

ECONOMIC AND FINANCIAL ANALYSIS

I. Economic Analysis

A. Subproject Benefits

1. Lao People's Democratic Republic

1. The **Mekong River Left Embankment Improvement Subprojects** comprise two closely linked subprojects, the Vientiane Capital Flood Protection Subproject and the Vientiane Capital Irrigation Development Subproject, which have been analyzed together. They involve increasing the height of the left embankment along the Mekong River from the end of the planned embankment downstream (to be financed by the People's Republic of China) to the point where the Mak Hiao River delivers into the Mekong River.¹ The impact area is bordered by the Houy Deua River in the north, the Mak Hiao River in the south, and the Mekong River to the west. It incorporates the floodplains of these rivers and the extensive wetlands to the southwest of Vientiane township, including some 60,000 hectares (ha) of paddy (39,000 ha of wet season and 21,000 ha of irrigated dry season crop) and densely populated settlements along the Mekong River. An incremental 1,200 ha of paddy land will be irrigated in the dry season while improved drainage and sluice gates will allow better water control in agricultural areas as well as wetlands to preserve the environmental function critical to Vientiane's waste water and drainage system. Benefits from this investment will be achieved through reduced losses from flood damage as well as incremental rice production from existing and expanded rice-growing areas.

2. Viet Nam

2. The **Ba Rai – Phu An Subproject** involves the construction of some 24 sluice gates to manage the movement of water, given tidal influences and increasingly frequent flooding over a discrete area to be isolated by the structures. The impact area is planted with significant areas of fruit trees (370 ha of durians and 1,950 ha of citrus) and 1,460 ha of rice. Rice does not generate the financial returns of perennial crops. However, given the threat of flooding, which damages the more vulnerable fruit trees, farmers are reluctant to adopt a longer term planning perspective. Orchard establishment periods are 3–7 years and full production is not achieved for 10 years, by which time flooding could have decimated the orchard. Benefits are estimated based on assumed flooding frequencies at two levels, which have associated levels of tree losses. The with-subproject scenario analyzes the impact from the expansion of more profitable fruit trees and reduced rice farming on existing agricultural land.

3. The **Go-Cong Salinity Intrusion and Water Management Subproject** involves the development of three proposed barrages and sluice gates that will enable independent control of tidal and brackish water movement from urban areas, permitting flushing while retaining additional freshwater resources in paddy-growing areas. Being relatively close to the ocean, the Go Cong area suffers from saline intrusions as brackish water extends up the drainage system into agricultural areas with two peak tides each day depressing crop yields. The nearby urban area benefits from this regular flushing, removing urban waste water through the natural drainage lines. For farmers in the area seek to retain freshwater in rice paddies rather than have it drain out each day and face the continual threat of saline intrusion. After installation, the water level in irrigation canals will be an estimated 50 centimeters higher, which will reduce pumping costs by as much as 30%. Benefits from the investment therefore include an incremental crop

¹ Civil works include earthworks to raise the height of the embankment along 30 kilometers (km) of the embankment, two flood control gates, five sluice and flap gates in culverts to improve the water management in the impact area to reduce flooding, and asphalt surfacing of the road along the crest of the embankment.

yield in response to reduced saline intrusion into rice-growing areas, and a reduction in water pumping costs. For urban inhabitants, the avoided cost of public health care and improved labor efficiency have been estimated as part of the subproject benefit.

4. The **Plain of Reeds Irrigation Rehabilitation Subproject** will rehabilitate four irrigation canals, increasing their capacity from current levels (that can inadequately irrigate 37,000 ha of winter–spring crop and a similar area of summer–autumn crop) to an adequately watered area of 38,000 ha for both crops, with an associated increase in productivity given the timely application of water. It will also increase flood discharge capacity in the canals to protect property and economic activity in the immediate vicinity—benefiting agriculture, public infrastructure, and urban and private rural property while reducing the need to relocate flood-affected households. The subproject will improve road access along the length of the canals (about 19.7 kilometers [km]), thereby enhancing market access. It will also improve water transport services (both freight and passenger) with the increased capacity of canals to accommodate larger and small craft in increasing numbers. Benefits are estimated from incremental agricultural productivity, improved transport services (both rural road and waterway transport of passengers and agricultural goods), and from the increased capacity of the canals to accommodate greater floodwater during periods of peak flood—reducing potential flood threats.

