A RAPID APPRAISAL OF THE IRRIGATION PROGRAM OF THE PHILIPPINE GOVERNMENT

EXECUTIVE SUMMARY

Introduction

Irrigation has been the major expenditure outlay of the Philippine government for agriculture. However, performance of the national irrigation program has been below expectation. This paper reports the findings of a rapid appraisal of the irrigation program of the Philippine government, upon request of National Economic Development Authority (NEDA) and Department of Budget and Management (DBM) through the Philippine Institute for Development Studies (PIDS). The assessment findings and recommendations will then serve as inputs to budget and allocation decisions. Key implementation and evaluation issues covered by this rapid appraisal are summarized in the following.

Funding allocation

Foreign versus local funding. The predominance of foreign funding in the 1970s to early 1980s in irrigation development biased investments towards overly large systems with inappropriate designs. With the shift from foreign funding to local funding, and less influence by the donor agenda, the government can now set its own irrigation agenda. However, with the rise in local funding, a different set of concerns arises. Often associated with local finance would be the less rigid set of controls compared to foreign funding. For example, fewer locally funded projects produce, if at all, completion reports at the end of the project. A greater concern would be the external review and evaluation which would be carried out for foreign assisted projects.

Bias for national systems and rehabilitation works. For four decades and a half, public investment for irrigation had been largely for NIS and rehabilitation. The total share of NIS in total public support is in fact higher when the cost of O&M and other support services funded from NIA's corporate revenues are included.

Financial sustainability of NIA. While total contribution from farmers is increasing, this covers only about half of total corporate expenses of NIA, the ROs operations cannot be fully covered by NIA's revenue sources. Also, with the removal of the management fees in 2012, the Central Office will be left with miscellaneous income and current corporate incomes which will not be enough to cover its expenses. NIA will be needing large national government subsidy every year. According to DBM, from 2014 onwards, the subsidy to NIA will cover funding gaps in corporate operations taking into account internal income generated. Else, it will have to find alternative sources of incomes or reduce its spending.

Project preparation and analysis

Non-economic indicator for identification. Caution should be exercised in project identification and design, as these are often based on a flawed measure of *potential irrigable area* that does not fully consider economic and physical viability and alternatives to gravity systems, i.e. groundwater and pumped irrigation. The consistently lower service area relative to design area, indicate gross overestimate of irrigable area with aspects of urbanization not factored in, built-up areas not counted out, areas in higher elevation likely to be beyond reach of the system still counted in, flooded areas which cannot be served during wet seasons not counted out in service area.

In addition, the latter estimate does not include potential of groundwater development, where the private sector investments have been significant since the 1990s. There is a need to better document this phenomenon and for government to perform its proper developmental and regulatory role in this area.

Growth of private pump irrigation. Private investments in irrigation development have grown significantly over the past two decades even in areas with NIS or CIS which maybe providing inadequate service. Future growth in irrigated area will increasingly be through expansion of private pumps. Most of these pumps will be utilizing groundwater resources in areas where yields are favorable as economic potential for expanding gravity irrigation systems reaches its limits, efficient management of existing systems continue to be elusive, and effective demand for irrigation water comes mainly from higher valued crops.

It is therefore important to have a more accurate estimate of irrigated area by pumps, knowledge about where and in what crops they are currently used, and a better understanding of the factors affecting supply and demand for pump irrigation, including the relative importance of government support in their adoption *vis a vis* private initiatives and investments. This is not only for the government to better assist in individual groundwater development, but to better manage groundwater resources by designing the appropriate regulatory framework for its sustainable use. Groundwater use for agriculture needs to be better understood, monitored and then, managed.

More importantly, with the growth of private pump irrigation in NIS/CIS systems (especially shallow tubewells or STWs drawing from shallow aquifers), NIA and the irrigators associations operating the systems will need to consider conjunctive management to better manage and allocate the ground and surface water resources for agricultural use. To implement conjunctive management, data on STWs in NIS and CIS will be necessary.

In order to manage irrigation systems, it is important to recognize the need for information at several levels: trans-basin (for adjoining basin-level projects); basin-level (esp. for large systems, or sets of smaller systems); and river system level (for smaller systems).

Implementation issues

The persistent under-funding of routine maintenance raises the cost of maintenance requirement over time as irrigation facilities continue to depreciate. The costs of repair and rehabilitation increase significantly if minor repairs are not undertaken in a timely manner, leading to an earlier requirement for major rehabilitation. Practical preventive maintenance may have been overlooked, e.g. silt excluder, in the interest of staying within project cost at the price of higher maintenance in the future.

Project reports reviewed indicate that majority of the projects at completion and evaluation indicate large digression from appraisal or project proposal estimates of EIRR. The completion EIRRs have been significantly lower than at appraisal, costs and time overruns incurred and actual area generated lower than targets.

Recommendations

Feasibility studies need to carefully review the assumptions over space and time, as ex post assessment of past projects have shown many of these key assumptions are flawed (and if made more realistic, would have fundamentally altered project design and even approval).

A RAPID APPRAISAL OF THE IRRIGATION PROGRAM OF THE PHILIPPINE GOVERNMENT

Final Report submitted to the Philippine Institute for Development Studies[1]

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1. INTRODUCTION

Irrigation is a key component in the government's strategy to improve agricultural productivity and attain food self-sufficiency. To realize these goals, there is a need to ensure that the program of the National Irrigation Administration (NIA) is performing its assigned role. Irrigation development has historically been the single biggest item of public expenditure for agriculture, accounting for about a third of the total since the 1960s. In the 1970s, 1980s, and in recent years when world rice prices rose to unprecedented levels, this ratio went up to close to 50 percent of total public expenditures for agriculture. With increased pressure on irrigation to help attain food sufficiency, more resources are allocated to the sector at a time when NIA's capacity and role have been scaled down in the past few years under the agency's rationalization program.

A critical reexamination of NIA's role in irrigation development and operation is necessary. This entails a proper understanding of the problems and factors that undermine the irrigation sector's performance. Many of these concerns involve institutions and institutional performance, transparency in procedures and agenda, concerns with equity, access and rights, financial sustainability and reducing the financial burdens of the public sector. This paper reports the findings of a rapid appraisal of the irrigation program of the Philippine government, upon request of National Economic Development Authority (NEDA) and Department of Budget and Management (DBM) through the Philippine Institute for Development Studies (PIDS). The assessment findings and recommendations will then serve as inputs to budget and allocation decisions.

The objective of the study is to evaluate the government's irrigation program and the policy and institutional framework governing the irrigation sector, with focus on national irrigation systems (NIS). Specifically, the study aims to deliver the following:

i) Brief description of the policy and institutional framework of governance of irrigation and their historical evolution over time;

ii) Analysis of the financial structure and operations, including the historical patterns of public expenditures for irrigation (1960-2013), focusing on the last five years as data permits;

iii) Analysis of the performance indicators of national irrigation systems from 1965 to 2013;

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[1]The views expressed in this report is the private opinion of the authors and does not represent the views of PIDS, DBM, NEDA, or any other institutions with which they are affiliated.

iv) Critical review of the processes of evaluating the feasibility of irrigation projects, project selection, designing of dams and distribution network, project execution, operation and maintenance, repairs, rehabilitation, and effectiveness of monitoring performance at various stages of irrigation development and management.

