fee of \$12-25/ha to pay for water pumping costs, and the fee collection rate is high.¹⁴ As long as beneficiary commune continues to reap benefits from a reliable irrigation water supply,

¹³ In the engineer consultant's opinion, provided the DRR-resilient infrastructure are properly built, and (specifically for road subprojects) the cargo vehicles are not overloaded, they can have an economic life of over 10 years with limited maintenance.

¹⁴ The water pump is operated and maintained by the Ministry of Water and Meteorology. The commune only pay for water pumping costs.

its members should have sufficient incentives to maintain the subproject tertiary canal.

49. For the overall TSSD-AF project in general, there are several risks that may dampen beneficiary households' financial incentives. First, given the \$200,000 limit on civil works, the irrigation subprojects are likely to be tertiary canals. Delivery of services ultimately depend on the conditions of the primary and secondary canals, which are under the responsibility of MOWRAM. Secondly, uneven distribution of water and ensuing conflicts within and between irrigation schemes will reduce farmer's level and thus willingness to contribute to O&M.

50. To mitigate these risks, the project team secured the government's commitment to provide adequate and timely funding for irrigation schemes O&M.¹⁵ On the second potential risk, the initial O&M provisions between Year 3 and 5 can be allocated to enhance communes' capacity in farmer water user communities management, canal management, water control, and fee collection. In addition, during implementation the project management unit will prioritize communes which demonstrate stronger commitment to contributing to infrastructure O&M (Section E). With these arrangements, the irrigation component is considered to be likely sustainable.

¹⁵ Project Loan Agreement, Schedule 5, Para. 2 to 3. There had been no government funding on irrigation schemes O&M until 2015, when the government provided \$7.5 million (KR30,000 million). In 2016, the O&M budget is \$10.0 million (KR40,066 million).

Annex 1 – Crops and Livestock Budgets

Table A1-1: Wet Season Crop Rice Budget (Per Hectare, \$)

	Unit	Financial			Economic		
		W/O	W/	Dif.	W/O	W/	Dif.
Wet season rice	ha	1.0	1.0	0.0	1.0	1.0	0.0
Cycle	month	4.5	3.5	-1.0	4.5	3.5	-1.0
							0.0
Revenue							0.0
Produce	kg	2,001.6	2,400.0	398.4	2,001.6	2,400.0	398.4
Produce price	US\$/kg	0.2	0.2	0.0	0.2	0.2	0.0
Total revenue	US\$	398.0	465.3	67.3	450.1	539.7	89.6
Costs							
Planting material	US\$	74.6	74.6	0.0	68.6	68.6	0.0
Land preparation	US\$	65.6	54.7	-10.9	60.4	50.3	-10.1
Insecticide	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Herbicide	US\$	11.4	10.4	-1.0	10.5	9.6	-0.9
Fertilizer	US\$	67.3	122.3	55.0	61.9	112.5	50.6
Watering	US\$	0.0	30.5	30.5	0.0	28.1	28.1
Hired labor	US\$	43.3	22.7	-20.5	35.8	18.8	-17.0
Harvesting (machine)	US\$	89.5	74.6	-14.9	82.3	68.6	-13.7
Produce transport	US\$	17.9	17.9	0.0	16.5	16.5	0.0
Total costs (excl. interest payment)	US\$	369.5	407.7	38.2	336.0	373.0	37.0
Net (excl. interest payment)	US\$	28.5	57.6	29.1	114.1	166.6	52.6

W/O = without-project; W/ = with-project; Dif. = difference

Source: PPTA consultant, based on TSSD experience and Agro-Ecosystem Analyses of both communes by the General Department of Agriculture of the Ministry of Agriculture, Forestry and Fisheries.

Table A1-2: Dry Season Crop Rice Budget (Per Hectare, \$)

	Unit	Financial			Economic		
		W/O	W/	Dif.	W/O	W/	Dif.
Dry season rice	ha	1.0	1.0	0.0	1.0	1.0	0.0
Cycle	month	3.0	3.0	0.0	3.0	3.0	0.0
Revenue							
Produce	kg	3,500.0	4,000.0	500.0	3,500.0	4,000.0	500.0
Produce price	US\$/kg	0.2	0.2	0.0	0.2	0.2	0.0
Total revenue	US\$	652.5	696.0	43.5	787.0	899.5	112.4
Costs							
Planting material	US\$	74.6	74.6	0.0	68.6	68.6	0.0
Land preparation	US\$	65.6	54.7	-10.9	60.4	50.3	-10.1
Insecticide	US\$	28.0	34.8	6.8	25.7	32.0	6.3
Herbicide	US\$	37.9	37.9	0.0	34.9	34.9	0.0
Fertilizer	US\$	154.1	163.1	9.0	141.8	150.1	8.3
Watering	US\$	30.2	72.1	41.9	27.8	66.3	38.5
Hired labor	US\$	36.7	30.5	-6.1	30.4	25.3	-5.1
Harvesting (machine)	US\$	89.5	74.6	-14.9	82.3	68.6	-13.7
Produce transport	US\$	31.3	29.8	-1.5	28.8	27.4	-1.4
Total costs (excl. interest payment)	US\$	547.8	572.1	24.3	500.6	523.5	22.9
Net (excl. interest payment)	US\$	104.6	123.9	19.2	286.4	375.9	89.6

W/O = without-project; W/ = with-project; Dif. = difference

Source: PPTA consultant, based on TSSD experience and Agro-Ecosystem Analyses of both communes by the General Department of Agriculture of the Ministry of Agriculture, Forestry and Fisheries.

