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PROJECT PERFORMANCE ASSESSMENT REPORT



VIETNAM

Water Resources Assistance Project

Report No. 138389

AUGUST 20, 2019

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PROJECT PERFORMANCE ASSESSMENT REPORT

VIETNAM

**WATER RESOURCES ASSISTANCE PROJECT
(IDA-38800, TF-54751)**

August 20, 2019

Financial, Private Sector, and Sustainable Development

Independent Evaluation Group

Currency Equivalents (annual averages)

Currency Unit = Vietnamese Dong (D)

2004	\$1.00	D5,713	2009	\$1.00	D17,484
2005	\$1.00	D15,786	2010	\$1.00	D18,474
2006	\$1.00	D15,918	2011	\$1.00	D19,497
2007	\$1.00	D16,050	2012	\$1.00	D21,033
2008	\$1.00	D15,970			

Abbreviations

DCA	Development Credit Agreement
EIRR	economic internal rate of return
FY	fiscal year
ICR	Implementation Completion and Results Report
IEG	Independent Evaluation Group
IMC	irrigation management company
JSDF	Japan Social Development Fund
M&E	monitoring and evaluation
O&M	operation and maintenance
PDO	project development objective
PIM	participatory irrigation management
PPAR	Project Performance Assessment Report
SCADA	Supervisory Control and Data Acquisition
VWRAP	Vietnam Water Resources Assistance Project

All dollar amounts are U.S. dollars unless otherwise indicated.

Fiscal Year

Government: January 1 – December 31

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This report was prepared by Ebru Karamete and Richard Pollard, who assessed the project in March 2019. The report was peer reviewed by Bernhard Tischbein and panel reviewed by Stephen Hutton. Romayne Pereira provided administrative support.

Principal Ratings

Indicator	ICR	ICR Review	PPAR
Outcome	Moderately satisfactory	Moderately satisfactory	Moderately satisfactory
Risk to development outcome	Moderate	Moderate	Moderate
Bank performance	Moderately satisfactory	Moderately satisfactory	Moderately satisfactory
Borrower performance	Moderately satisfactory	Moderately satisfactory	Moderately satisfactory

Note: The Implementation Completion and Results Report (ICR) is a self-evaluation by the responsible Global Practice. The ICR Review is an intermediate Independent Evaluation Group product that seeks to independently validate the findings of the ICR. PPAR = Project Performance Assessment Report.

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IEG Mission: Improving World Bank Group development results through excellence in independent evaluation.

About This Report

The Independent Evaluation Group (IEG) assesses the programs and activities of the World Bank for two purposes: first, to ensure the integrity of the World Bank's self-evaluation process and to verify that the World Bank's work is producing the expected results, and second, to help develop improved directions, policies, and procedures through the dissemination of lessons drawn from experience. As part of this work, IEG annually assesses 20–25 percent of the World Bank's lending operations through fieldwork. In selecting operations for assessment, preference is given to those that are innovative, large, or complex; those that are relevant to upcoming studies or country evaluations; those for which executive directors or World Bank management have requested assessments; and those that are likely to generate important lessons.

To prepare a Project Performance Assessment Report (PPAR), IEG staff examine project files and other documents, visit the borrowing country to discuss the operation with the government and other in-country stakeholders, interview World Bank staff and other donor agency staff both at headquarters and in local offices as appropriate, and apply other evaluative methods as needed.

Each PPAR is subject to technical peer review, internal IEG panel review, and management approval. Once cleared internally, the PPAR is commented on by the responsible World Bank Country Management Unit. The PPAR is also sent to the borrower for review. IEG incorporates both World Bank and borrower comments as appropriate, and the borrower's comments are attached to the document sent to the World Bank's Board of Executive Directors. After an assessment report is sent to the Board, it is disclosed to the public.

About the IEG Rating System for Public Sector Evaluations

IEG's use of multiple evaluation methods offers both rigor and a necessary level of flexibility to adapt to lending instrument, project design, or sectoral approach. IEG evaluators all apply the same basic method to arrive at their project ratings. Following is the definition and rating scale used for each evaluation criterion (additional information is available on the IEG website: <http://ieg.worldbankgroup.org>).

Outcome: The extent to which the operation's major relevant objectives were achieved, or are expected to be achieved, efficiently. The rating has three dimensions: relevance, efficacy, and efficiency. *Relevance* includes relevance of objectives and relevance of design. Relevance of objectives is the extent to which the project's objectives are consistent with the country's current development priorities and with current World Bank country and sectoral assistance strategies and corporate goals (expressed in Poverty Reduction Strategy Papers, Country Assistance Strategies, sector strategy papers, and operational policies). Relevance of design is the extent to which the project's design is consistent with the stated objectives. *Efficacy* is the extent to which the project's objectives were achieved, or are expected to be achieved, taking into account their relative importance. *Efficiency* is the extent to which the project achieved, or is expected to achieve, a return higher than the opportunity cost of capital and benefits at least cost compared with alternatives. The efficiency dimension is not applied to development policy operations, which provide general budget support. *Possible ratings for outcome:* highly satisfactory, satisfactory, moderately satisfactory, moderately unsatisfactory, unsatisfactory, and highly unsatisfactory.

Risk to development outcome: The risk, at the time of evaluation, that development outcomes (or expected outcomes) will not be maintained (or realized). *Possible ratings for risk to development outcome:* high, significant, moderate, negligible to low, and not evaluable.

Bank performance: The extent to which services provided by the World Bank ensured quality at entry of the operation and supported effective implementation through appropriate supervision (including ensuring adequate transition arrangements for regular operation of supported activities after loan or credit closing toward the achievement of development outcomes). The rating has two dimensions: quality at entry and quality of supervision. *Possible ratings for Bank performance:* highly satisfactory, satisfactory, moderately satisfactory, moderately unsatisfactory, unsatisfactory, and highly unsatisfactory.

Borrower performance: The extent to which the borrower (including the government and implementing agency or agencies) ensured quality of preparation and implementation and complied with covenants and agreements toward the achievement of development outcomes. The rating has two dimensions: government performance and implementing agency(ies) performance. *Possible ratings for borrower performance:* highly satisfactory, satisfactory, moderately satisfactory, moderately unsatisfactory, unsatisfactory, and highly unsatisfactory.

Preface

This is a Project Performance Assessment Report (PPAR) by the Independent Evaluation Group (IEG) for the Vietnam Water Resources Assistance Project (P065898) in the agriculture sector of Vietnam supported by the World Bank. IEG is currently carrying out a meso evaluation of the World Bank Group's efforts on irrigation, which includes in-depth evaluations of a sample of completed World Bank projects, including the Vietnam Water Resources Assistance Project.

The project was approved in March 2004 for a total cost of special drawing rights 105.7 million (\$157.8 million equivalent). Total project cost at completion was special drawing rights 102.83 million (\$159.44 million equivalent). The project closed on December 31, 2012, after a one-year extension from the original closing date of December 31, 2011.

The assessment is based on a review of all relevant documentation, interviews with World Bank staff at headquarters and in the country office, and the findings of an IEG mission, comprising consultants Richard Pollard and Hoàn Pham, that visited Vietnam during March 2019. The project was discussed with the central government, nongovernmental organizations, and provincial officials engaged with the project, representatives of the Asian Development Bank, staff of the World Bank's country office, and beneficiaries in three of the six irrigation schemes that were involved with the project, through individual and group interviews. The list of persons interviewed during the mission is attached in appendix C. Their cooperation and assistance in preparing the report is gratefully acknowledged.

Copies of the draft PPAR were sent to government officials and implementing agencies for their review. Comments from the implementing agency are attached in appendix D.

Summary

When the Vietnam Water Resources Assistance Project (VWRAP) was designed, Vietnam was the world's second largest rice exporter, but land and labor productivity was relatively low in comparison with neighboring countries. About half of cultivated land was irrigated. Ninety-six percent of the nation's 7,600 dams were used for irrigation, but the hydraulic infrastructure was deteriorating, and dam safety monitoring was considered inadequate. A major constraint to improving agricultural productivity was underperformance of the large rice-based flood irrigation systems, because of their outdated infrastructure and institutional design. The government of Vietnam had initiated a broad-based program to modernize agriculture and requested World Bank assistance to finance a project that would introduce innovative approaches to irrigation modernization and address dam safety issues.

The project development objectives were to modernize and increase the productivity of Vietnamese agriculture, improve the management of water resources, and reduce dam safety risks. The components of the project included modernizing of irrigation services in the six largest irrigation schemes in Vietnam, improving dam safety and management, and achieving integrated development and management of the Thu Bon River Basin in Quang Nam Province.

Project Performance and Ratings

The relevance of the development objective was **substantial** at project appraisal and completion, and the outcomes continue to be substantially relevant today. The project addressed critical challenges to irrigation modernization and demonstrated important infrastructure and institutional innovations and the links between them that were subsequently adapted for national policies, strategies, and follow-on investments in the sector. Among other outcomes, the project developed guidelines for the modernization of irrigation and drainage that informed the government's 2013 plan for restructuring the agricultural sector, the 2013 Law on Water Resources, and drafting of the 2017 Law on Hydraulic Works. The project objectives remained consistent with the World Bank's 2012–16 Country Partnership Strategy and the current Country Partnership Framework. However, the objectives on improving agricultural productivity per se were excessively broad and not focused on the geographic scope of the project (six irrigation schemes); nor did they reflect the technical focus of the project on improving irrigation services, dam safety, and water resources management.

Relevance of design was **modest** owing to the objectives and the partial disconnect between the components and the excessively broad objective to increase agricultural productivity. In addition, a key part of the irrigation modernization model on which the

project design was based on the introduction of a volumetric irrigation service fee that was not tested or piloted before and would have required significant additional investments in flow measurement infrastructure.

Achievement of the first objective, to modernize and increase productivity of agriculture, is **substantial**, based on data and information on productivity and farm income increases and introduction of modern, more efficient irrigation infrastructure, though achievement of this objective relied partially on the government extension programs that were not part of the project. World Bank–financed activities installed more efficient irrigation works and focused on improving the performance of irrigation management institutions. Achievement of the second objective, improving the management of water resources, was **modest** because of the insufficient results on irrigation management modernization. On the one hand, management of on-farm water service delivery by commune-level water user groups that was piloted by the project has evolved into a range of models, and the overall concept of participatory irrigation management is now deeply ingrained in national irrigation and drainage policy. On the other hand, over time the operational performance of irrigation management companies (IMCs) has not changed substantively; that is, the financial and operational performance of IMCs are still weak, and the IMC performance benchmarking program developed by the project was discontinued. The third objective, to reduce dam safety risks, is rated **substantial**, based on the sustained reduction in safety risks that the project accomplished within the project area, and the influence it has had on national dam safety policies and practices and follow-on projects. Efficiency is rated **substantial** owing to significant economic and financial rates of return.

The economic analysis completed at the end of the project provided an estimated economic internal rate of return of 15 percent for the project as a whole, with the economic internal rate of return for individual irrigation schemes ranging between 20 percent and about 7 percent, resulting in a **substantial** efficiency rating.

The overall development outcome is rated **moderately satisfactory**.

The risk to development outcome is rated **moderate** in light of the strong and sustained government commitment to providing budget support to IMCs and continued support for further developing the participatory irrigation management model for water service delivery. However, limited change in financial or service delivery performance by most of the IMCs, and their reliance on government budget subsidies in the absence of irrigation service fees, pose risks to the sustainability of infrastructure that was constructed or rehabilitated by the project. Similarly, most water user groups are unable to cover their costs solely with water service fees or, in some cases, small budget transfers from IMCs. However, water user groups can be linked with local agricultural

cooperatives with multiple revenue streams in addition to service fees and can thereby increase their financial viability.

The overall rating of Bank performance is **moderately satisfactory**, based on a moderately satisfactory rating for quality at entry and a satisfactory rating for quality of supervision. The project was ambitious in introducing new concepts for irrigation modernization, but in doing so introduced risks in the project design that could have been mitigated by following a phased approach (as was originally planned) and taking a structured learning approach to allow for design adaptation based on experience. The feasibility study that was conducted during project design did not provide a comprehensive baseline for monitoring achievement of the project development objective. Supervision of the project was well-executed and effective, with strong support from the country office team. The supervision team identified implementation weaknesses in a timely manner and worked with the implementing agency to correct them effectively. The World Bank's supervisory support was highly appreciated by the implementing agency and a positive relationship has continued to the present day.

Borrower performance is rated **moderately satisfactory**, based on a rating of moderately satisfactory for both government performance and the performance of the implementing agency of the Ministry of Agriculture and Rural Development. There were delays in mobilizing staff and procuring technical assistance for the project, which had significant deleterious impacts on implementation, but the implementing agency was highly committed and effective during the project. Following the project, the IMC benchmarking program was dropped, and support for improving the performance of IMCs has been only marginally effective.

Lessons

- The project's close alignment with the government of Vietnam's agriculture reform programs allowed it to pilot innovations that have had enduring policy impacts. VWRAP was conceived at the request of the Ministry of Agriculture and Rural Development, and aspects of its design and implementation were closely coordinated with the ministry's Center for Participatory Irrigation Management. This institutional "buy-in" imparted strong ownership of the project outcomes that has contributed to national agricultural policy reforms and legislation that occurred after the project was completed.
- Irrigation modernization is a complex learning process that requires time and a phased approach. In this project, the planned phased approach was dropped, resulting in lost opportunities for learning and adaptation. The project introduced a complex mix of physical, operational, and institutional

changes, many of which were untried in Vietnam. Testing and scaling up these changes can take time and adaptation. VWRAP was initially designed with a phased approach to implementing the infrastructure component, but the phasing was dropped when startup delays and price inflation required a reduced infrastructure component. The project thus removed some of the farm-level innovations that were intended to be assessed by the phasing and pushed infrastructure contracts into the later years of the project. Many of the outputs related to institutional innovations were only completed in the final year of the project, limiting time for capacity building, adoption, or analysis. Longer-term, multiproject phasing might have been a more prudent approach.