Data will be obtained from both secondary sources and field work. Secondary data will include: NIA financial records, programs of work, NIS performance indicators (aggregate and by system), thematic maps, and foreign assisted project (FAP) documents. Case studies will cover large, medium, and small systems in Luzon (which accounts for the bulk of the country's irrigation systems), i.e. Upper Pampanga Integrated Irrigation System (UPRIIS), together with Casecnan Phase 1 and Phase 2 in Nueva Ecija; the Pampanga Delta system; two systems in Tarlac, namely Balog-balog irrigation system and Tarlac Groundwater Reactivation; Agno River Irrigation System in Pangasinan; Bonga 1, 2, and 3, and Ilocos Norte Irrigation Program (INIP) in Ilocos Norte; Banaoang Pump System in Ilocos Sur; and the Sta Maria, Balanac, and Agos River Irrigation Systems in Laguna/Quezon. There will be one case study for Visayas, namely the Bohol Integrated Irrigation System.[2]

The rest of the paper is organized as follows: Section 2 describes the framework and context of the study. Section 3 reviews the recent history of irrigation development in the Philippines, examining both expenditure and performance. Section 4 discusses implementation problems with focus on results of the case studies. Section 6 summarizes and states recommendations.

2. CONTEXT AND FRAMEWORK

Benefits from irrigation services and water resource management are characterized by externalities, public good-like features, and large economies of scale. Irrigation systems have multiple purposes, involving many participants, and competing interests between upstream and downstream farmers. These lead to market failure, opening up a rationale for public sector intervention.

Public investments in large gravity irrigation systems grew rapidly in South and Southeast Asia in the 1970s and 1980s, contributing to the Green Revolution in rice and wheat. Poor performance of this type of irrigation has however been widely reported throughout the region. In the early 1970s and 1980s, NIA was among the most reputable in irrigation development and management in the region. It pioneered the development of participatory approaches and irrigators' associations in the 1980s. NIA's technical staff were called on to assist other countries. Since then, the reputation of NIA has greatly deteriorated.

Governance of irrigation is highly complex, covering the capture, storage, conveyance, distribution, and application of water. Irrigation systems have multiple purposes, involving many participants, and competing interests between upstream and downstream farmers. Interdependence of surface water and groundwater requires conjunctive management. Multi-sectoral demand for water under scarcity conditions requires basin level management.

[2] Time constraint excluded Mindanao from the rapid appraisal. Luzon and Central Visayas irrigation systems account for 71% of irrigation service area based on NIA data.

The irrigation investment and service delivery is to achieve efficiency and maximize social welfare. This is the stated policy of government and lending agencies. Government policy and institutional interventions should be evaluated based on social cost-benefit analysis (CBA or economic internal rate of return, EIRR). CBAs are performed for foreign-funded projects and large locally funded projects. Also, CBA is performed *ex ante* (feasibility studies), and at project completion, but is seldom done *ex post*. A few impact studies may be available, but these studies focus on the impacts or benefits, without comparing these to costs.

Over an irrigation project cycle, tasks cover identification, preparation, appraisal and selection, implementation/construction, evaluation. Then operation and maintenance, repair, restoration, and rehabilitation follow. ***Project identification*** aims to find potential projects. Common sources for this would be well-informed technical specialists and local irrigators associations or farmer leaders. While performing their professional duties, technical specialists will have identified many areas where they feel new investment might be profitable. Local farmer leaders may have a number of suggestions about where investment might be carried out. Ideas for new projects also come from proposals to extend existing programs.

With the identification of projects, more detailed ***preparation and analysis of project*** plans follow. This process includes conduct of feasibility studies. The feasibility study will define the objectives of the project and explicitly address the question of whether alternative ways to achieve the same objectives may be preferable. This will enable project planners to exclude poor alternatives. The feasibility study will provide the opportunity to shape the project to fit its physical and social environment and to ensure that it will be high yielding. The level of detail of a feasibility study depends on the complexity of the project; for some projects, a succession of increasingly detailed feasibility studies will have to be carried out.

After a project has been prepared a critical review or an ***independent appraisal*** should follow. This process provides an opportunity to reexamine every aspect of the project plan to assess whether the proposal is appropriate and sound before large sums of money would be committed. The appraisal process builds on the project plan, but it may involve new information if the specialists on the appraisal team feel that some of the data are questionable or some of the assumptions faulty. If the appraisal team concludes that the project plan is sound, the investment may proceed. But if the appraisal team finds serious flaws, it may be necessary for the analyst to alter the project plan or to develop a new plan altogether.

Project implementation. Implementation is the most important part of the project cycle. In the implementation phase some departures from original project design may be deemed necessary given new information from the ground. In general such discrepancies should be avoided by preparing better and more realistic a project plans.

The final phase in the project cycle is ***evaluation***. The analyst looks systematically at the elements of success and failure in the project experience to learn how better to plan for the future. Formalized evaluation may take place at several times in the life of a project; it may be appropriate when a major capital investment such as a dam is in place and operating, even though the full implementation of the plan to utilize the water and power is still under way. Ideally, careful evaluation should precede any effort to plan follow-up projects.

The project cycle framework described above serves as the benchmark for this irrigation appraisal study. In practice, political pressures, rent-seeking, and corruption perpetuate technical and economic inefficiencies in the irrigation and water sector (Wade 1982, Repetto 1986, Araral 2005, Huppert 2013). Hupert notes “local as well as international professionals on different levels in the water sector are caught in multifaceted conflicts between formal objectives and hidden interests—and often tend to resort to rent-seeking behavior themselves”. These professionals are in the bureaucracy, foreign lending agencies, consulting firms, and even local and international academic institutions dependent on the irrigation agencies and international donors for funding. In the Philippines as perhaps elsewhere, politicians interfere in project selection, construction, rehabilitation, distribution of water, and staff appointments and promotions. This is not just due to concerns for constituents, but because they are themselves are landowners, contractors, or can manipulate the contracting process.

3.1. Trends in Irrigation Investments

Table 3-1 summarizes the investment and income of NIA in recent years. Since 2008, irrigation investments (capital outlays) have tripled. The large budgetary commitment of government for irrigation has been sustained up to the present with the 2014 budget for capital outlay at ₱22 billion.

Corporate revenues on the other hand, show an increasing contribution of ISF. Up to 2011 NIA had been charging a management fee, which was then replaced by an annual subsidy starting 2012. The subsidies in 2012 and 2013 represent 7.85% of total project costs broken down as 5% for management fee and 2.85% for engineering and administrative expenses (EAO) or general engineering and supervision and administration expenses (GESA). For 2014, according to the Department of Budget and Management (DBM), the subsidy will cover operational funding deficiency net of internally generated income (DBM 2014). The relatively high “other” corporate revenues in 2008 is largely accounted by the national government’s contribution to the first year of NIA-Rationalization Plan implementation following Executive Order (EO) 718. The Participatory Irrigation Development Project (PIDP) was to cover the 2nd to 5th years. So, the substantial subsidy in 2008 did not cover project implementation but benefits for retired NIA staff.