Table A1-3: Lotus Crop Budget (Per Hectare, \$)

	Unit	Financial			Economic		
		W/O	W/	Dif.	W/O	W/	Dif.
Lotus	ha	1.0	1.0	0.0	1.0	1.0	0.0
Cycle	month	3.0	3.0	0.0	3.0	3.0	0.0
Revenue							
Produce	kg	1,000.0	1,200.0	200.0	1,000.0	1,200.0	200.0
Produce price	US\$/kg	2.0	1.6	-0.4	1.8	1.5	-0.3
Total revenue	US\$	1,988.6	1,938.9	-49.7	1,829.5	1,783.7	-45.7
Costs							
Planting material	US\$	671.1	671.1	0.0	617.4	617.4	0.0
Land preparation	US\$	65.6	54.7	-10.9	60.4	50.3	-10.1
Insecticide	US\$	34.8	34.8	0.0	32.0	32.0	0.0
Herbicide	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Fertilizer	US\$	74.6	124.3	49.7	68.6	114.3	45.7
Watering	US\$	313.2	78.3	-234.9	288.1	72.0	-216.1
Hired labor	US\$	134.2	198.9	64.6	111.1	164.7	53.5
Harvesting (machine)	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Produce transport	US\$	8.9	8.9	0.0	8.2	8.2	0.0
Total costs (excl. interest payment)	US\$	1,302.5	1,171.0	-131.5	1,186.0	1,059.0	-126.9
Net (excl. interest payment)	US\$	686.1	767.8	81.8	643.5	724.7	81.2

W/O = without-project; W/ = with-project; Dif. = difference

Source: PPTA consultant, based on TSSD experience and Agro-Ecosystem Analyses of both communes by the General Department of Agriculture of the Ministry of Agriculture, Forestry and Fisheries.

Table A1-4: Sugar Cane Crop Budget (Per Hectare, \$)

	Unit	Financial			Economic		
		W/O	W/	Dif.	W/O	W/	Dif.
Sugar cane	ha	1.0	1.0	0.0	1.0	1.0	0.0
Cycle	month	9.0	9.0	0.0	9.0	9.0	0.0
Revenue							
Produce	Cane	24,000.0	28,000.0	4,000.0	24,000.0	28,000.0	4,000.0
Produce price	US\$/Cane	0.1	0.1	0.0	0.1	0.1	0.0
Total revenue	US\$	2,982.8	3,132.0	149.1	2,744.2	2,881.4	137.2
Costs							
Planting material	US\$	1,522.5	1,522.5	0.0	1,400.7	1,400.7	0.0
Land preparation	US\$	131.2	109.4	-21.9	120.7	100.6	-20.1
Insecticide	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Herbicide	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Fertilizer	US\$	177.5	177.5	0.0	163.3	163.3	0.0
Watering	US\$	47.8	25.9	-22.0	44.0	23.8	-20.2
Hired labor	US\$	223.7	335.6	111.9	185.2	277.9	92.6
Harvesting (machine)	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Produce transport	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Total costs (excl. interest payment)	US\$	2,210.1	2,260.3	50.1	2,012.7	2,048.6	35.8
Net (excl. interest payment)	US\$	880.1	961.2	81.1	830.3	915.2	84.9

W/O = without-project; W/ = with-project; Dif. = difference

Source: PPTA consultant, based on TSSD experience and Agro-Ecosystem Analyses of both communes by the General Department of Agriculture of the Ministry of Agriculture, Forestry and Fisheries.

Table A1-5: Water Melon Crop Budget (Per Hectare, \$)

	Unit	Financial			Economic		
		W/O	W/	Dif.	W/O	W/	Dif.
Water melon	ha	1.0	1.0	0.0	1.0	1.0	0.0
Cycle	month	3.0	3.0	0.0	3.0	3.0	0.0
Revenue							
Produce	kg	18,000.0	23,000.0	5,000.0	18,000.0	23,000.0	5,000.0
Produce price	US\$/kg	1.99	1.57	-0.42	1.83	1.44	-0.39
Total revenue	US\$	35,794.2	36,017.9	223.7	32,930.6	33,136.5	205.8
Costs							
Planting material	US\$	298.3	298.3	0.0	274.4	274.4	0.0
Land preparation	US\$	131.2	109.4	-21.9	120.7	100.6	-20.1
Insecticide	US\$	0.0	14.9	14.9	0.0	13.7	13.7
Herbicide	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Fertilizer	US\$	109.4	218.7	109.4	100.6	201.2	100.6
Other material	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Watering	US\$	0.0	28.7	28.7	0.0	26.4	26.4
Hired labor	US\$	24.9	74.6	49.7	20.6	61.7	41.2
Harvesting (machine)	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Produce transport	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Total costs (excl. interest payment)	US\$	563.8	744.6	180.8	516.4	678.2	161.8
Net (excl. interest payment)	US\$	35,230.4	35,273.3	42.9	32,414.3	32,458.3	44.0

W/O = without-project; W/ = with-project; Dif. = difference

Source: PPTA consultant, based on TSSD experience and Agro-Ecosystem Analyses of both communes by the General Department of Agriculture of the Ministry of Agriculture, Forestry and Fisheries.

