ECONOMIC AND FINANCIAL ANALYSIS OF TAN SON SUBPROJECT, GIA LAI PROVINCE

A. Introduction

1. The proposed subproject will upgrade Tan Son Irrigation system and rehabilitation of access road in Nghia Hung and Chu Jor Communes, Chu Pah District, Gia Lai Province. The subproject will construct/upgrade a total of 10.9 km of irrigation canals, providing them with a rectangular concrete-lined cross-section serving a full command area of 900 ha of land in the core and surrounding areas, primarily for paddy but also involving some other crops. The subproject will also construct 38 structures on the canal sections. The subproject will also upgrade and rehabilitate 9.8 km of access road, since the existing community earth road network is extremely difficult to access during the rainy season and thus makes transport between the production area, the residential areas of the communities, and the markets, very costly. In the dry season, roads are largely passable but still with difficulty due to the damaged surface. Some sections, for example the road parallel to N3 canal, cannot be accessed by car. Improvement of the road will make irrigation system management and crop production easier. The sub-project will improve two routes: (i) Route 1 connects the local main road to the headworks, the existing dirt track of which has a base of 3-4.5 meter wide, with extremely uneven road surface, with deep mud in the rainy season; (ii) Route 2 provides access to the production areas on the left bank, running along N3 branch canal, linking Chu Jor Commune to neighboring Chu Dang Ja Commune, the dirt road of which has a base of 2-4 meter wide and lacks side ditches and culverts. Its surface is badly damaged due to intensive use by trucks.

B. Methodology

2. In this economic and financial analysis all benefits and costs of the irrigation and access road subproject are examined in order to assess its viability as well as to comment on its expected impact on various sectors of the local society, particularly the poor. For this analysis the costs and benefits associated to irrigation and access road are calculated for two alternative situations: “with” the subproject and “without” the subproject.

3. For the irrigation part, the same command area will be examined in both scenarios - namely the full intended area that will be irrigated once the canals have been rehabilitated. In the “without” project scenario part of this command area is not, in fact, irrigated. Nevertheless, the analysis must take account of what may be grown on this land “without” the irrigation that the canal rehabilitation will allow. The intent is to identify the incremental value of production allowed by the subproject (over its expected useful life) and compare this value to the incremental cost of implementing the project and of operating and maintaining the rehabilitated infrastructure over time. It is also assumed that the rehabilitation of access road will contribute to the realization of the producer’s surplus reflected in the incremental value of production.

4. For the access road, in the “without” subproject scenario road travel will continue to be as difficult as it now is. The intent is to identify the incremental value of travel cost savings and of induced local production allowed by the subproject (over its expected useful life) and compare this value to the incremental cost of implementing the subproject and of operating and maintaining the rehabilitated infrastructure over time.

5. To develop a model for the analysis, certain assumptions are made regarding future practice (both “with” and “without” the subproject) and about the valuation of inputs and outputs. These include:

- Subproject life is counted as 20 years. That is, assuming adequate maintenance, the irrigation system should be able to maintain its expected benefits for 20 years before another major renovation may be required.
- "Without" the subproject present cultivation patterns and technology are expected to continue for the life of the project.
- "With" the subproject, the full command area is expected to continue to be irrigated throughout the life of the project, allowing farmers to adopt appropriate cropping patterns and technology.
- Some agricultural outputs may be consumed within the household, but are valued as if sold.
- Some agricultural inputs such as farm labor are provided by farm households but are valued at the market rate as if hired.
- Values are expressed in constant 2013 prices so as to exclude inflation.
- The Vietnamese Dong is the unit of account. The exchange rate used is Dong 21,000 per U.S. dollar.

6. Financial prices used in this analysis were identified through field visits conducted by the PPTA team and validated by ADB/SEER economist before this analysis was undertaken. These prices have been cross-checked with prices identified in other projects and in some secondary sources.

7. In order to assess the subproject's contributions (and costs) to the economy of Viet Nam 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 analysis include:

- The analysis uses the domestic price numeraire and for traded goods a shadow exchange rate factor (SERF) of 1.1 is applied.
- For rural labor, a shadow wage rate factor (SWRF) of 0.8 is applied.
- Transfer payments such as taxes and subsidies are excluded in the calculation of economic values.
- To calculate the economic net present value (ENVP) of the subproject a discount rate of 12% is used as representing the opportunity cost of the capital invested.

8. In the analysis, estimated results of Year 10 of the Subproject (i.e., year 2024) were used as a snapshot of the annual subproject profile in the with- and without-subproject and increments. The subproject was assumed to be completed by December 2014 and 2015 would be Year 1 of the Subproject. The reason for Year 10 (2024) to be used as a representative is that it is from when the subproject benefits are most stable until the end of its life cycle Year 20 (or year 2034).

9. Table A summarizes key indicators of this economic and financial analysis.

Table A: Summary Figures for the Gia Lai - Tan Son Irrigation-Road Subproject – Gia Lai Province

Sub-project Area:		
Irrigated command area "with" subproject	ha	900.0
2013 irrigated area ("without" subproject)	ha	440.0
Incremental Subproject Output		
Expected Incremental Production (year 10 of subproject)		
Rice	t	4,390.5
Maize	t	(1,186.1)
Coffee	t	927.1
Potato	t	(674.0)
Watermelon	t	(996.7)
Fish	t	43.9
Expected Total Incremental Net Crop Economic Value (year 10)	billion VND	13.0
Expected Total Incremental Net VOC Saving Economic Value (year 10)	billion VND	10.7
Household		
Estimated Number of Benefited Households	Number	1,200.0
Expected Incremental Production per Household (year 10)		
Rice	kg	3,658.8
Maize	kg	(988.5)
Coffee	kg	772.5
Potato	kg	(561.7)
Watermelon	kg	(830.6)
Fish	kg	36.6
Expected Incremental Net Crop Financial Value per Household (year 10)	million VND	12.0
The Poor		
Estimated Number of Poor Beneficiary Households	Number	480.0
Total Incremental Net Crop Financial Value of the Poor	billion VND	2.8
Share of the Poor in Incremental Net Crop Financial Value	%	21.3%
Incremental Net Crop Financial Value per Poor Household (year 10)	million VND	5.8
Subproject Financial Costs:		
Irrigation Component	billion VND	30.7
Access Road Component	billion VND	22.8
Total Subproject Costs	billion VND	53.5
Economic Returns:		
ENPV (base case)	billion VND	40.0
EIRR (base case)	%	20.0%
EIRR (sensitive cases)		
1. Capital Costs + 10%	%	18.5%
2. O&M Costs + 10%	%	19.7%
3. Benefits decrease - 10%	%	17.9%
4. Benefits decrease - 20%	%	15.7%
5. Benefits decrease - 30%	%	13.2%
6. Benefits delay - 2 years	%	14.1%
7. Subproject life is 5 years shorter	%	18.5%
8. Subproject life is 7 years shorter	%	17.0%

10. At the end of the text of this analysis are Annex Tables 1-19 showing the flow of calculations. **Table 1** shows the derivation of certain important internationally traded outputs such as rice, maize, and coffee while **Table 2** does the same for internationally traded inputs such as fertilizers. **Table 3** lists farm-gate prices of inputs and outputs in financial terms and **Table 4** shows economic farm-gate prices. **Table 5** presents the derivation of vehicle operating costs for various types of vehicles and **Table 6** shows the vehicle operating cost savings “with”

versus “without” the rehabilitation of the access road. Command area land use “with” and “without” the subproject over the life of the subproject appears in **Table 7** while **Table 8** shows crop patterns in both scenarios. Crop yields used in the analysis are displayed in **Table 9** and total crop production in **Table 10**. Incremental crop production due to the project is in **Table 11** and the total crop economic value “with” and “without” the project (and the resulting increment) is shown in **Table 12**. **Table 13** displays the crop inputs assumed to be used for crops grown within the command area and total (and incremental) economic crop production costs are calculated in **Table 14**. Incremental farm labor due to the Project is figured in **Table 15**. Net incremental crop benefits are in **Table 16**. Subproject cost in economic terms appears in **Table 17**. The economic internal rate of return (EIRR) is presented in **Table 18** and sensitivity analysis is in **Table 19**.

C. Subproject Benefits

11. Two major benefits have been identified for the subproject. For the combined road and irrigation, a potential producer surplus from anticipated increased crop production made possible by the improved road and irrigation system rehabilitation. For the road there is an anticipated reduction in vehicle operating costs due to road improvements.

1. Rehabilitation of the Irrigation System

12. At the time of this analysis the Tan Son irrigation system is irrigating about 440 ha. Some of this area receives fully adequate water while in other parts of the scheme irrigation water is less reliable. Similarly, some areas get irrigation water in both the autumn and spring seasons while other areas receive water only in one season. The 440 ha getting some sort of irrigation service is far smaller than the area serviced at the time the scheme was originally constructed (30 years ago). With a lack of significant maintenance the system has deteriorated to its present state and coverage. In the “Without” the subproject scenario, it is assumed that the area irrigated will continue to decrease at a pace of 3% a year. In the “with” the subproject scenario, the irrigated area is expected to grow to 900 ha (after a dip during the two years of construction scheduled for 2015 and 2016).

13. Changes in command area land use, crop practices/patterns, cropping intensities, and crop yields were based on the locally collected data during the feasibility study in the Subproject area. SERD/SEER economist validated these details with technical staff of the provincial Department of Agriculture and Rural Development before the analysis was conducted. All detailed assumptions are in Annex Tables 7, 8, and 9.

14. A snapshot of year 10 in the life of the subproject would indicate that incremental paddy production within the command area can be expected to be more than 4,390 tons per year. Maize, watermelon, and potatoes (which will be displaced by paddy) will decrease by close to 1,200 tons, 670 tons, and 1,000 tons respectively. Coffee production should increase by about 930 tons per annum, and fish (from fish ponds) by about 44 tons. This increase in production due to the subproject will be worth 22.8 billion VND (in constant 2013 prices). In effect, production costs will also increase as higher value crops are grown and more productive inputs are used. Incremental (economic) production costs can be expected to increase by almost 9.8 billion VND within the command area - producing a net economic increase in crop income of 13.0 billion VND (see Annex Table 16).

2. Rehabilitation of the Access Road

15. Representative vehicle operating costs (VOC) have been estimated for several types of vehicles likely to use the proposed access road. These include motorcycles, cars, buses, four wheel drive trucks, agricultural tractors and bicycles. Operating costs include fuel, oil, lubricants, coolants, repairs and maintenance based on expected levels of utilization while annual overhead costs include insurance and depreciation. The difference between the "with" and "without" subproject scenarios relates to the significantly higher repairs and maintenance costs associated with the deteriorated road surfaces "without" the subproject compared to these costs "with" the subproject (see Table B).

Table B: VOC Incremental Savings

	Vehicle Operating Costs				
	Capital Cost	Assumed Annual Utilization	Without Project	With Project	Incremental Savings
	VND million	Kms	VND/km	VND/km	VND/km
Motor Cycle (100 ccs)	9.6	15,000	1,237	742	495
Tractor (1,000-1,500cc) - diesel	92.0	1,500	14,864	11,891	2,973
Car (1,000-2,300cc) - petrol	260.0	10,000	7,885	3,943	3,943
Bus (1500-2000cc) - diesel	160.0	15,000	4,668	2,801	1,867
Trucks (1,500-2,500cc) - four-wheel diesel	260.0	20,000	6,248	3,749	2,499
Trucks (2,000-3,500cc) - six-wheel diesel	400.0	25,000	6,035	4,224	1,810
Bicycles	0.8	750	273	218	55

16. The access road, in its present condition, gets very little through traffic (due to the difficult hill-track section) and a limited amount of local traffic or traffic out to main roads. Rough estimates have been made of this traffic as well as of the anticipated increase in traffic within the road service area in the "with" subproject scenario. A weighted average of vehicle operating cost savings of the various types of vehicles has been developed for both the "without" subproject traffic distribution and the "with" subproject traffic distribution (see Table C).

Table C: Weighted Average of VOC by Types of Vehicles

	Without Rehabilitation				Projected With Rehabilitation				Projected Diverted Traffic		
Traffic Types	Traffic	Percent	VOC	Weighted Average[a] VOC saving	Traffic Count	Percent	VOC	Weighted Average[a] VOC saving	Traffic	Percent	Weighted Average[b] VOC saving
	veh/day		VND	VND	veh/day		VND	VND	veh/day		VND
Motorized											
Motorcycle	80	16.8%	1,237	83	300	29.9%	742	148	600	82.2%	610
Tractors	20	4.2%	14,864	125	40	4.0%	11,891	118	0	0.0%	0
Motor Car	5	1.1%	7,885	42	20	2.0%	3,943	78	100	13.7%	540
Buses	0	0.0%	4,668	0	5	0.5%	2,801	9	0	0.0%	0
Truck - 4 wheel	20	4.2%	6,248	105	40	4.0%	3,749	99	30	4.1%	154
Truck - 6 wheel	0	0.0%	6,035	0	200	19.9%	4,224	360	0	0.0%	0
Non Motorized											
Bicycle	350	73.7%	273	40	400	39.8%	218	22	0	0.0%	0
Total	475	100.0%		395	1005	100.0%		835	730	100%	1,304

a/ The weighted average is the difference in VOC (Without minus With the project) times the percent of the traffic count for each vehicle type.
b/ For projected diverted traffic the weighted average VOC is based on With Rehabilitation VOC figures.

17. The level of utilization of the access road in Table C was based on locally collected data and data from past and ongoing rural access roads in the corresponding province and district. Since the geo-demographics are quite similar in all five Project provinces, this level of utilization is intended to serve as a guide for analysis of the remaining 26 proposed subprojects. However, economic re-evaluation should be done during the mid-term review (in 2016, a year after the subproject is completed) to validate actual rural road utilization.

18. Immediately after the completion of subproject construction the weighted average cost saving of "without" subproject traffic is applied in the analysis to the "without" subproject traffic estimate. Within a short time, however, it is expected that the "with" subproject traffic expectations will be reached, after which the "with" subproject weighted average of vehicle operation cost savings is applied to the "with" subproject traffic. Traffic benefits calculated on a km basis are applied to the full length of the road from year 4 of the subproject. Traffic is assumed to grow at a rate of 4%[1] a year after that time, reflected in a similar growth in value of the economic annual VOC savings. Taking year 10 of subproject life as an example, the economic VOC saving for local area traffic are expected to be 3.8 billion VND. Diverted traffic from the district road will save 15 km en route to the main road compared to its present longer route. This traffic (which also will be expected to grow at 4% a year) will save its full VOC per km on this 15 km. Again using the year 10 example, diverted traffic economic annual VOC savings are expected to be 6.9 billion VND (see Table D). The aggregate VOC savings are expected to be 10.7 billion VND for this snapshot year.