Table 2-1. Irrigation investments and corporate revenues of the NIA (Bn pesos), 2008 - 2012

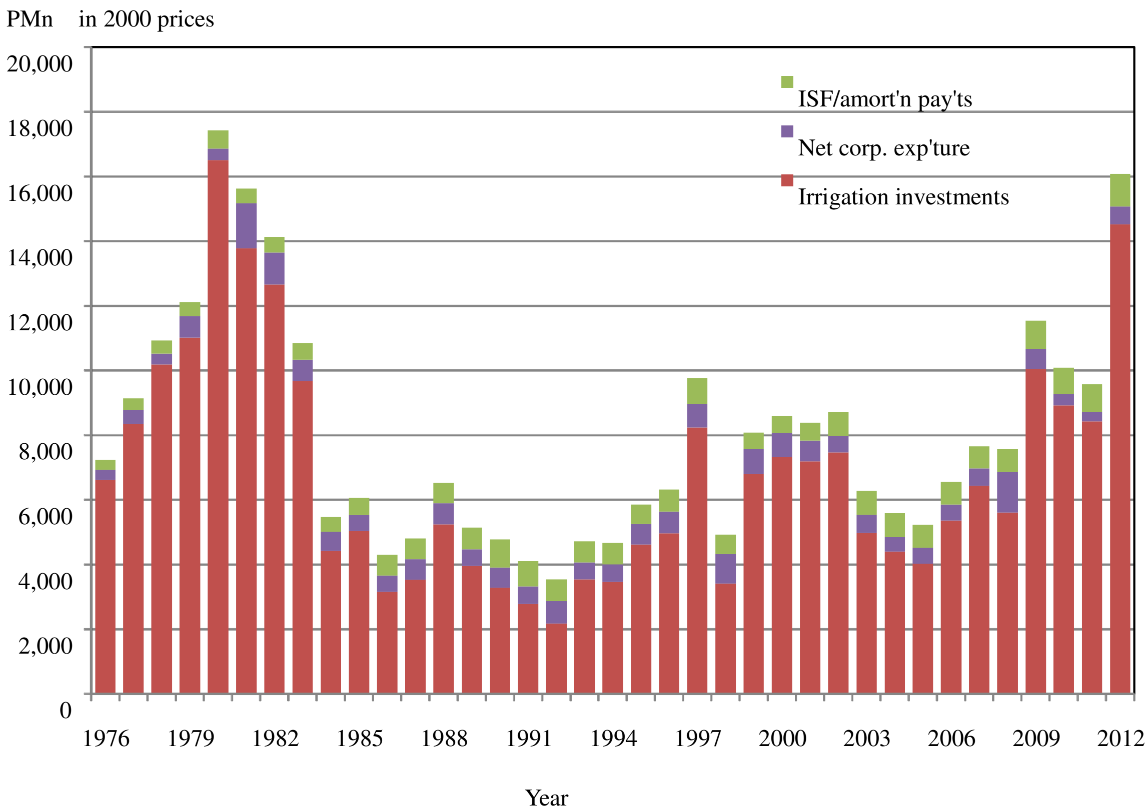
	Irrigation Investment	Corporate Revenues			
		Total	ISF	Management fee	Others
2008	8.33	3.76	0.89	0.53	2.34
2009	15.20	2.67	1.11	0.79	077
2010	14.11	2.69	1.10	0.77	0.82
2011	13.86	2.77	1.25	0.75	0.77
2012	24.31	3.55	1.35	0.03	2.17

Note: 2014 NEP is ₱22.37 Bn, DBM (2013). For consistency throughout the paper, irrigation investment is used to also mean capital outlay.
Sources: NIA Yearend Reports and NIA Corporate Incomes and Expenses, various years.

Figure 3-1 presents the trends in total public expenditures for irrigation investments in 2000 prices. Public expenditures for irrigation investments over the past four decades have been characterized by wide fluctuations, rising sharply in the 1970s, dropping precipitously in 1983, and recovering to some extent in the early 1990s. The sharp increase in the world rice prices in the 1970s together with the introduction of modern rice varieties suited to irrigated conditions raised the marginal rates of returns for irrigation investments. At about the same time, the greater supply of foreign financing in the mid-70s up to the early 1980s due to recycling of petrodollars generated by the sharp rise in oil prices eased budgetary constraints for long-term investments during this period. As world commodity prices resumed its long-term declining trend and the cost of further expansion of irrigation increased, public expenditures for irrigation investments slowed down.

Based on regression analysis, Kikuchi, Maruyama, and Hayami (2001) showed that levels of public investments in irrigation from 1953 to 1998 can be explained largely by short-run changes in world rice prices (with only one to three year lags) as these affect marginal rates of returns to irrigation investments. A two-level (above or below 90%) indicator of rice self-sufficiency, a political objective, was also found to be a significant explanatory variable. They concluded that the government was overly responsive to the short-run fluctuations in world rice prices and self-sufficiency levels in its decisions to invest in irrigation.

Figure 2-1. Trends in irrigation investments and corporate expenditures, 1976 – 2012 (P Mn in 2000 prices)



Sources: NIA Yearend Reports and NIA Corporate Incomes and Expenses, various years

The dramatic increase in investment in recent years can therefore be readily explained in the aftermath of the rice price crisis of 2008, when world monthly prices tripled over the first five months of the year. The food self-sufficiency drive was pushed, with the current administration targeting 100% self-sufficiency in late-2013.[3]

Investments classified as foreign assisted projects initially dominated investments, particularly in the 1970s and 1980s, when they accounted for more than 90% of irrigation investments (Table **3-2**). With lower irrigation investments since the 1990s, the share of locally funded projects rose to an average of 50 to 60%. In fact, local funds have supported around 80% of irrigation investments at least up to the late 1970s, when the peso counterpart of foreign assisted projects (FAP) is added to the expenditures for locally funded projects (LFP). In recent years, the reliance on local funding has intensified. Specifically, the resurgence in investments in the late 2000s has been mostly due to increase in local funding brought about by the food self-sufficiency program of the present administration.

Over the whole period, the World Bank assisted projects constituted slightly more than half of foreign assisted projects, followed by the ADB with about a fourth, and the remainder by bilateral donors led by Japan. Until the early mid 1980s, the World Bank was the dominant source of funds for foreign assisted irrigation investments with 70% contribution, but its share declined over time as the share of ADB assisted projects rose to more than 40% between 1985 and 1996. Since the late 1980s, Japan through the Overseas Economic Cooperation Fund (OECF), Japan Bank for International Cooperation (JBIC), and Japan International Cooperation Agency (JICA), has become the most important foreign lender for irrigation investments accounting for nearly two-thirds foreign assisted irrigation expenditures.