Table A1-6: Yard Long Bean Crop Budget (Per Hectare, \$)

	Unit	Financial			Economic		
		W/O	W/	Dif.	W/O	W/	Dif.
Yard long bean	ha	1.0	1.0	0.0	1.0	1.0	0.0
Cycle	month	3.5	3.5	0.0	3.5	3.5	0.0
Revenue							
Produce	kg	18,000.0	22,000.0	4,000.0	18,000.0	22,000.0	4,000.0
Produce price	US\$/kg	0.50	0.42	-0.07	0.46	0.39	-0.07
Total revenue	US\$	8,948.5	9,296.5	348.0	8,232.7	8,552.8	320.2
Costs							
Planting material	US\$	99.4	845.1	745.7	91.5	777.5	686.1
Land preparation	US\$	131.2	109.4	-21.9	120.7	100.6	-20.1
Insecticide	US\$	207.1	165.7	-41.4	190.6	152.5	-38.1
Herbicide	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Fertilizer	US\$	3,285.3	3,235.6	-49.7	3,022.5	2,976.7	-45.7
Other material	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Watering	US\$	1,491.4	994.3	-497.1	1,372.1	914.7	-457.4
Hired labor	US\$	298.3	447.4	149.1	247.0	370.5	123.5
Harvesting (machine)	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Produce transport	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Total costs (excl. interest payment)	US\$	5,512.8	5,797.5	284.7	5,044.3	5,292.5	248.2
Net (excl. interest payment)	US\$	3,435.7	3,499.0	63.3	3,188.3	3,260.3	72.0

W/O = without-project; W/ = with-project; Dif. = difference

Source: PPTA consultant, based on TSSD experience and Agro-Ecosystem Analyses of both communes by the General Department of Agriculture of the Ministry of Agriculture, Forestry and Fisheries.

Table A1-7: Cucumber Crop Budget (Per Hectare, \$US)

	Unit	Financial			Economic		
		W/O	W/	Dif.	W/O	W/	Dif.
Cucumber	ha	1.0	1.0	0.0	1.0	1.0	0.0
Cycle	month	1.5	1.5	0.0	1.5	1.5	0.0
Revenue							
Produce	kg	17,000.0	21,500.0	4,500.0	17,000.0	21,500.0	4,500.0
Produce price	US\$/kg	0.4	0.3	0.0	0.3	0.3	0.0
Total revenue	US\$	6,338.6	6,947.6	609.0	5,831.5	6,391.7	560.3
Costs							
Planting material	US\$	182.8	928.5	745.7	168.2	854.2	686.1
Land preparation	US\$	131.2	109.4	-21.9	120.7	100.6	-20.1
Insecticide	US\$	2.2	0.7	-1.5	2.1	0.7	-1.4
Herbicide	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Fertilizer	US\$	1,074.7	1,129.5	54.8	988.7	1,039.2	50.4
Other material	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Watering	US\$	1,085.7	723.8	-361.9	998.8	665.9	-332.9
Hired labor	US\$	298.3	447.4	149.1	247.0	370.5	123.5
Harvesting (machine)	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Produce transport	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Total costs (excl. interest payment)	US\$	2,774.9	3,339.3	564.4	2,525.5	3,031.0	505.6
Net (excl. interest payment)	US\$	3,563.6	3,608.2	44.6	3,306.0	3,360.7	54.7

W/O = without-project; W/ = with-project; Dif. = difference

Source: PPTA consultant, based on TSSD experience and Agro-Ecosystem Analyses of both communes by the General Department of Agriculture of the Ministry of Agriculture, Forestry and Fisheries.

Table A1-8: Morning Glory Crop Budget (Per Hectare, \$)

	Unit	Financial			Economic		
		W/O	W/	Dif.	W/O	W/	Dif.
Morning glory	ha	1.0	1.0	0.0	1.0	1.0	0.0
Cycle	month	1.0	1.0	0.0	1.0	1.0	0.0
Revenue							
Produce	kg	18,000.0	20,000.0	2,000.0	18,000.0	20,000.0	2,000.0
Produce price	US\$/kg	0.24	0.22	-0.01	0.22	0.21	-0.01
Total revenue	US\$	4,250.6	4,474.3	223.7	3,910.5	4,116.3	205.8
Costs							
Planting material	US\$	994.3	994.3	0.0	914.7	914.7	0.0
Land preparation	US\$	131.2	109.4	-21.9	120.7	100.6	-20.1
Insecticide	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Herbicide	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Fertilizer	US\$	186.4	266.0	79.5	171.5	244.7	73.2
Other material	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Watering	US\$	447.4	298.3	-149.1	411.6	274.4	-137.2
Hired labor	US\$	298.3	447.4	149.1	247.0	370.5	123.5
Harvesting (machine)	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Produce transport	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Total costs (excl. interest payment)	US\$	2,057.7	2,115.3	57.7	1,865.6	1,904.9	39.3
Net (excl. interest payment)	US\$	2,192.9	2,358.9	166.0	2,044.9	2,211.4	166.5

W/O = without-project; W/ = with-project; Dif. = difference

Source: PPTA consultant, based on TSSD experience and Agro-Ecosystem Analyses of both communes by the General Department of Agriculture of the Ministry of Agriculture, Forestry and Fisheries.