A similar case in point is that VWRAP's institution reform platform rested on the introduction of volumetric service fees for irrigation; but measuring water volume had never previously been practiced in Vietnam, and there were additional practical concerns associated with allocating charges through water user groups that are geographically based on administrative rather than hydraulic boundaries. Furthermore, government concerns about rural poverty that led to removal of the irrigation service fee entirely were under discussion leading up to the project, although removal of the IMC water service fee was not explicitly proposed by government during the design phase. Project designs should include a "Plan B" for innovative, untested components, to mitigate the impact of changes in the implementing environment on overall objectives. Such adaptability could be accommodated with a phased or programmatic approach that conforms to evolving government policies for the sector.

- Key results indicators and monitoring and evaluation frameworks should be linked to development objectives and a clearly stated theory of change. VWRAP's results indicators were linked to the project's components rather than to a results framework, and therefore did not measure progress toward achieving the development objective itself. Indicators and monitoring and evaluation frameworks should be designed with development objectives in mind, and this should be an element of project design assessed prior to appraisal.
- For affordability reasons, water user fees may be insufficient to ensure the financial viability of water user groups; in that case, additional sources of funds, including subsidies, may need to be considered. In Vietnam, almost all the successful water user groups established by VWRAP and subsequently are agricultural cooperatives with other mandates and revenue streams in addition to irrigation service fees. What poor farmers can afford to pay can vary, so irrigation service fees may be insufficient. A cooperative model with

multiple sources of revenue may prove more financially sustainable. If a single-purpose water user group is considered, then government subsidies may be needed for the sustainability of these organizations.

José Carbajo Martínez

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1. Background and Context

Sector Background

1.1 At the outset of the project, agriculture employed two-thirds of the labor force, but the sector needed to be modernized. Its contribution to growth and poverty reduction had begun to weaken. The pace of agriculture growth was also slowing, from 4.5 percent a year in 1994–2000 to 3.8 percent in 2001–05.¹ Labor productivity was declining, and land productivity was low compared with that in neighboring countries (World Bank 2017a). Further, over-intensive use of inputs and natural resources were contributing to environmental degradation. Most cultivated land was allocated to rice production and most jobs were still in primary agriculture. Agribusiness and the food industry were slow in supplying better-paying jobs.

Irrigation

1.2 In the early 2000s, more than half of Vietnam’s irrigation and drainage systems were deteriorating and operating below their potential capacity, and on average only about 50 percent of the command² areas of irrigation schemes were actually being irrigated. Irrigation management companies (IMCs) are state-owned enterprises with responsibility for managing the dams and the water distribution networks within the irrigation schemes. Most of the irrigation systems were constructed after 1975 and were designed primarily for flood irrigation and rice production. They were intended to operate at full capacity and were not designed with water conservation in mind. Flows were regulated manually, so that achieving even and reliable distribution of water over the entire area of an irrigation scheme was nearly impossible.

1.3 Until 2007, IMCs managed all irrigation systems through district-level irrigation management teams who managed secondary canals, while tertiary canals and on-farm water delivery were managed through voluntary labor organized by communes. When VWRAP was designed, IMCs attempted to cover their costs by collecting from farmers fixed irrigation service fees based on irrigated area. IMCs passed on a percentage of irrigation service fees to decentralized irrigation management teams, who were also responsible for collecting the fees. Vietnam at that time was one of the few countries where users were expected to pay the full cost of irrigation operation and maintenance (O&M). In practice, collection rates were low because many farmers were poor, their productivity was low, and they were charged up to 28 different fees and tariffs annually, of which irrigation service fees were a significant component. Because of the low collection rates, IMCs often ran budget shortfalls and were unable to provide reliable irrigation services in many cases. In 2007 and 2008, after the VWRAP project was designed and beginning implementation, the government issued two decrees: one

eliminating irrigation service fees and the other introducing government budget allocations for O&M of irrigation systems by IMCs. This policy change was not anticipated by the donor community and therefore was not factored into VWRAP project design, which called for the introduction of volume-based water fees to create incentives for more efficient delivery and management of water by IMCs and farmers. Tertiary canals and on-farm water management continued to be the responsibility of farmers and commune- or village-level organizations.

1.4 When the VWRAP was designed, prior investments in irrigation had been aimed primarily at rehabilitating infrastructure and expanding irrigated area rather than revamping infrastructure and service delivery models to improve their efficiency, reliability, and equity, in line with best practice approaches for irrigation modernization.³ In recognition of these constraints, the government of Vietnam established the Center for Participatory Irrigation Management in 2004 within the Vietnam Academy of Water Resources. The Center for Participatory Irrigation Management leads applied research on modernizing Vietnam's irrigated agriculture systems by involving farmers, through water user groups, in more efficiently managing lower-level irrigation services and sharing irrigation management responsibilities with IMCs. This decentralized model, with delegated responsibilities for local institutions, was also expected to create an enabling environment for corporatizing IMCs, making them more efficient and demand-responsive. These institutional modifications were to be complemented by upgrades to irrigation infrastructure to increase water management efficiency and reliability and expand the irrigated area within the command areas of existing schemes. VWRAP was envisioned as an innovative project for both Vietnam and the World Bank because it was aimed at both rehabilitating and modernizing water management infrastructure and irrigation service delivery systems. According to staff of the Ministry of Agriculture and Rural Development who were interviewed by the IEG mission, VWRAP was the first project in Vietnam to introduce irrigation infrastructure modernization along with participatory irrigation management.

Dam Safety

1.5 Many of the irrigation dams were in a dangerously deteriorated state in the early 2000s. There are about 7,600 dams in Vietnam; 96 percent of them are used for irrigation. Most were constructed in 1970–90 when financial resources and technical expertise were scarce. The dams were built with limited technical investigations, and designs and construction quality were often inadequate. These concerns were compounded by the limited financial resources for O&M because irrigation dams were financed through government transfers and irrigation service fees that were often insufficient. Dam monitoring and regulatory capacity were also weak, with an inadequate legal framework and limited institutional capacity within the Ministry of Agriculture and

Rural Development. As a result, many dams had deteriorated, posing safety and economic security risks. In response, beginning in the early 2000s the government initiated a series of legal and regulatory reforms to enhance dam safety, for which it sought financial and technical assistance from the World Bank.

Integrated Water Resources Management

1.6 To address water resource management issues more comprehensively, Vietnam passed a Law on Water Resources in 1999, established a National Water Resources Council, and committed to river basin-wide, integrated water resource planning and management as a long-term goal. When VWRAP was designed, no basin-level institutions to coordinate water resources management had yet been established. The Thu Bon River Basin covers Da Nang, which is the third largest economic center in Vietnam. Major storm damage in the late 1990s had diverted the flow of rivers in the basin, causing flow reductions downstream that affected commercial river traffic and the quality of the principal water source for Da Nang. The government requested World Bank support to establish an institution for integrated water resources management in the Thu Bon Basin as a pilot case to help operationalize the Law on Water Resources, and to re-establish adequate river flows to Da Nang.

Vietnam Water Resources Assistance Project

Objectives

1.7 The project development objectives (PDOs) as stated in the Development Credit Agreement (DCA) were to assist the borrower to modernize and increase the productivity of Vietnamese agriculture, improve the management of water resources, and reduce dam safety risks through (i) the modernization of irrigation services in selected irrigation schemes within the project provinces; (ii) improvement of dam safety and management, and (iii) integrated development and management of the Thu Bon River Basin in Quang Nam Province. In accordance with IEG evaluation methodology, the PDO is understood to be the three objectives defined in the first clause of the statement: improving agricultural productivity, improving the management of water resources, and reducing dam safety risks. The subsequent clauses describe the broad mechanisms that were to be used to achieve the PDOs.

1.8 The Implementation Completion and Results Report (ICR) notes that there are differences in the PDO statements in the project appraisal document and the DCA. The project appraisal document version includes goals of poverty reduction and increasing farm incomes and does not explicitly mention irrigation modernization as a mechanism to achieve the objectives. The Project Performance Assessment Report analysis is based on the DCA version of the PDO.

Components and Costs

1.9 The project comprised four components:

1.10 **Irrigation modernization** (cost at appraisal, \$154.7 million).⁴ This component aimed to modernize the infrastructure and management of the six largest irrigation schemes in Vietnam. The bulk of the investment was for rehabilitating and renovating hydraulic infrastructure, including renovating degraded canals, installing long-crested weirs for improved water flow control and measurement, and developing tertiary canal systems. The safety of small and medium-sized dams supplying water for the schemes was improved as well. In addition, the management of schemes was to be improved. Each IMC was expected to prepare comprehensive management improvement plans, IMC performance benchmarking was piloted, and participatory irrigation management (PIM) was introduced on a pilot basis to increase farmer involvement through water user groups in management of final service delivery through tertiary networks. Transfer of management of secondary canals to water user associations was also piloted in three areas.

1.11 **Dam safety management** (cost at appraisal, \$10.2 million). The component was to improve dam safety and management throughout Vietnam by establishing a Dam Safety Unit with the Ministry of Agriculture and Rural Development and remedial safety works at three large dams, plus installation of safety instrumentation at Hoa Binh Dam. Hoa Binh is the largest reservoir in Vietnam, primarily constructed for hydropower.

1.12 **Thu Bon River Basin** (cost at appraisal, \$2.6 million). The component was to fund high-priority Quang Hue River flow stabilization works to control the flow of water to the cities of Da Nang and Hoi An. \$1.0 million was reserved for preinvestment studies for priority projects to be identified in the Thu Bon River Basin Master Plan.

1.13 **Project management and capacity building** (cost at appraisal, \$8.7 million). The component financed technical assistance for project management and training programs for capacity building, primarily for central and provincial staff of the Ministry of Rural and Agricultural Development. It also covered the incremental operating costs of the project management office and 11 subproject offices.

Implementation Arrangements

1.14 The Ministry of Agriculture and Rural Development was the lead executing agency for VWRAP. The small subcomponent for upgrading the safety instrumentation of Hoa Binh Dam was executed by the national electricity agency, Electricity Vietnam. Within the ministry, the Department of Water Resources took lead responsibility for technical oversight, under its mandate to provide policy, planning, and management

supervision for all irrigation systems in Vietnam. The central project office in the ministry manages all externally financed water resources projects in Vietnam. A VWRAP project management office was established within the central project office for general project administration and liaison with the World Bank and provincial level implementing agencies. At the provincial level the project was implemented by two entities. For complex dam safety and interprovincial works, the ministry's subproject implementation offices led implementation. Most irrigation schemes are owned by provincial governments and operated by IMCs. Provincial project management units were established comprising staff from the ministry's provincial Departments of Agriculture and Rural Development, along with IMC staff. In total, the project worked with seven project management units and four subproject implementation offices.

1.15 The project was initially designed to be implemented in three phases to allow some piloting of new water control structures and new approaches to PIM, and adaptation of the implementation approach based on experience before scaling these up over a wider area. The introduction of long-crested weirs and other infrastructure improvements required modifications to the prevailing approaches to infrastructure management; these modifications were expected to require some experimentation and learning. Similarly, a range of models for tertiary and secondary canal management was envisioned that inevitably was expected to require some analysis and adjustment based on practical experience. Major implementation reviews were envisioned for years three and five, to inform the adaptive process.

Financing and Duration

1.16 VWRAP was financed as a Specific Investment Loan with an original commitment of \$157.8 million. A Japan Social Development Fund (JSDF) grant of \$1.65 million was also provided as cofinancing for the PIM pilot activities. \$1.60 million of the grant was disbursed and it was closed in December 2009. The loan was fully disbursed by the end of the project in December 2012. The project was appraised in October 2003, approved on March 30, 2004, and became effective on December 21, 2004. The project had a relatively long, seven-year planned duration because the many innovations that it introduced in irrigation modernization required additional time for training and experimentation. Also, irrigation infrastructure work can only be implemented intermittently to accommodate the agricultural cycle, and this prolonged the time required for construction.

1.17 There were no significant changes in financing during the project. The DCA was amended in 2010 to eliminate the indicator for establishing a Thu Bon River Basin Coordination Committee because of the lack of agreement at the time on ministerial responsibilities for river basin management. In 2011 the project was restructured to

allow for a one-year extension of the closing date. The project closed on December 31, 2012.

2. Relevance of the Objectives and Design

Relevance of the Objectives

2.1 The PDOs for VWRAP responded very well to the development challenges facing Vietnam at the time the project was designed, and they continued to be relevant during and after implementation. They complement the aims of Vietnam's Social-Economic Development Strategy for the period 2011–20 and were relevant to the priorities for the World Bank's previous Country Partnership Strategies for the periods 2006–11 and 2012–16, which included better sustaining and managing natural resources, and modernizing development planning with participatory approaches. The Social-Economic Development Strategy targets agricultural modernization as a means to increase agricultural productivity, improve farm incomes and living standards, and contribute to national security.

2.2 The World Bank's current Country Partnership Framework for fiscal year (FY)18–FY22 cites the need for new drivers of agricultural growth, including greater sustainability of farm production, climate change resilience, and more efficient water use. The VWRAP's objectives for irrigation modernization continue to be highly relevant to the Country Partnership Framework's second objective: to promote private sector and agribusiness development.

2.3 There was a clear need for modernizing and increasing the productivity of agriculture, given weakening productivity; for improving management of water resources, given the lack of basin management; and for reducing dam safety risks, given the stock of old and deteriorating dams. The project objectives were quite relevant; however, the high degree of relevance notwithstanding, the PDOs as written were much broader than the geographic and subsectoral focus of the project. Though the project could be expected to contribute to modernizing and increasing the productivity of agriculture, improving the management of water resources, and reducing dam safety risks in Vietnam broadly, a more precise articulation would say the project would do this within the project areas rather than throughout the country, and would thus limit the modernization focus to irrigation only rather than to the entire agriculture sector.

2.4 The relevance of the objectives is rated **substantial**.

Relevance of Design

2.5 There is a partial disconnect between the PDO to increase agricultural productivity and the activities. Based on interviews, it is apparent that the intent of the design was that productivity would be indirectly increased as a result of the impacts of irrigation modernization; but many other factors in addition to irrigation modernization would be needed to improve agricultural productivity, and these other factors were beyond the scope of the project design, leading to attribution issues in evaluating achievement of the productivity objective. The project capitalized on links to the government of Vietnam's robust agriculture extension program to help achieve productivity gains.