Table D: Economic Annual VOC Savings with the Access Road Rehabilitation

	Year	Road Km	Projected Road Area Traffic	Economic VOC Savings/km	Economic Annual VOC Savings	Diverted Traffic km Saved	Projected Diverted Traffic	Economic VOC Savings/km	Economic Annual VOC Savings	Economic Total Annual VOC Savings
			4%	VND /km	mill VND/yr	km	veh/day	VND /km	mill VND/yr	mill VND/yr
1	2015	4.0	888	0	0	0	0	0	0	0
2	2016	8.0	962	395	1,111	15	730	1,304	5,212	6,322
3	2017	9.8	962	615	2,117	15	730	1,304	5,212	7,329
4	2018	9.8	1,005	835	3,002	15	759	1,304	5,420	8,423
5	2019	9.8	1,045	835	3,123	15	790	1,304	5,637	8,760
6	2020	9.8	1,087	835	3,247	15	821	1,304	5,863	9,110
7	2021	9.8	1,130	835	3,377	15	854	1,304	6,097	9,474
8	2022	9.8	1,176	835	3,512	15	888	1,304	6,341	9,853
9	2023	9.8	1,223	835	3,653	15	924	1,304	6,595	10,247
10	2024	9.8	1,272	835	3,799	15	961	1,304	6,858	10,657
11	2025	9.8	1,323	835	3,951	15	999	1,304	7,133	11,084
12	2026	9.8	1,375	835	4,109	15	1,039	1,304	7,418	11,527
13	2027	9.8	1,430	835	4,273	15	1,081	1,304	7,715	11,988
14	2028	9.8	1,488	835	4,444	15	1,124	1,304	8,023	12,468
15	2029	9.8	1,547	835	4,622	15	1,169	1,304	8,344	12,966
16	2030	9.8	1,609	835	4,807	15	1,216	1,304	8,678	13,485
17	2031	9.8	1,673	835	4,999	15	1,264	1,304	9,025	14,024
18	2032	9.8	1,740	835	5,199	15	1,315	1,304	9,386	14,585
19	2033	9.8	1,810	835	5,407	15	1,367	1,304	9,762	15,169
20	2034	9.8	1,882	835	5,623	15	1,422	1,304	10,152	15,776

D. Subproject Cost

19. The estimated cost of rehabilitating the access road and irrigation system is 53.5 billion VND in financial prices and 42.5 billion VND in economic prices. The access road by itself will cost 22.8 billion VND and the irrigation system 30.7 billion (both in financial prices). Annual O&M expenditures are assumed to amount to 3% of construction costs while the more major periodic maintenance (every eighth year) will be about 30% (see Annex Tables 17 and 18).

[1] The traffic growth rate is the average rate for rural transport in the Central Highland Region as indicated in various past and ongoing rural transport initiatives.

E. Economic Analysis

1. Economic Returns

20. To calculate the economic returns of the subproject, the net incremental value benefits (both VOC savings as well as producer surplus in terms of crop production) is determined for each year of project life and arranged as a stream of cash flow. Costs are similarly arrayed - with construction costs falling in the first two years followed by annual maintenance costs in each subsequent year and a somewhat more major periodic maintenance expenditure every eighth year after construction. To calculate the cash flow of net project economic benefits the cost cash flow is subtracted from the benefit cash flow.

21. The Tan Son Irrigation – Road subproject is expected to be economically viable in that the economic internal rate of return (EIRR) has been calculated to be 20.0% and the net present value (ENPV) of the investment (using a 12% discount rate) is 40.0 billion VND. Cost and revenue streams are presented in Annex Tables 16 and 18.

2. Sensitivity Analysis

22. The reported economic returns of the subproject are based on the assumption that costs and benefits over the life of the project will be "as calculated". The future, of course, may not perfectly follow that assumption. It is useful to examine particular risks and check what difference they may make to the economic returns of the project. Some of these risks include the following:

- **Investment Cost**: A 10% increase in investment cost will cause the EIRR to fall to 18.5%. The sensitivity factor[2] is 1.4 and the switching value[3] is at a 70.8% increase in investment cost.
- **O&M Cost**: A 10% increase in O&M cost will cause the EIRR to fall to 19.7%. The sensitivity factor is 0.5 and the switching value is at a 202.5% increase in O&M cost.
- **Revenue/Benefits**: If prices of crop produces and VOC benefits are reduced by 30%, the EIRR will decrease to 13.2%. The sensitivity factor in this case is 2.9 and the switching value is at a price level that is 34.4% of its predicted level used in the base case scenario.
- **Delay of Revenue/Benefit Realization**: ADB project implementation in the sector indicates an average delay of project implementation by 2 years. If it is the case with this subproject, the EIRR will decrease to 14.1%. The sensitivity factor in this case is 2.9 and the ENPV is 71.4% lower than its level estimated in the base case scenario.
- **Life of Subproject**: It has been assumed that, with adequate O&M, the Tan Son road - irrigation subproject will last for at least twenty years. If the subproject life actually turns out to be 15 years (75% of the assumed 20-year life) the EIRR will

[2] Sensitivity is the absolute value of the percent change in the EIRR divided by the percent change in the risk factor (such as cost). A sensitivity level that is greater than 1.0 indicates that a percent change in the risk factor will cause a change in the EIRR of more than 1% of its base case value --- indicating a relatively high degree of volatility. A relatively low degree of volatility would be indicated by a sensitivity factor level that is less than 1.0.

[3] The switching value is the percent change in the risk variable that will make the EIRR fall to the level of the opportunity cost of capital (which is 12%).

fall to 18.5% - and if project life is 13 years the EIRR will be 17.0%. The sensitivity indicators are 2.3 and 2.4 respectively and a switching value of 10 years in both cases.

23. Overall, the Tan Son road – irrigation subproject is expected to have economic returns which are quite attractive and fairly robust. None of the risk factors appear to place the subproject's economic viability in immediate jeopardy. Effective maintenance of the canal and road infrastructure, however, is a basic assumption to support this assessment (see section H for further discussion).

F. Household Financial Returns

24. Since the economic analysis was developed from the financial prices, presentation of the subproject's FIRR in addition to the EIRR would have limited meaning. In this context, it is more meaningful to discuss how the Subproject will impact the household financial returns. It should be noted that all figures presented hereunder have been converted back to local financial prices.

25. There are 1,200 households farming land within the 900 ha of the Tan Son irrigation scheme's "with" subproject command area. The average farm size within the command area is 0.75 ha. This land is often located in two or more widely separated parcels. If the "average" farm can be assumed to have representative proportions of irrigated and non-irrigated command area land "without" the subproject, this household land will be able to produce 12.0 million VND ($573) in incremental net crop income in the "with" subproject scenario in the year 10 snapshot. (Returns will continue to grow per year over the remaining life of the Subproject.) Assuming a household size of 4.5 people, this means that per person incremental net crop income will increase by 2.68 million VND ($127) (see Annex Table 16).

26. The incremental net crop income noted above assumes all labor inputs are a cost (valued at the going rate for farm labor in the area). "With" the subproject, however, different cropping patterns and increased crop inputs will be applied compared to the "without" subproject situation. These differences will call for an increased amount of farm labor. For the part of the incremental labor that is drawn from the farm household itself, these (wages) comprise part of incremental household income (in addition to incremental net crop revenue) - although the additional time commitment to on-farm work may partly have an opportunity cost of work and income off the farm. For the "average" household, the incremental labor requirements in year 10 come to 49 days a year or 3.6 million VND ($171) (see Annex Table 15). The part of this figure that is not hired labor and is not off-set by lost employment opportunities off the farm represents an increase in household income. The portion of the figure that goes toward hired labor can be seen as income for other households (which may or may not have land within the command area).

27. In addition to the quantified benefits associated with crop production, there are VOC savings that have been quantified but it would be arbitrary to estimate per-household benefit due to the lack of realistic road unitization by local households, particularly the 1200 households under the analysis. In this context, a more detailed analysis is needed after the completion of the access road rehabilitation. However, it is certain that the majority of the 1,200 households will benefit from the improved road one way or another since the access road is in the examined production areas.

G. Analysis of Poverty Impacts

28. Validated information indicates that 480 households are considered “poor”. While the actual location of the farms of the poor households is not known, it is likely that a high proportion of these farms are in the non-irrigated (“without” the subproject) portion of the 440 ha of the command area. This non-irrigated area produces much less value in the way of crops per ha than does the irrigated area. A way of calculating the amount of incremental crop benefit going to poor households is to assume that all of them farm in the non-irrigated (“without”) lower section of the system. A further assumption is that poor households have an average farm size that is 50% of that of the over-all average farm size in the area. The 480 poor farm households, then, have farms of an average 0.33 ha. In aggregate these poor farm households can be expected to have incremental net crop income from the subproject of 2.77 billion VND (in the year 10 snapshot) or 21% of the over-all incremental net crop income from the subproject. This translates into 5.77 million VND ($274) per poor household (see Annex Table 16).

29. For the same poor households the incremental labor inputs (in year 10) from the subproject come to 52 days per year - which, at the wage for on-farm labor, would be valued at 3.93 million VND ($186). Some of this, again, might be in the form of hired labor while some of the increased household labor contributions may have an opportunity cost in regards to other paid jobs. A good deal of this figure, however, is likely to be a net contribution to poor household income.

30. A note could be made regarding labor inputs in the construction activities of the subproject (irrigation and access road). Local poor households having some significant level of under-employment may well share in this temporary work. It is not clear from the preliminary cost estimates as to how many days of manual labor will be involved in construction or how much of that labor will come from the local area (rather than being brought in by the contractors). However, it is likely that a significant number of labor days will go to local households, many of them drawn from the poor.

31. As with average households in this subproject area, it is difficult to put a figure on how much of the subproject benefits poor households will receive from VOC savings due to the improved access road.

32. Detailed calculations supporting the above analysis are in Annex Tables 1-19 at the end of the analysis.

H. Fiscal Affordability and Sustainability

33. Based on the above analysis, sustainability of all subprojects proposed by all five project provinces (including the Subproject under examination in this document) is dependent on effective maintenance of the system. Since irrigation fee is currently waived by the Government and water user group can only take care of on-farm facilities, the responsibility of operating and maintaining the whole system rests with the provincial irrigation and drainage companies (IDMCs) in each province.

34. To ensure adequate O&M of the all proposed subprojects for the period of 2018-2034, each of the five Provincial People’s Committees (PPCs) will need to set aside an annual budget of at least VND8.8 billion (in 2013 constant price) for O&M of the newly constructed/rehabilitated systems (irrigation and access road).

35. The analysis presented in Table E indicates that (i) based on the past five year's figures, all PPCs actually will be able to allocate significant amounts of budget for infrastructure investment and O&M; (ii) the levels required of VND8.8 billion is only in the range of 2.0%-3.4% of these projected allocations. Therefore, the required O&M budget level is assessed as highly affordable to all PPCs. Reviews of ongoing past and ongoing projects suggested that if the O&M budget required of PPCs is below 5% of these annual allocations, PPCs will be able to finance it.

36. This analysis suggests that the Project Loan Agreement must include (i) a covenant to bind all five PPCs to allocate a budget of VND8.8 billion (in 2013 constant price) for O&M of the newly constructed/rehabilitated systems (irrigation and access road; and (ii) a covenant to ensure the provincial IDMCs receive adequate allocations for the O&M work under their responsibility. The level of VND8.8 billion is intended to serve as the estimate for referencing by the PPCs in their endorsement to the Provincial People's Councils prior to the submission to the Central Government.

Table E: Provincial Contributions Required and Affordability (for all five Project Provincial People's Committees)

Unit: VND million

PPC	Provincial Contribution Required and Affordability					
	2013 (Project Start)	2014	2015	2016	2017	2018 - onwards
0. Budget Required for Each Province						
Counterpart contribution Required during Project implementation	1,949	1,949	1,949	1,949	1,949	0
Budget Required for Annual Operation and Maintenance	0	2,940	2,940	2,940	4,410	8,820
Total Annual Budget Required for Each Province (VND million)	**1,949**	**4,889**	**4,889**	**4,889**	**6,359**	**8,820**
Total Annual Budget Required for Each Province (USD thousand)	**93**	**233**	**233**	**233**	**303**	**420**
1. Dak Nong Province Affordability Profile						
Annual Allocation for Infrastructure Investment and O&M In-province *	432,024	373,632	370,100	371,966	359,349	430,356
Total Budget Required as % of the In-province Annual Allocation	0.5%	1.3%	1.3%	1.3%	1.8%	2.0%
2. Kon Tum Affordability Profile						
Annual Allocation for Infrastructure Investment and O&M In-province *	140,900	190,860	250,000	260,000	260,000	260,000
Total Budget Required as % of the In-province Annual Allocation	1.4%	2.6%	2.0%	1.9%	2.4%	3.4%
3. Dak Lak Affordability Profile						
Annual Allocation for Infrastructure Investment and O&M In-province *	472,445	404,632	410,000	415,000	425,000	435,000
Total Budget Required as % of the In-province Annual Allocation	0.4%	1.2%	1.2%	1.2%	1.5%	2.0%
4. Gia Lai Affordability Profile						
Annual Allocation for Infrastructure Investment and O&M In-province *	319,944	335,941	352,738	370,375	388,894	408,339
Total Budget Required as % of the In-province Annual Allocation	0.6%	1.5%	1.4%	1.3%	1.6%	2.2%
5. Lam Dong Affordability Profile						
Annual Allocation for Infrastructure Investment and O&M In-province *	303,898	275,640	291,420	306,000	321,300	337,000
Total Budget Required as % of the In-province Annual Allocation	0.6%	1.8%	1.7%	1.6%	2.0%	2.6%

* Annual allocation required for infrastructure investment and O&M in each province was estimated based on actual allocations for this item over the 2009-2012 period.

Source: Asian Development Bank estimates.

ANNEX TABLES 1-19

Table 1a: Economic Price Estimates for Internationally Traded Outputs (Rice)

Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

(2013 Constant Viet Nam Dong)		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	…	2034
Rice: (Export parity in 2013 currencies)[a/]																
Thailand (current $)[a/]	$/t	563	540	520	500	498	496	494	492	490	490	490	490	490		480
Thailand (constant 2005 $)[a/]		467	440	414	391	382	374	366	358	350	350	350	350	350		314
MUV (2005=1.00)[b/]	2005	1.21	1.23	1.21	1.27	1.30	1.32	1.34	1.37	1.40	1.40	1.40	1.40	1.37		1.53
MUV (2013=1.00)[b/]	2013	0.98	1.00	0.98	1.04	1.06	1.08	1.10	1.12	1.14	1.14	1.14	1.14	1.12		1.25
Rice FOB Bangkok (constant 2013 $)	$/t	573	540	528	482	471	461	451	441	430	430	430	430	438		385
Freight & insurance	$/t	0	0	0	0	0	0	0	0	0	0	0	0	0		0
CIF price at Sai Gon port	$/t	573	540	528	482	471	461	451	441	430	430	430	430	438		385
Landed price at port	$/t	573	540	528	482	471	461	451	441	430	430	430	430	438		385
Quality-Adjusted Price	$/t	516	486	476	434	424	415	406	397	387	387	387	387	395		347
Adjusted border price	$/t	573	540	528	482	471	461	451	441	430	430	430	430	438		385
Border price in local currency	'000 VND/t	12,036	11,340	11,097	10,118	9,885	9,678	9,471	9,264	9,020	9,020	9,020	9,020	9,208		8,093
Port handling and storage charges	'000 VND/t	145	145	145	145	145	145	145	145	145	145	145	145	145		145
Storage, handling and transport to/from local market	'000 VND/t	70	70	70	70	70	70	70	70	70	70	70	70	70		70
Average marketing margin	'000 VND/t	510	510	510	510	510	510	510	510	510	510	510	510	510		510
Price at local market / ex- rice mill	'000 VND/t	11,311	10,615	10,372	9,393	9,160	8,953	8,746	8,539	8,295	8,295	8,295	8,295	8,483		7,368
Processing cost	'000 VND/t	110	110	110	110	110	110	110	110	110	110	110	110	110		110
Price at mill gate (in paddy form)	'000 VND/t	7,617	7,143	6,978	6,312	6,154	6,013	5,873	5,732	5,566	5,566	5,566	5,566	5,694		4,935
Storage, handling and transport from farm	'000 VND/t	60	60	60	60	60	60	60	60	60	60	60	60	60		60
Export parity farm gate price (paddy)	'000 VND/t	7,557	7,083	6,918	6,252	6,094	5,953	5,813	5,672	5,506	5,506	5,506	5,506	5,634		4,875
Export parity farm gate price (paddy)	'000 VND/kg	7.56	7.08	6.92	6.25	6.09	5.95	5.81	5.67	5.51	5.51	5.51	5.51	5.63		4.88

a/ WB Commodity Price Projections prepared January 15, 2013 for 2013-2020, and 2025 with other years interpolated.
(Thailand, 5% broken, white rice, milled, f.o.b. Bangkok)

b/ Manufacturing Unit Value Index

c/ Adjustment for Quality 10%

d/ Exchange rate of Vietnamese Dong (VND) per $ during in January 2013: 21,000

e/ SCF 0.9 SERF 1.1

f/ Conversion factor of paddy to rice 68%

Table 1b: Economic Price Estimates for Internationally Traded Outputs (Maize)

Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

(2013 Constant Viet Nam Dong)		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	…	2034
Maize: (Import parity in 2013 currencies)[a/]																
Maize: Gulf Port (in current $)[a/]	$/t	298	290	270	250	248	246	244	242	240	240	240	240	240		230
Maize: Gulf Port (constant 2005 $)[a/]	$/t	247	236	215	195	190	185	181	176	172	172	172	172	172		150
MUV (2000=1.00)[b/]	2000	1.21	1.23	1.26	1.28	1.31	1.33	1.35	1.38	1.40	1.40	1.40	1.40	1.40		1.53
MUV (2013=1.00)[b/]	2013	0.98	1.00	1.02	1.04	1.06	1.08	1.10	1.12	1.14	1.14	1.14	1.14	1.14		1.25
Maize: Gulf Port (in constant 2013 $)	$/t	304	290	264	240	233	227	222	216	211	211	211	211	211		184
Frieght and Insurance to Sai Gon	$/t	50	50	50	50	50	50	50	50	50	50	50	50	50		50
CIF price at Sai Gon port	$/t	354	340	314	290	283	277	272	266	261	261	261	261	261		234
Landed price at port	$/t	354	340	314	290	283	277	272	266	261	261	261	261	261		234
Quality-Adjusted Price	$/t	283	306	283	261	255	250	245	240	235	235	235	235	235		211
Adjusted border price	$/t	314	340	314	290	283	277	272	266	261	261	261	261	261		234
Border price in local currency	'000 VND/t	6,599	7,140	6,598	6,082	5,953	5,824	5,721	5,592	5,488	5,488	5,488	5,488	5,488		4,921
Port handling and storage charges	'000 VND/t	145	145	145	145	145	145	145	145	145	145	145	145	145		145
Storage, handling and transport to/from local market	'000 VND/t	70	70	70	70	70	70	70	70	70	70	70	70	70		70
Average marketing margin	'000 VND/t	100	100	100	100	100	100	100	100	100	100	100	100	100		100
Price at local market	'000 VND/t	6,914	7,455	6,913	6,397	6,268	6,139	6,036	5,907	5,803	5,803	5,803	5,803	5,803		5,236
Processing cost	'000 VND/t	30	30	30	30	30	30	30	30	30	30	30	30	30		30
Price at mill gate (raw material)	'000 VND/t	4,166	4,491	4,166	3,856	3,779	3,701	3,639	3,562	3,500	3,500	3,500	3,500	3,500		3,159
Storage, handling and transport from farm	'000 VND/t	110	110	110	110	110	110	110	110	110	110	110	110	110		110
Farmgate price per tonne	'000 VND/t	4,056	4,381	4,056	3,746	3,669	3,591	3,529	3,452	3,390	3,390	3,390	3,390	3,390		3,049
Farmgate price per kg	'000 VND/kg	4.06	4.38	4.06	3.75	3.67	3.59	3.53	3.45	3.39	3.39	3.39	3.39	3.39		3.05

a/ WB Commodity Price Projections prepared January 15, 2013 for 2013-2020, and 2025 with other years interpolated.
(U.S. hard red winter, Gulf port)

b/ Manufacturing Unit Value Index

c/ Exchange rate of Vietnamese Dong (VND) per $ during in January 2013: 21,000

Table 1c: Economic Price Estimates for Internationally Traded Outputs (Coffee, Arabica)

Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

(2013 Constant Viet Nam Dong)		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	…	2034
Coffee, Arabica (in 2013 currencies)[a/]																
Coffee, Arabica: Gulf Port (in current $)[a/]	$/t	411	380	370	360	359	358	357	356	355	355	355	355	355		350
Coffee, Arabica: Gulf Port (constant 2005 $)[a/]		341	309	295	281	276	270	265	259	254	254	254	254	254		229
MUV (2005=1.00)[b/]	2005	1.21	1.23	1.22	1.28	1.30	1.32	1.34	1.37	1.40	1.40	1.40	1.40	1.38		1.53
MUV (2013=1.00)[b/]	2013	0.98	1.00	0.99	1.04	1.06	1.08	1.09	1.12	1.14	1.14	1.14	1.14	1.12		1.25
Rice FOB Bangkok (constant 2013 $)	$/t	419	379	372	346	340	332	326	319	312	312	312	312	316		281
Quality Adjustment[c/]	$/t	377	341	335	311	306	299	294	287	281	281	281	281	285		253
Freight, insurance, etc.	$/t	35	35	35	35	35	35	35	35	35	35	35	35	35		35
CIF Saigon	$/t	412	376	370	346	341	334	329	322	316	316	316	316	320		288
CIF Saigon in VND [d/]	'000 VND/t	8,645	7,902	7,768	7,271	7,155	7,015	6,899	6,760	6,627	6,627	6,627	6,627	6,711		6,047
Freight & handling Saigon to project area[e/]	'000 VND/t	399	399	399	399	399	399	399	399	399	399	399	399	399		399
Conversion to dry coffee beans[f/]	'000 VND/t	6,184	5,628	5,527	5,154	5,067	4,962	4,875	4,770	4,671	4,671	4,671	4,671	4,734		4,236
Processing charges[e/]	'000 VND/t	100	100	100	100	100	100	100	100	100	100	100	100	100		100
Handling and transport farm to processor[e/]	'000 VND/t	50	50	50	50	50	50	50	50	50	50	50	50	50		50
Economic Farmgate Price per tonne	'000 VND/t	6,034	5,478	5,377	5,004	4,917	4,812	4,725	4,620	4,521	4,521	4,521	4,521	4,584		4,086
Economic Farmgate Price per kg	'000 VND/kg	6.03	5.48	5.38	5.00	4.92	4.81	4.73	4.62	4.52	4.52	4.52	4.52	4.58		4.09

a/ WB Commodity Price Projections prepared January 15, 2013 for 2013-2020, and 2025 with other years interpolated.

b/ Manufacturing Unit Value Index

c/ Adjustment for Quality 10%

d/ Exchange rate of Vietnamese Dong (VND) per $ during in January 2013: 21,000

e/ SCF 0.9 SERF 1.1

f/ Conversion factor to dry beans 75%

Table 2a: Economic Price Estimates for Internationally Traded Inputs (Urea)

Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

(2013 Constant Viet Nam Dong)		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	…	2034
(Urea: (in 2013 currencies)[a/]																
Urea: Black Sea (in current $)[a/]	$/t	405	390	370	350	345	339	334	329	324	324	324	324	324		300
Urea: Black Sea (in constant 2005 $)[a/]	$/t	336	317	295	274	265	256	248	240	232	232	232	232	232		196
MUV (2005=1.00)[b/]	2005	1.21	1.23	1.25	1.28	1.30	1.32	1.35	1.37	1.40	1.40	1.40	1.40	1.40		1.53
MUV (2013=1.00)[b/]	2013	0.98	1.00	1.02	1.04	1.06	1.08	1.09	1.11	1.14	1.14	1.14	1.14	1.14		1.24
Urea: Black Sea (in constant 2013 $)	$/t	413	390	363	337	326	315	305	295	285	285	285	285	285		241
Freight and Insurance to Haiphong	$/t	50	50	50	50	50	50	50	50	50	50	50	50	50		50
CIF Haiphong	$/t	463	440	413	387	376	365	355	345	335	335	335	335	335		291
CIF Haiphong in VND[c/]	'000 VND/t	9,731	9,240	8,672	8,129	7,897	7,664	7,457	7,251	7,044	7,044	7,044	7,044	7,044		6,114
Handling and transport to district center[d]	'000 VND/t	399	399	399	399	399	399	399	399	399	399	399	399	399		399
Price at District Center	'000 VND/t	10,130	9,639	9,071	8,528	8,296	8,063	7,856	7,650	7,443	7,443	7,443	7,443	7,443		6,513
Transport and Handling to Farm[d/]	'000 VND/t	100	100	100	100	100	100	100	100	100	100	100	100	100		100
Farmgate price per tonne	'000 VND/t	10,030	9,539	8,971	8,428	8,196	7,963	7,757	7,550	7,343	7,343	7,343	7,343	7,343		6,413
Farmgate price per kg	'000 VND/kg	10.03	9.54	8.97	8.43	8.20	7.96	7.76	7.55	7.34	7.34	7.34	7.34	7.34		6.41

a/ WB Commodity Price Projections prepared January 15, 2013 for 2013-2020, and 2025 with other years interpolated.
(Bulk, f.o.b. Black Sea ports)

b/ Manufacturing Unit Value Index

c/ Exchange rate of Vietnamese Dong (VND) per $ during in January 2013:

d/ SCF 0.9 SERF 1.1

Table 2b: Economic Price Estimates for Internationally Traded Inputs (TSP)

Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

(2013 Constant Viet Nam Dong)		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	…	2034
(TSP: (in 2013 currencies)[a/]																
TSP: Tunisia (in current $)[a/]	$/t	462	430	425	420	415	409	404	399	394	394	394	394	394		370
TSP: Tunisia (in constant 2000 $)[a/]	$/t	383	350	339	328	318	309	300	291	282	282	282	282	282		242
MUV (2005=1.00)[b/]	2005	1.21	1.23	1.25	1.28	1.31	1.32	1.35	1.37	1.40	1.40	1.40	1.40	1.40		1.53
MUV (2013=1.00)[b/]	2013	0.98	1.00	1.02	1.04	1.06	1.08	1.10	1.12	1.14	1.14	1.14	1.14	1.14		1.24
TSP: Tunisia (in constant 2013 $)	$/t	471	430	416	403	391	380	369	358	346	346	346	346	346		297
Freight and Insurance to Haiphong	$/t	50	50	50	50	50	50	50	50	50	50	50	50	50		50
CIF Haiphong	$/t	521	480	466	453	441	430	419	408	396	396	396	396	396		347
CIF Haiphong in VND[c/]	'000 VND/t	10,931	10,080	9,796	9,512	9,254	9,022	8,790	8,558	8,326	8,326	8,326	8,326	8,326		7,294
Handling and transport to district center[d]	'000 VND/t	399	399	399	399	399	399	399	399	399	399	399	399	399		399
Price at District Center	'000 VND/t	11,330	10,479	10,195	9,911	9,653	9,421	9,189	8,957	8,725	8,725	8,725	8,725	8,725		7,693
Transport and Handling to Farm[d/]	'000 VND/t	100	100	100	100	100	100	100	100	100	100	100	100	100		100
Farmgate price per tonne	'000 VND/t	11,231	10,379	10,095	9,812	9,554	9,321	9,089	8,857	8,625	8,625	8,625	8,625	8,625		7,593
Farmgate price per kg	'000 VND/kg	11.23	10.38	10.10	9.81	9.55	9.32	9.09	8.86	8.62	8.62	8.62	8.62	8.62		7.59

a/ WB Commodity Price Projections prepared January 15, 2013 for 2013-2020, and 2025 with other years interpolated.
(Bulk, granular, f.o.b. Tunisian ports)

b/ Manufacturing Unit Value Index

c/ Exchange rate of Vietnamese Dong (VND) per $ during in January 2013: VND 21,000

d/ SCF 0.9 SERF 1.1

Table 2c Economic Price Estimates for Internationally Traded Inputs (DAP)

Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

(2013 Constant Viet Nam Dong)		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	…	2034
(DAP: (in 2013 currencies)[a/]																
DAP: U.S. gulf (in current $)[a/]	$/t	540	500	490	480	478	476	474	472	470	470	470	470	470		460
DAP: U.S. gulf (in constant 2005 $)[a/]	$/t	447	407	390	375	367	359	351	344	336	336	336	336	336		301
MUV (2005=1.00)[b/]	2005	1.21	1.23	1.26	1.28	1.30	1.33	1.35	1.37	1.40	1.40	1.40	1.40	1.40		1.53
MUV (2013=1.00)[b/]	2013	0.98	1.00	1.02	1.04	1.06	1.08	1.10	1.12	1.14	1.14	1.14	1.14	1.14		1.24
DAP: U.S. gulf (in constant 2013 $)	$/t	549	500	479	461	451	441	431	423	413	413	413	413	413		370
Freight and Insurance to Haiphong	$/t	50	50	50	50	50	50	50	50	50	50	50	50	50		50
CIF Haiphong	$/t	599	550	529	511	501	491	481	473	463	463	463	463	463		420
CIF Haiphong in VND[c/]	'000 VND/t	12,582	11,550	11,111	10,724	10,518	10,312	10,105	9,925	9,718	9,718	9,718	9,718	9,718		8,815
Handling and transport to district center[d]	'000 VND/t	399	399	399	399	399	399	399	399	399	399	399	399	399		399
Price at District Center	'000 VND/t	12,981	11,949	11,510	11,123	10,917	10,711	10,504	10,324	10,117	10,117	10,117	10,117	10,117		9,214
Transport and Handling to Farm[d/]	'000 VND/t	100	100	100	100	100	100	100	100	100	100	100	100	100		100
Farmgate price per tonne	'000 VND/t	12,881	11,849	11,411	11,024	10,817	10,611	10,405	10,224	10,018	10,018	10,018	10,018	10,018		9,115
Farmgate price per kg	'000 VND/kg	12.88	11.85	11.41	11.02	10.82	10.61	10.40	10.22	10.02	10.02	10.02	10.02	10.02		9.11

a/ WB Commodity Price Projections prepared January 15, 2013 for 2013-2020, and 2025 with other years interpolated.
(Bulk, standard size, f.o.b. U.S. gulf ports)

b/ Manufacturing Unit Value Index

c/ Exchange rate of Vietnamese Dong (VND) per $ during in January 2013: VND 21,000

d/ SCF 0.9 SERF 1.1

Table 3: Summary of Financial Prices

Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

(2013 Constant Viet Nam Dong)		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	…	2034
Financial[a/]																
Outputs																
Paddy (Spring)	'000 VND/kg	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2		6.2
Paddy (Autumn)	'000 VND/kg	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8		6.8
Sraw[b/]	'000 VND/kg	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7		0.7
Maize	'000 VND/kg	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5		5.5
Coffee	'000 VND/kg	7.2	6.6	6.5	6.0	5.9	5.8	5.7	5.5	5.4	5.4	5.4	5.4	5.5		4.9
Potatoes	'000 VND/kg	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7		2.7
Watermelon	'000 VND/kg	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7		2.7
Fish	'000 VND/kg	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5		13.5
Inputs																
Rice seed (local)	'000 VND/kg	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0		18.0
Rice seed (improved)	'000 VND/kg	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0		45.0
Maize seed	'000 VND/kg	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5		58.5
Coffee seedling for 1 ha	'000 VND/ha	3,500.0	3,500.0	3,500.0	3,500.0	3,500.0	3,500.0	3,500.0	3,500.0	3,500.0	3,500.0	3,500.0	3,500.0	3,500.0		3,500.0
Potato seed	'000 VND/kg	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7		2.7
Watermelon seed	'000 VND/kg	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0		72.0
Fish Fingerlings	'000 VND/kg	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6		0.6
Urea	'000 VND/kg	11.0	10.5	9.9	9.3	9.0	8.8	8.5	8.3	8.1	8.1	8.1	8.1	8.1		7.1
Super Phosphate	'000 VND/kg	11.8	10.9	10.6	10.3	10.0	9.8	9.5	9.3	9.1	9.1	9.1	9.1	9.1		8.0
DAP	'000 VND/kg	13.1	12.1	11.6	11.2	11.0	10.8	10.6	10.4	10.2	10.2	10.2	10.2	10.2		9.3
NPK	'000 VND/kg	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0
N	'000 VND/kg	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4		5.4
P	'000 VND/kg	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5
K	'000 VND/kg	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2		7.2
Manure	'000 VND/t	171.0	171.0	171.0	171.0	171.0	171.0	171.0	171.0	171.0	171.0	171.0	171.0	171.0		171.0
Pesticide	'000 VND/ha	1,260.0	1,260.0	1,260.0	1,260.0	1,260.0	1,260.0	1,260.0	1,260.0	1,260.0	1,260.0	1,260.0	1,260.0	1,260.0		1,260.0
Tractor hire	'000 VND/ha	1,755.0	1,755.0	1,755.0	1,755.0	1,755.0	1,755.0	1,755.0	1,755.0	1,755.0	1,755.0	1,755.0	1,755.0	1,755.0		1,755.0
Labor (Irrigation, road and embankments)	'000 VND/day	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0		75.0
Labor (Water Supply)	'000 VND/day	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0		65.0

a/ Financial crop and input prices were mostly derived from the district DARD and District Extension offices --- supplemented by interviews with local farmers.