Table A1-9: Bitter Gourd Crop Budget (Per Hectare, \$)

	Unit	Financial			Economic		
		W/O	W/	Dif.	W/O	W/	Dif.
Bitter gourd	ha	1.0	1.0	0.0	1.0	1.0	0.0
Cycle	month	2.5	2.5	0.0	2.5	2.5	0.0
Revenue							
Produce	kg	15,000.0	18,000.0	3,000.0	15,000.0	18,000.0	3,000.0
Produce price	US\$/kg	0.62	0.57	-0.05	0.57	0.53	-0.05
Total revenue	US\$	9,321.4	10,290.8	969.4	8,575.7	9,467.6	891.9
Costs							
Planting material	US\$	389.5	1,135.2	745.7	358.3	1,044.4	686.1
Land preparation	US\$	131.2	109.4	-21.9	120.7	100.6	-20.1
Insecticide	US\$	114.5	34.4	-80.2	105.4	31.6	-73.8
Herbicide	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Fertilizer	US\$	561.3	704.5	143.2	516.4	648.1	131.7
Other material	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Watering	US\$	447.4	298.3	-149.1	411.6	274.4	-137.2
Hired labor	US\$	298.3	447.4	149.1	247.0	370.5	123.5
Harvesting (machine)	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Produce transport	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Total costs (excl. interest payment)	US\$	1,942.3	2,729.1	786.8	1,759.4	2,469.6	710.2
Net (excl. interest payment)	US\$	7,379.1	7,561.7	182.6	6,816.3	6,998.0	181.7

W/O = without-project; W/ = with-project; Dif. = difference

Source: PPTA consultant, based on TSSD experience and Agro-Ecosystem Analyses of both communes by the General Department of Agriculture of the Ministry of Agriculture, Forestry and Fisheries.

Table A1-10: Muskmelon Crop Budget (Per Hectare, \$)

	Unit	Financial			Economic		
		W/O	W/	Dif.	W/O	W/	Dif.
Muskmelon	ha	1.0	1.0	0.0	1.0	1.0	0.0
Cycle	month	3.0	3.0	0.0	3.0	3.0	0.0
Revenue							
Produce	kg	18,700.0	22,500.0	3,800.0	18,700.0	22,500.0	3,800.0
Produce price	US\$/kg	0.75	0.62	-0.12	0.69	0.57	-0.11
Total revenue	US\$	13,944.8	13,982.1	37.3	12,829.2	12,863.5	34.3
Costs							
Planting material	US\$	3,586.5	3,586.5	0.0	3,299.6	3,299.6	0.0
Land preparation	US\$	131.2	109.4	-21.9	120.7	100.6	-20.1
Insecticide	US\$	1,761.3	1,761.3	0.0	1,620.4	1,620.4	0.0
Herbicide	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Fertilizer	US\$	1,175.4	1,175.4	0.0	1,081.4	1,081.4	0.0
Other material	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Watering	US\$	4,971.4	4,474.3	-497.1	4,573.7	4,116.3	-457.4
Hired labor	US\$	1,305.0	1,553.6	248.6	1,080.5	1,286.4	205.8
Harvesting (machine)	US\$	0.0	0.0	0.0	0.0	0.0	0.0
Produce transport	US\$	0.0	167.8	167.8	0.0	154.4	154.4
Total costs (excl. interest payment)	US\$	12,930.9	12,828.2	-102.7	11,776.3	11,659.0	-117.3
Net (excl. interest payment)	US\$	1,014.0	1,153.9	139.9	1,052.9	1,204.5	151.6

W/O = without-project; W/ = with-project; Dif. = difference

Source: PPTA consultant, based on TSSD experience and Agro-Ecosystem Analyses of both communes by the General Department of Agriculture of the Ministry of Agriculture, Forestry and Fisheries.

Table A1-11: Chicken Raising Livestock Budget (Per Head, \$)

	Unit	Financial			Economic		
		W/O	W/	Dif.	W/O	W/	Dif.
Chicken	head	1.00	1.00	0.00	1.00	1.00	0.00
Cycle	month	6.00	4.00	-2.00	6.00	4.00	-2.00
Revenue							
Produce	kg	0.50	1.50	1.00	0.50	1.50	1.00
Produce's farmgate price	US\$/kg	4.23	3.48	-0.75	3.89	3.20	-0.75
Total revenue	US\$	2.11	5.22	3.11	1.94	4.80	3.11
Costs							
Chic	US\$	0.25	1.12	0.87	0.23	1.03	0.87
Feed	US\$	0.50	0.37	-0.12	0.46	0.34	-0.12
Broken rice	US\$	0.16	0.20	0.04	0.15	0.18	0.04
Bran	US\$	0.06	0.25	0.19	0.06	0.23	0.19
Rice	US\$	0.37	0.07	-0.30	0.34	0.07	-0.30
Vaccines/animal medicines	US\$	0.00	0.10	0.10	0.00	0.09	0.10
Pen	US\$	0.02	0.25	0.22	0.02	0.23	0.22
Net	US\$	0.00	0.05	0.05	0.00	0.05	0.05
Palm/thatch roof	US\$	0.00	0.02	0.02	0.00	0.02	0.02
Tools	US\$	0.00	0.02	0.02	0.00	0.02	0.02
Produce transport	US\$	0.00	0.00	0.00	0.00	0.00	0.00
Total costs (excl. interest payment)	US\$	1.37	2.46	1.09	1.26	2.26	1.09
Net (excl. interest payment)	US\$	0.75	2.76	2.01	0.69	2.54	2.01

W/O = without-project; W/ = with-project; Dif. = difference

Source: PPTA consultant, based on TSSD experience and Agro-Ecosystem Analyses of both communes by the General Department of Agriculture of the Ministry of Agriculture, Forestry and Fisheries.