Over the past four decades and a half, approximately 85% of public expenditures for irrigation investments have been allocated for the construction, rehabilitation, restoration, repairs, and support services of national irrigation systems, only 12% for CIS, and 3% for SWIPs, tubewells, and others (Table 3-2). The share of NIS in total public support for irrigation would even be somewhat higher when the cost of operation and maintenance and other support services funded from corporate revenues discussed below are included. Even if the budgets for shallow tubewells (STWs), small water impounding projects (SWIPS), small farm reservoirs (SFRs) allocated by the BSWM and other agencies were included, public expenditures for this type of irrigation will not reach 5% of total.

Budgetary resources for the expansion and rehabilitation of communal irrigation systems have increased, but there is hardly any systematic database to evaluate the effects of these expenditures on the performance of these systems. The fact that locally-funded CIS projects have been mostly implemented as part of Congressional pork barrel funds and/or buy-out of political patronage of LGU officials may explain at least in part the very slow growth of irrigated area under CIS. Anecdotal evidence indicates that many CIS have disbanded and now operated as individual or private systems.

[3] Subsequently, this target has been moved in the view of the catastrophic typhoons of late 2013.

Up to early 1980s, nearly all (about 95%) of public expenditures for irrigation were allocated for NIS. The share of CIS began to increase by the mid-1980s as donor agencies focused on poverty reduction and the government embarked on the Comprehensive Agrarian Reform Program (CARP) in 1988. Its share to total irrigation investments rose from an average of less than 5% in the 1970s, up to more than 40% in early 1990s. Foreign assisted communal projects were typically part of integrated area development projects (e.g. Palawan Integrated Development Projects and the Southern Philippines Irrigation Sector Project or SPISP) and agrarian reform related projects undertaken. Local funding for communal projects had been mostly sourced from the Agrarian Reform Funds, with NIA being the lead implementor of CARP-related irrigation projects. There has been a resurgence of spending on CIS in late 2000.

By the late 1990s, the NIS has again received the bulk of irrigation investments (over 80% on the average and up to 90% in 2007 and 2008), despite the passage of the Agriculture and Fisheries Modernization Act (AFMA) in 1997 which directed public support for irrigation be re-oriented towards small-scale gravity systems such as the CIS, rehabilitation and irrigation management transfer to irrigators' associations of NIS, and groundwater resources development. It has been difficult to separate expenditures for irrigation investments between new construction and/or extension and rehabilitation because these are usually combined within an irrigation project.

Interestingly, investment in irrigation between 2011 and 2012 almost doubled just as the NIA's 5-year rationalization program is nearing completion. The doubling is due entirely to government-funded projects. This program is intended to generate some income surplus to fully cover operating expenses through implementation of a phased reduction of NIA staffing, concurrently with the irrigation management transfer (IMT), and the improvement of national irrigation systems. The new role of NIA would be to withdraw from direct management of all NIS to management of head-works and main canals of large NIS, and enhance its technical back-stopping and institutional support functions to farmers. The rationalization program was effectively shelved with the reversal in government policy.

Note that some of the irrigation investments for NIS reported in NIA's Yearend Reports refer to expenditures for project development, institutional development, repair and restoration, and maintenance, in part as a response to damages due to earthquakes, typhoons and other calamities, but also to meet minimum required repair and maintenance costs that are supposed to be funded by corporate income or revenues.

Table 2-2. Distribution of public expenditures for irrigation investments by funding source, type of system, purpose per year, 1965-2012 (%).