b/ Rice straw as a percent of rice output. 10%

Table 4: Summary of Economic Prices

Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

(2013 Constant Viet Nam Dong)		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	…	2034
Economic[a/]																
Outputs																
Paddy (Spring)	'000 VND/kg	6.8	6.4	6.2	5.6	5.5	5.4	5.2	5.1	5.0	5.0	5.0	5.0	5.1		4.4
Paddy (Autumn)	'000 VND/kg	7.6	7.1	6.9	6.3	6.1	6.0	5.8	5.7	5.5	5.5	5.5	5.5	5.6		4.9
Sraw[b/]	'000 VND/kg	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7		0.7
Maize	'000 VND/kg	4.1	4.4	4.1	3.7	3.7	3.6	3.5	3.5	3.4	3.4	3.4	3.4	3.4		3.0
Coffee	'000 VND/kg	6.0	5.5	5.4	5.0	4.9	4.8	4.7	4.6	4.5	4.5	4.5	4.5	4.6		4.4
Potatoes	'000 VND/kg	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7		2.7
Watermelon	'000 VND/kg	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7		2.7
Fish	'000 VND/kg	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5		13.5
Inputs																
Rice seed (local)	'000 VND/kg	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0		18.0
Rice seed (improved)	'000 VND/kg	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0		45.0
Maize seed	'000 VND/kg	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5		58.5
Coffee seedling	'000 VND/ha	3,500.0	3,500.0	3,500.0	3,500.0	3,500.0	3,500.0	3,500.0	3,500.0	3,500.0	3,500.0	3,500.0	3,500.0	3,500.0		3,500.0
Potato seed	'000 VND/kg	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7		2.7
Watermelon seed	'000 VND/kg	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0		72.0
Fish Fingerlings	'000 VND/kg	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6		0.6
Urea	'000 VND/kg	10.0	9.5	9.0	8.4	8.2	8.0	7.8	7.5	7.3	7.3	7.3	7.3	7.3		6.4
Super Phosphate	'000 VND/kg	11.2	10.4	10.1	9.8	9.6	9.3	9.1	8.9	8.6	8.6	8.6	8.6	8.6		7.6
DAP	'000 VND/kg	12.9	11.8	11.4	11.0	10.8	10.6	10.4	10.2	10.0	10.0	10.0	10.0	10.0		9.1
NPK	'000 VND/kg	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0
N	'000 VND/kg	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4		5.4
P	'000 VND/kg	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5
K	'000 VND/kg	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2		7.2
Manure	'000 VND/t	171.0	171.0	171.0	171.0	171.0	171.0	171.0	171.0	171.0	171.0	171.0	171.0	171.0		171.0
Pesticide	'000 VND/ha	1,260.0	1,260.0	1,260.0	1,260.0	1,260.0	1,260.0	1,260.0	1,260.0	1,260.0	1,260.0	1,260.0	1,260.0	1,260.0		1,260.0
Tractor hire	'000 VND/ha	1,755.0	1,755.0	1,755.0	1,755.0	1,755.0	1,755.0	1,755.0	1,755.0	1,755.0	1,755.0	1,755.0	1,755.0	1,755.0		1,755.0
Labor	'000 VND/day	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0		60.0

a/ Economic prices for major items are as derived in Tables 1 and 2 above.

b/ The Shadow Wage Rate adjustment is assumed to be: 0.8

Table 5a: Vehicle Operating Cost Derivation: Tan Son Irrigation-Road Subproject

Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

(2013 Constant Viet Nam Dong)

Motor Cycle (100 ccs)	Rate	Unit	Financial Price VND '000s	Financial Price $	C/F	Economic Price VND '000s	Economic Price $	Financial cost per km 12,000 km/yr	Financial cost per km 15,000 km/yr	Financial cost per km 20,000 km/yr	Economic cost per km 12,000 km/yr	Economic cost per km 15,000 km/yr	Economic cost per km 20,000 km/yr
Investment cost	1	cycle	9,600	505.3	0.88	8,448	444.6						
Economic life	7	year											
Depreciation	14%	year	1,371	72.2	0.88	1,207	63.5						
Operating cost		km/yr											
Fuel consumption (gasoline)	3.5	l	18.0	0.9	0.88	15.84	0.8	398	497	663	350	438	584
Lubricant	1	lt/400 km	33	1.7	0.88	29.04	1.5	52	65	87	46	57	76
Repairs and maintenance	5%	year	480	25.3	0.95	456.00	24.0	25.3	31.6	42.1	24.0	24.0	24.0
Insurance	1	year	65	3.4	0.95	61.75	3.3	3.4	3.4	3.4	3.3	3.3	3.3
Operating cost		$/km						0.04	0.04	0.04	0.04	0.03	0.03
		VND/km						757.9	756.8	755.8	670.1	661.5	652.9
Depreciation cost		$/km						0.006	0.005	0.004	0.005	0.004	0.003
		VND/km						114.3	91.4	68.6	100.6	80.5	60.3
Vehicle Operating Cost (VOC)		$/km						0.046	0.045	0.043	0.041	0.039	0.038
		VND/km						872.2	848.3	824.3	770.7	742.0	713.2

Bus (1500-2000cc) - diesel	Rate	Unit	Financial Price VND '000s	Financial Price $	C/F	Economic Price VND '000s	Economic Price $	Financial 10,000 km/yr	Financial 15,000 km/yr	Financial 20,000 km/yr	Economic 10,000 km/yr	Economic 15,000 km/yr	Economic 20,000 km/yr
Investment cost	1	bus	160,000	8,421	0.88	140,800	7,410.5						
Economic life	10	year											
Depreciation	10%	year	16,000	842	0.88	14,080	741.1						
Operating cost		km/yr											
Fuel consumption (diesel)	14	lt/100 km	13.0	0.7	0.88	11.4	0.6	958	1437	1916	843	1264	1686
Lubricant and coolant	4.5	lt/4,000 km	149	7.8	0.88	130.7	6.9	20	29	39	17	26	34
Repairs and maintenance	2%	year	3,200	168.4	0.95	3,040.0	160.0	168.4	252.6	336.8	160	160	160
Insurance	1	year	400	21.1	0.95	380.0	20.0	21.1	21.1	21.1	20.0	20.0	20.0
Operating cost		$/km						0.12	0.12	0.12	0.10	0.10	0.10
		VND/km						2,217.1	2,203.8	2,197.1	1,976.3	1,862.3	1,805.3
Depreciation cost		$/km						0.084	0.056	0.042	0.074	0.049	0.037
		VND/km						1,600.0	1,066.7	800.0	1,408.0	938.7	704.0
Vehicle Operating Cost (VOC)		$/km						0.201	0.172	0.158	0.178	0.147	0.132
		VND/km						3,817.1	3,270.5	2,997.1	3,384.3	2,800.9	2,509.3

Car (1,000-2,300cc) - petrol	Rate	Unit	Financial Price VND '000s	Financial Price $	C/F	Economic Price VND '000s	Economic Price $	Financial 8,000 km/yr	Financial 10,000 km/yr	Financial 12,000 km/yr	Economic 8,000 km/yr	Economic 10,000 km/yr	Economic 12,000 km/yr
Investment cost	1	sedan	260,000	13,684	0.88	228,800	12,042.1						
Economic life	12	year											
Depreciation	8%	year	21,667	1,140	0.88	19,067	1,003.5						
Operating cost		km/yr											
Fuel consumption (petrol)	10	lt/100 km	18.0	0.9	0.88	15.8	0.8	758	947	1137	667	834	1000
Lubricant and coolant	4.5	lt/3,000 km	149	7.8	0.88	130.7	6.9	21	26	31	18	23	28
Repairs and maintenance	1.5%	year	3,900	205.3	0.95	3,705.0	195.0	205.3	256.6	307.9	195	195	195
Insurance	1	year	400	21.1	0.95	380.0	20.0	21.1	21.1	21.1	20.0	20.0	20.0
Operating cost		$/km						0.13	0.13	0.12	0.11	0.11	0.10
		VND/km						2,387.0	2,377.0	2,370.3	2,138.2	2,036.1	1,968.0
Depreciation cost		$/km						0.143	0.114	0.095	0.125	0.100	0.084
		VND/km						2,708.3	2,166.7	1,805.6	2,383.3	1,906.7	1,588.9
Vehicle Operating Cost (VOC)		$/km						0.268	0.239	0.220	0.238	0.208	0.187
		VND/km						5,095.3	4,543.7	4,175.9	4,521.5	3,942.7	3,556.9

Tractor (1,000-1,500cc) - diesel	Rate	Unit	Financial Price VND '000s	Financial Price $	C/F	Economic Price VND '000s	Economic Price $	Financial 1,200 km/yr	Financial 1,500 km/yr	Financial 2,000 km/yr	Economic 1,200 km/yr	Economic 1,500 km/yr	Economic 2,000 km/yr
Investment cost	1	tractor	92,000	4,842	0.88	80,960	4,261.1						
Economic life	8	year											
Depreciation	13%	year	11,500	605	0.88	10,120	532.6						
Operating cost		km/yr											
Fuel consumption ***(diesel)***	17	lt/100 km	13.0	0.7	0.88	11.4	0.6	140	174	233	123	154	205
Lubricant and coolant	4.5	lt/4,000 km	149	7.8	0.88	130.7	6.9	2	3	4	2	3	3
Repairs and maintenance	5.0%	year	4,600	242.1	0.95	4,370.0	230.0	242.1	302.6	403.5	230	230	230
Insurance	1	year	400	21.1	0.95	380.0	20.0	21.1	21.1	21.1	20.0	20.0	20.0
Operating cost		$/km						0.34	0.33	0.33	0.31	0.27	0.23
		VND/km						6,413.8	6,347.1	6,280.5	5,935.8	5,144.1	4,352.5
Depreciation cost		$/km						0.504	0.404	0.303	0.444	0.355	0.266
		VND/km						9,583.3	7,666.7	5,750.0	8,433.3	6,746.7	5,060.0
Vehicle Operating Cost (VOC)		$/km						0.842	0.738	0.633	0.756	0.626	0.495
		VND/km						15,997.1	14,013.8	12,030.5	14,369.1	11,890.8	9,412.5

Table 5b: Vehicle Operating Cost Derivation: Tan Son Irrigation-Road Subproject (continued)
Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

(2013 Constant Viet Nam Dong)

Trucks (1,500-2,500cc) - four-wheel diesel

	Rate	Unit	Financial Price VND '000s	Financial Price $	C/F	Economic Price VND '000s	Economic Price $	Financial 15,000 km/yr	Financial 20,000 km/yr	Financial 25,000 km/yr	Economic 15,000 km/yr	Economic 20,000 km/yr	Economic 25,000 km/yr
Investment cost	1	truck	260,000	13,684	0.88	228,800	12,042.1						
Economic life	10	year											
Depreciation	10%	year	26,000	1,368	0.88	22,880	1,204.2						
Operating cost		km/yr											
Fuel consumption ***(diesel)***	20	lt/100 km	13.0	0.7	0.88	11.4	0.6	2,053	2,737	3,421	1,806	2,408	3,011
Lubricant and coolant	4.5	lt/4,000 km	149	7.8	0.88	130.7	6.9	29	39	49	26	34	43
Repairs and maintenance	2.0%	year	5,200	273.7	0.95	4,940.0	260.0	273.7	364.9	456.1	260	260	260
Insurance	1	year	785	41.3	0.95	745.8	39.3	41.3	41.3	41.3	39.3	39.3	39.3
Operating cost		$/km						0.16	0.16	0.16	0.14	0.14	0.13
		VND/km						3,036.1	3,023.0	3,015.2	2,699.7	2,605.0	2,548.1
Depreciation cost		$/km						0.091	0.068	0.055	0.080	0.060	0.048
		VND/km						1,733.3	1,300.0	1,040.0	1,525.3	1,144.0	915.2
Vehicle Operating Cost (VOC)		$/km						0.251	0.228	0.213	0.222	0.197	0.182
		VND/km						4,769.5	4,323.0	4,055.2	4,225.1	3,749.0	3,463.3

Trucks (2,000-3,500cc) - six-wheel diesel

	Rate	Unit	Financial Price VND '000s	Financial Price $	C/F	Economic Price VND '000s	Economic Price $	Financial 20,000 km/yr	Financial 25,000 km/yr	Financial 30,000 km/yr	Economic 20,000 km/yr	Economic 25,000 km/yr	Economic 30,000 km/yr
Investment cost	1	truck	400,000	21,053	0.88	352,000	18,526.3						
Economic life	10	year											
Depreciation	10%	year	40,000	2,105	0.88	35,200	1,852.6						
Operating cost		km/yr											
Fuel consumption ***(diesel)***	20	lt/100 km	13.0	0.7	0.88	11.4	0.6	2,737	3,421	4,105	2,408	3,011	3,613
Lubricant and coolant	4.5	lt/4,000 km	149	7.8	0.88	130.7	6.9	39	49	59	34	43	52
Repairs and maintenance	3.0%	year	12,000	631.6	0.95	11,400.0	600.0	631.6	789.5	947.4	600	600	600
Insurance	1	year	1,045	55.0	0.95	992.8	52.3	55.0	55.0	55.0	52.3	52.3	52.3
Operating cost		$/km						0.17	0.17	0.17	0.15	0.15	0.14
		VND/km						3,289.4	3,278.9	3,272.0	2,940.3	2,816.4	2,733.8
Depreciation cost		$/km						0.105	0.084	0.070	0.093	0.074	0.062
		VND/km						2,000.0	1,600.0	1,333.3	1,760.0	1,408.0	1,173.3
Vehicle Operating Cost (VOC)		$/km						0.278	0.257	0.242	0.247	0.222	0.206
		VND/km						5,289.4	4,878.9	4,605.3	4,700.3	4,224.4	3,907.1