5. The **Thuong Thoi Tien Prevention Embankment Subproject** involves the stabilization of the left bank of the Tien River in the vicinity of Thuong Thoi Tien township. The embankment will have little impact on flooding in the immediate area of the town site but will at least stabilize the river bank from further erosion. Commercial and industrial activity in close proximity to the planned embankment is considerable while agricultural production, which is limited to small-scale household production will have limited impact. The need for relocation of houses (and people) and businesses along the embankment will be relatively small. The greatest impact will come from industrial output, and loss of public infrastructure and personal property.

B. Methodology for Economic Analysis

6. Basic assumptions adopted in the economic analysis include the following: (i) analysis is carried out in the domestic currency at the level of border prices; (ii) in the case of major tradable commodities (food grains and fertilizers), economic values are based on border parity prices; (iii) a standard conversion factor (SCF) of 0.9 is used for non-traded goods and services; a shadow wage rate factor (SWRF) applicable in each country, which reflects the productivity of rural labor in the area, is applied for rural labor; (iv) transfer payments (such as taxes, subsidies, and compensation) are excluded in the calculation of economic values; the administration cost for compensation is included; and (v) to calculate the economic net present value (ENPV) of the subproject, a discount rate of 12% is used to represent the opportunity cost of capital invested. Separate models have been developed to assess the viability of each subproject. Where benefit streams are based on the level of economic activity, 2012 estimated benefits are extrapolated at the rate of local economic activity (gross domestic product growth rate) for the country concerned to project potential benefits in constant 2011 terms.

1. Lao People's Democratic Republic

7. For the **Mekong River Left Embankment Improvement Subprojects**, benefits have been grouped into three sources: (i) those derived from flood prevention, (ii) those from incremental irrigation, and (iii) those from the impact of the road upgrading along the crest of the embankment. Flood benefits have been broken down into (i) those from the reduced need to evacuate people from flooded areas, (ii) those from the impact of flooding on agricultural output, and (iii) those from the prevention of damage to public infrastructure and to household and

private assets. Irrigation benefits are derived from incremental rice production on the expanded dry season irrigated paddy area. Road benefits have been estimated from the reduction in vehicle operating costs (VOCs) and the incremental traffic volumes attracted by the sealed alignment. The methods used for estimating these impacts are discussed below (paras. 8-10).

8. Flood benefits have been estimated considering six different flood return periods: a 2-year flood, a 5-year flood, a 10-year flood, a 20-year flood, a 50-year flood, and a 100-year flood. At each of these, progressively more water inundates an increasing area of land. The topographical analysis provided estimates of the areas inundated and the depths to which they would be inundated for each severity level of flooding. For each level of flood severity, the extent of damage caused to human evacuation, agricultural output, public infrastructure, and household and private assets has been assumed based on available flood damage reports. These ratios were then applied to the local population within the impact area (51,100 people), to the agricultural output of the area (\$61 million per annum), to the estimate of public infrastructure (\$200 million), and to the estimate of private assets—houses (at an average of \$10,000 per house). This generated a financial cost estimate of the level of damage caused by flooding at the various levels. To obtain economic terms, the financial figures were adjusted by the factors depending on their proportional composition: civil works (weighted conversion factor of 0.84), materials (weighted conversion factor of 0.75), equipment (weighted conversion factor of 0.9), and labor (weighted conversion factor of 0.71). The resultant calculation provided an estimate of the economic losses incurred at each level of flood severity. These losses would be avoided under the with-subproject scenario.

9. For the irrigation benefit, incremental production from a second dry season crop was compared with the one wet season crop on the same 1,200 ha. Wet season yields under the without-subproject scenario were 4.5 tons per ha (t/ha) compared with 4.7 t/ha under the with-subproject scenario in view of the improved water management. Dry season production is not currently undertaken but with improved irrigation, yields would increase from 5.5 t/ha to 5.8 during the irrigated crop on the full 1,200 ha in view of the community-based initiatives proposed.