Years	Total								Foreign assisted projects							Locally funded projects								
	CIS	NIS/CIS	NIS					Others	CIS	NIS				Others	**Sub total**	CIS	NIS/CIS	NIS					Others	**Sub total**
		New + Rehab	Sub-total	New	New + Rehab/Restor	Rehab/ Restore	Rehab + New			Sub-total	New	New + Rehab/Restor	Rehab/ Restore		NIS & CIS		New + Rehab	Sub-total	New	New + Rehab/Restor	Rehab/ Restore	Rehab + New		NIS & CIS
1965	-	-	100.0	86.0	8.9	5.1	-	-	-	23.4	23.4	-	-	-	23.4	-	-	76.6	62.6	8.9	5.1	-	-	76.6
1966	-	-	100.0	87.6	4.7	7.7	-	-	-	22.6	22.6	-	-	-	22.6	-	-	77.4	65.0	4.7	7.7	-	-	77.4
1967	-	-	100.0	71.0	16.1	13.0	-	-	-	23.0	23.0	-	-	-	23.0	-	-	77.0	48.0	16.1	13.0	-	-	77.0
1968	-	-	100.0	55.4	24.7	19.9	-	-	-	11.7	7.7	4.0	-	-	11.7	-	-	88.3	47.7	20.8	19.9	-	-	88.3
1969	-	-	100.0	44.5	36.3	19.2	-	-	-	29.8	3.8	26.0	-	-	29.8	-	-	70.2	40.7	10.3	19.2	-	-	70.2
1970	-	-	100.0	15.8	77.8	6.4	-	-	-	80.3	4.1	76.2	-	-	80.3	-	-	19.7	11.7	1.5	6.4	-	-	19.7
1971	-	-	100.0	12.1	86.5	1.5	-	-	-	95.7	9.5	86.2	-	-	95.7	-	-	4.3	2.6	0.2	1.5	-	-	4.3
1972	-	-	100.0	14.2	84.6	1.2	-	-	-	96.3	11.7	84.6	-	-	96.3	-	-	3.7	2.5	-	1.2	-	-	3.7
1973	-	-	100.0	11.1	87.5	1.5	-	-	-	93.3	5.8	87.5	-	-	93.3	-	-	6.7	5.2	-	1.5	-	-	6.7
1974	-	-	100.0	35.8	63.3	0.9	-	-	-	91.1	27.9	63.2	-	-	91.1	-	-	8.9	7.9	0.1	0.9	-	-	8.9
1975	-	-	100.0	28.3	66.7	5.0	-	-	-	86.2	16.6	66.3	3.3	-	86.2	-	-	13.8	11.8	0.3	1.7	-	-	13.8
1976	-	-	100.0	39.2	58.8	2.0	-	-	-	84.6	26.1	58.5	-	-	84.6	-	-	15.4	13.1	0.2	2.0	-	-	15.4
1977	0.6	-	99.4	12.7	84.8	1.9	-	-	0.5	92.7	6.3	84.8	1.6	-	93.2	0.1	-	6.7	6.4	-	0.3	-	-	6.8
1978	-	-	100.0	14.4	81.0	2.4	-	2.2	-	97.0	11.7	81.0	2.2	2.2	99.1	-	-	3.0	2.8	-	0.2	-	-	3.0
1979	-	-	100.0	15.7	82.3	0.4	-	1.6	-	97.2	13.3	82.3	-	1.6	98.7	-	-	2.8	2.5	-	0.4	-	-	2.8
1980	-	-	100.0	17.0	82.5	0.3	-	0.1	-	97.2	14.5	82.5	-	0.1	97.3	-	-	2.8	2.5	-	0.3	-	-	2.8
1981	0.5	-	99.5	18.6	79.3	0.3	-	1.4	0.5	97.0	16.3	79.3	-	1.4	98.9	-	-	2.5	2.2	-	0.3	-	-	2.5
1982	0.8	-	99.2	21.2	74.7	0.1	-	3.2	0.8	96.1	18.3	74.7	-	3.2	100.1	-	-	3.1	3.0	-	0.1	-	-	3.1
1983	10.3	-	89.7	30.8	53.8	0.0	-	5.0	10.3	84.6	26.0	53.6	-	5.0	100.0	-	-	5.0	4.8	0.2	0.0	-	-	5.0
1984	8.0	-	92.0	32.7	53.2	0.1	-	6.0	8.0	88.6	29.4	53.2	-	6.0	102.6	-	-	3.4	3.3	-	0.1	-	-	3.4
1985	9.6	-	90.4	35.0	49.9	0.1	-	5.5	9.6	88.3	32.9	49.9	-	5.5	103.4	-	-	2.1	2.0	-	0.1	-	-	2.1
1986	16.2	-	83.8	32.7	44.2	-	-	6.9	16.2	82.4	31.4	44.2	-	6.9	105.6	-	-	1.3	1.3	-	-	-	-	1.3
1987	32.0	-	68.0	29.9	26.9	4.0	-	7.2	32.0	63.8	29.6	26.9	-	7.2	102.9	-	-	4.3	0.2	-	4.0	-	-	4.3
1988	31.6	-	68.4	27.5	33.2	-	-	7.7	31.6	56.9	27.2	21.9	-	7.7	96.2	-	-	11.5	0.3	11.2	-	-	-	11.5
1989	31.6	-	68.4	19.0	31.5	13.7	-	4.2	31.6	57.3	19.0	20.4	13.7	4.2	93.1	-	-	11.1	-	11.1	-	-	-	11.1
1990	23.9	-	76.1	14.9	27.8	28.8	-	4.6	23.9	64.0	14.9	16.1	28.8	4.1	92.0	-	-	12.2	-	11.7	-	-	0.4	12.6
1991	39.9	-	60.1	17.2	9.9	23.3	-	9.8	20.4	50.3	17.2	7.1	21.6	4.4	75.1	19.5	-	9.8	-	2.7	1.8	-	5.3	34.7
1992	43.0	-	57.0	12.2	16.7	18.7	-	9.3	17.7	41.5	12.2	16.0	12.3	0.9	60.1	25.3	-	15.5	-	0.8	6.4	-	8.3	49.1
1993	44.5	2.6	52.8	22.8	10.5	17.9	-	1.6	22.1	37.1	22.8	5.2	9.0	0.2	59.4	22.4	2.6	15.7	-	5.4	8.9	-	1.5	42.3
1994	47.6	-	52.4	21.0	14.3	6.0	-	11.1	20.8	43.8	20.9	12.3	4.7	5.9	70.6	26.8	-	8.6	0.2	2.0	1.3	-	5.2	40.5
1995	41.5	7.5	51.0	14.0	9.5	18.3	-	9.3	14.7	37.1	13.5	9.5	13.2	0.9	52.7	26.8	7.5	13.9	0.5	-	5.0	-	8.4	56.6
1996	39.9	6.4	53.7	26.1	14.7	5.1	-	7.8	14.8	34.7	21.1	11.7	1.3	0.6	50.2	25.0	6.4	19.0	4.9	3.0	3.9	-	7.2	57.6
1997	29.8	7.8	62.5	22.2	14.1	6.1	0.8	19.3	9.3	33.4	19.2	12.4	1.5	0.3	43.0	20.5	7.8	29.1	3.0	1.7	4.5	0.8	19.0	76.2
1998	17.5	8.2	74.4	30.3	11.2	15.1	4.6	13.2	6.7	43.8	24.8	10.0	9.0	0.1	50.6	10.7	8.2	30.5	5.6	1.2	6.1	4.6	13.1	62.5
1999	24.3	9.2	66.5	25.1	21.4	9.6	1.7	8.8	8.5	43.0	21.7	16.2	5.0	-	51.5	15.8	9.2	23.6	3.4	5.2	4.5	1.7	8.8	57.4
2000	11.6	18.1	70.3	23.2	24.2	12.6	2.4	8.0	2.5	41.9	19.2	17.4	5.3	-	44.4	9.1	18.1	28.4	4.0	6.8	7.3	2.4	8.0	63.6
2001	12.8	16.0	71.3	23.0	29.7	11.1	2.0	5.4	6.9	47.1	17.4	25.8	4.0	-	54.0	5.9	16.0	24.1	5.6	4.0	7.1	2.0	5.4	51.4
2002	15.5	5.7	78.8	34.7	27.1	9.1	7.1	0.8	6.1	49.2	18.4	25.0	5.8	-	55.3	9.4	5.7	29.6	16.3	2.1	3.2	7.1	0.8	45.6
2003	30.3	-	69.7	10.5	38.9	9.1	9.5	1.8	14.6	51.0	14.2	32.5	4.3	-	65.6	15.7	-	18.7	(3.7)	6.4	4.8	9.5	1.8	36.2
2004	25.5	7.9	66.6	16.8	31.2	5.4	11.0	2.1	15.1	41.8	11.6	26.5	3.7	-	56.9	10.5	7.9	24.8	5.2	4.7	1.7	11.0	2.1	45.3
2005	19.9	9.0	71.0	12.5	46.8	5.1	5.3	1.5	14.5	48.5	7.8	38.9	1.7	-	63.0	5.4	9.0	22.6	4.6	7.9	3.4	5.3	1.5	38.4
2006	15.4	11.1	73.4	6.2	46.9	1.9	16.5	2.0	12.0	43.9	4.4	39.6	-	-	56.0	3.4	11.1	29.5	1.8	7.3	1.9	16.5	2.0	46.1
2007	46.6	2.5	50.9	4.0	40.5	-	5.3	1.0	5.8	36.4	3.2	33.2	-	-	42.2	40.8	2.5	14.4	0.8	7.3	-	5.3	1.0	58.8
2008	48.6	0.0	51.4	5.5	35.3	-	9.0	1.5	4.5	25.1	1.0	24.1	-	-	29.6	44.1	0.0	26.3	4.5	11.2	-	9.0	1.5	71.9
2009	60.6	-	39.4	16.7	15.8	-	3.0	4.0	3.2	15.5	7.5	8.0	-	-	18.7	57.4	-	23.9	9.2	7.8	-	3.0	4.0	85.3
2010	62.2	-	37.8	2.7	27.0	-	5.1	3.1	3.0	24.3	-	24.3	-	-	27.3	59.2	-	13.5	2.7	2.7	-	5.1	3.1	75.7
2011	27.6	-	72.4	6.0	39.9	0.1	18.0	8.4	3.9	36.7	1.4	35.3	-	-	40.5	23.7	-	35.8	4.6	4.6	0.1	18.0	8.4	67.9
2012	68.1	-	31.9	3.9	16.9	0.6	0.1	10.3	1.6	16.4	0.6	15.8	0.0	-	18.1	66.5	-	15.5	3.3	1.1	0.6	0.1	10.3	92.3
Total	20.1	2.4	77.5	19.3	47.6	4.2	2.2	4.2	6.4	63.2	14.7	44.8	2.4	1.3	70.9	13.6	2.4	14.3	4.6	2.7	1.9	2.2	2.9	33.3

Source of basic data: Year-end Reports, National Irrigation Administration

3.2. Trends in NIA Corporate Income and Expenditure

Aside from public expenditures for irrigation investments discussed above, NIAs corporate income or revenues finance its various offices in the performance of their functions. The central office sets policies and guidelines, provides technical, financial, and administrative support services to field offices, and exercises control by monitoring and evaluation of operations of field offices. Thirteen regional offices implement plans, programs, and policies in the field, oversee the operations of all field offices, and implement locally funded projects. The 72 provincial offices develop and implement CIS projects and organize and train irrigators' associations. The operation and maintenance of 217 NIS is the responsibility of the 120 irrigation system offices (ISOs) and two (2) integrated irrigation systems offices. Finally, fifteen (15) project management offices administer foreign-assisted national and communal irrigation projects.