Bicycles

	Rate	Unit	Financial Price VND '000s	Financial Price $	C/F	Economic Price VND '000s	Economic Price $	Financial 600 km/yr	Financial 750 km/yr	Financial 1,000 km/yr	Economic 600 km/yr	Economic 750 km/yr	Economic 1,000 km/yr
Investment cost	1	cycle	800	42	0.88	704	37.1						
Economic life	5	year											
Depreciation	20%	year	160	8	0.88	141	7.4						
Operating cost		km/yr											
Fuel consumption ***(diesel)***	0	lt/100 km	13.0	0.7	0.88	11.4	0.6	0	0	0	0	0	0
Lubricant and coolant	0	lt/4,000 km	0	0.0	0.88	0.0	0.0	0	0	0	0	0	0
Repairs and maintenance	3.0%	year	24	1.3	0.95	22.8	1.2	1.3	1.6	2.1	1	1	1
Insurance	0	year	0	0.0	0.95	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0
Operating cost		$/km						0.00	0.00	0.00	0.00	0.00	0.00
		VND/km						40.0	40.0	40.0	38.0	30.4	22.8
Depreciation cost		$/km						0.014	0.011	0.008	0.012	0.010	0.007
		VND/km						266.7	213.3	160.0	234.7	187.7	140.8
Vehicle Operating Cost (VOC)		$/km						0.016	0.013	0.011	0.014	0.011	0.009
		VND/km						306.7	253.3	200.0	272.7	218.1	163.6

Summary

	Capital Cost	Assumed Annual Utilization	Vehicle Operating Costs: Without Project	Vehicle Operating Costs: With Project	Vehicle Operating Costs: Incremental Savings
	VND million	Kms	VND/km	VND/km	VND/km
Motor Cycle (100 ccs)	9.6	15,000	1,237	742	495
Tractor (1,000-1,500cc) - diesel	92.0	1,500	14,864	11,891	2,973
Car (1,000-2,300cc) - petrol	260.0	10,000	7,885	3,943	3,943
Bus (1500-2000cc) - diesel	160.0	15,000	4,668	2,801	1,867
Trucks (1,500-2,500cc) - four-wheel diesel	260.0	20,000	6,248	3,749	2,499
Trucks (2,000-3,500cc) - six-wheel diesel	400.0	25,000	6,035	4,224	1,810
Bicycles	0.8	750	273	218	55

Table 6: Vehicle Operating Cost Savings With the Road Rehabilitation: Tan Son Irrigation-Road Subproject
Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

(2013 Constant Viet Nam Dong)

A: Weighted Per Vehicle VOC Derivation With and Without the Road Rahabilitation

	Without Rehabilitation				Projected With Rehabilitation				Projected Diverted Traffic		
Traffic Types	**Traffic**	**Percent**	**VOC**	**Weighted Average[/a] VOC saving**	**Traffic Count**	**Percent**	**VOC**	**Weighted Average[/a] VOC saving**	**Traffic**	**Percent**	**Weighted Average[b/] VOC saving**
	veh/day		VND	VND	veh/day		VND	VND	veh/day		VND
Motorized											
Motorcycle	80	16.8%	1,237	83	300	29.9%	742	148	600	82.2%	610
Tractors	20	4.2%	14,864	125	40	4.0%	11,891	118	0	0.0%	0
Motor Car	5	1.1%	7,885	42	20	2.0%	3,943	78	100	13.7%	540
Buses	0	0.0%	4,668	0	5	0.5%	2,801	9	0	0.0%	0
Truck - 4 wheel	20	4.2%	6,248	105	40	4.0%	3,749	99	30	4.1%	154
Truck - 6 wheel	0	0.0%	6,035	0	200	19.9%	4,224	360	0	0.0%	0
Non Motorized											
Bicycle	350	73.7%	273	40	400	39.8%	218	22	0	0.0%	0
Total	475	100.0%		395	1005	100.0%		835	730	100%	1,304

a/ The weighted average is the difference in VOC (Without minus With the project) times the percent of the traffic count for each vehicle type.
b/ For projected diverted traffic the weighted average VOC is based on With Rehabilitation VOC figures.

B: Economic Annual VOC Savings with the Road Rehabilitation

		Projected	Economic	Economic	Diverted	Projected	Economic	Economic	Economic
Year	**Road Km**	**Road Area Traffic**	**VOC Savings/km**	**Annual VOC Savings**	**Traffic km Saved**	**Diverted Traffic**	**VOC Savings/km**	**Annual VOC Savings**	**Total Annual VOC Savings**
		4%	VND /km	mill VND/yr	km	veh/day	VND /km	mill VND/yr	mill VND/yr
1 2015	4.0	888	0	0	0	0	0	0	0
2 2016	8.0	962	395	1,111	15	730	1,304	5,212	6,322
3 2017	9.8	962	615	2,117	15	730	1,304	5,212	7,329
4 2018	9.8	1,005	835	3,002	15	759	1,304	5,420	8,423
5 2019	9.8	1,045	835	3,123	15	790	1,304	5,637	8,760
6 2020	9.8	1,087	835	3,247	15	821	1,304	5,863	9,110
7 2021	9.8	1,130	835	3,377	15	854	1,304	6,097	9,474
8 2022	9.8	1,176	835	3,512	15	888	1,304	6,341	9,853
9 2023	9.8	1,223	835	3,653	15	924	1,304	6,595	10,247
10 2024	9.8	1,272	835	3,799	15	961	1,304	6,858	10,657
11 2025	9.8	1,323	835	3,951	15	999	1,304	7,133	11,084
12 2026	9.8	1,375	835	4,109	15	1,039	1,304	7,418	11,527
13 2027	9.8	1,430	835	4,273	15	1,081	1,304	7,715	11,988
14 2028	9.8	1,488	835	4,444	15	1,124	1,304	8,023	12,468
15 2029	9.8	1,547	835	4,622	15	1,169	1,304	8,344	12,966
16 2030	9.8	1,609	835	4,807	15	1,216	1,304	8,678	13,485
17 2031	9.8	1,673	835	4,999	15	1,264	1,304	9,025	14,024
18 2032	9.8	1,740	835	5,199	15	1,315	1,304	9,386	14,585
19 2033	9.8	1,810	835	5,407	15	1,367	1,304	9,762	15,169
20 2034	9.8	1,882	835	5,623	15	1,422	1,304	10,152	15,776

Table 7 : Command Area Land Use With and Without the Project: Tan Son Irrigation-Road Subproject

Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	…	2034
sub-project year				1	2	3	4	5	6	7	8	9	10		20
Without Project[a/]															
Spring Season															
Well irrigated	ha	200	194	188	183	177	172	167	162	157	152	147	143		105
Irregularly irrigated	ha	240	233	226	219	212	206	200	194	188	182	177	172		127
Unirrigated	ha	460	473	486	498	510	522	533	544	555	565	576	585		668
Total Spring cropped area	ha	900	900	900	900	900	900	900	900	900	900	900	900		900
Autumn Season															
Well irrigated	ha	300	291	282	274	266	258	250	242	235	228	221	215		158
Irregularly irrigated	ha	240	233	226	219	212	206	200	194	188	182	177	172		127
Unirrigated	ha	360	376	392	407	422	436	450	464	477	489	502	514		615
Total Autumn cropped area	ha	900	900	900	900	900	900	900	900	900	900	900	900		900
Winter Season															
More reliably irrigated	ha	300	291	282	274	266	258	250	242	235	228	221	215		158
Less reliably irrigated	ha	50	49	47	46	44	43	42	40	39	38	37	36		26
Unirrigated	ha	550	561	571	581	590	599	608	617	626	634	642	650		715
Total Winter cropped area	ha	900	900	900	900	900	900	900	900	900	900	900	900		900
Fish ponds	ha	7	6	6	6	6	6	5	5	5	5	5	5		3
With Project[b/c/d/]															
Spring Season															
Well irrigated	ha	200	194	165	140	430	720	720	720	720	720	720	720		720
Irregularly irrigated	ha	240	233	198	168	174	180	180	180	180	180	180	180		180
Unirrigated	ha	460	473	537	592	296	0	0	0	0	0	0	0		0
Total Spring cropped area	ha	900	900	900	900	900	900	900	900	900	900	900	900		900
Autumn Season															
Well irrigated	ha	300	291	247	210	465	720	720	720	720	720	720	720		720
Irregularly irrigated	ha	240	233	198	168	174	180	180	180	180	180	180	180		180
Unirrigated	ha	360	376	455	522	261	0	0	0	0	0	0	0		0
Total Spring area	ha	900	900	900	900	900	900	900	900	900	900	900	900		900
Winter Season															
Well irrigated	ha	300	291	247	210	150	90	90	90	90	90	90	90		90
Irregularly irrigated	ha	50	49	41	35	63	90	90	90	90	90	90	90		90
Unirrigated	ha	550	561	611	655	687	720	720	720	720	720	720	720		720
Total Winter cropped area	ha	900	900	900	900	900	900	900	900	900	900	900	900		900
Fish Ponds	ha	7	6	5	5	9	14	14	14	14	14	14	14		14

a/ Without Project irrigated area deteriorates at a rate of:	3.0%
b/ With Project Command Area is assumed to be ha:	900
c/ Construction is in 2013 and 2014 --- causing, during construction, a loss of irrigated coverage of:	15%
d/ System is assumed to be operational in 2015 with irrigation coverage maximized by 2016. Partial benefits in 2015.	
e/ In most systems tail areas get poorer water supplies than upstream areas. Assumed percent less reliably irrigated:	20%
f/ Winter season With-Project reliable irrigation percent:	10%
Winter season With-Project unreliable irrigation percent:	10%

Table 8: Crop Pattern With and Without Project: Tan Son Irrigation-Road Subproject

Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	…	2034
sub-project year				1	2	3	4	5	6	7	8	9	10		20
Without Project															
Spring Season															
Paddy: Well Irrigated	ha	180	175	169	164	159	155	150	145	141	137	133	129		95
Paddy: Irregularly Irrigated	ha	216	210	203	197	191	185	180	175	169	164	159	155		114
Coffee: Irrigated	ha	44	43	41	40	39	38	37	36	34	33	32	31		23
Maize: Unirrigated[a/]	ha	230	237	243	249	255	261	267	272	278	283	288	293		334
Fallow	ha	230	237	243	249	255	261	267	272	278	283	288	293		334
Total Spring area	ha	900	900	900	900	900	900	900	900	900	900	900	900		900
Autumn Season															
Paddy: Well Irrigated	ha	300	291	282	274	266	258	250	242	235	228	221	215		158
Paddy: Irregularly Irrigated	ha	240	233	226	219	212	206	200	194	188	182	177	172		127
Paddy: Unirrigated	ha	288	301	314	326	338	349	360	371	381	392	401	411		492
Maize: Unirrigated[a/]	ha	72	75	78	81	84	87	90	93	95	98	100	103		123
Total Autumn area	ha	900	900	900	900	900	900	900	900	900	900	900	900		900
Winter Season															
Potatoes	ha	340	330	320	310	301	292	283	275	266	258	251	243		179
Watermelon	ha	60	58	56	55	53	52	50	48	47	46	44	43		32
Total Winter area	ha	400	388	376	365	354	343	333	323	313	304	295	286		211
Fish Ponds[b/]	ha	7	6	6	6	6	6	5	5	5	5	5	5		3
With Project[c/]															
Spring Season															
Paddy: Well Irrigated	ha	180	175	148	126	387	648	648	648	648	648	648	648		648
Paddy: Irregularly Irrigated	ha	216	210	178	151	157	162	162	162	162	162	162	162		162
Coffee: Irrigated	ha	44	43	36	31	60	90	90	90	90	90	90	90		90
Maize: Unirrigated[a/]	ha	230	237	269	296	148	0	0	0	0	0	0	0		0
Fallow	ha	230	237	269	296	148	0	0	0	0	0	0	0		0
Total Spring area	ha	900	900	900	900	900	900	900	900	900	900	900	900		900
Autumn Season															
Paddy: Well Irrigated	ha	300	291	247	210	465	720	720	720	720	720	720	720		720
Paddy: Irregularly Irrigated	ha	240	233	198	168	174	180	180	180	180	180	180	180		180
Paddy: Unirrigated	ha	368	379	430	473	237	0	0	0	0	0	0	0		0
Maize: Unirrigated[a/]	ha	92	95	107	118	59	0	0	0	0	0	0	0		0
Total Autumn area	ha	1,000	997	982	970	935	900	900	900	900	900	900	900		900
Winter Season															
Potatoes	ha	340	330	280	238	200	162	162	162	162	162	162	162		162
Watermelon	ha	10	10	8	7	13	18	18	18	18	18	18	18		18
Total Winter area	ha	350	340	289	245	213	180	180	180	180	180	180	180		180
Fish Ponds[b/]	ha	7	6	5	5	9	14	14	14	14	14	14	14		14

a/ While maize is not the only non-irrigated crop that people grow, it is used here as a proxy for all non-irrigated crops grown.

b/ Most households with access to water have fish ponds --- primarily for home consumption. As the effectively irrigated area increases (with the project), the number of households able to have fishponds will also increase.

c/ During the two years of construction it is assumed that there will be some decrease in the area irrigated. Following construction it is assumed that full irrigation coverage will be attained over a two year period.

Table 9: Crop Yields per ha With and Without Project: Tan Son Irrigation-Road Subproject

Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	…	2034
sub-project year				1	2	3	4	5	6	7	8	9	10		20
Without Project[a/]															
Spring Season															
Paddy: Well Irrigated	t/ha	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4		5.4
Paddy: Irregularly Irrigated	t/ha	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5
Coffee: Irrigated	t/ha	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0
Maize: Unirrigated	t/ha	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0
Autumn Season															
Paddy: Well Irrigated	t/ha	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5
Paddy: Irregularly Irrigated	t/ha	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0
Paddy: Unirrigated	t/ha	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8		1.8
Maize: Unirrigated	t/ha	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0
Winter Season															
Potatoes	t/ha	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3		8.3
Watermelon	t/ha	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0		40.0
Fish	t/ha	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0
With Project															
Spring Season															
Paddy: Well Irrigated	t/ha	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4		5.4
Paddy: Irregularly Irrigated	t/ha	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5
Coffee: Irrigated	t/ha	2.0	2.0	2.0	2.0	4.3	6.5	8.8	11.0	11.0	11.0	11.0	11.0		11.0
Maize: Unirrigated	t/ha	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0
Autumn Season															
Paddy: Well Irrigated	t/ha	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5
Paddy: Irregularly Irrigated	t/ha	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0
Paddy: Unirrigated	t/ha	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8		1.8
Maize: Unirrigated	t/ha	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0
Winter Season															
Potatoes	t/ha	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3		8.3
Watermelon	t/ha	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0		40.0
Fish	t/ha	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0

a/ Yields were mostly derived from the district DARD and District Extension offices --- supplemented by interviews with local farmers.