2.6 The project fundamentally was designed to address dam safety and irrigation modernization. In addition, a component was added for improving water resource management in the area around Da Nang. The results framework provides a logical sequencing of component outputs and measurable indicators for improving dam safety, modernizing irrigation systems, and improving water resource management in the Thu Bon Basin. At the PDO level the project activities were expected to result in the establishment of a Dam Safety Unit and a national dam safety strategy, a national irrigation performance assessment program, and a national irrigation modernization training program. Component outputs and indicators were relevant and linked to these higher-level targets. They were expected to result in an expanded irrigated area in each scheme, which would lead to increased agricultural productivity for each scheme by putting more land into more intensive production.

2.7 A key part of the irrigation modernization model on which the project design was based relied on the introduction of irrigation service fees based on the volume of water delivered to farmers, but the concept had significant flaws. There was no tradition of charging for irrigation water based on volume, the water user groups were based on commune administrative boundaries rather than canal hydraulic boundaries, and reliably measuring gravity-fed flows to individual farmers or even to water user groups would have required significant additional investments in flow measurement infrastructure. The fees were still the primary source for IMC O&M budgets when the project was designed, and the introduction of volume-based fees was expected to create a more reliable measure of service delivery by IMCs and greater incentives for fee payments by farmers as well as more efficient operations by IMCs. The government abolished irrigation service fees shortly after the project began, thus removing what could have been a very complex element of the project design to implement.

2.8 The relevance of design is rated **modest**.

3. Implementation

Implementation Experience

3.1 **Project startup.** The project was launched during a period of significant inflation in Vietnam, which was not factored into the cost estimates of the feasibility study. Also, the inclusion of additional works, primarily for dam safety, led to a need to significantly redesign the infrastructure elements of the project to keep it within the original financial scope. By June 2006, the price of cement had risen by 20 percent, steel by 100 percent, excavation by 150 percent, and labor by 150 percent over the unit costs in the feasibility study. The project responded to these increased costs by reducing investments in lower-level canal improvements, primarily canal lining, which were executed on a significantly reduced scale. Overall, 37 percent of planned canal upgrading was dropped.

3.2 VWRAP's startup was also affected by a protracted delay in procurement of technical assistance. Because of delays in processing and clearing the technical assistance contract by the borrower, consultants were not mobilized until the spring of 2006, 2 years after the project was approved and 15 months after effectiveness. Ultimately, engineering design work did not start until June 2007 and major construction works were delayed until late 2008. The original project design anticipated a three-phased approach to implementation to allow for piloting of new water control infrastructure, with major reviews in years three and five to allow for learning and adaptation, given the innovations that the project was introducing. The extended delay in technical assistance contracting and mobilization led to cancellation of the phased approach.

3.3 **Mid-Term Review.** The Mid-Term Review, held in June 2007, assessed the impact of the implementation delays, cost overruns, and the changes to irrigation service financing policy. A revised implementation plan was adopted and the phased approach that would have allowed for some piloting and adaptation based on experience was abandoned in the interest of completing project performance targets on schedule. The project was also reviewed by the Quality Assurance Group in late 2008. They identified weaknesses in the PDO, principally the objective to improve agricultural productivity that relied on factors outside the scope of the project, and recommended amendments to the objectives and key indicators. The likelihood of achieving the objectives was rated Moderately Unlikely, but no restructuring was undertaken to amend the PDO.

3.4 **DCA amendment.** A jurisdictional dispute between the Ministry of Agriculture and Rural Development and the Ministry of Natural Resources and the Environment that could not be resolved during the period of project implementation meant that the

Thu Bon River Basin Coordination Committee could not be established. The DCA was amended in March 2010 to reflect this and the target was dropped.

3.5 **Extension.** The project required one no-cost extension of closing date, from December 31, 2011, to December 31, 2012, to complete all civil works.

Safeguards Compliance

3.6 VWRAP was classified as Category A for environmental assessment. It also triggered safeguards on the Safety of Dams (OP/BP 4.37), Natural Habitats (OP/BP 4.04), Pest Management (OP 4.09), Cultural Property (OP 4.11), Involuntary Resettlement (OD 4.30), and Indigenous Peoples (OP 4.10). A summary environmental impact assessment was prepared, as well as seven detailed ones, for the six irrigation schemes covered by the project and for the Quang Hue River subproject. At the outset, the Environmental Management Plan was not effectively monitored, primarily because of the overall delay in mobilizing technical assistance for the project. An independent monitoring consultant was appointed in 2007 and thereafter, environmental safeguards compliance was satisfactory. In the years after the project, no negative environmental impacts attributable to the project activities were reported.

3.7 The project caused either temporary or permanent loss of the use of some lands and property because of construction activities and the development of new infrastructure. In all, 5,974 households were negatively affected; of these 167 households were classified as “severely affected” with losses of more than 20 percent of their land. Sixty-five households required resettlement. Ethnic minorities were affected in one of the six irrigation schemes (Cau Son-Cam Son). Sixty-nine households of the Tay and Nung minorities were affected. The Provincial Project Management Unit prepared and implemented an Ethnic Minority Development Plan to compensate those affected. Gender and poverty aspects of the project were not specifically monitored by the social surveys or the monitoring and evaluation (M&E) system, which was a missed opportunity to assess project benefits in these areas.

3.8 Overall environmental and social safeguards compliance was adequate based on Implementation Status and Results Report and ICR documentation and the final report on the implementation of resettlement action plans.

Financial Management and Procurement

3.9 Following the mobilization of technical assistance and the Mid-Term Review, financial management and procurement were satisfactory. Annual audited financial statements and interim financial reports were on time and of acceptable quality.

3.10 Procurement was very slow during the first three years of the project but accelerated after full mobilization of technical assistance and project management staff. Procurement procedures followed the World Bank’s procurement guidelines and legal agreements, and processes were strengthened by the development of standardized forms and guidelines, and intensive training for procurement staff. Procurement arrangements for the project were complex and management-intensive. The irrigation modernization component alone involved 25 survey and design contracts and 295 construction contracts procured through national competitive bidding procedures.

3.11 Financial management and procurement practices and compliance with World Bank guidelines were assessed in the ICR to have been adequate.

4. Achievement of the Objectives

4.1 **IEG mission.** The IEG mission visited a purposive sample of three out of the six irrigation schemes in the project. In addition, the mission visited the Hoa Binh Dam and the Thu Bon River Basin. The irrigation schemes were selected to be representative of geography and project performance, based on assessed performance pertaining to institutional development at the time of the ICR. Within the irrigation schemes water user groups and a water user association were selected that were toward the downstream ends of the schemes. The mission used a set of structured questions and points for discussion for group interviews with government officials, water user group staff, and farmers. Field notes on the irrigation scheme visits and the set of structured questions used can be found in appendix B.

Table 4.1. Irrigation Schemes Visited by the IEG Mission

Irrigation Scheme	Province(S)	Institutions Visited	Geographic Area
Dau Tieng	Tay Binh, Ho Chi Minh City	3 IMCs, DARD, WUG, IMT	Southern
Phu Ninh	Quang Nam	IMC, DARD, WUA	Central
Yen Lap	Quang Ninh	IMC, DARD, WUG	Northern

Note: DARD = Department of Water Resources (provincial office of Ministry of Agriculture and Rural Development); IMC = irrigation management company; IMT = irrigation management team; WUA = water user association; WUG = water user group.

Objective 1: Modernizing and Increasing the Productivity of Vietnamese Agriculture

4.2 Achievement of this objective is **substantial**, based on productivity data and information on increases in farm incomes provided by the Ministry of Agriculture and Rural Development after the completion of the project.

Outputs

4.3 Productivity increases were expected to result from the improvements to water management for irrigation described under objective 2, supported by agricultural education and promotion of best practices provided by the ongoing national agricultural extension program as well as by project-specific initiatives. In addition, the PIM pilot program with 66 water user groups comprising more than 20,000 farmers conducted an extensive array of training activities. These included training on efficient use of irrigation water, crop diversification, and study tours to “best practice” farms in Dalat, Vung Tau, and China. The total number of training events and participants was not made available to the IEG mission, but feedback provided by water user group members and IMC representatives uniformly stated that the training and orientation provided by VWRAP were very effective.

4.4 The program was closely coordinated with Vietnam’s agriculture extension network, which provides improved seed varieties, advisory services for improving productivity, and a limited compensation program for crop failures.

Outcomes

4.5 Given the extensive array of variables that have affected agricultural productivity in the years since the project terminated, it was not possible to acquire updated data that could meaningfully assess the contribution of the VWRAP to current changes in productivity.

4.6 Agricultural production and productivity both increased significantly in the project areas by the end of VWRAP. Most of the increase was attributed to the one-third increase in irrigated area that was achieved through irrigation infrastructure improvements, but control group data were not available to verify this attribution, or any other estimations of productivity changes. In those areas where JSDF-supported water user groups were established, the project also included training, agricultural inputs such as improved seeds, and extensive coordination with Vietnam’s robust agricultural extension program. The expansion in area allowed for an increase in padi production of the equivalent of one season of rainfed cultivation in the newly irrigated lands. Padi yields in new fully gravity-fed areas increased by about 6.6 tons per hectare per year, and in partially pumped and gravity-fed areas by 6.0 tons per hectare per year. Productivity was already high in the 2007 base year in the previously irrigated areas of the six irrigation schemes, and productivity did not increase substantially in those areas as a result of increased water management efficiency, as measured by the amount of water needed per hectare and crop. Table 4.2, drawn from the ICR, summarizes the project’s estimated impacts on total production for selected crops. Increases in production were observed across all crops. Differences in the percentage increase across

crops could be partially explained by increases in crop diversification away from padi and toward higher-value vegetables.

Table 4.2. Changes in Total Estimated Production in the Six Irrigation Schemes under VWRAP

Commodity	Tons (thousands)		Increase (percent)
	Preproject (2007 base year)	With Project (2012)	
Padi	662	865	31
Maize	29	40	41
Soybeans	9	13	52
Sweet Potato	46	72	57
Vegetables	73	142	94

Source: World Bank 2013a, 13.

Note: Dau Tieng, the largest and most southerly irrigation scheme, accounts for about half of the non-padi crop production. Maize, soybeans, sweet potato, and vegetables are proxies for a range of low-, medium-, and high-value crops grown in the six schemes. VWRAP = Vietnam Water Resources Assistance Project.

4.7 Cropping intensity (number of crops per year) was estimated to have increased modestly in the areas with partially gravity-fed and pumped irrigation (from 150 percent to 170 percent), and in Dau Tieng, the only irrigation scheme with three crop seasons (from 260 percent to 270 percent).

4.8 Other productivity gains, such as increases in farming household incomes and crop diversification, were not monitored as a part of the project's M&E system but could be assessed from data provided by the Ministry of Agriculture and Rural Development. Incomes for smallholders (0.25 hectares farms) on gravity-fed irrigated farms rose by 124 percent, based on the ministry's data. Incomes on partially gravity-irrigated and pumped farms rose by 201 percent, considerably more than the average increase in farm incomes of 138 percent that was estimated at appraisal. Interviewees during the IEG mission reported substantial increases in padi crop yields (for example, from 4,800 kilograms per hectare to 7,500 kilograms per hectare per crop in Yen Lap), and all reported schemes reported increases in total production owing to increased irrigated area.

4.9 Following completion of the project, all the irrigation schemes are being affected by encroaching urbanization and employment shifts away from farming. The command areas of some schemes are being reduced as farm lands are converted for industrialization and water is used for industry as well as agriculture. There are also shifts toward more profitable aquaculture, which has been made possible by increased and more reliable access to irrigation water. Bulk water supplies to urban areas are

becoming an increasingly important source of revenue for IMCs adjacent to urban areas, and at least one IMC (Cuchi) is now also a retail water supplier.

Objective 2: Improve the Management of Water Resources

4.10 Achievement of this objective is rated **modest** because of the one-third reduction in actually completed infrastructure improvements versus what was originally planned, the limited improvement in IMC service delivery and financial performance (based on interviews conducted by the IEG mission), and the discontinuation of the IMC performance benchmarking program.

4.11 This objective was expected to be achieved by a combination of infrastructure rehabilitation, the introduction of new infrastructure technologies, and institutional reforms. The key results expected were the expansion of IMC collection areas (that is, the extent of irrigation services actually provided within the command areas of each scheme), the establishment of 66 water user groups managing on-farm water services for 25 percent of the irrigation command areas, benchmarked improvements to the financial and service delivery performance of IMCs, restoration of river flows to Da Nang City, and completion of two feasibility studies for water resources infrastructure in the Thu Bon River Basin.

Outputs

4.12 The planned activities and outputs for modernizing irrigation services involved the rehabilitation or upgrading of irrigation infrastructure in six irrigation schemes, and the establishment of 66 commune-level water user groups comprising in total about 20,000 farmers through the JSDF-financed PIM pilot project. Only about two-thirds of the originally planned infrastructure improvements were completed, because the project scaled back the number of planned works in response to cost increases. Almost all lower-level canal improvements, including the installation of flow measuring equipment needed for volumetric water pricing, were canceled. Headworks rehabilitation, primary and secondary canal lining, and the installation of long-crested weirs were fully achieved,⁵ but in a few cases weirs were incorrectly installed and their functionality was compromised, requiring reconstruction. The schemes were not expanded per se. The schemes had canals in place that covered their entire command areas but owing to inefficient and deteriorated structures and poor management the water was only distributed, on average, to about 50 percent of the command areas. The improvements allowed for more efficient management and distribution of the water so that more of the command areas could be reached.

4.13 The PIM pilot program established 66 water user groups across all six irrigation schemes. This involved an extensive series of orientation meetings and training activities for commune leaders and farmers, IMCs, and staff of the Ministry of Agriculture and Rural Development. The IEG mission was informed by the ministry, IMCs, and water user group representatives that the PIM training was very effective in improving local knowledge of and imparting skills for managing on-farm water service delivery. In the Thu Bon River Basin civil works to restore the Vu Gia River to its historical minimum flow levels for navigation and meet the raw water demand for Da Nang City, water supplies were completed. The works reconstructed a diversion canal between two rivers that had been damaged by a cyclone in the 1990s. Minimum flow levels have been achieved, as well as raw water supply for the Da Nang water utility.