10. The benefit from surfacing the embankment is derived from (i) the reduction in vehicle operating costs (VOCs) for all modes of transport, and (ii) the increased traffic volumes attracted by a sound road surface. Estimates of VOCs were prepared for each of the main types of vehicles using the alignment including motorcycles, hand tractors, motorcars, minibuses, small trucks, and pick-ups. Under the without-subproject scenario, VOCs were considered to increase by 50% for each mode of transport in view of higher repairs and maintenance, the lower speeds necessitated, and the increased depreciation from the uneven surfacing. The VOC savings for the existing and incremental traffic volumes were applied to the full length of the rehabilitated alignment, as this does not constitute a local road and the majority of its traffic would travel its full length. Traffic volumes are progressively increased to reflect the growth in economic activity surrounding the embankment in line with the gross domestic product growth rate.

2. Viet Nam

11. The **Plain of Reeds Subproject** in Viet Nam has significant resettlement costs that are not reflected in the estimation of the economic internal rate of return (EIRR), as transfer payments are not included in the EIRR calculation. Even so, the subproject will generate an EIRR estimated at 18.8%, suggesting that the investment will contribute positively to Viet Nam's economy. The composition of the benefits are dominated by incremental rice production based on an average incremental yield of 0.75 t/ha over two crops throughout the entire command area. Other significant contributions to the net benefit will be derived from flood-related impacts

and the savings in population evacuation during floods and the damage to private houses and property. The benefits from transport remain relatively small throughout the period under assessment. The net present value (NPV) of the investment is estimated at \$5.99 million (assessed at 12%). In economic terms, the investment is considered well in excess of the opportunity cost of capital.

12. **Thuong Thoi Tien Town Embankment Subproject.** Given that the flood protection influence of the investment is minimal, benefits are generated in the immediate vicinity of the embankment; these are restricted to public infrastructure and a small level of industrial and commercial activities along the river embankment. Based on the models adopted to assess the economic benefits, the EIRR for the subproject is 12.1% and the NPV is \$0.39 million. Benefits are dominated by the prevention of damage from erosion along the embankment, including private land and houses, and small-scale industry and commerce, as the area has a small port complex and is an active trading and passenger land–water interface.

13. **Ba Rai – Phu An Subproject.** The proposed subproject will isolate the area from the influences of flooding and provide improved water management control in an area where high-value crops are grown. Dominated by fruit orchards, the area is highly productive and generates significant income for the economy. It is not surprising that the EIRR generated is highly attractive—20.39% for the subproject. This reflects the high profitability of both durian and citrus production, which have EIRRs of 42.8% (durian) and 37.4% (citrus) for unit hectare production models. The reason for the high EIRR reflects the fact that the investment makes possible substitution from rice to higher value production.

14. **Go Cong Salinity Intrusion Subproject.** This subproject has a potentially large impact on economic activity through the two benefits identified—irrigation efficiency and savings in health care costs from environmental improvement in the nearby urban area. The EIRR is estimated at 24.43% and the NPV is \$3.97 million at a discount rate of 12%. The reason for the high return is the potential benefit area, with some 30,000 ha being affected plus an additional 1,075 ha of new rice production (two crops a year) that can be brought into production. The improved water management will result in higher yields for the affected area (assumed to be 40% of the command area) and will save in pumping costs (currently D1.8 million/crop-ha). The high EIRR is also because the capital cost to achieve this benefit response is relatively small, involving only three barrages and sluice gates to control the movement of water and halt the saline intrusion. Benefits for the urban population are measured through the reduced cost of health services, with better health resulting from the flushing effect made possible by the sluice gates. The health benefit is relatively small in comparison with the irrigation benefit, which represents 90% of the estimated benefit.