Table 10: Crop Production With and Without the Project: Tan Son Irrigation-Road Subproject

Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	…	2034
sub-project year				1	2	3	4	5	6	7	8	9	10		20
Without Project[a/]															
Spring Season															
Paddy: Well Irrigated	t	972	943	915	887	861	835	810	785	762	739	717	695		513
Paddy: Irregularly Irrigated	t	540	524	508	493	478	464	450	436	423	411	398	386		285
Coffee: Irrigated	t	88	85	83	80	78	76	73	71	69	67	65	63		46
Maize: Unirrigated	t	690	710	729	748	766	783	800	817	833	848	863	878		1,002
Autumn Season															
Paddy: Well Irrigated	t	1,350	1,310	1,270	1,232	1,195	1,159	1,125	1,091	1,058	1,026	996	966		712
Paddy: Irregularly Irrigated	t	960	931	903	876	850	824	800	776	752	730	708	687		506
Paddy: Unirrigated	t	518	542	564	586	608	628	648	668	687	705	723	740		886
Maize: Unirrigated	t	216	226	235	244	253	262	270	278	286	294	301	308		369
Winter Season															
Potatoes	t	2,822	2,737	2,655	2,576	2,498	2,423	2,351	2,280	2,212	2,145	2,081	2,019		1,489
Watermelon	t	2,400	2,328	2,258	2,190	2,125	2,061	1,999	1,939	1,881	1,825	1,770	1,717		1,266
Fish	t	33	32	31	30	29	28	27	27	26	25	24	24		17
With Project															
Spring Season															
Paddy: Well Irrigated	t	972	943	801	681	2,090	3,499	3,499	3,499	3,499	3,499	3,499	3,499		3,499
Paddy: Irregularly Irrigated	t	540	524	445	378	392	405	405	405	405	405	405	405		405
Coffee: Irrigated	t	88	85	73	62	257	585	788	990	990	990	990	990		990
Maize: Unirrigated	t	690	710	806	887	444	0	0	0	0	0	0	0		0
Autumn Season															
Paddy: Well Irrigated	t	1,350	1,310	1,113	946	2,093	3,240	3,240	3,240	3,240	3,240	3,240	3,240		3,240
Paddy: Irregularly Irrigated	t	960	931	792	673	696	720	720	720	720	720	720	720		720
Paddy: Unirrigated	t	662	681	774	852	426	0	0	0	0	0	0	0		0
Maize: Unirrigated	t	276	284	322	355	177	0	0	0	0	0	0	0		0
Winter Season															
Potatoes	t	2,822	2,737	2,327	1,978	1,661	1,345	1,345	1,345	1,345	1,345	1,345	1,345		1,345
Watermelon	t	400	388	330	280	500	720	720	720	720	720	720	720		720
Fish	t	33	32	27	23	45	68	68	68	68	68	68	68		68

Table 11: Incremental Crop Production: Tan Son Irrigation-Road Subproject

Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	…	2034
sub-project year				1	2	3	4	5	6	7	8	9	10		20
Over-all Incremental Crop Production															
Rice															
Spring Paddy: Well Irrigated	t	0	0	(113)	(206)	1,230	2,665	2,690	2,714	2,737	2,760	2,782	2,804		2,986
Spring Paddy: Irregularly Irrigated	t	0	0	(63)	(114)	(86)	(59)	(45)	(31)	(18)	(6)	7	19		120
Autumn Paddy: Well Irrigated	t	0	0	(157)	(286)	898	2,081	2,115	2,149	2,182	2,214	2,244	2,274		2,528
Autumn Paddy: Irregularly Irrigated	t	0	0	(112)	(203)	(153)	(104)	(80)	(56)	(32)	(10)	12	33		214
Autumn Paddy: Unirrigated	t	144	140	209	266	(182)	(628)	(648)	(668)	(687)	(705)	(723)	(740)		(886)
Total Paddy	t	144	140	(236)	(544)	1,706	3,954	4,032	4,108	4,182	4,254	4,323	4,391		4,962
Maize															
Spring Maize: Unirrigated	t	0	0	77	140	(322)	(783)	(800)	(817)	(833)	(848)	(863)	(878)		(1,002)
Autumn Maize: Unirrigated	t	60	58	87	111	(76)	(262)	(270)	(278)	(286)	(294)	(301)	(308)		(369)
Total Maize	t	60	58	164	251	(398)	(1,045)	(1,070)	(1,095)	(1,119)	(1,142)	(1,164)	(1,186)		(1,371)
Coffee	t	0	0	(10)	(19)	179	509	714	919	921	923	925	927		944
Potato	t	0	0	(328)	(598)	(837)	(1,079)	(1,006)	(936)	(867)	(801)	(736)	(674)		(144)
Watermellon	t	(2,000)	(1,940)	(1,928)	(1,910)	(1,625)	(1,341)	(1,279)	(1,219)	(1,161)	(1,105)	(1,050)	(997)		(546)
Fish	t	0	0	(4)	(7)	16	39	40	41	42	42	43	44		50
Incremental Crop Production per Household															
Number of Households[a/]	1,200														
Rice	kg/hh	120.0	116.4	(196.4)	(453.4)	1,421.8	3,294.9	3,360.3	3,423.6	3,485.1	3,544.8	3,602.7	3,658.8		4,135.3
Maize	kg/hh	50.0	48.5	136.7	208.8	(331.4)	(870.8)	(892.0)	(912.5)	(932.3)	(951.6)	(970.3)	(988.5)		(1,142.5)
Coffee	kg/hh	0.0	0.0	(8.5)	(15.5)	149.1	424.5	595.2	765.7	767.5	769.2	770.9	772.5		786.3
Potato	kg/hh	0.0	0.0	(273.7)	(498.2)	(697.6)	(899.0)	(838.4)	(779.6)	(722.6)	(667.3)	(613.7)	(561.7)		(120.0)
Watermelon	kg/hh	(1,666.7)	(1,616.7)	(1,607.0)	(1,591.7)	(1,353.8)	(1,117.5)	(1,065.9)	(1,016.0)	(967.5)	(920.5)	(874.8)	(830.6)		(455.0)
Fish	kg/hh	0.0	0.0	(3.2)	(5.8)	13.4	32.6	33.3	34.0	34.7	35.3	36.0	36.6		41.7

a/ Figures in this table are hh averages only. For a given location within the command area (CA) households will benefit in proportion to the amount of land in the CA that they have. In addition, hhs with irrigation water Without the Project will have less of an increment than hhs (Without the Project) that have no irrigation water. Also, not all households grow the same proportionate mix of crops.

Table 12: Economic Total Crop Production Value With and Without the Project: Tan Son Irrigation-Road Subproject
Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

(2013 Constant Viet Nam Dong)		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	…	2034
sub-project year				1	2	3	4	5	6	7	8	9	10		20
Without Project Total Production Value															
Rice															
Spring Paddy: Well Irrigated	billion VND	7.35	6.68	6.33	5.55	5.24	4.97	4.71	4.45	4.19	4.07	3.95	3.83		2.50
Spring Paddy: Irregularly Irrigated	billion VND	4.08	3.71	3.51	3.08	2.91	2.76	2.61	2.47	2.33	2.26	2.19	2.13		1.39
Autumn Paddy: Well Irrigated	billion VND	10.20	9.28	8.79	7.70	7.28	6.90	6.54	6.19	5.83	5.65	5.48	5.32		3.47
Autumn Paddy: Irregularly Irrigated	billion VND	7.25	6.60	6.25	5.48	5.18	4.91	4.65	4.40	4.14	4.02	3.90	3.78		2.47
Autumn Paddy: Unirrigated	billion VND	3.92	3.84	3.90	3.67	3.70	3.74	3.77	3.79	3.78	3.88	3.98	4.07		4.32
Total Paddy	billion VND	32.80	30.10	28.78	25.47	24.32	23.28	22.27	21.30	20.27	19.88	19.50	19.13		14.15
Rice straw	billion VND	3.28	3.01	2.88	2.55	2.43	2.33	2.23	2.13	2.03	1.99	1.95	1.91		1.41
Maize															
Spring Maize: Unirrigated	billion VND	2.80	3.11	2.96	2.80	2.81	2.81	2.82	2.82	2.82	2.88	2.93	2.98		3.06
Autumn Maize: Unirrigated	billion VND	0.88	0.99	0.95	0.92	0.93	0.94	0.95	0.96	0.97	1.00	1.02	1.04		1.13
Total Maize	billion VND	3.68	4.10	3.91	3.72	3.74	3.75	3.78	3.78	3.79	3.87	3.95	4.02		4.18
Coffee	billion VND	0.53	0.47	0.45	0.40	0.38	0.36	0.35	0.33	0.31	0.30	0.29	0.28		0.20
Potato	billion VND	7.62	7.39	7.17	6.95	6.75	6.54	6.35	6.16	5.97	5.79	5.62	5.45		4.02
Watermelon	billion VND	6.48	6.29	6.10	5.91	5.74	5.56	5.40	5.24	5.08	4.93	4.78	4.64		3.42
Fish	billion VND	0.45	0.43	0.42	0.41	0.39	0.38	0.37	0.36	0.35	0.34	0.33	0.32		0.23
Total Without Project Value	billion VND	54.83	51.78	49.70	45.41	43.75	42.21	40.74	39.29	37.81	37.10	36.41	35.75		27.62
With Project Total Production Value[a/]															
Rice															
Spring Paddy: Well Irrigated	billion VND	7.35	6.68	5.54	4.26	12.74	20.83	20.34	19.85	19.27	19.27	19.27	19.27		17.06
Spring Paddy: Irregularly Irrigated	billion VND	4.08	3.71	3.08	2.37	2.39	2.41	2.35	2.30	2.23	2.23	2.23	2.23		1.97
Autumn Paddy: Well Irrigated	billion VND	10.20	9.28	7.70	5.92	12.75	19.29	18.83	18.38	17.84	17.84	17.84	17.84		15.80
Autumn Paddy: Irregularly Irrigated	billion VND	7.25	6.60	5.48	4.21	4.24	4.29	4.19	4.08	3.96	3.96	3.96	3.96		3.51
Autumn Paddy: Unirrigated	billion VND	5.01	4.83	5.35	5.33	2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
Total Paddy	billion VND	33.89	31.09	27.15	22.07	34.72	46.82	45.71	44.61	43.30	43.30	43.30	43.30		38.34
Rice straw	billion VND	3.39	3.11	2.72	2.21	3.47	4.68	4.57	4.46	4.33	4.33	4.33	4.33		3.83
Maize															
Spring Maize: Unirrigated	billion VND	2.80	3.11	3.27	3.32	1.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
Autumn Maize: Unirrigated	billion VND	1.12	1.24	1.31	1.33	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
Total Maize	billion VND	3.92	4.35	4.58	4.65	2.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
Coffee	billion VND	0.53	0.47	0.39	0.31	1.26	2.82	3.72	4.57	4.48	4.48	4.48	4.48		4.37
Potato	billion VND	7.62	7.39	6.28	5.34	4.49	3.63	3.63	3.63	3.63	3.63	3.63	3.63		3.63
Watermelon	billion VND	1.08	1.05	0.89	0.76	1.35	1.94	1.94	1.94	1.94	1.94	1.94	1.94		1.94
Fish	billion VND	0.45	0.43	0.37	0.31	0.61	0.91	0.91	0.91	0.91	0.91	0.91	0.91		0.91
Total With Project Value	billion VND	50.87	47.89	42.37	35.65	48.18	60.80	60.49	60.13	58.59	58.59	58.59	58.59		53.03
Incremental Economic Crop Production Value															
Rice	billion VND	1.20	1.09	(1.79)	(3.74)	11.44	25.89	25.78	25.63	25.33	25.76	26.18	26.59		26.61
Maize	billion VND	0.24	0.25	0.67	0.94	(1.46)	(3.75)	(3.78)	(3.78)	(3.79)	(3.87)	(3.95)	(4.02)		(4.18)
Coffee	billion VND	0.00	0.00	(0.06)	(0.09)	0.88	2.45	3.37	4.25	4.16	4.17	4.18	4.19		4.16
Potato	billion VND	0.00	0.00	(0.89)	(1.61)	(2.26)	(2.91)	(2.72)	(2.53)	(2.34)	(2.16)	(1.99)	(1.82)		(0.39)
Watermelon	billion VND	(5.40)	(5.24)	(5.21)	(5.16)	(4.39)	(3.62)	(3.45)	(3.29)	(3.13)	(2.98)	(2.83)	(2.69)		(1.47)
Fish	billion VND	0.00	0.00	(0.05)	(0.09)	0.22	0.53	0.54	0.55	0.56	0.57	0.58	0.59		0.68
Total	billion VND	(3.96)	(3.89)	(7.33)	(9.76)	4.43	18.59	19.75	20.83	20.79	21.49	22.18	22.84		25.41
U.S. $ Equivalent	million $	(0.19)	(0.19)	(0.35)	(0.46)	0.21	0.89	0.94	0.99	0.99	1.02	1.06	1.09		1.21

a/ As the area irrigated during construction will be less than normal, there will be a decrease in irrigated crop production during that period.

Table 13: Physical Inputs for Major Crops Without & With the Project: Tan Son Irrigation-Road Subproject

Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

(2013 Constant Viet Nam Dong) Notes: Amounts in VND in this table are in financial terms. In crop models, they are converted into economic terms.

Without Project

		Spring Paddy well irrigated	Spring Paddy not well irrigated	Autumn Paddy well irrigated	Autumn Paddy not well irrigated	Rainfed Paddy	Spring Maize	Autumn Maize	Coffee	Potato	Water-melon	Fish
Inputs												
	amount/ha											
Seed	kg	28	28	28	28	35	28	28		1,100	10	
	'000 VND								3,500			
Fert	'000 VND											
Urea	kg	250	200	250	200	50	220	220	650	332	220	
K	kg	70	70	70	70	60			500			
Super P	kg	300	150	300	150		230	230	700	300	200	
Herbicide/Pesticides	'000 VND	600	450	600	450	400	300	300	1,000	280		
Tractor hire	'000 VND	1,940	1,940	1,940	1,940	1,940	1,200	1,200	1,940	1,940	1,940	
Labor	person-days	120	120	120	120	90	80	80	300	152	140	40
Fingerlings	number											20,000
Processing costs	'000 VND	700	700	700	700	350			1,000			

With Project

		Spring Paddy well irrigated	Spring Paddy not well irrigated	Autumn Paddy well irrigated	Autumn Paddy not well irrigated	Rainfed Paddy	Spring Maize	Autumn Maize	Coffee	Potato	Water-melon	Fish
Inputs												
	amount/ha											
Seed	kg	28	28	28	28	35	28	28		1,100	10	
	'000 VND								3,500			
Fert	'000 VND											
Urea	kg	300	200	300	200	50	220	220	650	332	220	
K	kg	80	70	80	70	60			500			
Super P	kg	320	150	320	150		230	230	700	300	200	
Herbicide/Pesticides	'000 VND	600	450	600	450	400	300	300	1,000	280		
Tractor hire	'000 VND	1,940	1,940	1,940	1,940	1,940	1,200	1,200	1,940	1,940	1,940	
Labor	person-days	120	120	120	120	90	80	80	300	152	140	40
Fingerlings	number											20,000
Processing costs	'000 VND	700	700	700	700	350			1,000			

Table 14: Total Crop Economic Costs With and Without the Project: Tan Son Irrigation-Road Subproject
Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