Intermediate Outcomes

4.14 The expected intermediate outcomes were substantially achieved by project completion:

4.15 **Target: IMC collection area increased from 2007 levels averaging less than 50 percent to 75 percent of the total command area.** The collection area is the portion of the total irrigation scheme command area that is actually irrigated, and within which IMCs formerly collected irrigation service fees. As a result of infrastructure improvements, collection and irrigated areas expanded to a projectwide average of 81 percent. All but one of the irrigation schemes marginally or substantially exceeded the target of 75 percent for irrigation expansion. For the one irrigation scheme (Phu Ninh) that did not meet the target, different evidence sources provided different data. The project completion report indicated that the irrigated area was expanded by 67 percent, but data provided by the IMC to the IEG mission indicated that coverage expansion was only about 50 percent.

4.16 **Target: Water user groups cover 25 percent of each scheme's command area and are served by volumetric contracts with IMCs.** Within the six irrigation schemes covered by the project there were no prior formal water user groups, so the baseline was 0 percent. Volumetric contracts were not possible because flow measuring infrastructure for lower-level canals was not installed after the prices increased. Instead, water user groups signed area-based water service contracts with IMCs. Sixty-six water user groups were established and trained under the PIM pilot program and were able to manage tertiary irrigation covering about 20 percent of the total command areas of the six schemes. In most locations, this amounted to more than 25 percent of the actual irrigated area of each scheme.

4.17 Improving the financial and service delivery performance of IMCs was a key part of the modernization strategy. All IMCs were expected to prepare and implement

comprehensive management plans that, among other things, reflected the enhanced roles of water user groups in irrigation management and laid out financial performance improvement plans. The plans were only completed in the final year of the project. Similarly, irrigation modernization guidelines and O&M manuals for improved infrastructure were only completed at the end of the project, without time for orientation or additional training.

4.18 An IMC performance benchmarking program and pilot activities for transferring secondary canal management to farmer-managed local bodies (referred to as irrigation management transfer) were developed with technical assistance provided as part of the World Bank-funded Climate Change Development Policy Operation (P122667). Guidelines for benchmarking were only completed in the final year of the project, allowing time for only one round of data collection and no basis for measuring performance changes over time. The Ministry of Agriculture and Rural Development collected data sporadically for the benchmarking program until 2016, when the program was terminated.

4.19 The irrigation management transfer pilot activity established three multicommuene water user associations in three irrigation schemes. The intent was to pilot the transfer of secondary canal management to the water user associations, which were larger organizations than water user groups, covering multiple communes, with boundaries based on the canal command areas rather than the administrative boundaries of communes. As with the benchmarking program, the water user associations were only established in the final year of the project with limited orientation or training. The ministry followed up with support for the water user associations after the project closed.

4.20 The Supervisory Control and Data Acquisition (SCADA) instruments that were installed for dam safety (see para. 4.24) were also intended to support improved management of canal flows and operation of weirs. These too were only installed in the final year of implementation, and insufficient time was available for training in their use or for calibrating the sensors.

4.21 The Thu Bon River Basin management committee that was envisioned to pilot basin-based water resources management was not established, pending a decision on ministerial responsibilities for river basin management between the Ministry of Agriculture and Rural Development and the Ministry of Natural Resources and the Environment. This target was eliminated in an amendment of the DCA. The Ministry of Agriculture and Rural Development prepared a Vu Gia–Thu Bon River Master Plan and completed and approved two feasibility studies for implementing aspects of the plan.

Outcomes

4.22 The longer-term outcomes of the project with respect to improving water resource management were mixed. However, given that many of the project activities were innovative and experimental, a mix of levels of achievement is not unusual. The project provided valuable lessons from experience that contributed to the development of the Ministry of Agriculture and Rural Development's irrigation modernization strategy, and to the design of subsequent investments by the World Bank and other donors. The utility and impact of the lessons would have been stronger if a more rigorous and comprehensive M&E framework had been developed and implemented.

4.23 Water user groups have financial sustainability challenges. The concepts of water user groups and delegated irrigation management have endured as key elements of irrigation modernization in Vietnam. The 2017 Hydraulic Law encourages management of tertiary canals and on-farm water delivery by "grassroots organizations," and there are now more than 21,000 operating nationwide. However, most of these are informal organizations that lack adequate revenue or authority to engage with IMCs for service delivery contracts. Of the 66 water user groups established by VWRAP, the Ministry of Agriculture and Rural Development reported that about 70 percent are financially viable and continue to function as independent entities. About 30 per cent have been taken over by commune people's committees. Very few water user groups can meet costs solely on the basis of fees collected from farmers, based on information provided by the ministry and IMC staff and interviews with water user group members. Most are integrated with cooperatives, which have additional sources of revenue, such as aquaculture. The PIM concepts have also influenced commune and lower-level irrigation management models where water user groups per se are not established. In Dau Tieng, irrigation management teams employed by IMCs operate in a very similar manner, being selected by constituent households, but with assignments and stipends provided by IMCs rather than from fees collected from farmers by a water user group.

4.24 The establishment of pilot water user associations through the irrigation management transfer initiatives led to mixed results. The IEG mission met with one of the associations in Phu Ninh. The association was formed in 2012, disbanded a few years later, and was recently re-established with support from the provincial Department of Water Resources office of the Ministry of Agriculture and Rural Development. The water user association in Phu Ninh is intended to function as a larger, multicommune water user group, managing all irrigation services (secondary and tertiary canals) within its jurisdiction. The water user association receives an insufficient stipend from the IMC (12 percent of the per-hectare provincial budget allocation to the IMC for O&M), and there is a high level of dissatisfaction among farmers (based on IEG mission interviews) with irrigation service delivery. The mission was informed that other institutional

models for water user associations have been introduced in other schemes with greater success. In these other locations, the association only manages secondary canals, and coordinates with water user groups and communes for lower-level irrigation management. The ministry has supported the formation of seven water user associations as the model for irrigation management transfer evolves.

4.25 Efficiency of the system and water productivity. The Ministry of Agriculture and Rural Development reported that the modernized irrigation infrastructure installed through the project was functioning well, and the infrastructure observed by the mission supported this. The infrastructure and training for operating it have resulted in significant improvement in water use efficiency and the reliability and extent of irrigation services. For example, in Phi Ninh, the number of times water levels in secondary canals need to be regulated to distribute water to tertiary canals and farms per crop season dropped from 33 before the project to 3 now. In Dau Tieng, the amount of water needed per hectare for each padi crop dropped from 12,000–14,000 cubic meters preproject to 10,000–11,000 cubic meters today.

4.26 The SCADA systems for monitoring and managing irrigation canals are operational in only two of the six irrigation schemes, in Yen Lap and Dau Tieng (primarily the Cuchi IMC for Ho Chi Minh City). Key reasons for discontinuing operation of the SCADA systems for irrigation management at other locations include i) the poor quality of sensors that were initially procured during the project. Most became dysfunctional after a few years and the IMCs do not have funds to replace them; and ii) the perception by some IMC managers that SCADA systems are unnecessary, that manual monitoring and management is equally reliable and less expensive. However, the IMCs that have integrated SCADA systems in their modernized operations have found significant advantages, including allowing them to reduce staffing numbers. The Cuchi IMC has expanded their SCADA system, introducing phone applications for receiving monitoring data and expanding the monitoring system to tertiary canals.

4.27 Other aspects of irrigation modernization centered on improving service delivery by IMCs, and their institutional efficiency is progressing slowly. Only Yen Lap and Dau Tieng have comprehensively adopted the modern irrigation management principles that the project espoused. The IMC performance benchmarking program was scaled back and then discontinued; the last report was issued in 2016.⁶ IMCs, as state-owned enterprises dependent on central government budget allocations, lack the incentives to take the steps necessary to become financially efficient enterprises. Most are overstaffed and under-invest in preventive maintenance of infrastructure, according to ministry staff and irrigation experts interviewed by the IEG mission.

4.28 **Thu Bon River Basin management.** Both the feasibility studies prepared under VWRAP for implementing aspects of the Vu Gia–Thu Bon Master Plan resulted in projects that were financed by the government of Vietnam; both have been completed. Discussion continues with the government about institutional arrangements for river basin management. To date, no river basin management organization has been established in Vietnam.

Objective 3: Reduce Dam Safety Risks

4.29 Achievement of the dam safety objective is rated **substantial**, based on the sustained reduction in safety risks that the project accomplished within the project area, and on the influence it has had on national dam safety policies and practices.

4.30 This was to be achieved through the rehabilitation of infrastructure and institutional strengthening within the Ministry of Agriculture and Rural Development. The key results monitored were the establishment of a Dam Safety Unit within the ministry, rehabilitation of at least 10 of the 750 major dams in Vietnam, and installation of dam safety instrumentation at Hoa Binh Reservoir.

Outputs

4.31 All the performance targets for reducing dam safety risks were met during the life of the project. Ten large dams within the project area were rehabilitated, and safety monitoring equipment was installed at these dams and at the Hoa Binh hydroelectric dam. A Dam Safety Unit was established within the Ministry of Agriculture and Rural Development to ensure the safety of all irrigation dams.

4.32 SCADA monitoring equipment was installed at the Hoa Binh Hydropower Dam, as per the project design, to allow real-time monitoring of key safety parameters. Seven technical staff were trained to operate the monitoring equipment and use a modern, standardized reporting format. SCADA systems were also installed for dam safety monitoring and headworks control at the major dams within the six irrigation schemes. These systems were installed in the final year of the project, with only limited time for training and performance evaluation. Also, major rehabilitation and upgrading of 10 large dams was completed, a Dam Safety Manual was prepared, and Emergency Preparedness Plans were developed for the 10 dams. Government Decree No. 72 on Dam Safety Management, prepared with input from the project-prepared Dam Safety Manual, applies to all dams nationwide.

Outcomes

4.33 Overall, the project expanded the focus of responsible agencies from ensuring dam construction standards to monitoring and ensuring the safe management and

operation of dams. It established the institutional framework and supported the formulation of legislation to ensure the safety of dams nationwide. Following project completion, the ministry continued to expand the dam safety program, and upgraded the Dam Safety Unit to department level, the Dam Safety Department, comprising a director, two subdirectors, and six expert staff. The Dam Safety Department assists IMCs with developing annual safety plans, conducts technical safety audits every 5–7 years at each dam, and identifies priority dam safety investments. An additional six larger dams have been rehabilitated to meet safety standards with a combination of national budget and donor financing. Experience from the dam safety component of VWRAP informed the design of the follow-on World Bank–financed Dam Safety Project, which addresses safety issues for 415 smaller irrigation dams and supports implementation of a reservoir safety management program and a climate change mitigation plan.

4.34 The IEG mission found that all trained staff are still working at the Hoa Binh Dam, managing the SCADA systems satisfactorily. The SCADA equipment monitors dam body movement, seepage, and other parameters. The original monitoring equipment procured through VWRAP was inexpensive but not very durable. Most of the 92 sensors broke down after a few years. Electricity Vietnam has replaced all of them with better-quality European-manufactured sensors. The Hoa Binh Dam is now fully compliant with national dam safety regulations.

4.35 SCADA systems installed at the major dams within irrigation schemes have been less successful. Only two IMCs continue to use the systems comprehensively for headworks monitoring: Dau Tieng and Yen Lap. In these locations, the low-quality sensors procured by VWRAP had to be replaced within a few years. In other locations, the IMCs have found the SCADA systems too expensive to operate and maintain.

5. Efficiency

5.1 The economic analysis followed the method adopted in the project appraisal document and was limited to component 1 (irrigation modernization), which accounted for 88 percent of total project costs (World Bank 2013a, 15–16). The results of the analysis and comparison with the estimates at appraisal show a similar total economic internal rate of return (EIRR) of 15 percent versus 14 percent estimated at appraisal. The results for each irrigation scheme are shown in table 5.1.

Table 5.1. Economic Internal Rate of Return for the Six Irrigation Schemes (EIRR percent)

Document	Irrigation Scheme						Total
	Cau Son	Yen Lap	Ke Go	Phu Ninh	Da Ban	Dau Tieng	
PAD	22.3	33.7	11.8	11.0	12.5	11.9	14.2
ICR	15.0	20.1	13.8	10.1	6.8	18.8	15.3

Note: EIRR = economic internal rate of return; ICR = Implementation Completion and Results Report; PAD = project appraisal document.

5.2 This positive result, despite the lack of completion of about 37 percent of the lower-level irrigation canal infrastructure that was envisioned in the project appraisal document, appears to be owing to several factors. Most importantly, both fully gravity-irrigated area and partially gravity-irrigated and pumped area expanded by one-third through the project interventions between 2007 and 2012, based on data provided by the ministry, exceeding the original estimates at the outset of the project. Most of the canceled infrastructure investment was for lining of lower-level canals, which would have primarily allowed some reduction in water loss through seepage. The civil works that provided more reliable and efficient distribution of water to expand the irrigated area, such as long-crested weirs and the lining of large canals, were retained and completed. An additional factor is that the value of agricultural commodities turned out to be higher than expected at the end of the project. Another consideration is that the actual investment costs expended per hectare, at \$1,775, were moderate. As at appraisal, the analysis conducted for the ICR included municipal and industrial water benefits for the Yen Lap and Da Ben schemes. These additional water supply benefits boost the result for Yen Lap by about 5 percent, from 15 percent to 20 percent. For Da Ban the impact is less significant, with an increase from 5 percent to 7 percent, about the same as at appraisal.

5.3 The analysis shows a significant difference in results for the individual schemes between the estimated EIRR at appraisal and that calculated for the ICR. The poorest result is for the Da Ban scheme, which is largely to the effect of relatively high capital costs, moderate expansion in irrigated area, and lack of crop diversification. Both Cau Son and Yen Lap results are poorer because of higher investment costs and lower agricultural benefits. These poorer results are compensated by the large Dau Tieng scheme, which benefits from large-scale production of non-padi crops in the winter season. Sensitivity analysis showed how a one year earlier development of benefits relative to cost would improve the overall EIRR by about 6 percent, which would have been achievable if the project startup and procurement delays in the early years had been mitigated. Further sensitivity analysis demonstrated that decreasing the incremental net benefits stream by 15 percent would reduce the return for the whole project to 12 percent.