C. General Results, Sensitivity Analyses, and Conclusions

15. Results from the analyses suggest that all subprojects will have a positive impact on their respective economies. The EIRRs range from 12% for the Embankment Stabilization Subproject in Dong Thap, Viet Nam to 24% for the Go Cong Salinity Intrusion Subproject. The lowest EIRR reflects the limited impact on prevention of damage from flooding, as the subproject is more concerned with erosion control—hence a lower impact. The subprojects with impacts relating to flood prevention generally have a higher internal rate of return than those with benefits dominated by irrigated agricultural production. Irrigation systems involving incremental rice production report lower EIRRs than those involving non-rice crops. The importance of rice varies in each country—Viet Nam is a major exporter of the commodity whereas the Lao PDR is self-sufficient. The Lao PDR still reports localized rice shortages as a result of limited rural infrastructure to facilitate market access. Under these conditions,

incremental rice production assumes a greater value compared to the derived market value based on international price predictions. Nevertheless, in economic terms, the models developed demonstrate some sensitivity to the farm-gate price of rice.

16. Sensitivity analyses were tested against threats to subproject viability—development cost escalations, reductions in flood benefits, reductions in commodity prices, and in the case of the irrigation subprojects, the risk that the estimated command area (and consequent dry season irrigation potential) would not be realized. For the six subprojects, two were most sensitive to increases in development costs, two to the flood benefits realized, two to the commodity price decreases, and one to the impact from declining irrigation benefit. However, all are relatively robust to the identified risks. In the case of the Ba Rai – Phu An subproject, involving high-value orchard crops, the greatest risk was from increased construction costs. In that case, establishment costs would need to increase by 47% before the investment recorded a negative NPV (i.e., the EIRR would be below 12%). For the Go-Cong subproject, the greatest threat was a reduction in the irrigation benefit, which would need to decline a further 55.12% before the EIRR would fall below 12%. For the Plain of Reeds subproject, the largest identified risk was the cost escalation but the establishment cost would need to increase by 48.7% before the EIRR would decline below 12%. The only subproject considered a real risk is the erosion prevention embankment in the township of Thuong Thoi Tien.

17. The greatest risk factor to the Mekong River embankment subproject in the Lao PDR is the potential decline in flood benefit. The subproject will continue the protection work initiated under the sections of the embankment financed by the Republic of Korea and the People's Republic of China; these together will complete the protection of Vientiane capital and surrounding areas. With a high population density and considerable public infrastructure, the potential savings from flood protection are significant. Such is the size of the benefit that it would need to decline to 77% of the estimated figure before the EIRR falls below the cost of capital.

18. In summary, the return on each investment exceeds the opportunity cost of capital and each will be expected to make a positive contribution to overall economic activity. While some vulnerability to risk has been identified, particularly in respect of declining commodity prices, this is considered acceptable given the potential impact in the local area of each subproject.

Table: Summary Economic Internal Rate of Return Estimates and Sensitivity Analyses

Subproject	Base Case EIRR (%)	Base Case NPV (\$'000)	Greatest Sensitivity to Change in EIRR	Impact of 20% Change on EIRR (%)	EIRR Switching Value (%)
Lao People's Democratic Republic					
Mekong River Left Embankment Improvement Subproject	24.23	17,634	Flood benefit decline	21	(77)
Viet Nam					
Ba Rai – Phu An Subproject	20.39	6,316	Construction cost increase	17	47
Go Cong Salinity Intrusion Subproject	24.43	2,369	Irrigation benefit decline	20	(55)
Thuong Toi Thien Embankment Subproject	12.08	385	Flood benefit decline	12	(1)
Plain of Reeds Irrigation Subproject	18.83	5,987	Construction cost increase	16	49

() = negative, EIRR = economic internal rate of return, NPV = net present value.

Source: ADB. 2008. *Technical Assistance for Greater Mekong Subregion Flood and Drought Risk Management and Mitigation Project*. Manila and mission estimates.

II. Financial Management Assessments

19. The key findings of the financial management assessments carried out in the Lao PDR and Viet Nam are as follows:

1. Lao People's Democratic Republic

20. The executing agency of the structural subproject in the Lao PDR will be the Department of Irrigation (DOI), Ministry of Agriculture and Forestry. The Ministry of Public Works and Transport (MPWT) and the Provincial Agriculture and Forestry Office (PAFO), Vientiane Capital, will be the implementing agencies.