(2013 Constant Viet Nam Dong)		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	…	2034
sub-project year				1	2	3	4	5	6	7	8	9	10		20
Without Project Total Crop Production Cost															
Rice															
Spring Paddy: Well Irrigated	billion VND	3.07	2.94	2.81	2.71	2.61	2.51	2.42	2.33	2.26	2.19	2.12	2.06		1.47
Spring Paddy: Irregularly Irrigated	billion VND	3.22	3.09	2.96	2.86	2.76	2.66	2.57	2.48	2.40	2.33	2.26	2.19		1.58
Autumn Paddy: Well Irrigated	billion VND	5.12	4.90	4.69	4.51	4.34	4.18	4.03	3.88	3.76	3.65	3.54	3.43		2.44
Autumn Paddy: Irregularly Irrigated	billion VND	3.57	3.43	3.29	3.18	3.06	2.96	2.85	2.75	2.67	2.59	2.51	2.44		1.75
Autumn Paddy: Unirrigated	billion VND	2.65	2.76	2.87	2.98	3.08	3.18	3.28	3.37	3.47	3.56	3.65	3.74		4.45
Total Paddy	billion VND	17.63	17.12	16.63	16.23	15.85	15.49	15.14	14.80	14.56	14.31	14.08	13.86		11.69
Maize															
Spring Maize: Unirrigated	billion VND	2.82	2.86	2.89	2.94	2.98	3.02	3.06	3.10	3.16	3.22	3.28	3.33		3.66
Autumn Maize: Unirrigated	billion VND	0.88	0.91	0.93	0.96	0.99	1.01	1.03	1.06	1.09	1.11	1.14	1.17		1.35
Total Maize	billion VND	3.71	3.77	3.82	3.90	3.97	4.04	4.10	4.16	4.25	4.33	4.42	4.50		5.00
Coffee	billion VND	1.59	1.53	1.47	1.42	1.37	1.32	1.28	1.23	1.20	1.16	1.13	1.09		0.79
Potato	billion VND	6.99	6.69	6.41	6.17	5.94	5.72	5.51	5.30	5.14	4.99	4.84	4.70		3.35
Watermelon	billion VND	0.90	0.86	0.83	0.80	0.77	0.74	0.71	0.69	0.67	0.65	0.63	0.61		0.44
Fish	billion VND	0.10	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07		0.05
Total Without Project Value	billion VND	30.92	30.06	29.25	28.60	27.98	27.39	26.82	26.26	25.89	25.52	25.17	24.82		21.33
With Project Total Crop Production Cost[a]															
Rice															
Spring Paddy: Well Irrigated	billion VND	3.07	2.94	2.47	2.08	6.58	10.93	10.85	10.76	10.76	10.76	10.76	10.76		10.36
Spring Paddy: Irregularly Irrigated	billion VND	3.22	3.09	2.60	2.20	2.29	2.36	2.34	2.33	2.33	2.33	2.33	2.33		2.28
Autumn Paddy: Well Irrigated	billion VND	5.12	4.90	4.11	3.46	8.15	12.51	12.42	12.32	12.32	12.32	12.32	12.32		11.88
Autumn Paddy: Irregularly Irrigated	billion VND	3.57	3.43	2.89	2.44	2.51	2.58	2.57	2.55	2.55	2.55	2.55	2.55		2.49
Autumn Paddy: Unirrigated	billion VND	3.39	3.47	3.93	4.32	2.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
Total Paddy	billion VND	18.37	17.83	15.99	14.50	21.69	28.39	28.17	27.96	27.96	27.96	27.96	27.96		27.01
Maize															
Spring Maize: Unirrigated	billion VND	2.82	2.86	3.20	3.49	1.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
Autumn Maize: Unirrigated	billion VND	1.13	1.14	1.28	1.39	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
Total Maize	billion VND	3.95	4.00	4.47	4.88	2.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
Coffee	billion VND	1.59	1.53	1.29	1.09	2.12	3.15	3.14	3.13	3.13	3.13	3.13	3.13		3.07
Potato	billion VND	6.99	6.69	5.61	4.73	3.95	3.17	3.15	3.13	3.13	3.13	3.13	3.13		3.03
Watermelon	billion VND	0.15	0.14	0.12	0.10	0.18	0.26	0.26	0.26	0.26	0.26	0.26	0.26		0.25
Fish	billion VND	0.10	0.09	0.08	0.07	0.13	0.19	0.19	0.19	0.19	0.19	0.19	0.19		0.19
Total With Project Value	billion VND	31.15	30.29	27.56	25.38	30.49	35.16	34.91	34.67	34.66	34.66	34.66	34.66		33.55
Incremental Economic Crop Production Costs															
Rice	billion VND	0.74	0.71	(0.64)	(1.73)	5.84	12.90	13.03	13.16	13.41	13.65	13.88	14.10		15.32
Maize	billion VND	0.25	0.23	0.65	0.98	(1.55)	(4.04)	(4.10)	(4.16)	(4.25)	(4.33)	(4.42)	(4.50)		(5.00)
Coffee	billion VND	0.00	0.00	(0.18)	(0.33)	0.75	1.83	1.86	1.89	1.93	1.96	2.00	2.03		2.28
Potato	billion VND	0.00	0.00	(0.79)	(1.43)	(1.99)	(2.55)	(2.36)	(2.18)	(2.02)	(1.86)	(1.71)	(1.57)		(0.32)
Watermelon	billion VND	(0.75)	(0.72)	(0.71)	(0.70)	(0.59)	(0.48)	(0.46)	(0.43)	(0.41)	(0.39)	(0.37)	(0.35)		(0.19)
Fish	billion VND	0.00	0.00	(0.01)	(0.02)	0.05	0.11	0.12	0.12	0.12	0.12	0.12	0.13		0.14
Total	billion VND	**0.23**	**0.23**	**(1.68)**	**(3.22)**	**2.52**	**7.78**	**8.10**	**8.40**	**8.78**	**9.14**	**9.50**	**9.84**		**12.22**
U.S. dollar equivalent	million $	0.01	0.01	(0.08)	(0.15)	0.12	0.37	0.39	0.40	0.42	0.44	0.45	0.47		0.58

a/ As the area irrigated during construction will be less than normal, there will be a decrease in irrigated crop production during that period.

Table 15: Incremental Crop Labor: Tan Son Irrigation-Road Subproject
Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

(2013 Constant Viet Nam Dong)		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	…	2034
sub-project year				1	2	3	4	5	6	7	8	9	10		20
Without Project Crop Labor Days															
Spring Paddy: Well Irrigated	person days	21,600	20,952	20,323	19,714	19,122	18,549	17,992	17,452	16,929	16,421	15,928	15,451		11,394
Spring Paddy: Irregularly Irrigated	person days	25,920	25,142	24,388	23,656	22,947	22,258	21,591	20,943	20,315	19,705	19,114	18,541		13,672
Autumn Paddy: Well Irrigated	person days	36,000	34,920	33,872	32,856	31,871	30,914	29,987	29,087	28,215	27,368	26,547	25,751		18,989
Autumn Paddy: Irregularly Irrigated	person days	28,800	27,936	27,098	26,285	25,496	24,732	23,990	23,270	22,572	21,895	21,238	20,601		15,191
Autumn Paddy: Unirrigated	person days	25,920	27,086	28,218	29,315	30,380	31,412	32,414	33,386	34,328	35,242	36,129	36,989		44,292
Spring Maize Unirrigated	person days	18,400	18,928	19,440	19,937	20,419	20,886	21,340	21,780	22,206	22,620	23,021	23,411		26,716
Autumn Maize Unirrigated	person days	5,760	6,019	6,271	6,515	6,751	6,981	7,203	7,419	7,628	7,832	8,029	8,220		9,843
Coffee	person days	13,200	12,804	12,420	12,047	11,686	11,335	10,995	10,665	10,345	10,035	9,734	9,442		6,963
Potato	person days	51,680	50,130	48,626	47,167	45,752	44,379	43,048	41,757	40,504	39,289	38,110	36,967		27,260
Watermelon	person days	8,400	8,148	7,904	7,666	7,436	7,213	6,997	6,787	6,583	6,386	6,194	6,009		4,431
Fish	person days	264	256	248	241	234	227	220	213	207	201	195	189		139
Total Without Project Labor	person days	235,944	232,322	228,808	225,400	222,094	218,887	215,776	212,759	209,832	206,993	204,240	201,568		178,890
With Project Crop Labor Days															
Spring Paddy: Well Irrigated	person days	21,600	20,952	17,809	15,138	46,449	77,760	77,760	77,760	77,760	77,760	77,760	77,760		77,760
Spring Paddy: Irregularly Irrigated	person days	25,920	25,142	21,371	18,165	18,803	19,440	19,440	19,440	19,440	19,440	19,440	19,440		19,440
Autumn Paddy: Well Irrigated	person days	36,000	34,920	29,682	25,230	55,815	86,400	86,400	86,400	86,400	86,400	86,400	86,400		86,400
Autumn Paddy: Irregularly Irrigated	person days	28,800	27,936	23,746	20,184	20,892	21,600	21,600	21,600	21,600	21,600	21,600	21,600		21,600
Autumn Paddy: Unirrigated	person days	33,120	34,070	38,680	42,598	21,299	0	0	0	0	0	0	0		0
Spring Maize Unirrigated	person days	18,400	18,928	21,489	23,665	11,833	0	0	0	0	0	0	0		0
Autumn Maize Unirrigated	person days	7,360	7,571	8,596	9,466	4,733	0	0	0	0	0	0	0		0
Coffee	person days	13,200	12,804	10,883	9,251	18,125	27,000	27,000	27,000	27,000	27,000	27,000	27,000		27,000
Potato	person days	51,680	50,130	42,610	36,219	30,421	24,624	24,624	24,624	24,624	24,624	24,624	24,624		24,624
Watermelon	person days	1,400	1,358	1,154	981	1,751	2,520	2,520	2,520	2,520	2,520	2,520	2,520		2,520
Fish	person days	264	256	218	185	363	540	540	540	540	540	540	540		540
Total With Project Labor	person days	237,744	234,068	216,238	201,082	230,483	259,884	259,884	259,884	259,884	259,884	259,884	259,884		259,884
Incremental Crop Labor Days															
Spring Paddy: Well Irrigated	person days	0	0	(2,514)	(4,576)	27,327	59,211	59,768	60,308	60,831	61,339	61,832	62,309		66,366
Spring Paddy: Irregularly Irrigated	person days	0	0	(3,017)	(5,491)	(4,144)	(2,818)	(2,151)	(1,503)	(875)	(265)	326	899		5,768
Autumn Paddy: Well Irrigated	person days	0	0	(4,190)	(7,627)	23,944	55,486	56,413	57,313	58,185	59,032	59,853	60,649		67,411
Autumn Paddy: Irregularly Irrigated	person days	0	0	(3,352)	(6,101)	(4,605)	(3,132)	(2,390)	(1,670)	(972)	(295)	362	999		6,409
Autumn Paddy: Unirrigated	person days	7,200	6,984	10,462	13,283	(9,081)	(31,412)	(32,414)	(33,386)	(34,328)	(35,242)	(36,129)	(36,989)		(44,292)
Spring Maize Unirrigated	person days	0	0	2,049	3,729	(8,586)	(20,886)	(21,340)	(21,780)	(22,206)	(22,620)	(23,021)	(23,411)		(26,716)
Autumn Maize Unirrigated	person days	1,600	1,552	2,325	2,952	(2,018)	(6,981)	(7,203)	(7,419)	(7,628)	(7,832)	(8,029)	(8,220)		(9,843)
Coffee	person days	0	0	(1,536)	(2,796)	6,440	15,665	16,005	16,335	16,655	16,965	17,266	17,558		20,037
Potato	person days	0	0	(6,016)	(10,948)	(15,331)	(19,755)	(18,424)	(17,133)	(15,880)	(14,665)	(13,486)	(12,343)		(2,636)
Watermelon	person days	(7,000)	(6,790)	(6,749)	(6,685)	(5,686)	(4,693)	(4,477)	(4,267)	(4,063)	(3,866)	(3,674)	(3,489)		(1,911)
Fish	person days	0	0	(31)	(56)	129	313	320	327	333	339	345	351		401
Total Incremental Crop Labor	person days	1,800	1,746	(12,571)	(24,318)	8,389	40,997	44,108	47,125	50,052	52,891	55,644	58,316		80,994
Incremental days/hh[a/]	person days	2	1	(10)	(20)	7	34	37	39	42	44	46	49		67
Incremental value of labor inputs/hh	million VND	0.1	0.1	(0.8)	(1.5)	0.5	2.6	2.8	2.9	3.1	3.3	3.5	3.6		5.1
Incremental Labor Income[b/]	billion VND	0.14	0.13	(0.94)	(1.82)	0.63	3.07	3.31	3.53	3.75	3.97	4.17	4.37		6.07

a/ Some of the incremental days will be from family labor (to the extent that it is underemployed Without the Project) and the remainder will be in the form of hired labor.

b/ Labor income is at the average financial wage. Some of this will go to hired labor. The rest will go as a "wage" to family labor inputs --- increasing household income to the extent that that family labor would have been underutilized without the Project.

Table 16: Net Incremental Economic Crop Benefits: Tan Son Irrigation-Road Subproject

Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

(2013 Constant Viet Nam Dong)		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	…	2034
sub-project year				1	2	3	4	5	6	7	8	9	10		20
Without Proj. Net Econ Crop Benefit	billion VND	23.91	21.72	20.46	16.82	15.78	14.83	13.92	13.03	11.92	11.58	11.25	10.92		6.29
With Project Net Econ Crop Benefit	billion VND	19.72	17.60	14.81	10.28	17.69	25.64	25.58	25.46	23.93	23.93	23.93	23.93		19.48
Incremental Value of Production	billion VND	(3.96)	(3.89)	(7.33)	(9.76)	4.43	18.59	19.75	20.83	20.79	21.49	22.18	22.84		25.41
Incremental Crop Cost	billion VND	0.23	0.23	(1.68)	(3.22)	2.52	7.78	8.10	8.40	8.78	9.14	9.50	9.84		12.22
Net Incremental Crop Benefit	billion VND	**(4.19)**	**(4.12)**	**(5.65)**	**(6.54)**	**1.91**	**10.81**	**11.65**	**12.43**	**12.01**	**12.35**	**12.68**	**13.00**		**13.19**
Incremental Average Crop Benefit per Household[a/]															
Number of households involved in examined crops (field estimates	1,200														
Economic benefits/hh	million VND	(3.49)	(3.43)	(4.71)	(5.45)	1.59	9.01	9.71	10.36	10.01	10.29	10.57	10.84		10.99
Financial benefits/hh	million VND	(3.88)	(3.82)	(5.23)	(6.06)	1.77	10.01	10.79	11.51	11.12	11.44	11.74	12.04		12.21
U.S. $ equivalent/hh	$	(184.79)	(181.70)	(248.99)	(288.44)	84.30	476.67	513.73	548.07	529.54	544.60	559.20	573.37		581.52
Incremental Average Crop Benefits per Person[a/]															
Ave. number of persons/hh	4.5														
Economic benefits/person	million VND	(0.78)	(0.76)	(1.05)	(1.21)	0.35	2.00	2.16	2.30	2.22	2.29	2.35	2.41		2.44
Financial benefits/person	million VND	(0.86)	(0.85)	(1.16)	(1.35)	0.39	2.22	2.40	2.56	2.47	2.54	2.61	2.68		2.71
U.S.$ equivalent/person	$	(41.06)	(40.38)	(55.33)	(64.10)	18.73	105.93	114.16	121.79	117.68	121.02	124.27	127.41		129.23
Incremental Ave. Financial Crop Benefits for Poor Households --- assumed to be located in "without" subproject unirrigated area															
Ave. farm size per household (ha)	0.75														
Unirrigated ha 'without' net cr. ben.	billion VND	1.67	1.83	1.56	0.92	0.80	0.69	0.59	0.46	0.28	0.29	0.30	0.31		(0.47)
Same ha 'with' net crop benefit	billion VND	1.67	1.83	1.56	0.92	1.09	6.14	6.62	7.06	6.82	7.01	7.20	7.38		7.49
Same ha incremental cr. Ben	billion VND	0.00	0.00	0.00	0.00	0.28	5.45	6.03	6.60	6.54	6.73	6.90	7.08		7.96
This figure per ha	million VND	0.00	0.00	0.00	0.00	0.61	11.84	13.11	14.35	14.22	14.62	15.01	15.39		17.31
This figure per average household	million VND	0.00	0.00	0.00	0.00	0.46	8.88	9.83	10.76	10.67	10.97	11.26	11.54		12.99
% poor households among those involved in examined crops	40%														
No. of poor households among those involved in examined crops	480														
Assumed poor hh farm size (ha)	0.38														
Incremental bennefit per poor household	million VND	0.00	0.00	0.00	0.00	0.23	4.44	4.91	5.38	5.33	5.48	5.63	5.77		6.49
Total incremental benefit of the poor	billion VND	0.00	0.00	0.00	0.00	0.11	2.13	2.36	2.58	2.56	2.63	2.70	2.77		3.12
Share of poor of total incremental benefits	%			0%	0%	6%	20%	20%	21%	21%	21%	21%	21%		24%
Incremental farm labor "income" of poor on own land															
Unirrig. ha "without" labor inputs	person-days	50,080	52,034	53,929	55,767	57,550	59,279	60,957	62,584	64,163	65,694	67,179	68,620		80,850
Same ha "with" labor inputs	person-days	50,080	52,034	53,929	55,767	117,802.4	132,830	132,830	132,830	132,830	132,830	132,830	132,830		132,830
Same ha incremental labor inputs	person-days	0.00	0	0	0	60,253	73,550	71,873	70,245	68,667	67,136	65,651	64,210		51,979
This figure per ha	person-days	0.00	0.00	0.00	0.00	130.98	159.89	156.25	152.71	149.28	145.95	142.72	139.59		113.00
This figure per poor hh	person-days	0.00	0.00	0.00	0.00	49.12	59.96	58.59	57.27	55.98	54.73	53.52	52.35		42.37
Equivalent financial wage/poor hh	million VND	0.00	0.00	0.00	0.00	3.68	4.50	4.39	4.29	4.20	4.10	4.01	3.93		3.18