Table A1-12: Fish Aquaculture Livestock Budget (Per Square Meter, \$)

	Unit	Financial			Economic		
		W/O	W/	Dif.	W/O	W/	Dif.
Fish raising	sqm	1.00	1.00	0.00	1.00	1.00	0.00
Cycle	month	12.00	6.00	-6.00	12.00	6.00	-6.00
Revenue							
Produce	kg	0.80	2.50	1.70	0.80	2.50	1.70
Produce's farmgate price	US\$/kg	1.99	1.74	-0.25	1.83	1.60	-0.23
Total revenue	US\$	1.59	4.35	2.76	1.46	4.00	2.54
Costs							
Fingerling	US\$	0.07	0.15	0.07	0.07	0.14	0.07
Feed	US\$	0.00	0.99	0.99	0.00	0.91	0.91
Fish medicine	US\$	0.00	0.05	0.05	0.00	0.05	0.05
Lime	US\$	0.20	0.06	-0.14	0.18	0.05	-0.13
Fertilizer	US\$	0.12	0.00	-0.11	0.11	0.00	-0.11
Pond	US\$	0.09	0.05	-0.04	0.08	0.05	-0.03
Net	US\$	0.00	0.10	0.10	0.00	0.09	0.09
Watering	US\$	0.00	0.43	0.43	0.00	0.40	0.40
Produce transport	US\$	0.00	0.00	0.00	0.00	0.00	0.00
Total costs (excl. interest payment)	US\$	0.48	1.84	1.36	0.44	1.69	1.25
Net (excl. interest payment)	US\$	1.12	2.51	1.40	1.03	2.31	1.29

W/O = without-project; W/ = with-project; Dif. = difference

Source: PPTA consultant, based on TSSD experience and Agro-Ecosystem Analyses of both communes by the General Department of Agriculture of the Ministry of Agriculture, Forestry and Fisheries.

Table A1-13: Frog Aquaculture Livestock Budget (Per Square Meter, \$)

	Unit	Financial			Economic		
		W/O	W/	Dif.	W/O	W/	Dif.
Frog raising	sqm	1.00	1.00	0.00	1.00	1.00	0.00
Cycle	month	4.00	4.00	0.00	4.00	4.00	0.00
Revenue							
Produce	kg	12.00	20.00	8.00	12.00	20.00	8.00
Produce's farmgate price	US\$/kg	2.49	1.99	-0.50	2.29	1.83	-0.46
Total revenue	US\$	29.83	39.77	9.94	29.83	39.77	9.94
Costs							
Baby frog	US\$	8.08	10.87	2.80	7.43	10.00	2.57
Feed	US\$	16.16	21.35	5.19	14.86	19.64	4.77
Medicine	US\$	0.00	0.00	0.00	0.00	0.00	0.00
Lime	US\$	0.00	0.00	0.00	0.00	0.00	0.00
Fertilizer	US\$	0.00	0.00	0.00	0.00	0.00	0.00
Containment	US\$	0.00	0.00	0.00	0.00	0.00	0.00
Roof	US\$	0.00	0.15	0.15	0.00	0.14	0.14
Net	US\$	0.06	0.06	0.00	0.05	0.05	0.00
Watering	US\$	0.87	0.43	-0.43	0.80	0.40	-0.40
Produce transport	US\$	0.00	0.00	0.00	0.00	0.00	0.00
Total costs (excl. interest payment)	US\$	25.16	32.86	7.70	23.15	30.23	7.08
Net (excl. interest payment)	US\$	4.67	6.91	2.24	4.29	6.36	2.06

W/O = without-project; W/ = with-project; Dif. = difference

Source: PPTA consultant, based on TSSD experience and Agro-Ecosystem Analyses of both communes by the General Department of Agriculture of the Ministry of Agriculture, Forestry and Fisheries.

Table A1-14: Tiger Prawn Aquaculture Livestock Budget (Per Square Meter, \$US)

	Unit	Financial			Economic		
		W/O	W/	Dif.	W/O	W/	Dif.
Freshwater giant prawn raising	US\$/kg	1.00	1.00	0.00	1.00	1.00	0.00
Cycle	US\$	12.00	12.00	0.00	12.00	12.00	0.00
Revenue							
Produce	kg	0.50	0.70	0.20	0.50	0.70	0.20
Produce's farmgate price	US\$/kg	24.86	19.89	-4.97	22.87	18.29	-4.57
Total revenue	US\$	12.43	13.92	1.49	11.43	12.81	1.37
Costs							
Juvenile prawn (not PL)	US\$	0.20	0.22	0.02	0.18	0.21	0.02
Feed	US\$	0.25	0.51	0.26	0.23	0.47	0.24
Fish medicine	US\$	0.00	0.05	0.05	0.00	0.05	0.05
Lime	US\$	0.04	0.06	0.02	0.03	0.06	0.02
Fertilizer	US\$	0.00	0.00	0.00	0.00	0.00	0.00
Pond	US\$	0.05	0.05	0.00	0.05	0.05	0.00
Net	US\$	0.10	0.10	0.00	0.09	0.09	0.00
Watering	US\$	0.04	0.07	0.03	0.03	0.06	0.03
Produce transport	US\$	0.00	0.00	0.00	0.00	0.00	0.00
Total costs (excl. interest payment)	US\$	0.67	1.06	0.39	0.62	0.98	0.36
Net (excl. interest payment)	US\$	11.76	12.86	1.10	10.82	11.83	1.01

W/O = without-project; W/ = with-project; Dif. = difference.