Table 3-3 shows the trends and distribution of NIAs corporate income by source from 1980 to 2012. The levels of corporate income fluctuated from year to year, higher on the

Table 3-3 Trends and distribution of NIAs corporate incomes by source and corporate expenses,1980 – 2012.

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
INCOME (₱ Mn)	**135**	**242**	**325**	**328**	**432**	**483**	**377**	**460**	**465**	**469**	**636**	**695**	**646**	**691**	**750**	**792**	**1,009**	**1,327**	**1,333**	**1,225**	**1,153**	**1,325**	**1,460**	**1,558**	**1,414**	**1,675**	**1,681**	**1,789**	**3,819**	**2,764**	**2,788**	**2,863**	**3,649**
Share to Total Income (%)																																	
Irrigation Fees / Irrigation Service Fee	44	22	18	22	23	30	48	38	39	46	44	49	51	49	50	44	42	39	27	27	34	36	45	45	55	48	49	47	25	43	43	47	40
Equipment Rental	12	7	8	7	6	8	10	16	17	16	11	13	11	12	15	21	19	16	15	18	15	14	13	10	10	5	-	5	3	4	4	4	4
Pump Amortization	6	3	2	2	2	1	1	1	1	1	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	1	1	0	1	0	0	0
Management Fees	-	-	32	25	16	7	15	17	16	14	16	14	10	18	9	14	15	21	14	23	23	16	17	12	12	17	17	19	14	28	27	26	1
CIP Amortization	-	-	2	2	2	2	2	7	9	10	16	8	7	7	7	10	9	9	12	12	10	11	13	11	10	8	8	7	3	7	6	5	9
Subsidies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	0	-	3	22	4	5	9	1	-	4	-	-	-	-	-	-	-	-
Subsidy Income from National Gov't	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	43	-	-	-	27
Subsidy Income from LGU's	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	0	-	-
Water Delivery Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	11	11	13
Others/Misc. Income [1/]	39	68	39	42	52	52	23	21	18	14	13	16	21	14	12	12	15	12	8	14	13	14	11	22	9	21	25	21	11	4	7	6	6
EXPENSES (₱ Mn)	**109**	**245**	**211**	**190**	**261**	**304**	**350**	**416**	**462**	**466**	**672**	**687**	**757**	**697**	**789**	**873**	**1,028**	**1,225**	**1,343**	**1,242**	**1,275**	**1,271**	**1,414**	**1,537**	**1,445**	**1,570**	**1,646**	**1,732**	**2,941**	**2,377**	**1,917**	**1,951**	**2,699**
Share to Total Expenses (%)																																	
Personal Services	74	68	78	72	74	69	71	68	68	70	76	73	77	77	76	77	80	83	81	85	84	86	80	79	77	75	75	74	70	67	66	66	62
Operating & Maintenance Expenses [2/]	26	32	22	28	26	31	29	32	32	30	24	27	23	23	24	23	20	17	19	15	16	14	20	21	23	25	25	26	30	33	34	34	38
NON-CASH EXPENSES [3/] (₱ Mn)	**-**	**-**	**-**	**-**	**282**	**72**	**130**	**20**	**20**	**42**	**40**	**46**	**45**	**30**	**297**	**300**	**258**	**313**	**295**	**496**	**526**	**356**	**555**	**466**	**146**	**229**	**366**	**334**	**593**	**582**	**1,086**	**1,206**	**1,091**
NET INCOME (₱ Mn)																																	
Excluding Non Cash & Capital Expenses	25	(3)	114	138	171	178	27	44	3	3	(36)	9	(111)	(6)	(39)	(81)	(19)	102	(11)	3	(122)	54	45	21	(31)	104	35	57	877	387	871	912	949
Excluding Non Cash Expenses	25	(3)	114	138	(111)	106	(103)	24	(17)	(39)	(75)	(38)	(156)	(37)	(336)	(381)	(277)	(211)	(306)	(493)	(648)	(302)	(509)	(444)	(177)	(125)	(331)	(277)	877	387	871	912	949
Including Non Cash and Capital Expenses	25	(3)	114	138	(111)	106	(103)	24	(17)	(39)	(75)	(38)	(156)	(37)	(336)	(381)	(277)	(211)	(306)	(514)	(648)	(302)	(509)	(444)	(177)	(125)	(331)	(277)	284	(196)	(215)	(294)	(142)

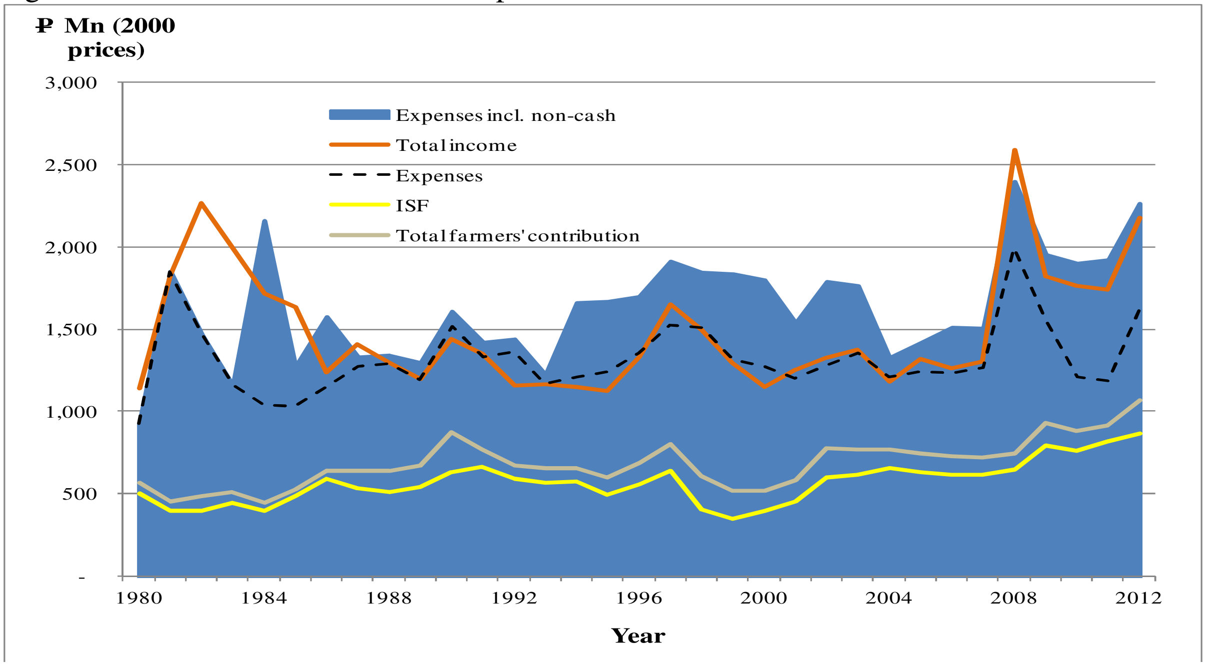
[1/] Other/Misc. income includes interest, sale of fixed assets, income from grant & donations, energy delivery fee (NPC), fines & penalties-service income, other fines & penalties, sale of fixed/disposed assets, gain foreign exchange

[2/] Lumped into O&M expenses for 1999 is the P21Mn capital expense for Matapol dam.