21. The nonstructural subproject will be implemented by the Department of Meteorology and Hydrology of the Ministry of Natural Resources and Environment.

22. The DOI has five functional divisions: (i) administration, (ii) planning and cooperation, (iii) irrigation and drainage development, (iv) irrigation management, and (v) Irrigation Survey Design Center. The DOI has gained limited experience in implementing Asian Development Bank (ADB) projects.²

23. The MPWT has 11 departments: (i) administration, (ii) personnel, (iii) roads and bridges, (iv) transport, (v) waterways, (vi) housing and urban planning, (vii) internal inspections, (viii) public works and transport, (ix) aviation, (x) railways, and (xi) planning and cooperation. The project will be implemented by the Department of Waterways, which was established in 2009. The MPWT has implemented at least 15 road projects and five water projects financed by ADB.³

24. The PAFO of Vientiane capital has 10 divisions: (i) planning, (ii) administration, (iii) agriculture, (iv) livestock, (v) irrigation, (vi) forestry, (vii) conservation, (viii) extension, (ix) forestry inspection, and (x) internal inspection. PAFO Vientiane Capital has implemented one ADB-financed project, the Decentralized Irrigation Development and Management Sector Project financed by ADB and the Agence Française de Développement from 2000 to 2008.⁴

25. To date, accounting standards have not been established in the Lao PDR. All executing and implementing agencies in the Lao PDR have followed the Lao Accounting System, which requires the submission of a completed chart of accounts to the Taxation Department of the Ministry of Finance since 1992. The accounting and audit laws were issued in July 2007 and have been revised and sent to the National Assembly in June 2012 for review and approval. The Ministry of Finance is establishing accounting and audit standards in the Lao PDR. It also releases a series of policies and regulations that guide the accounting activities in the executing and implementing agencies. In addition, all the executing and implementing agencies have established internal rules to guide accounting activities.

² ADB. 2004. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the Lao People's Democratic Republic for the Northern Community-Managed Irrigation Sector Project*. Manila. ADB. 2000. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the Lao People's Democratic Republic for the Decentralized Irrigation Development and Management Sector Project*. Manila.

³ ADB. 2005. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the Lao People's Democratic Republic for the Northern and Central Regions Water Supply and Sanitation Sector Project*. Manila. ADB. 2009. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the Lao People's Democratic Republic for the Small Towns Water Supply and Sanitation Sector Project*. Manila. ADB. 2010. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the Lao People's Democratic Republic for the Northern and Central Regions Water Supply and Sanitation Sector Project*. Manila.

⁴ ADB. 2000. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the Lao People's Democratic Republic for the Decentralized Irrigation Development and Management Sector Project*. Manila.

26. The current accounting procedures, invoice procedures, and internal control are adequate for the entities and the project. There are controls relating to the preparation, approval, and conduct of transactions in the executing and implementing agencies. The costs normally match the various funding sources based on the established agreements. The functions of authorizing the execution of a transaction, recording of the transaction, and custody of assets are in principle segregated in the executing and implementing agencies. The responsibilities of ordering and paying for goods and services are generally separated in the executing and implementing agencies. The bank reconciliations are conducted by someone other than those who make or approve payment in the executing and implementing agencies.

27. The executing and implementing agencies have internal audit departments or divisions (or internal inspection). The internal auditors in the executing and implementing agencies have undergraduate degrees and extensive experience in internal audit. They report directly to director of the DOI (executing agency), the minister of the MPWT, and the Provincial Director of Agriculture and Forestry. Nevertheless, the internal audit divisions in the executing agency (DOI) and PAFO do not include the project in their working scope since they are only responsible for the entities, but not the projects. In contrast, the internal audit department of the MPWT will cover the project in its work plan.

28. The financial management assessment concluded that the current organizational structures of the executing and implementing agencies are generally adequate to the needs of the project. The funds flow from ADB to the executing and implementing agencies will be arranged through the Ministry of Finance.⁵ (see the Project Administration Manual for details).