Source: PPTA consultant, based on TSSD experience and Agro-Ecosystem Analyses of both communes by the General Department of Agriculture of the Ministry of Agriculture, Forestry and Fisheries.

Annex 2 – Cultivation Areas for Different Crops and Livestock

Table A2-1: Wet Season Rice Cultivation Area

	Irrigation area (ha)	Improved Practice Adoption rate (%)	Cultivation intensity (crop/HH)	Adopting Area (ha) ^a	Incremental ^a (\$/ha)	Incremental Income ^b (US\$)
	(A)	(B)	(C)	(D=A*B*C)	(E)	(F=D*E)
Year 1	777	0.0%	1.00	0.0	29.09	0.00
Year 2	777	7.0%	1.00	54.4	29.09	1,582.41
Year 3	777	14.0%	1.00	108.8	29.09	3,164.82
Year 4	777	21.0%	1.00	163.2	29.09	4,747.23
Year 5	777	28.0%	1.00	217.6	29.09	6,329.64
Year 6	777	28.0%	1.00	217.6	29.09	6,329.64
Year 7+	777	28.0%	1.00	217.6	29.09	6,329.64

HH = Household; ha = hectare; hd = head; sqm = square meter.

^a This is taken from the incremental financial income in Annex 2.

^b Annual incremental income for each crop and livestock are summed to produce the figures in Table 5 of the supplementary report.

Source: PPTA consultant.

Table A2-2: Dry Season Rice Cultivation Area

	Irrigation area (ha)	Improved Practice Adoption rate (%)	Cultivation intensity (crop/HH)	Adopting Area (ha) ^a	Incremental ^a (\$/ha)	Incremental Income ^b (US\$)
	(A)	(B)	(C)	(D=A*B*C)	(E)	(F=D*E)
Year 1	305	0.0%	2.00	0.0	19.25	0.00
Year 2	305	7.7%	2.00	47.0	19.25	904.11
Year 3	305	15.4%	2.00	93.9	19.25	1,808.22
Year 4	305	23.1%	2.00	140.9	19.25	2,712.33
Year 5	305	30.8%	2.00	187.9	19.25	3,616.44
Year 6	305	30.8%	2.00	187.9	19.25	3,616.44
Year 7+	305	30.8%	2.00	187.9	19.25	3,616.44

HH = Household; ha = hectare; hd = head; sqm = square meter

^a This is taken from the incremental financial income in Annex 1.

^b Annual incremental income for each crop and livestock are summed to produce the figures in Table 5 of the supplementary report.

Source: PPTA consultant.

Table A2-3: Lotus Cultivation Area

	Irrigation area (ha)	Improved Practice Adoption rate (%)	Cultivation intensity (crop/HH)	Adopting Area (ha)	Incremental ^a (\$/ha)	Incremental Income ^b (US\$)
	(A)	(B)	(C)	(D=A*B*C)	(E)	(F=D*E)
Year 1	305	0.0%	2.00	0.0	81.78	0.00
Year 2	305	4.4%	2.00	26.7	81.78	2,184.99
Year 3	305	8.8%	2.00	53.4	81.78	4,369.98
Year 4	305	13.1%	2.00	80.2	81.78	6,554.98
Year 5	305	17.5%	2.00	106.9	81.78	8,739.97
Year 6	305	21.9%	2.00	133.6	81.78	10,924.96
Year 7+	305	21.9%	2.00	133.6	81.78	10,924.96

HH = Household; ha = hectare; hd = head; sqm = square meter.

^a This is taken from the incremental financial income in Annex 1.

^b Annual incremental income for each crop and livestock are summed to produce the figures in Table 5 of the supplementary report.

Source: PPTA consultant.

Table A2-4: Sugar Cane Cultivation Area

	Irrigation area (ha)	Improved Practice Adoption rate (%)	Cultivation intensity (crop/HH)	Adopting Area (ha)	Incremental ^a (\$/ha)	Incremental Income ^b (US\$)
	(A)	(B)	(C)	(D=A*B*C)	(E)	(F=D*E)
Year 1	305	0.0%	1.00	0.0	81.13	0.00
Year 2	305	2.2%	1.00	6.7	81.13	541.93
Year 3	305	4.4%	1.00	13.4	81.13	1,083.86
Year 4	305	6.6%	1.00	20.0	81.13	1,625.79
Year 5	305	8.8%	1.00	26.7	81.13	2,167.72
Year 6	305	11.0%	1.00	33.4	81.13	2,709.66
Year 7+	305	11.0%	1.00	33.4	81.13	2,709.66

HH = Household; ha = hectare; hd = head; sqm = square meter.

^a This is taken from the incremental financial income in Annex 1.

^b Annual incremental income for each crop and livestock are summed to produce the figures in Table 5 of the supplementary report.

Source: PPTA consultant.