[3/] Total non-cash expenses include depreciation, bad debts, loses on current assets, other non-cash expense.

Source: NIA Financial Management Dept., various years.

Figure 3-2. Trends in total incomes, expenses, ISF and total farmers' contribution



Source: NIA Incomes and Expenses, various years.

average before 1990 because of the relatively high earnings from interest income and unexpended project funds and government equity contributions. Service fee collections rose up to early 1990s as service area was increasing, but stagnated since then as growth in service area leveled off. Over the whole period, irrigation service fee collections comprise an average of 40% of total corporate income; and together with the share of amortization payments for CIS and pumps, farmer beneficiaries contributed close to half (48%) of total corporate income. Equipment rental and management fees accounted for about 11% and 18% (excluding minimal amount in 2012), respectively, of total corporate income. Notable is the average of 12% contributed by water delivery fee from 2009 to 2012.

Since the late 1980s, as unexpended government's equity contributions have dwindled and interest earnings declined, the relative importance of ISF collections rose to about 45%, except in 1998 and 1999 when then President Estrada briefly suspended the collections of irrigation service fees. The large 2008 Rationalization Plan subsidy that came from the national government (comprising 43% of total income) which covered incentives and terminal leave of NIA personnel affected reduced the relative contribution of ISF although in absolute terms, it has maintained its slightly increasing momentum.[4]

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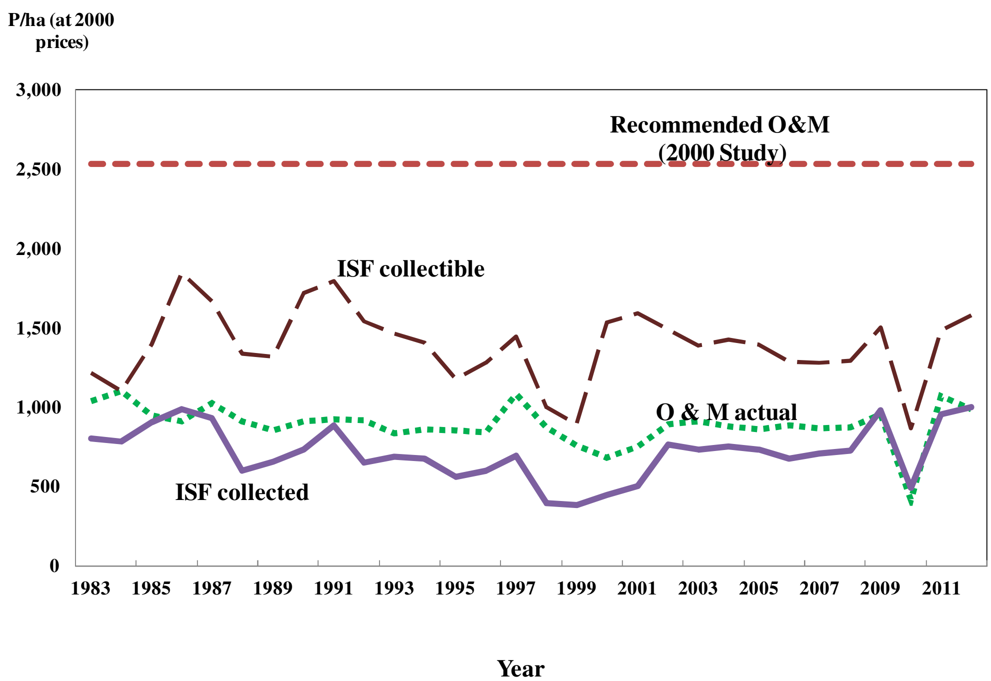
[4] This is following Executive Order (EO) 718 which provides that the national government shall provide for the benefits for the first year of NIA-Rationalization Plan implementation while the Participatory Irrigation Development Project (PIDP) was to cover the 2nd to 5th years. So, the substantial subsidy in 2008 did not cover project implementation.

The average share of O&M of 26% to corporate expenditures is about equal to the contribution of irrigation service fee collections to corporate income in the same period. The average for the last four years is higher at 35%, consistent with the agency rationalization program.

Comparing the actual O&M expenses with the collected ISF and recommended O&M seems to support claims of O&M under spending with O&M in later years not exceeding the levels of the collected ISF (Fig. 3-3 below). The collectible ISF is simply based on the "benefitted" irrigated areas both in the dry and wet seasons every year multiplied by the respective prescribed rates (in cavans or 50 kg per ha valued at the NFA support price of P17/kg) per type of system by season. These benefitted areas are derived from actual irrigated areas in each season less the areas with yields falling below 40 cavans/ha due to pests and diseases or drought or calamities. These exemptions are validated by NIA and DA and approved by the NIA Regional Director. The recommended O&M by a 2000 study of Shepley, et al. refers to the total direct costs which include costs of water scheduling and gate operations, canal cleaning labor, gate repairs/greasing and locks, hand held radios and equipment rental. Since the late 1980s, the O&M expenses are way below the 1999 recommended level.

Figure 3-3 Trends in NIA actual O&M, ISF collected Current Collectible and Recommended O&M (2000 study), 1983-2012 (₱/ha at 2000 prices).



Sources: NISPER, NIA-SMD, various years; Shepley, et al. 2000.

Not surprisingly, given the above pattern of O&M spending, there are indications of severe deterioration of irrigation facilities of NIS (field visits Aug.-Oct. 2013; Araral 2006). Based on a 2002 assessment, approximately 80% of then 196 NIS were in need of rehabilitation and/or improvement; more than 50% of control structures for both lateral and main canals; and more than 60% of main and lateral canals were in need of rehabilitation such as desilting, reshaping, and heightening of embankments. About three fourths of the 13,967 km of irrigation service roads were in need of rehabilitation. The magnitude of the problem suggests chronic underfunding of irrigation maintenance. Furthermore, initial findings of delos Reyes (2013) indicate that about 80% of rehabilitation projects are mostly spent on lining of canals, seemingly reinforcing the failure to rectify the operations and maintenance backlog.

The above observations are supported by the following estimates of rehabilitation cycle based on information for 141 systems. Table 3–4 shows that for more recent projects, it takes only an average of 9 years before the first major rehabilitation project, much shorter than the average for all systems. For older systems, a much longer duration elapsed before the first major rehabilitation.