5.4 A financial analysis showed that farmers received significant increases in income. This is not surprising, because they were receiving benefits from the irrigation systems whose costs were born by government. The financial analysis showed that for a typical 0.25 hectares farm, income (after charging all labor at market prices) on fully gravity-irrigated farms increased from about D0.96 million (\$46) per farm per year to D2.15 million (\$103), or by 124 percent. For partially gravity-irrigated and pumped farms, income increased from D0.49 million (\$24) to D1.49 million (\$71), or by 201 percent. The comparable estimates in the project appraisal document showed an average increase of 138 percent. At completion, the returns per labor day (after charging all labor at D150,000 or \$7.20 per day) more than doubled on both farm types. The overall project financial internal rate of return at completion was 12.7 percent, compared with 12.5 percent estimated at appraisal.

5.5 Administrative efficiency was affected by the long delay in procuring and mobilizing management staff and technical assistance during the first three years of project implementation. Once the project management units and project management office were fully staffed, the units functioned well, and administrative efficiency was adequate.

5.6 Taking all the above factors into consideration, efficiency is rated **substantial**.

6. Ratings

Outcome

6.1 The project was substantially relevant to Vietnam's development priorities at the outset, and its outcomes continue to be so today. Relevance of design was **modest** because of a disconnect between the project's broad objectives and the design; the focus of the activities was on improving irrigation services, dam safety, and water resources management rather than on improving agricultural productivity per se. In addition, a key part of the irrigation modernization model on which the project design was based relied on the introduction of a volumetric irrigation service that was not tested or piloted before and would have required significant additional investments in flow measurement infrastructure.

6.2 Project efficacy was mixed, with partial achievement of institutional outcomes. The first objective of modernizing and increasing the productivity of agriculture is **substantial**, based on data and information on productivity and farm income increases, although achievement of this objective relied heavily on the government extension program that was not part of the project. The second objective of improving the management of water resources was **modest** owing to the insufficient results on

irrigation management modernization; that is, limited improvement in IMC service delivery and financial performance (based on interviews conducted by the IEG mission), and the discontinuation of the IMC performance benchmarking program; coupled with a one-third reduction in actually completed infrastructure improvements versus what was originally planned. The third objective, to reduce dam safety risks, is rated **substantial**, based on the sustained reduction in safety risks that the project accomplished within the project area, and the influence it has had on national dam safety policies and practices. Efficiency is rated **substantial** because of significant economic and financial rates of return.

6.3 The overall development outcome is rated **moderately satisfactory**.

Risk to Development Outcome

6.4 The principal risk is the continued reliance of IMCs and water user associations on budget support from the central government, and the possibility that irrigation infrastructure will once again deteriorate without adequate resources for maintenance. Provision of budget support for operation and maintenance of higher-level irrigation infrastructure and services is an explicit government policy that is unlikely to change, so the risk is not great. Also, with increasing urbanization, most IMCs can earn increasing income from the sale of water for municipal and industrial uses that can offset any budget shortfalls. However, few of the IMCs have improved the efficiency of their operations by, among other things, improving staffing ratios, and the IMCs associated with only one of the irrigation schemes in the project has been able to demonstrate financial viability.

6.5 There is also some risk associated with the limited technical and financial capacity of water user groups to manage tertiary infrastructure and on-farm water delivery. The IEG mission was informed at all three irrigation schemes visited that only water user groups that are integrated with agricultural cooperatives that have multiple sources of income can cover their costs, which are primarily staffing costs.

6.6 The risk to development outcomes is assessed to be **moderate**.

Bank Performance

Quality at Entry

6.7 There were significant weaknesses in the PDO, which led to a disconnect between the objectives and the project design. The project was admirably ambitious in introducing new concepts for irrigation modernization, but in doing so introduced risks in the project design that could have been mitigated through a stepwise approach, with

some innovations identified that could have been earmarked for introduction in subsequent investments based on the VWRAP experience. In fact, the original project design anticipated a more learning-driven, phased approach, but this was abandoned because implementation delays precluded the opportunity for phasing and adaptation. As an innovative project, the feasibility study should have provided a comprehensive baseline for monitoring achievement of the PDO.

6.8 In hindsight, the project could have benefited from inclusion of supplementary support for agricultural productivity training, to augment the ongoing government program. The project did provide a comprehensive array of training and capacity building for farmers and local institutions in the 66 communes that took part in the PIM pilot program, but other areas relied on the existing agricultural extension program. Although Vietnam benefits from a robust agricultural extension network, it operates with a very limited budget. The project might have benefited from supplementary investments to capitalize on opportunities that the improved irrigation systems were expected to bring, such as crop diversification. The long delay in starting up might have been shortened by simplifying the project procurement design with fewer, larger works packages and by completing procurement processes for consultant services immediately after appraisal.

6.9 Quality at entry is assessed to be **moderately satisfactory**.

Quality of Supervision

6.10 The supervision team initiated a Quality Assurance Group review around the time of the Mid-term Review; it advised on changes to the project design and approach to implementation, to address the slow rate of technical assistance procurement and weaknesses in the PDO, but the Quality Assurance Group's recommendation to amend the PDO was not acted on. World Bank supervisory staff responded appropriately to key project financing constraints by scaling back irrigation civil works but might have looked for ways to retain a phased approach to allow for more adaptation and learning, possibly through restructuring. Supervision missions and reporting were timely, accurate, and comprehensive throughout the project. The Ministry of Agriculture and Rural Development highly valued the active supervisory support that the project received from the World Bank's country office and continues to cite VWRAP, which is known as "WB3" in government agencies, as a stellar example of development cooperation.

6.11 Quality of supervision is deemed to be **moderately satisfactory**.

6.12 Overall Bank performance is assessed to have been **moderately satisfactory**.

Borrower Performance

Government Performance

6.13 The government's overall commitment to the project was strong and its support during both design and implementation was robust; the government clearly saw the project as an important instrument for operational research that would contribute to designing a national agriculture modernization program. Government procedures for technical assistance procurement and delays in staff appointments in the first years of the project significantly delayed early implementation, but overall support was strong, and project outcomes were integrated in subsequent policy and strategic decisions in the sector. Government performance is rated **moderately satisfactory**.

Implementing Agency Performance

6.14 The Ministry of Agriculture and Rural Development was highly committed to the project and was actively involved in its conceptualization and design. The central project office managed more than 300 contracts and worked actively to overcome delays in technical assistance mobilization and staffing which affected the project in the first two years. There was a focus on the infrastructure aspects of the project during implementation at the expense of the institutional reforms and PIM, but subsequently the ministry has taken on board the concepts of PIM that the project introduced. Support for improving the institutional performance of IMCs is more mixed. The suspension of the IMC performance benchmarking program, and limited uptake of irrigation management changes introduced by the project, have likely contributed to the lack of performance improvement of most IMCs. Implementing agency performance is assessed as **moderately satisfactory**.

6.15 Overall borrower performance was **moderately satisfactory**.

Quality of Monitoring and Evaluation

Design

6.16 The project had 10 performance indicators to measure progress and outcomes by subcomponent, but none of the performance indicators directly addressed the objective to improve agricultural productivity, or improvements in water resource management (for example, by measuring improvements in water use efficiency). The indicators focused on increases in irrigation coverage, establishment of water user groups, and completion of dam safety rehabilitation works, among others.

6.17 M&E implementation work was delayed by almost two years because of slow consultant procurement and national staff mobilization. Ultimately an M&E framework

was developed, but it focused primarily on measuring progress with infrastructure outputs, though the separate M&E system for the JSDF-financed PIM activities provided some additional monitoring information on the formation of water user groups over a three-year period.

6.18 The M&E framework was constrained by the link between key results indicators to project components rather than to the PDO itself. There was no indicator for assessing project impacts on agricultural productivity, and no baseline or control group data were compiled during the feasibility study or by the implementing agency prior to mobilization of the technical assistance that could have been used to measure productivity or irrigation efficiency gains. Major opportunities to monitor the impact of the project on agricultural productivity, poverty alleviation, gender aspects, and ethnic minorities were missed. The framework could have monitored the participation of women in water user groups and changes in crop productivity by water user group or commune, for example. A benchmarking program for assessing the performance of IMCs was conceived during the project but was not implemented until the final year.

Implementation

6.19 M&E was carried out through a contract with a national firm. Delayed mobilization of the consultants to implement the M&E system meant that it did not begin until just prior to the Mid-Term Review, about three and a half years after the project began. Once the M&E consultants were on board, the M&E framework was executed comprehensively, subject to the design shortcomings cited in the preceding paragraph, and reporting was completed in a timely manner. The IMC benchmarking program was not operational until the final year of the project and therefore had no baseline information on which to assess performance changes. All other M&E work ceased when the project ended in 2012.

Use

6.20 M&E use was constrained by the limited focus of the M&E framework, primarily on physical indicators. The delayed startup also affected the utility of the data collected, but once the system was running, M&E data were used to support project reporting and to guide project management decisions during the second half of the project. M&E reports were not a significant resource for informing the design of subsequent projects. Reports were not available to the Project Performance Assessment Report mission.

6.21 The overall quality of M&E was **modest**.

7. Lessons

7.1 The project's close alignment with the government of Vietnam's agriculture reform programs allowed it to pilot innovations that have had enduring policy impacts. VWRAP was conceived at the request of the Ministry of Agriculture and Rural Development, and aspects of its design and implementation were closely coordinated with the ministry's Center for Participatory Irrigation Management. This institutional buy-in imparted strong ownership of the project outcomes that has contributed to national agricultural policy reforms and legislation that occurred after the project was completed.

7.2 Irrigation modernization is a complex learning process that requires time and a phased approach. In this project, the planned phased approach was dropped, resulting in lost opportunities for learning and adaptation. The project introduced a complex mix of physical, operational, and institutional changes, many of which were untried in Vietnam. Testing and scaling up these changes can take time and adaptation. VWRAP was initially designed with a phased approach to implementing the infrastructure component, but the phasing was dropped when startup delays and price inflation required a reduced infrastructure component, removed some of the farm-level innovations that were intended to be assessed by the phasing, and pushed infrastructure contracts into the latter years of the project. Many of the outputs related to institutional innovations were only completed in the final year of the project, limiting time for capacity building, adoption, or analysis. Longer-term, multiproject phasing might have been a more prudent approach.

7.3 A similar case in point is that VWRAP's institution reform platform rested on the introduction of volumetric service fees for irrigation; but measuring water volume had never previously been practiced in Vietnam, and there were additional practical concerns associated with allocating charges through water user groups that are geographically based on administrative rather than hydraulic boundaries. Furthermore, government concerns about rural poverty that led to removal of the irrigation service fee entirely were under discussion leading up to the project, though removal of the IMC water service fees was not explicitly proposed by the government during the design phase. Project designs should include a "Plan B" for innovative, untested components to mitigate the impact of changes in the implementing environment on overall objectives. Such adaptability could be accommodated with a phased or programmatic approach that conforms to evolving government policies for the sector.

7.4 Key results indicators and M&E frameworks should be linked to development objectives and a clearly stated theory of change. VWRAP's results indicators were linked

to the project's components rather than to a results framework, and therefore did not measure progress toward achieving the development objective itself. Indicators and M&E frameworks should be designed with development objectives in mind, and this should be an element of project design assessed prior to appraisal.

7.5 For affordability reasons, water user fees may be insufficient to ensure the financial viability of water user groups; in that case, additional sources of funds including subsidies may need to be considered. In Vietnam, almost all the successful water user groups established by VWRAP and subsequently are agricultural cooperatives with other mandates and revenue streams in addition to irrigation service fees. Because the affordability varies among poor farmers, irrigation service fees can be insufficient to cover costs. A cooperative model with multiple sources of revenue may prove more financially sustainable. If a single-purpose water user group is considered, then government subsidies may be needed for sustainability of these organizations.

¹Five-Year Socio-Economic Development Plan, 2006–2010, Ministry of Planning and Investment, Government of Vietnam, March 2006.

² The “command area” of an irrigation scheme is the total area that can be economically irrigated and is suitable for cultivation. The irrigated area is the amount of land that actually receives irrigation service.

³ Irrigation modernization is defined by the Food and Agriculture Organization as “a process of technical and managerial upgrading (as opposed to mere rehabilitation) of the irrigation systems with the objective to improve resources utilization (labor, water, economic, environmental) and water delivery service to farms.”

⁴ Costs by component at project completion are not provided in the Implementation Completion and Results Report and they were not available from other sources; only costs by financing category.

⁵ Headworks rehabilitation primarily involved repairs to dams and the spillways for managing flows out of the reservoirs behind the dams. Long-crested weirs are flow regulation structures in canals that can maintain more constant water levels and therefore more regular flows into smaller canals and fields than the traditional flood gate structures. Canal lining reduces water losses to seepage and improves canal durability by reducing erosion.

⁶ The benchmarking reports were not available to the IEG mission.

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Appendix A. Basic Data Sheet

Water Resources Assistance (Credit No. C3880; Project ID P065898)

Table A.1. Key Project Data

Financing	Appraisal Estimate (\$, millions)	Actual or Current	
		Estimate (\$, millions)	Actual as Percent of Appraisal Estimate
Total project costs	176.2	176.2	100
Loan amount	157.8	157.8	100
JSDF grant	1.65	1.6	-
Cancellation		.05	

Table A.2. Cumulative Estimated and Actual Disbursements

Disbursements ^a	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13
Appraisal estimate (\$, millions)	3.2	15.9	47.6	79.3	111.0	142.7	159.4	159.4	159.4
Actual (\$, millions)	5.2	6.3	9.5	18.8	38.2	89.3	122.9	148.0	159.4
Actual as percent of appraisal	163	40	20	24	34	63	78	94	100

Date of final disbursement April 2013

Note: a. Includes Japan Social Development Fund grant of \$1.6 million.

Table A.3. Project Dates

Event	Original	Actual
Concept review	—	05/23/2000
Negotiations	—	-
Board approval	—	03/30/2004
Signing	—	-
Effectiveness	—	12/21/2004
Closing date	12/31/2011	12/31/2012

Table A.4. Staff Time and Cost

Stage of Project Cycle	World Bank Budget Only	
	Staff time (no. weeks)	Cost ^a (\$, thousands)
Lending	249.94	1,003,343,.93
Supervision/ICR	222.91	719,950,.63
Total	472.85	1,723,294,.56

Note: ICR = Implementation Completion and Results Report.

a. Including travel and consultant costs.