Table A2-5: Water Melon Cultivation Area

	Irrigation area (ha)	Improved Practice Adoption rate (%)	Cultivation intensity (crop/HH)	Adopting Area (ha)	Incremental ^a (\$/ha)	Incremental Income ^b (US\$)
	(A)	(B)	(C)	(D=A*B*C)	(E)	(F=D*E)
Year 1	305	0.0%	2.00	0.0	42.88	0.00
Year 2	305	0.0%	2.00	0.0	42.88	0.00
Year 3	305	0.5%	2.00	3.2	42.88	136.01
Year 4	305	1.0%	2.00	6.3	42.88	272.02
Year 5	305	1.6%	2.00	9.5	42.88	408.03
Year 6	305	2.1%	2.00	12.7	42.88	544.04
Year 7+	305	2.6%	2.00	15.9	42.88	680.05

HH = Household; ha = hectare; hd = head; sqm = square meter.

^a This is taken from the incremental financial income in Annex 1.

^b Annual incremental income for each crop and livestock are summed to produce the figures in Table 5 of the supplementary report.

Source: PPTA consultant.

Table A2-6: Yard Long Bean Cultivation Area

	Beneficiary household (HH)	Adoption rate (%)	Adopting Household (HH)	Cultivation intensity (ha/HH)	Improved practices (ha)	Incremental ^a (\$/ha)	Incremental Income ^b (US\$)
	(A)	(B)	(C=A*B)	(D)	(E=C*D)	(F)	(G=E*F)
Year 1	320	0.0%	0.0	0.27	0.0	63.30	0
Year 2	320	0.0%	0.0	0.27	0.0	63.30	0
Year 3	320	3.8%	12.1	0.27	3.3	63.30	207
Year 4	320	5.4%	17.2	0.27	4.6	63.30	294
Year 5	320	7.0%	22.3	0.27	6.0	63.30	381
Year 6	320	7.0%	22.3	0.27	6.0	63.30	381
Year 7+	320	7.0%	22.3	0.27	6.0	63.30	381

HH = Household; ha = hectare; hd = head; sqm = square meter.

^a This is taken from the incremental financial income in Annex 1.

^b Annual incremental income for each crop and livestock are summed to produce the figures in Table 5 of the supplementary report.

Source: PPTA consultant.

Table A2-7: Cucumber Cultivation Area

	Beneficiary household (HH) (A)	Adoption rate (%) (B)	Adopting Household (HH) (C=A*B)	Cultivation intensity (ha/HH) (D)	Improved practices (ha) (E=C*D)	Incremental ^a (\$/ha) (F)	Incremental Income ^b (US\$) (G=E*F)
Year 1	320	0.0%	0.0	0.27	0.0	44.57	0
Year 2	320	0.0%	0.0	0.27	0.0	44.57	0
Year 3	320	3.8%	12.1	0.27	3.3	44.57	146
Year 4	320	5.4%	17.2	0.27	4.6	44.57	207
Year 5	320	7.0%	22.3	0.27	6.0	44.57	268
Year 6	320	7.0%	22.3	0.27	6.0	44.57	268
Year 7+	320	7.0%	22.3	0.27	6.0	44.57	268

HH = Household; ha = hectare; hd = head; sqm = square meter.

^a This is taken from the incremental financial income in Annex 1.

^b Annual incremental income for each crop and livestock are summed to produce the figures in Table 5 of the supplementary report.

Source: PPTA consultant.

Table A2-9: Morning Glory Cultivation Area

	Beneficiary household (HH) (A)	Adoption rate (%) (B)	Adopting Household (HH) (C=A*B)	Cultivation intensity (ha/HH) (D)	Improved practices (ha) (E=C*D)	Incremental ^a (\$/ha) (F)	Incremental Income ^b (US\$) (G=E*F)
Year 1	320	0.0%	0.0	0.36	0.0	166.05	0
Year 2	320	0.0%	0.0	0.36	0.0	166.05	0
Year 3	320	3.8%	12.1	0.36	4.4	166.05	723
Year 4	320	5.4%	17.2	0.36	6.2	166.05	1,027
Year 5	320	7.0%	22.3	0.36	8.0	166.05	1,331
Year 6	320	7.0%	22.3	0.36	8.0	166.05	1,331
Year 7+	320	7.0%	22.3	0.36	8.0	166.05	1,331

HH = Household; ha = hectare; hd = head; sqm = square meter.

^a This is taken from the incremental financial income in Annex 1.

^b Annual incremental income for each crop and livestock are summed to produce the figures in Table 5 of the supplementary report.

Source: PPTA consultant.

Table A2-9: Bitter Melon Cultivation Area

	Beneficiary household (HH) (A)	Adoption rate (%) (B)	Adopting Household (HH) (C=A*B)	Cultivation intensity (ha/HH) (D)	Improved practices (ha) (E=C*D)	Incremental ^a (\$/ha) (F)	Incremental Income ^b (US\$) (G=E*F)
Year 1	320	0.0%	0.0	0.09	0.0	182.59	0
Year 2	320	0.0%	0.0	0.09	0.0	182.59	0
Year 3	320	3.8%	12.1	0.09	1.1	182.59	199
Year 4	320	5.4%	17.2	0.09	1.5	182.59	282
Year 5	320	7.0%	22.3	0.09	2.0	182.59	366
Year 6	320	7.0%	22.3	0.09	2.0	182.59	366
Year 7+	320	7.0%	22.3	0.09	2.0	182.59	366

HH = Household; ha = hectare; hd = head; sqm = square meter.

^a This is taken from the incremental financial income in Annex 1.

^b Annual incremental income for each crop and livestock are summed to produce the figures in Table 5 of the supplementary report.

Source: PPTA consultant.