29. Nevertheless, there are shortcomings in financial management capacity in the executing and implementing agencies: (i) no project office has been established in the DOI, MPWT, or the PAFO; (ii) there are not enough accountants for the executing and implementing agencies for the project—the current accountants have only capacity for the existing accounting entity and current projects, but not for this project; (iii) although most accountants in the executing and implementing agencies have degrees in accounting and finance, they are familiar with entity accounting rather than project accounting; most accountants in the PAFO are not qualified or experienced enough for both entity accounting and project accounting; (iv) although most accountants in the DOI and MPWT have received training in ADB loan disbursement procedures, most accountants in the PAFO have not; (v) the current project budget system is not adequate for the project since it is not consistent with ADB's guideline on costing principle, i.e., estimates of costs by both component and expenditure accounts; (vi) the executing and implementing agencies' financial statements are not prepared in a timely manner so as to be useful for management since both entity and project financial statements are prepared quarterly; (vii) the existing entity financial reports are not adequate to reporting the project (ADB) in the executing and implementing agencies; financial statements for the entity, such as the expenditure statement, cannot be used to report ADB project activities directly; (viii) the entity's financial statements are not audited by independent auditors in either the executing or implementing agencies although the project's financial statements are audited annually; and (ix) the DOI's accounting system has not been computerized although its project accounting system has been computerized with the assistance of the loan implementation consultant; MPWT's accounting system has been computerized to some extent, but its project accounting system is computerized only in the Department of Roads and Bridges; PAFO's accounting systems have not been computerized.

⁵ Project Administration Manuals (accessible from the list of linked documents in Appendix 2).

2. Viet Nam

30. The executing agency is the Ministry of Agriculture and Rural Development, through its Central Project Office and a central project management unit. The implementing agencies are the Departments of Agriculture and Rural Development (DARDs) of Tien Giang and Dong Thap provinces. The DARDs will be the investment owners of the subprojects. They will be responsible for approval of implementation and operation arrangements for each subproject. They will receive overall guidance from the Provincial People's Committees in each participating province. The implementing agencies share a similar organizational structure and consist of divisions such as the business division, professional division, and management division.

31. However, the DARDs have not established project offices within the organization, which is considered an important condition for the successful implementation of externally financed projects. The executing agency has extensive experience in the implementation of externally financed projects. The implementing agencies have experience in the management of foreign exchange exposure. Except for Dong Thap, most of the accountants in the executing and implementing agencies have been trained in ADB loan disbursement procedures.

32. In summary, the existing institutional arrangements of the executing and implementing agencies are appropriate for the accounting entity and the project. The funds flow arrangements are clearly determined—from ADB to the Ministry of Finance, to the Ministry of Agriculture and Rural Development, to the three provincial DARDs. The existing accounting standards, systems, and policies are generally suitable for the accounting entities and for the project. Accounting and invoicing procedures and internal controls exist in the executing and implementing agencies.

33. The following measures are proposed to ensure the adequate financial management capacity of the executing and implementing agencies:

- (i) The two provincial DARDs should establish project implementation units (PIUs) for the project as soon as possible. The PIUs will be responsible for all activities from project preparation to project implementation.
- (ii) The accounting staff in implementing agencies should receive training on ADB loan disbursement procedures before the project is implemented. The training can take two forms—training programs organized by ADB or on-the-job training conducted by the executing agency's accountants or loan implementation consultants.
- (iii) The accounting staff in both the executing and implementing agencies should receive training in financial management—preparing and appraising investment projects, financial management, and financial reporting and auditing.
- (iv) The implementing agencies should set up a new budget system for the project, in which the project costs are classified by component and expenditure.
- (v) The executing and implementing agencies should prepare financial statements of the project based on the standard format specified by ADB. The financial statements for ADB-funded projects include balance sheets, summary of sources and uses of funds by project component, statements of implementation of credit agreement, and special account statements required by ADB.
- (vi) The executing agency should help the implementing agencies update their accounting system by incorporating the project accounting and provide the necessary training.
- (vii) The executing agency's existing accounting system should be upgraded by incorporating the module of financial statements for the ADB-funded project.