Table A.5. Task Team Members

Name	Title ^a	Unit	Responsibility or Specialty
Supervision/ICR			
Dung Thi Thuy Dao	Program Assistant	EACVP	Team member
Vinh Quoc Duong	Consultant	EASVS	Team member
Yoshiharu Kobayashi	Sr. Water Resources Spec.	MNSWA	TTL #2
Hung Viet Le	Sr. Financial Management Specialist	EASOS	Team member
Tuan Anh Le	Social Development Specialist	EASVS	Team member
Thu Thi Le Nguyen	Specialist	EASVS	Team member
Lan Thi Thu Nguyen	Operations Analyst	EASVS	Team member
Trang Phuong Thi Nguyen	Natural Resources Economist	EASVS	Team member
Cuong Hung Pham	E T Consultant	EASVS	TTL#3
Hoa Thi Mong Pham	Sr. Water Resources Spec.		Team member
Henrike Brecht	Senior Social Development Spec	EASFM	TTL ICR
Cung Van Pham	Disaster Risk Management Spec	ECSAR	Team member
Herve L. Plusquellec	Disaster Risk Management Spec	EASRP	Team member
Nguyen Chien Thang	Sr. Financial Management Special	AFTWR-HIS	Team member
Jan Timmerman	Specialist	EASOS	Team member
Yhong Quang Tran	Consultant	EASNS	Team member
Ly Thi Dieu Vu	Senior Procurement Specialist	EACVF	Team member
Thi Linh Anh Vu	Specialist	LCSWS	TTL #1
Greg Browder	Consultant		
	Financial Management Specialist		
	Consultant		
	Team Assistant		
	Lead Water and Sanitation Specialist		

Note: ICR = Implementation Completion and Results Report.

a. At time of appraisal and closure, respectively.

Table A.6. Other Project Data

Borrower or Executing Agency

Follow-on Operations

Operation	Credit No.	Amount (\$, <i>millions</i>)	Board Date
Irrigated Agriculture Improvement		180.0	12/11/2013
Dam Rehabilitation and Safety Improvement		415.0	11/20/2015

Appendix B. Observations from Project Site Visits

The Independent Evaluation Group (IEG) mission traveled to three of the six irrigation schemes that participated in Socialist Republic of Vietnam Water Resources Assistance Project (VWRAP)—Yen Lap in Quang Ninh Province, Phu Ninh in Quang Nam Province, and Dau Tieng in Tay Ninh Province—and the Hoa Binh hydroelectric dam. At each irrigation scheme, the mission met with representatives of the irrigation management company (IMC), the Department of Water Resources (provincial office of the Ministry of Agriculture and Rural Development), and at least one water user group. Summary findings for each location are described below.

Yen Lap Irrigation Scheme, Quang Ninh Province

Yen Lap is situated inland from Haiphong, the major industrial port for northern Vietnam. The area is rapidly urbanizing, and some of the command area of the irrigation scheme is being converted to industrial uses. At VWRAP completion, the scheme comprised a command area of 8,350 hectares. The dam and reservoir were constructed in 1977. The scheme covers parts of three districts.

Yen Lap Quang Ninh Irrigation Management Company

The IMC operates as a nonprofit public service delivery unit owned by the Quang Ninh Provincial People's Committee (PPC). The IMC has 322 staff, somewhat more than the provincially approved staffing level of 308. It manages 13 dams in the province (of which Yen Lap is the largest), 5 pumping stations, 18 drainage culverts, and 250 kilometers of canals.

Through VWRAP, the IMC prepared a dam safety master plan, an emergency response plan, and an emergency preparedness plan, all of which are reviewed and updated regularly. They also prepare annual corporate operations plans. VWRAP financed rehabilitation of the dam headworks, spillways, lining of key portions of primary and secondary canals, and installation of six long-crested weirs.

A Supervisory Control and Data Acquisition (SCADA) system was installed to allow remote, real-time monitoring of spillways and weirs on secondary canals. Currently, only the headworks monitoring system is operational. IMC management's view is that the SCADA system is expensive to maintain and not needed for canal management.

The IMC currently has water delivery contracts based on irrigated area with 26 water user groups, all of which are agricultural cooperatives. In areas without water user groups, contracts are with 19 commune people's committees (CPCs). Under VWRAP, six water user groups were established under the participatory irrigation management

(PIM) pilot program in Yen Lap. Of these, four exist now, as agricultural cooperatives. The other two have disbanded and tertiary irrigation management responsibilities have been taken over by the respective CPCs.

The IMC receives provincial budget allocations based on technical and economic norms – average unit costs of water delivery and irrigated area, based on contracts as cited above. In addition, the IMC sells bulk water to three water supply companies. The sale of water represented about 20 percent of the IMC’s total operating budget of D15 billion in 2018. The company also generates a small amount of income from consultancy services, aquaculture, and tourism.

Through VWRAP improvements, irrigation efficiency was said to have improved, but no figures were available to quantify this. Irrigation coverage within the command area increased from 40 percent to 100 percent. The increased reliability and extent of irrigation have allowed for crop diversification to higher-value crops. Now, during the dry season, 30 percent of crops are vegetables and flowers for nearby urban markets. However, urbanization is encroaching on the command area of Yen Lap and reducing its size.

In coordination with the PIM pilot program, the National Center for Farm Extension provided farmer training to maximize the productivity related to increased access to irrigation; it included promotion of crop diversification, provision of improved seed varieties, and training on better farming practices. The IMC itself also provides training on water use planning and efficient irrigation management.



Yen Lap dam and reservoir



Yen Lap SCADA system for monitoring headworks and primary canals



Long-crested weir, with the gated weir it replaced in the background

Linh Hoa 3 Water User Group

Linh Hoa 3 is in an urbanizing district, adjacent to urban development. It is also at the lower end of the Yen Lap command area and was not extensively irrigated before the project. During VWRAP, three water user groups were established in Linh Hoa. Numbers 1 and 2 have been terminated and their irrigation management responsibilities taken on by the CPCs. Linh Hoa 3 was formally registered as a cooperative in 2012. The water user group received extensive training from VWRAP on financial administration and irrigation management, along with basic office furnishings and a computer.

The water user group has 517 households as members and 250 hectares of land devoted to agriculture (185 hectares for crops and 65 hectares for aquaculture). Thirteen members have been appointed to an irrigation management team (a role assumed by IMC staff prior to establishment of the water user group), which signs annual contracts with the IMC and the water user group membership to maintain lengths of the tertiary canals and manage water distribution to farmers. Each team member receives about D15 million (about \$640) per year as a salary. The water user group generates funds from each household, who contribute the cash equivalent of 8 kg of padi annually, based on the market price. The water user group has three main expenses: irrigation management team (IMT) salaries, canal maintenance, and office overhead. The main services that the water user group as an agricultural cooperative provides are irrigation

management, purchase of agricultural inputs in bulk for members, and management of a co-op aquaculture enterprise, the profits of which are distributed to members. Members are primarily subsistence farmers, with very little surplus from their own fields for marketing. The average farm size is about 2000 square meters. As in other parts of the Yen Lap scheme, farm land is gradually being lost to industrialization. Forty-five hectares were recently acquired for an industrial estate, about 20 percent of the water user group's total agricultural land.

The water user group signs annual and monthly water delivery contracts with the IMC based on irrigated area.

The water user group chairman reported the following main benefits from VWRAP:

- Increased agricultural productivity owing to more water and better management. Annual padi production rose from 4,800 kilograms per hectare before the project to 7,500 kilograms per hectare after. Only 5 percent of the water user group's agriculture received gravity-fed irrigation before the project. By the end of VWRAP, 60 percent was gravity-fed. The IMC has continued to improve water access; now 85 percent receives gravity-fed irrigation.
- A strengthened irrigation management team, a result of better water supply and extensive training provided by VWRAP.

UỶ BAN NHÂN DÂN TỈNH QUẢNG NINH
CÔNG TY TNHH MTV THỦY LỢI YÊN LẬP QN
Số 02/VB-CT

CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh phúc
Quảng Yên, ngày 02 tháng 01 năm 2019

BẢNG KẾ HOẠCH MỠ NƯỚC NĂM 2019

Căn cứ vào lịch gieo trồng các vụ của thị xã Quảng Yên năm 2019;
Phòng Quản lý nước và Công trình - Công ty TNHH MTV Thủy Lợi Yên Lập Quảng Ninh lập Kế hoạch mỗ nước năm 2019 chi tiết từng đợt như sau:

Tháng	Đợt	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
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NGƯỜI LẬP: Dương Cao Phong
 Ghi chú: Những ngày mỗ nước
 CÔNG TY TNHH MTV THỦY LỢI YÊN LẬP QN
 GIÁM ĐỐC: Nguyễn Xuân Lương

Annual water delivery contract/schedule between IMC and Linh Hoa 3 water user group.



Canal managed by Linh Hoa 3 water user group, with encroaching urbanization in the background

Hoa Binh Hydroelectric Dam

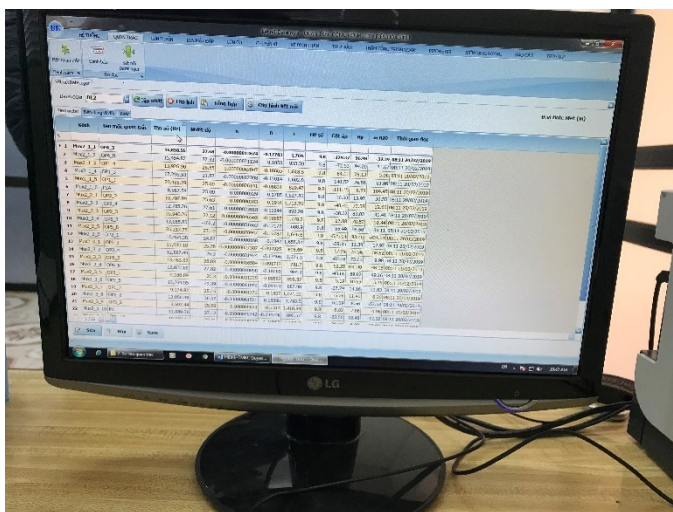
Hoa Binh Dam, located about 75 kilometers west of Hanoi, is the largest dam in Vietnam; it generates about 25 percent of the country's electricity. It also controls the flow of the Da River, reducing flood risks for Hanoi and the Red River Delta, and it regulates water levels for agriculture and river transportation.

VWRAP provided a SCADA system and staff training to operate it to improve the safety of the dam. The SCADA system primarily monitors dam body movement through seismic sensors, which allows for real-time data collection and timely decision making in the event of faults in the dam structure. Seven staff were trained to operate the SCADA system, and all continue to work at Hoa Binh in this capacity. The project also supported the establishment of a modern, standardized monitoring and safety reporting format that conforms to national dam safety regulations. An emergency preparedness plan is in place, but it was not prepared as a part of VWRAP.

Staff reported that the SCADA system is very effective and functioning well. The main drawback during project implementation was that procurement procedures that were followed resulted in the purchase of lower-cost but inferior-quality Chinese-manufactured equipment. Most of the original sensors malfunctioned shortly after the project was completed, but they have been replaced with superior European-manufactured equipment. More careful drafting of the technical specifications for SCADA equipment procurement might have resulted in the initial purchase of higher-quality sensors during the project.



Hoa Binh Dam



Hoa Binh SCADA equipment



Phu Ninh Irrigation Scheme, Quang Nam Province

The Phu Ninh Irrigation Scheme is in central Vietnam, about an hour south of Da Nang.

Quang Nam Irrigation Management Company

Like other IMCs, Quang Nam IMC is a provincially owned public service delivery unit that operates on a nonprofit basis. Any additional income it generates is factored into the overall operating budget and provincial subsidies are reduced proportionately. Also like most other IMCs, it is overstaffed (based on staffing ratios of staff per volume of water provided or area irrigated), with 400 employees in seven branch offices.

The IMC manages one main dam and five smaller dams with a total capacity of 500 million cubic meters, three spillways, and one hydropower plant. It provides irrigation water for 23,000 hectares of land in six districts, from a command area of about 50,000 hectares. It also provides water for municipal supplies and hydropower. For irrigation, there are two main canals totaling in length about 90 kilometers.

VWRAP provided financing for headworks rehabilitation, lining of 34 kilometers of the primary canals, and introduction of long-crested weirs for flow control. This resulted in an increase in irrigated area from 15,000 hectares before the project to 24,300 at the end (this has dropped back to 23,000 because parts of the command area were converted to industrial use). The current Irrigation Agriculture Improvement Project is also operating in Phu Ninh and will add an additional 2,000 hectares of irrigated area.

IMC management and Department of Water Resources representatives cited the introduction of long-crested weirs as a major improvement in irrigation efficiency. Before their construction, water levels had to be manually regulated 33 times per cropping season using traditional floodgate weirs. With the long-crested weirs, flows need to be adjusted only three times per crop.

VWRAP provided a SCADA system for Phu Ninh, but it was found to provide unreliable data and was expensive to operate and maintain. Most of the system has been inactive since it was installed. The electronic systems are only used to operate floodgates on spillways. None of the remote communications systems or canal sensors are functional. Management cited the poor quality of the equipment that was procured as a contributing factor in the dysfunctionality. All instructions provided were in Chinese, which IMC staff could not read.

The IMC has been experiencing financial difficulties for years. The primary budget allocation amount has been flat for several years, but operating costs have risen

significantly. In 2018, the annual budget provided by the province was D50 billion, plus an additional D12 billion earned from municipal water sales and other activities, making a total budget of D62 billion (about \$ 2.66 million). This was insufficient and the PPC provided a budget supplement of D10.5 billion. Overruns in recent years were as follows:

2016: D5.8 billion

2017: D7.5 billion

2018: D10.5 billion

The IMC developed a business plan during VWRAP, and it has continued to update the plan periodically, but the absence of user fees, and low budget allocations, have prevented real reforms in the way that it operates. They recognize a need to corporatize their operations but have been unable to do so.