Table A2-10: Muskmelon Cultivation Area

	Beneficiary household (HH) (A)	Adoption rate (%) (B)	Adopting Household (HH) (C=A*B)	Cultivation intensity (ha/HH) (D)	Improved practices (ha) (E=C*D)	Incremental ^a (\$/ha) (F)	Incremental Income ^b (US\$) (G=E*F)
Year 1	320	7.0%	22.3	0.27	6.0	182.59	1,098
Year 2	320	7.0%	22.3	0.27	6.0	182.59	1,098
Year 3	320	7.0%	22.3	0.27	6.0	182.59	1,098
Year 4	320	7.0%	22.3	0.27	6.0	182.59	1,098
Year 5	320	7.0%	22.3	0.27	6.0	182.59	1,098
Year 6	320	7.0%	22.3	0.27	6.0	182.59	1,098
Year 7+	320	7.0%	22.3	0.27	6.0	182.59	1,098

HH = Household; ha = hectare; hd = head; sqm = square meter.

^a This is taken from the incremental financial income in Annex 1.

^b Annual incremental income for each crop and livestock are summed to produce the figures in Table 5 of the supplementary report.

Source: PPTA consultant.

Table A2-11: Chicken Farming Area

	Beneficiary household (HH) (A)	Adoption rate (%) (B)	Adopting Household (HH) (C=A*B)	Farming intensity (hd/HH) (D)	Improved practices (hd) (E=C*D)	Incremental ^a (\$/hd) (F)	Incremental Income ^b (US\$) (G=E*F)
Year 1	320	0.0%	0.0	200	0	2.01	0
Year 2	320	0.0%	0.0	200	0	2.01	0
Year 3	320	7.0%	22.4	200	4,480	2.01	9,020
Year 4	320	14.0%	44.8	200	8,960	2.01	18,040
Year 5	320	21.0%	67.2	200	13,440	2.01	27,060
Year 6	320	28.0%	89.6	200	17,920	2.01	36,081
Year 7+	320	28.0%	89.6	200	17,920	2.01	36,081

HH = Household; ha = hectare; hd = head; sqm = square meter.

^a This is taken from the incremental financial income in Annex 1.

^b Annual incremental income for each crop and livestock are summed to produce the figures in Table 5 of the supplementary report.

Source: PPTA consultant.

Table A2-12: Fish Farming Area

	Beneficiary household (HH) (A)	Adoption rate (%) (B)	Adopting Household (HH) (C=A*B)	Farming intensity (sqm/HH) (D)	Improved practice (sqm) (E=C*D)	Incremental ^a (\$/sqm) (F)	Incremental Income ^b (US\$) (G=E*F)
Year 1	320	0.0%	0.0	450	0	1.40	0
Year 2	320	0.2%	0.6	450	264	1.85	488
Year 3	320	0.4%	1.2	450	527	1.85	976
Year 4	320	0.5%	1.8	450	791	1.85	1,464
Year 5	320	0.7%	2.3	450	1,054	1.85	1,953
Year 6	320	0.7%	2.3	450	1,054	1.85	1,953
Year 7+	320	0.7%	2.3	450	1,054	1.85	1,953

HH = Household; ha = hectare; hd = head; sqm = square meter.

^a This is taken from the incremental financial income in Annex 1.

^b Annual incremental income for each crop and livestock are summed to produce the figures in Table 5 of the supplementary report.

Source: PPTA consultant.

Table A2-12: Frog Farming Area

	Beneficiary household (HH) (A)	Adoption rate (%) (B)	Adopting Household (HH) (C=A*B)	Farming intensity (sqm/HH) (D)	Improved practice (sqm) (E=C*D)	Incremental^a (\$/sqm) (F)	Incremental Income^b (US\$) (G=E*F)
Year 1	320	0.0%	0.0	400	0	2.24	0
Year 2	320	0.1%	0.4	400	172	2.24	385
Year 3	320	0.3%	0.9	400	343	2.24	770
Year 4	320	0.4%	1.3	400	515	2.24	1,154
Year 5	320	0.5%	1.7	400	686	2.24	1,539
Year 6	320	0.5%	1.7	400	686	2.24	1,539
Year 7+	320	0.5%	1.7	400	686	2.24	1,539

HH = Household; ha = hectare; hd = head; sqm = square meter.

^a This is taken from the incremental financial income in Annex 1.

^b Annual incremental income for each crop and livestock are summed to produce the figures in Table 5 of the supplementary report.

Source: PPTA consultant.

Table A2-14: Tiger Prawn Farming Area

	Beneficiary household (HH) (A)	Adoption rate (%) (B)	Adopting Household (HH) (C=A*B)	Farming intensity (sqm/HH) (D)	Improved practice (sqm) (E=C*D)	Incremental^a (\$/sqm) (F)	Incremental Income^b (US\$) (G=E*F)
Year 1	320	0.0%	0.0	400	0	1.10	0
Year 2	320	0.0%	0.0	400	0	1.10	0
Year 3	320	0.2%	0.6	400	234	1.10	258
Year 4	320	0.4%	1.2	400	468	1.10	516
Year 5	320	0.5%	1.8	400	703	1.10	775
Year 6	320	0.7%	2.3	400	937	1.10	1,033
Year 7+	320	0.7%	2.3	400	937	1.10	1,033

HH = Household; ha = hectare; hd = head; sqm = square meter.

^a This is taken from the incremental financial income in Annex 1.

^b Annual incremental income for each crop and livestock are summed to produce the figures in Table 5 of the supplementary report.

Source: PPTA consultant.