a/ Note that household land that gets poor or no irrigation water without the Project will generate benefits larger than these average figures while household land already receiving reliable irrigation water without the Project will generate a smaller increment in income.

Table 17: Economic Project Costs: Tan Son Irrigation-Road Subproject
Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

(2013 Constant Viet Nam Dong)

Subproject Investment Cost Estimates

Financial Costs (Irrigation)		US$	million VND
Material Costs		800,000	16,800
Labor Costs		307,000	6,447
Land Acquisition and Resettlement (LAR) Costs		0	0
Sub-Total		1,107,000	23,247
Contingencies	10%	110,700	2,325
Detailed Design and Construction Supervision	9%	109,593	2,301
Value-added Taxes	10%	132,729	2,787
Sub-total Financial Cost (Irrigation)		1,460,022	30,660

Economic Costs (Irrigation)	US$	million VND
Material Costs	720,000	15,120
Labor Costs	245,600	5,158
Land Acquisition and Resettlement (LAR) Costs	0	0
Sub-Total	965,600	20,278
Contingencies	96,560	2,028
Detailed Design and Construction Supervision	95,594	2,007
Value-added Taxes	0	0
Sub-total Economic Costs (Irrigation)	1,157,754	24,313

Financial Costs (Access Road)		US$	million VND
Material Costs		650,000	13,650
Labor Costs		173,000	3,633
Land Acquisition and Resettlement (LAR) Costs		0	0
Sub-Total		823,000	17,283
Contingencies	10%	82,300	1,728
Detailed Design and Construction Supervision	9%	81,477	1,711
Value-added Taxes	10%	98,678	2,072
Sub-total Financial Cost (Access Road)		1,085,455	22,795
Grand Total Subproject Financial Costs		**2,545,477**	**53,455**

Economic Costs (Access Road)	US$	million VND
Material Costs	585,000	12,285
Labor Costs	138,400	2,906
Land Acquisition and Resettlement (LAR) Costs	0	0
Sub-Total	723,400	15,191
Contingencies	72,340	1,519
Detailed Design and Construction Supervision	71,617	1,504
Value-added Taxes	0	0
Sub-total Economic Costs (Access Road)	867,357	18,214
Grand Total Subproject Economic Costs	**2,025,111**	**42,527**

Table 18: Economic Rate of Return: Tan Son Irrigation-Road Subproject

Unit: VND billion in 2013 Constant Prices

Year	Subproject Year	Economic Costs of Irrigation Component			Economic Costs of Access Road Component			Total Economic Costs	Economic Benefits		Total Economic Benefits	Net Economic Cash Flow
		Construction Cost	O&M Cost	Periodic Major Maintenance	Construction Cost	O&M Cost	Periodic Major Maintenance		Crop Benefits	VOC Savings Benefits		
2013												
2014												
2015	1	12.16			21.26			33.42	(5.65)	-	(5.65)	(39.07)
2016	2	12.16			21.26			33.42	(6.54)	6.32	(0.22)	(33.64)
2017	3		0.73			1.28		2.01	1.91	7.33	9.24	7.24
2018	4		0.73			1.28		2.01	10.81	8.42	19.23	17.23
2019	5		0.73			1.28		2.01	11.65	8.76	20.41	18.41
2020	6		0.73			1.28		2.01	12.43	9.11	21.54	19.54
2021	7		0.73			1.28		2.01	12.01	9.47	21.48	19.48
2022	8		0.73			1.28		2.01	12.35	9.85	22.20	20.20
2023	9		0.73			1.28		2.01	12.68	10.25	22.93	20.92
2024	10		-	7.29		-	12.76	20.05	13.00	10.66	23.66	3.61
2025	11		0.73			1.28		2.01	14.44	11.08	25.53	23.52
2026	12		0.73			1.28		2.01	10.95	11.53	22.48	20.47
2027	13		0.73			1.28		2.01	11.22	11.99	23.21	21.20
2028	14		0.73			1.28		2.01	11.48	12.47	23.95	21.94
2029	15		0.73			1.28		2.01	11.73	12.97	24.70	22.69
2030	16		0.73			1.28		2.01	11.97	13.48	25.46	23.45
2031	17		0.73			1.28		2.01	12.21	14.02	26.23	24.23
2032	18		-	7.29		-	12.76	20.05	12.44	14.59	27.02	6.97
2033	19		0.73			1.28		2.01	12.66	15.17	27.83	25.82
2034	20		0.73			1.28		2.01	13.19	15.78	28.96	26.96
							ENPV	**76.2**			**116.2**	**40.0**
											EIRR	**20.0%**

Table 19: Sensitivity Analysis: Tan Son Irrigation-Road Subproject

Viet Nam: Productive Rural Infrastructure Development Project in the Central Highlands

Sub-project Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	...	2033	2034
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	...	19	20
B E N E F I T S	(5.65)	(0.22)	9.24	19.23	20.41	21.54	21.48	22.20	22.93	23.66	25.53	22.48	23.21	23.95	24.70	25.46	26.23	27.02		27.83	28.96
Sub-project Economic Benefits from Production	(5.65)	(6.54)	1.91	10.81	11.65	12.43	12.01	12.35	12.68	13.00	14.44	10.95	11.22	11.48	11.73	11.97	12.21	12.44		12.66	13.19
Sub-project Economic Benefits from VOC	-	6.32	7.33	8.42	8.76	9.11	9.47	9.85	10.25	10.66	11.08	11.53	11.99	12.47	12.97	13.48	14.02	14.59		15.17	15.78
B A S E C A S E A N A L Y S I S																					
Total costs	33.42	33.42	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05		2.01	2.01
Capital costs (billion VND)	33.42	33.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Maintenance Costs - Routine(billion VND)	-	-	2.01	2.01	2.01	2.01	2.01	2.01	2.01	-	2.01	2.01	2.01	2.01	2.01	2.01	2.01	-		2.01	2.01
Maintenance Costs - Periodic (billion VND)	-	-	-	-	-	-	-	-	-	20.05	-	-	-	-	-	-	-	20.05		-	-
Maintenance Costs (billion VND)	-	-	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05		2.01	2.01
Benefits (billion VND)	(5.65)	(0.22)	9.24	19.23	20.41	21.54	21.48	22.20	22.93	23.66	25.53	22.48	23.21	23.95	24.70	25.46	26.23	27.02		27.83	28.96
Net cash flow (billion VND)	(39.07)	(33.64)	7.24	17.23	18.41	19.54	19.48	20.20	20.92	3.61	23.52	20.47	21.20	21.94	22.69	23.45	24.23	6.97		25.82	26.96
S E N S I T I V I T Y A N A L Y S I S																					
Case 1 - Capital costs increase by 10%																					
Total costs	36.76	36.76	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05		2.01	2.01
Capital costs	36.76	36.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Maintenance Costs	-	-	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05		2.01	2.01
Benefits	(5.65)	(0.22)	9.24	19.23	20.41	21.54	21.48	22.20	22.93	23.66	25.53	22.48	23.21	23.95	24.70	25.46	26.23	27.02		27.83	28.96
Net cash flow	(42.41)	(36.98)	7.24	17.23	18.41	19.54	19.48	20.20	20.92	3.61	23.52	20.47	21.20	21.94	22.69	23.45	24.23	6.97		25.82	26.96
Case 2 - Maintenance costs increase by 10%																					
Total costs	33.42	33.42	2.21	2.21	2.21	2.21	2.21	2.21	2.21	22.06	2.21	2.21	2.21	2.21	2.21	2.21	2.21	22.06		2.21	2.21
Capital costs	33.42	33.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Maintenance Costs	-	-	2.21	2.21	2.21	2.21	2.21	2.21	2.21	22.06	2.21	2.21	2.21	2.21	2.21	2.21	2.21	22.06		2.21	2.21
Benefits	(5.65)	(0.22)	9.24	19.23	20.41	21.54	21.48	22.20	22.93	23.66	25.53	22.48	23.21	23.95	24.70	25.46	26.23	27.02		27.83	28.96
Net cash flow	(39.07)	(33.64)	7.04	17.03	18.21	19.33	19.28	20.00	20.72	1.60	23.32	20.27	21.00	21.74	22.49	23.25	24.03	4.97		25.62	26.76
Case 3 - Benefits decrease by 10%																					
Total costs	33.42	33.42	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05		2.01	2.01
Capital costs	33.42	33.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Maintenance Costs	-	-	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05		2.01	2.01
Benefits	(5.08)	(0.20)	8.32	17.31	18.37	19.39	19.34	19.98	20.64	21.30	22.97	20.23	20.89	21.55	22.23	22.91	23.61	24.32		25.05	26.07
Net cash flow	(38.50)	(33.62)	6.31	15.31	16.36	17.38	17.33	17.98	18.63	1.24	20.97	18.23	18.88	19.55	20.22	20.91	21.60	4.27		23.04	24.06
Case 4 - Benefits decrease by 20%																					
Total costs	33.42	33.42	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05		2.01	2.01
Capital costs	33.42	33.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Maintenance Costs	-	-	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05		2.01	2.01
Benefits	(4.52)	(0.18)	7.39	15.39	16.33	17.23	17.19	17.76	18.34	18.93	20.42	17.98	18.57	19.16	19.76	20.37	20.99	21.62		22.26	23.17
Net cash flow	(37.94)	(33.60)	5.39	13.38	14.32	15.23	15.18	15.76	16.34	(1.12)	18.42	15.98	16.56	17.15	17.75	18.36	18.98	1.57		20.26	21.17
Case 5 - Benefits decrease by 30%																					
Total costs	33.42	33.42	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05		2.01	2.01
Capital costs	33.42	33.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Maintenance Costs	-	-	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05		2.01	2.01
Benefits	(3.95)	(0.15)	6.47	13.46	14.29	15.08	15.04	15.54	16.05	16.56	17.87	15.74	16.24	16.76	17.29	17.82	18.36	18.92		19.48	20.28
Net cash flow	(37.37)	(33.57)	4.46	11.46	12.28	13.07	13.03	13.54	14.05	(3.49)	15.86	13.73	14.24	14.76	15.28	15.81	16.36	(1.14)		17.47	18.27
Case 6 - Benefits delay 2 years																					
Total costs	33.42	33.42	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05		2.01	2.01
Capital costs	33.42	33.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Maintenance Costs	-	-	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05		2.01	2.01
Benefits	-	-	(5.65)	(0.22)	9.24	19.23	20.41	21.54	21.48	22.20	22.93	23.66	25.53	22.48	23.21	23.95	24.70	25.46		26.23	27.02
Net cash flow	(33.42)	(33.42)	(7.65)	(2.22)	7.24	17.23	18.41	19.54	19.48	2.15	20.92	21.66	23.52	20.47	21.20	21.94	22.69	5.41		24.23	25.02
Case 7 - Subproject life is 5 years shorter																					
Total costs	33.42	33.42	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05	2.01	2.01	2.01	2.01	2.01	-	-	-		-	-
Capital costs	33.42	33.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Maintenance Costs	-	-	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05	2.01	2.01	2.01	2.01	2.01	-	-	-		-	-
Benefits	(5.65)	(0.22)	9.24	19.23	20.41	21.54	21.48	22.20	22.93	23.66	25.53	22.48	23.21	23.95	24.70	-	-	-		-	-
Net cash flow	(39.07)	(33.64)	7.24	17.23	18.41	19.54	19.48	20.20	20.92	3.61	23.52	20.47	21.20	21.94	22.69	-	-	-		-	-
Case 8 - Subproject life is 7 years shorter																					
Total costs	33.42	33.42	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05	2.01	2.01	2.01	-	-	-	-	-		-	-
Capital costs	33.42	33.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Maintenance Costs	-	-	2.01	2.01	2.01	2.01	2.01	2.01	2.01	20.05	2.01	2.01	2.01	-	-	-	-	-		-	-
Benefits	(5.65)	(0.22)	9.24	19.23	20.41	21.54	21.48	22.20	22.93	23.66	25.53	22.48	23.21	-	-	-	-	-		-	-
Net cash flow	(39.07)	(33.64)	7.24	17.23	18.41	19.54	19.48	20.20	20.92	3.61	23.52	20.47	21.20	-	-	-	-	-		-	-

SUMMARY FOR SENSITIVITY ANALYSIS

	ENPV (Bil. VND)	BCR	EIRR	SI (ENPV)	SV(ENPV)	
Base case	**40.0**	**1.52**	**20.0%**			
1. Capital Costs + 10%	34.3	1.42	18.5%	1.4	70.8%	
2. O&M costs + 10%	38.0	1.49	19.7%	0.5	202.5%	
3. Benefits decrease - 10%	28.4	1.37	17.9%	2.9	34.4%	
4. Benefits decrease - 20%	16.7	1.22	15.7%	2.9	34.4%	
5. Benefits decrease - 30%	5.1	1.07	13.2%	2.9	34.4%	
6. Benefits delay - 2 years	11.4	1.15	14.1%	2.9	ENPV = 71.4% lower	
7. Subproject life is 5 years shorter	25.9	1.36	18.5%	2.3	ENPV = 35.1% lower	
8. Subproject life is 7 years shorter	17.3	1.24	17.0%	2.4	ENPV = 56.7% lower	10 years