The IMC reported that water user groups are gradually disappearing in the province, in significant part because of a provincial decision to limit co-op member fees to D400,000 (\$17.14) per hectare per cropping season, and collection of even this amount is difficult. This is insufficient to cover the costs of irrigation management teams and the other overheads that these small organizations incur. Also, much of the command area is urbanizing and people are shifting from agriculture to factory employment, reducing the need for services that an agricultural cooperative can offer. CPCs are increasingly taking over aspects of the roles that water user groups have been playing in lower-level irrigation management, working with the IMCs' irrigation management teams.

VWRAP worked with four existing cooperatives to establish water user groups under the PIM pilot program; it also set up two water user associations.



Phu Ninh spillway rehabilitated under VWRAP, and SCADA spillway control

Phu Ninh N16 Canal Water User Association

Under the PIM pilot program, VWRAP established two water user associations within the Phu Ninh Irrigation Scheme, for the N16 and N18 secondary canals.¹ The idea was that water user associations, covering multiple communes and based on the irrigation system's hydraulic boundaries rather than on CPC administrative areas, would be more financially efficient at managing secondary irrigation infrastructure and would also be more responsive to farmers as association members and clients.

The Phu Ninh water user associations were essentially scaled-up water user groups, with responsibility for managing all irrigation infrastructure from the secondary canal to the farms. The associations would receive 12 percent of the area-based budget that the IMC obtained from the PPC to cover their staff and operating costs. No fees could be collected from farmers directly because the water user associations were not linked to CPC administrations.

This model did not work well. The 12 percent subsidiary budget allocation was insufficient for staffing and administrative costs, and water user associations had no other source of financing because they were not cooperatives. The water user association for the N18 secondary canal collapsed in 2014, and the N16 association ceased functioning temporarily a year or two later.

Shortly before the IEG mission, the Department of Water Resources had negotiated with farmers to re-establish the N16 water user association. The mission met with the recently

appointed association chairman, inspector, and a few farmers served by it. The association was initially established in 2012, in the final year of VWRAP. It covers 565 hectares and has responsibility for managing 8.8 km of secondary canal and 2.1 kilometers of drainage channels. It covers parts of three communes. The average farm size is about 2,000 square meters, and about half of the households had a production surplus for sale. Average production is about 6 tons of padi per hectare per crop, or 12 tons per hectare per year. VWRAP has not yet resulted in much crop diversification within the water user association area.

Each commune has one or more informal irrigation teams for managing tertiary canals and on-farm delivery. The PPC has agreed to an irrigation service fee that CPCs could collect to cover tertiary canal management, but CPCs do not collect it. Farmers maintain, to varying degrees, the portions of the tertiary canals on their lands themselves. Farmers and the water user association management itself were highly dissatisfied with the current irrigation management arrangements. Key issues included the following:

- The 12 percent subsidiary budget allocation was insufficient. An allocation of at least 20 percent was needed for the water user association to function effectively.
- The relationship between the IMC and the water user association was cumbersome. Monthly budget allocations were often delayed.
- Farmers felt that irrigation services at the secondary canal level and below were much better managed by IMC irrigation management teams, as they were prior to the establishment of the water user association. Water delivery by the association requires a written request every 10 days.

The mission was informed that the water user association model applied in other provinces functions much more effectively. These others are more akin to umbrella entities, with co-op-based water user groups managing tertiary canals and paying small service fees to the water user association for secondary canal management to supplement their IMC budget allocations. Water user groups overall are working well within the Phu Ninh Irrigation Scheme. There are now 165 water user groups established; 112 are agricultural cooperatives, 45 are committees within CPCs, and 8 are smaller groups arranged to meet local issues and capacities.

Elsewhere in the Phu Ninh Irrigation Scheme, the IMC manages irrigation services through seven irrigation management teams. Each irrigation management team covers four to five communes.



Poorly maintained secondary canal and unhappy farmers in N16 water user association service area.



N16 water user association meeting and office, financed by VWRAP.

Dau Tieng Irrigation Scheme

Dau Tieng is the largest irrigation scheme in Vietnam, with an irrigated area of 271,000 hectares. It is also one of the oldest and best established. The Dau Tieng dam was constructed with World Bank financing in the late 1970s. Because it covers parts of five provinces, there is an apex IMC state-owned enterprise that is owned by the

Ministry of Agriculture and Rural Development, as well as provincial or municipal subsidiary IMCs. The IEG mission met with the apex IMC and two subsidiary IMCs for Tay Ninh Province and Ho Chi Minh City Municipality.

Dau Tieng-Phuc Hua Irrigation Management Company

The Dau Tieng IMC manages two reservoirs and 145 kilometers of primary canals, and functions essentially as a bulk water provider. Three provinces receive water for both irrigation and municipal supplies, and two provinces only receive water for municipal use. The Ministry of Finance has established a pricing bracket for bulk water of D900–1,100 per cubic meter. The headworks IMC receives 20 percent of the bulk water price and provincial IMCs retain 80 percent. However, in cases where the headworks IMC sells directly to water supply companies or to industry, it retains 100 percent of the price.

The principal inputs from VWRAP were investment in headworks rehabilitation and installation of a SCADA system. The SCADA system continues to function adequately for headworks monitoring, but four out of seven transmission lines for canal monitoring have broken and have not been repaired. SCADA canal monitoring was not seen to be a priority investment, but headworks monitoring is. The IMC secured additional government funding to upgrade the system to include seepage monitoring, and it is now planning to invest in seismic monitoring.

The IMC has 270 staff and operates on an annual budget of D84 billion, of which about half is state budget allocation and half is water sales. This only covers staffing, operation, and maintenance, no capital investment.



Dau Tieng-Phuc Hua IMC office, financed by the Bank Group’s first irrigation project in Vietnam, and primary canal.



SCADA display and canal sensor

Tay Ninh Irrigation Management Company

This IMC is also a multiprovince entity and is owned by the Ministry of Agriculture and Rural Development. It manages 988 kilometers of canals and irrigated 45,000 hectares at the start of VWRAP. Through VWRAP 70 percent of the canals were rehabilitated or lined, and the West Canal was upgraded to expand irrigated area by 13,460 ha, bringing the total irrigated area to 53,460 hectares. Farmers can produce three crops per year. Infrastructure improvements have resulted in a 20 percent reduction in water losses.

The IMC is relatively well managed and efficient, with 240 staff, and including four district offices. It is financially sound, with D84 billion in receipts from the government budget allocation (D79 billion) and water sales (D5 billion) in 2018. This has allowed the IMC to invest in capital improvements.

Tay Ninh IMC worked with 21 water user groups and cooperatives during VWRAP, and now has contracts with 25 water user groups. Each water user group or co-op manages 300–500 hectares of irrigated lands. The water user groups receive 8 percent of the IMC’s per-hectare government budget allocation.

In areas without co-ops, the IMC works with 230 individual irrigation team members, who each manage up to 100 hectares of irrigation services. They too receive 8 percent of the government’s area-based irrigation budget from the IMC. Before the abolition of irrigation service fees, ITMs were the IMC agents responsible for collecting fees from farmers, of which they would retain 20 percent for their income, but collection rates were low.

The Japan Social Development Fund–funded PIM pilot program required water user groups to prepare agriculture development plans to maximize the productivity impacts

of VWRAP infrastructure and management improvements. The pilot program provided extensive training and technical assistance that covered

- Irrigation management;
- Efficient water use;
- Coordination with the existing agriculture extension services to provide improved seeds, promote and provide guidance for diversification to higher-value crops, advice on safe use of agrochemicals, subsidies for crop failures, and other advisory services; and
- Study tours to regional agriculture “best practices.”

Thai Binh II Irrigation Service Cooperative (Water User Group):

The co-op was established in 2009 as a part of the VWRAP pilot program. It received financing for an office, computer (now broken), rehabilitation of 46 tertiary canals, and extensive administrative training. Staffing comprises a director, two deputy directors, an accountant, and 10 irrigation team members. The water user group manages 920 ha, of which cropping is as follows:

- 192 hectares padi
- 289 hectares other seasonal crops, such as cassava, vegetables, and so on
- 433 hectares in perennial crops, primarily rubber
- 92 hectares aquaculture

Water user group management reported that the 8 percent budget allocation was insufficient to fully cover staffing and operating costs. Furthermore, payments from the IMC were often delayed and sometimes amounted to less than 8 percent. The water user group does not have sufficient capital to provide other services; its service area covers 697 households, of which only 36 are members. No fees are charged to farmers.

Management also reported that the agriculture extension program provides extensive training and is very responsive to requests for guidance. Agricultural extension meetings are held at the water user group every two to three months.

Key results from VWRAP were reported to be more reliable and predictable irrigation, resulting in the ability to plant additional crops and new varieties. The water user group is viewed positively by farmers because it is local and responsive, maintains canals well, and has supported increased crop production. Padi production is about 8 tons/ha/season, or 24 tons/ha annually.



Thai Binh II Irrigation Service Cooperative (water user group) office

Ho Chi Minh City IMC, Cuchi

The Ho Chi Minh City IMC is perhaps the best managed IMC in Vietnam, according to the Ministry of Agriculture and Rural Development. Located on the edge of the expanding Ho Chi Minh City urban area, it has a relatively diverse mix of irrigation, municipal water supply, and entrepreneurial mandates. The IMC comprises 10 canal management clusters. The IEG mission met with the N43 canal management cluster, and then with the IMC head office management.

The management cluster covers eight communes with 15 villages among them. It works with one water user group/co-op and 72 irrigation team members. The water user group represents 2 villages covering 331 ha, with 422 families. The water user group's formal membership is small, just a group head and deputy, both elected by their constituents. The Ho Chi Minh City IMC has a service contract with the head of the water user group based on area covered and responsibilities rather than on a simple per-hectare percentage of the provincial budget provided for the IMC (this is in part because of the complexity of the IMC's income streams, discussed below).

The IMC cluster feels that the water user group imparts a greater sense of responsibility for water management to farmers, and leads to more efficient water use, conservation, and lower-level infrastructure maintenance. It also has the advantage of covering multiple villages, a bit more than the alternative system described below. In total, VWRAP's PIM pilot program established seven water user groups in the Ho Chi Minh City catchment, all of which continue to function. However, there is no budget allocation to establish additional water user groups and co-ops, in part because the alternative system is very similar and seems to work effectively.

Areas not covered by the water user group operate in a very similar manner, but with irrigation management teams comprising one to three people. The IMTs are appointed by the farmers they serve, and their tasks are assigned by the IMC through service contracts, with pay based on tasks and area covered. The IMTs hold weekly meetings with their constituents to discuss and plan irrigation operations and coordinate with agricultural extension. There are no fees collected from farmers by the IMTs or the water user group.

VWRAP's PIM pilot program provided extensive training to 12 communes in the Ho Chi Minh City IMC catchment on irrigation management and coordinated with the agricultural extension program for improving productivity and promoting crop diversification. Study tours were organized for about 200 farmers to Dalat and Vung Tau to learn from improved agricultural practices in those locations.

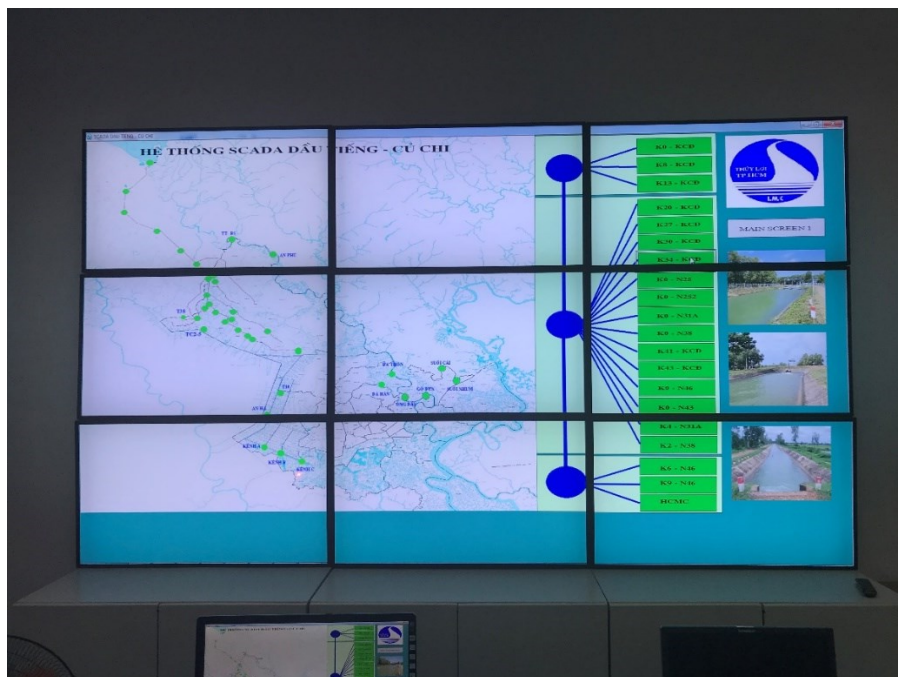
The Ho Chi Minh City IMC has several business lines in addition to irrigation service delivery. These include bulk water supply for municipal utilities (sold at D250/M³), operation of their own water treatment plant and water supply company (supported by capital investment from the PPC), construction contracting, sale of agricultural inputs, and trade in local agricultural products (orchids). The PPC budget allocation covered about half of their expenditures in 2018, with other income covering the rest. As in the other IMCs visited, urbanization is reducing agricultural land within the catchment and creating alternative employment for farmers, and it is a contributing incentive for business diversification.

The IMC is a strong proponent of the use of the SCADA system introduced by VWRAP, and they have maintained and expanded the system considerably since the project ended. They see the value of the real-time data collection and remote management, and the IMC can afford to invest in the system. Currently, there are two control centers managing data from 26 sensor stations (13 were installed under VWRAP). A smartphone application has also been developed. They are now introducing on-farm water monitoring and tertiary canal management with a goal to have this system fully operational by 2020. Other goals include full computerization of all irrigation management clusters. There is a program to upgrade high-performing water user groups and IMTs to become “advanced irrigation management clusters” that receive additional capital investments.

Key lessons from VWRAP that the Ho Chi Minh City IMC management described include the following:

- VWRAP infrastructure improvements, combined with the stronger sense of responsibility for water management by farmers imparted by the PIM program, has improved irrigation efficiency. Before VWRAP, 12,000 to 14,000 cubic meters of water per hectare were needed for each padi crop. Now, only 10,000 to 11,000 cubic meters are required.
- IMCs need to develop a better understanding of the value of information technology to take advantage of SCADA systems. VWRAP was an initial building block that introduced the concept for better irrigation management, but thus far only the Ho Chi Minh City and Yen Lap IMCs have seen the advantages.
- Investment in operation and maintenance (O&M) is important to maintain the value of infrastructure investments, especially SCADA. The Ho Chi Minh City IMC spends about D300 million (\$12,800) per year on SCADA O&M, against a capital investment of D17 billion (\$726,000). Regular maintenance of high-quality, durable sensors is particularly important.

- Human resources are the key to successful irrigation management in the long term. VWRAP helped develop an in-house training program to build up permanent, skilled staff. Outside consultants have been less useful, and only for very specific roles.



HCMC IMC's SCADA monitor wall.

Guiding Questions Used for Interviews

Ministry of Agriculture and Rural Development

1. Can you give an overview of the sector? What are the challenges currently on irrigation service delivery and integrated water resources management in general?
2. What were the main achievements of VWRAP? What could be cited as the key success factors of the project? Did the project make an impact on institutional and policy reforms in the sector? If so, how?
3. Conversely, what were the key challenges that the project faced, and how were they addressed? Were there aspects of the project that could be considered failures? What lessons could be learned from them?
4. How do you see the post-VWRAP situation regarding Vietnam's agriculture and irrigation sectors (in terms of sector structure, yields, farm income, irrigation coverage, water efficiency)? Are there any recent data on yields, irrigation coverage in the project areas that we can access to understand the long-term productivity impacts of VWRAP?
5. Are ongoing World Bank support projects helping in sustaining the VWRAP results? Have activities or lessons from VWRAP influenced the design or implementation of subsequent initiatives in water resources and agriculture?
6. How do you see the role of the World Bank in the sector compared with other donors/sources of funding—at the time that VWRAP was implemented and today? How coordinated/complementary are donor efforts in the sector?
7. Please describe how irrigation is managed in Vietnam. What are the respective roles of MARD [Ministry of Agriculture and Rural Development], IMCs [irrigation management companies], WUGs [water user groups], other agencies?
8. How is the sustainability of VWRAP-supported I&D systems assured? What are the budgets for O&M for the infrastructure built under the project (primary, secondary, tertiary)? How coordinated/complementary are the roles of water user associations, IMCs, and MARD?
9. Is maintenance of irrigation infrastructure fully covered by the government budget, or are there any contributions by WUGs? Are the funds collected/provided sufficient to manage, operate, maintain, and eventually replace? Is there any cost-recovery data?

10. Has the SCADA system that was initiated under VWRAP been fully operationalized, and is it currently functioning?
11. VWRAP provided a range of training and capacity building for MARD staff. Can you please assess the quality of the training, whether it provided staff with the skills required for dam safety management, monitoring of irrigation infrastructure, and so on.?
12. Are ongoing projects supported by the World Bank or other sources of financing helping to sustain the VWRAP results? Did VWRAP have an impact on the design or implementation of other projects in the water resources and agriculture sectors?
13. Was there any other/parallel effort on agricultural extension? Did lack of this component impact project outcomes on yields?
14. Please describe the Thu Bon River Basin management program, and VWRAP's inputs to improve river flows in Da Nang. Are the flows being maintained? Were any subsequent projects under the master plan that were identified by VWRAP subsequently implemented? Integrated Irrigation Management committee was dropped; why?
15. Please describe the role, responsibilities and structure of the Dam Safety Unit. Has the Unit continued to function as envisaged when it was established under VWRAP?
16. Are safety audits carried out periodically, or only at the design stage?
17. How is dam safety monitored/managed for dams under the responsibility of agencies other than MARD?

Donor Partners

1. Please describe the mandate and activities of your institution in water resources and agriculture.
2. How does your institution work/coordinate with the World Bank and other donor partners in Vietnam in the water resources and agriculture sector?
3. Did VWRAP influence the design or implementation of your institution's activities in any way? What is your institution's assessment of the effectiveness of VWRAP, and of the World Bank's program in Vietnam more broadly? Can you recommend ways to improve donor harmonization in WRM [water resources management] and agriculture?

Hoa Binh Dam Management

1. Please describe the safety instrumentation that was provided through VWRAP. Is it continuing to function as designed? Is it sufficient for the safe management of the dam?
2. Was training of staff provided through VWRAP? Was it adequate to ensure that staff can use the safety instrumentation?

Provincial Institutions (PPMU [Provincial Project Management Unit]/SPIO Staff, PPCs)

1. Please describe how irrigation systems are managed in your province. What are the respective roles of MARD, provincial/local government, IMCs, WUAs [water user associations], WUGs, individual farmers.
2. Please describe the infrastructure and training provided to your institution through VWRAP. Is the infrastructure continuing to function as designed?
3. Are there sufficient budgets for irrigation system operation, maintenance, depreciation?
4. What do you consider to be the main positive outcomes of VWRAP? Have they continued after the end of the project?
5. Are there indigenous groups in your province? Were they affected by VWRAP in any way, either positively or negatively? Did VWRAP undertake any activities that specifically targeted indigenous groups or women as beneficiaries? How did they work out?
6. Ask about SCADA system either to them or IMCs.

Irrigation Scheme Interviews (IMCs, WUGs, Farmers)

1. Please describe the respective roles of your institutions, or you as a farmer, for managing and maintaining irrigation and drainage systems in your area.
2. How do IMCs cover their costs? Are there central government subsidies? If so, what do they cover?
3. What were the key inputs or improvements to the irrigation system in your area that came from VWRAP?
4. For WUGs:
 - a. How many members does your WUG have? How is it structured, what are your key responsibilities?

- b. What are the main characteristics of members, in terms of farm size, crops, and so on. How has any of this changed as a result of VWRAP or subsequent activities?
- c. Do you collect any fees from your members? How are fees structured? Did VWRAP change any of the financing arrangements? Are fees and other sources of income/revenue sufficient to cover the costs of the WUG's activities and responsibilities?
- d. What benefits do you provide to your membership?
- e. What are your WUG's current main needs and challenges for performing your responsibilities?
- f. Do you recall what infrastructure or training was provided to your group by VWRAP? Did it fully meet your needs?
- g. Do farmers receive enough flow, pressure, and total quantity of water to meet their crop water requirements in a timely manner?
- h. Is there adequate drainage for excess water, and protection against flooding?
- i. Do you feel that irrigation water is distributed fairly across all WUGs and other users in the irrigation system?

Farmers

- a. What is the size of your farm?
- b. What are your main products/crops?
- c. Do you receive enough flow, pressure, and total quantity of water from the irrigation system to meet your crop water requirements?
- d. Is sufficient water available in a timely manner? Do you receive water according to an agreed schedule and with predictability?
- e. Do you feel that water is distributed fairly across all users of the irrigation system?
- f. Can you vary your access to water in response to changing needs during the cropping cycle and over seasons, or if you change crops?

- g. Do you pay for irrigation services? If so, how much do you pay (and how is the payment calculated), and how do you pay (that is, schedule of payments – monthly, seasonally, and so on).
- h. Does the irrigation system design also provide some protection against flooding?
- i. Have you switched to other crops because of more available water, or started cultivating multiple crops? If yes, since when?

¹ Water user associations were also established under the participatory irrigation management pilot program in Ke Go Province and one other scheme.

Appendix C. List of Persons Interviewed

No.	Name	Position	Organization/Department
Meeting with MARD (March 11)			
1.	Chu Van Chuong	DDG	ICD, MARD
2.	Le Van Duong	Deputy Director	Department of Dams Safety and Irrigation Schemes Management, Directorate for Water Resources, MARD
3.	Mr. Quang		CPO for Irrigation Projects
4.	Mr. Đàm		Department of Investment Management, DWR
Meeting with Vietnam Academy for Water Resources (VAWR) and its Center for Participatory Irrigation Management (CPIM) (March 12)			
1.	Nguyen Tung Phong	Deputy General Director	VAWR
2.	Ass Prof Dr Tran Chi Trung	Director	CPIM (under VAWR)
3.	Ass Prof Dr Doan Doan Tuan	Deputy Director	CPIM (under VAWR)
Meeting with Yen Lap Quang Ninh Irrigation One-member Limited Liability Company (March 13) Address: Khu Yên Lập, Phường Minh Thành, Thị xã Quảng Yên, Tỉnh Quảng Ninh			
1.	Vu Trong Tinh	Deputy Director	Yen Lap IMC
2.	Tran Sy Vinh	Ex- deputy Director	Irrigation Department (now DWR), MARD
Meeting with Lien Hoa 3 Agricultural Cooperative (also WUG), Lien Hoa commune, Quang Yen Town, Quang Ninh Province (March 13)			
1.	Dao Van Tao	Board Chairman	Lien Hoa-3 Agri Cooperative
Meeting with DWR (March 14)			
1.	Chu Thi Thu Huyen	Head of Division	Division of Irrigation Economy, Department of Irrigation Schemes Management, DWR
2.	Nguyen Hoang Quan	Expert	Division of Irrigation Economy, Department of Irrigation Schemes Management, DWR
3.	Nguyen Hoang Minh	Expert	Department of Infrastructure Development, DWR
4.	Le Hung Nam	Director	Water Resource Management Department, DWR
Meeting with Hoa Binh Hydropower Plant (March 15)			
1.	Mr. Thắng	Ex-Deputy Director, VWRAP	CPO
2.	Nguyen Van Minh	Director	Hoa Binh Hydropower Company

No.	Name	Position	Organization/Department
3.	Tran Van Hoa	Manager, Technical Department	Hoa Binh Hydropower Company
4.	Do Chi Bich	Manager, Hydraulic Workshop	Hoa Binh Hydropower Company
5.	Nguyen Dinh Thuy	Reservoir Regulating Officer	Hoa Binh Hydropower Company
Meeting with Quang Nam DARD and IMC (March 18)			
1.	Le Van Thu	Deputy Manager	Subdepartment of Irrigation, DARD
2.	Nguyen Thanh Phat	Head of Technical Department	Subdepartment of Irrigation, DARD
3.	Tong Viet Khoi	Deputy Director	ODA Projects Management Unit, DARD
4.	Le Dinh Son	PMU staff	ODA Projects Management Unit, DARD
5.	Luu Hong Co	PMU staff	ODA Projects Management Unit, DARD
6.	Huynh Hoang	Chairman of BOD	Quang Nam IMC
7.	Nguyen Dinh Hai	Director/CEO	Quang Nam IMC
8.	Nguyen Ngoc Chau	Head of Irrigation Management and Exploitation Department	Quang Nam IMC
9.	Dao Van Thien	Manager	Phu Ninh (district) Irrigation Management Branch, Quang Nam IMC
10.	Pham Van Tan	Deputy Manager	Phu Ninh (district) Irrigation Management Branch, Quang Nam IMC
Meeting with Phu Ninh N16-Canal Water User Cooperative (WUA) (March 18)			
1.	Nguyen Van Quyen	(newly-elected) Director	Phu Ninh N16-Canal Water User Cooperative
2.	Phan Tang Anh	Supervisor	Phu Ninh N16-Canal Water User Cooperative
3.	Luong Tan Hung	Head of Binh Tu Irrigation Works Management Cluster	Thang Binh (district) Irrigation Management Branch, Quang Nam IMC
Meeting with Tay Ninh DARD, IMC, WUG (March 20)			
1.	Nguyen Hong Phuc	Acting Director	Agricultural Projects PMU, DARD
2.	Tran Van Cang	Division Head	Infrastructure Management and Development Division, DARD
3.	Le Anh Tam	Deputy Manager	Irrigation Schemes Development Subdepartment, DARD
4.	Nguyen The Thu	Management Staff	Chau Thanh (district) Irrigation Enterprise, Tay Ninh IMC
5.	Bui Phu Quoc	Management Staff	Chau Thanh (district) Irrigation Enterprise, Tay Ninh IMC
6.	Le Phu Thanh	Head of Cooperative	Thai Binh II Irrigation Service Cooperative (WUG), Chau Thanh District

No.	Name	Position	Organization/Department
7.	Nguyen Tan Tai	Deputy Head of Cooperative	Thai Binh II Irrigation Service Cooperative (WUG), Chau Thanh District
Meeting with Dau Tieng – Phuoc Hoa IMC under MARD (March 20)			
1.	Trần Quang Hùng	Director	Dau Tieng – Phuoc Hoa IMC (this company is under direct management of MARD)
Meeting with HCMC-Cuchi IMC (March 21)			
2.	Nguyen Huu Duc	Chairman of the Board	Ho Chi Minh City IMC
3.	Doan Van Hung	Board Member	Ho Chi Minh City IMC
4.	Nguyen Van Dam	CEO	Ho Chi Minh City IMC
5.	Le Truong Tho	Manager	Irrigation Department, Ho Chi Minh City IMC
6.	Chu Van Huynh	Deputy Manager	Irrigation Department, Ho Chi Minh City IMC

World Bank Staff and consultants with whom interviews were held:

1. Achim Fock, Operations Manager, EACVF
2. Greg Browder, Lead Water Resources Management Specialist, GWADR
3. Cuong Hung Pham, Senior Water Resources Management Specialist, GWA02
4. Yoshiharu Kobayashi, Senior Water Resources Management Specialist (retired)
5. Herve Plusquellec, irrigation engineering consultant

Other interviews:

1. Ryutaro Takaku, Water Resources Management Specialist, Asian Development Bank (Project Manager for Water Efficiency Improvement in Drought-Affected Provinces Project)

Appendix D. Borrower Comments

From: iaip@cpo.vn <iaip@cpo.vn>

Sent: Monday, August 5, 2019 10:00 AM

To: Linh Thi Thuy Tran <ltran5@worldbank.org>

Cc: 'Hung Vu Dinh' <hungvd_cpo@yahoo.com>

Subject: RE: Unofficial Vietnamese translation: Water Resources Assistance Project (WRAP) - IEG Draft Project Performance Assessment

[External]

Dear Ms. Linh

This is useful report as my view. The report reflects rightly information obtained from the meeting with relevant agencies/stakeholders and Subproject site visits of the IEG Mission March 2019 that I was accompanied. And I would fully agree with the report's assessment.

Best regards,

Quang