Table 3-4 . Average number of years before first major rehabilitation and count of NIS with information

By vintage	Average number of years before Rehab	No. of NIS with recorded Rehab
All systems	**20**	**141**
Before NIA	32	51
1965-1980	18	41
1981-1995	9	49
1996-2008	-	-

Source of basic data: NIA NIS database

In fact, the country's irrigation performance is characterized by a cycle of chronic underinvestment in maintenance, deterioration of many system structures, poor water service, low productivity and poor farm incomes. NIA's limited resources and its preoccupation with generating its own funds, may have justified the preference for big irrigation projects. Foreign aid as an important source of funding, reinforces NIA's under-investment in irrigation maintenance. The management fee may have provided an incentive to NIA to prefer big projects (e.g. rehabilitation projects) and under spend on minor repairs and routine maintenance.

With the decentralization of the NIA structure in 1986, the corporate financial accounts were likewise distributed among the responsibility centers. That is, the operations of the Central Office (CO) are funded by its collections of management fees and interest income, the Regional Offices (ROs) by equipment rental, management fees, and interest income, the Provincial Offices (POs) by CIS and pump amortizations, and the Irrigation Systems Offices (ISOs) by irrigation service fee collections.

The available breakdown of corporate income and expenditures from 2001 to 2012 (Table **3-5**) indicates that approximately 15% of corporate expenditures are spent for central office operations and 85% for field offices at various levels. Given the average ratio of expenditures for operations and maintenance of NIS from 2001 to 2012 spent by the ISOs of 45%, the costs of providing technical and financial assistance in the design and construction of CIS, organization and training of irrigators' associations, implementation of locally funded and foreign funded projects, and overall supervision of all field operations take up the remaining 40% of corporate expenditures.

Table 3-5. Total revenues, operating and non-operating income, cash expenses, net income/loss at CO, RO, and overall corporate accounts of NIA, 2001-2012 (PMn).

Year	Total revenues	Operating income				Non-operating income					Cash expenses			Net income/(loss)	
		Total	Net ISF	Equipm't rent	Interest	Total	Manage't fees	Amortization CIP/CIS	Pump	Miscellaneous income	Total	Personal services	MOOE	From operation	Before non-cash expenses
	Central office														
2001	365	5	-	0	5	360	212	-	-	147	195	156	39	170	171
2002	289	5	-	0	5	284	242	-	-	42	201	160	41	88	88
2003	406	4	-	3	1	402	191	-	-	211	206	158	48	201	202
2004	228	2	-	0	2	226	151	-	-	75	195	150	44	33	36
2005	475	7	-	6	1	468	289	-	-	179	193	154	39	282	287
2006	433	10	-	7	2	423	287	-	0	136	218	178	40	216	216
2007	412	14	-	8	6	399	339	-	-	60	228	185	43	184	183
2008	1,341	15	-	7	8	1,326	530	-	-	796	980	924	56	(150)	357
2009	816	32	-	11	21	784	779	-	-	5	745	520	225	(227)	72
2010	807	41	-	16	24	766	766	-	-	0	131	86	45	(175)	676
2011	831	31	-	13	17	801	751	-	-	50	242	174	69	(312)	592
2012	2,371	26	-	12	13	2,345	34	-	-	2,311	858	398	460	614	1,515
	Regional offices														
2001	934	647	455	184	8	287	2	138	7	140	1,048	938	110	(124)	(119)
2002	1,134	824	626	190	8	310	2	201	4	103	1,169	976	193	(38)	(33)
2003	1,088	823	661	154	7	265	-	142	16	106	1,211	994	218	(119)	(111)
2004	1,183	891	741	146	4	293	13	130	13	136	1,214	962	252	(71)	(63)
2005	1,142	845	759	84	3	298	1	124	17	156	1,332	1,024	308	(243)	(236)
2006	1,197	864	779	81	3	333	4	139	9	181	1,379	1,052	327	(224)	(223)
2007	1,304	896	790	102	5	407	1	108	19	279	1,412	1,086	326	(160)	(153)
2008	2,416	994	892	99	3	1,422	-	132	12	1,278	1,900	1,132	768	434	520
2009	1,856	1,215	1,106	105	4	641	-	201	17	424	1,541	1,076	466	31	315
2010	1,885	1,205	1,103	97	5	680	-	177	11	492	1,690	1,170	519	(40)	195
2011	1,943	1,356	1,254	95	7	586	0	150	10	426	1,620	1,111	508	18	320
2012	1,183	1,525	1,350	150	25	(343)	-	325	14	(682)	1,746	1,287	459	(755)	(565)
	Overall														
2001	1,299	653	455	184	13	646	214	138	7	288	1,243	1,094	149	46	51
2002	1,423	829	626	190	13	594	244	201	4	145	1,370	1,137	233	50	55
2003	1,494	827	661	157	9	667	191	142	16	317	1,417	1,152	265	82	91
2004	1,412	893	741	146	7	519	164	130	13	211	1,409	1,112	296	(38)	(27)
2005	1,617	852	759	90	4	765	290	124	17	334	1,525	1,178	347	39	51
2006	1,631	874	779	89	6	756	291	139	9	318	1,596	1,230	366	(8)	(8)
2007	1,716	910	790	110	11	806	340	108	19	338	1,640	1,271	369	24	30
2008	3,758	1,009	892	106	11	2,749	530	132	12	426	2,880	2,057	823	284	877
2009	2,672	1,247	1,106	116	25	1,425	779	201	17	429	2,286	1,595	691	(196)	387
2010	2,692	1,245	1,103	113	29	1,447	766	177	11	492	1,821	1,257	564	(215)	871
2011	2,774	1,387	1,254	108	25	1,387	751	150	10	476	1,862	1,285	577	(294)	912
2012	3,553	1,551	1,350	162	39	2,002	34	325	14	645	2,604	1,685	919	(142)	949

Notes:

Net ISF includes fines and penalties and net of 10% discount and losses from palay sale.
Miscellaneous income includes dividends, fines and penalties, grants and donations, and subsidy income among others.
Net income/(loss) before non-cash expenses include gains/losses from foreign exchange adjustments and sale of fixed assets.

Source of basic data: National Irrigation Administration.

With the removal of management fees, the Central Office will not likely be able to cover its operations with revenues from miscellaneous income which includes subsidies and interest earnings. The regional offices on the other hand, are generally not self-sustaining even before non-cash expenses.

According to the Department of Budget and Management, the subsidy provided in 2012 and 2013 represents 7.85% of total project cost (Management Fee of 5%; Engineering and Administrative Expenses (EAO) or General Engineering, Supervision and Administrative (GESA) expenses of 2.85% or 3% of total project cost after deducting Management Fee). Also, for 2014, the subsidy to NIA covers the funding deficiency for the operations taking into account internally generated income (ISF and others).

3.3. Performance of the irrigation systems

Accurate analysis of the trends and patterns of irrigation development is hampered by the limited availability of good data. There are three data sources: NIA itself, the National Statistics Office

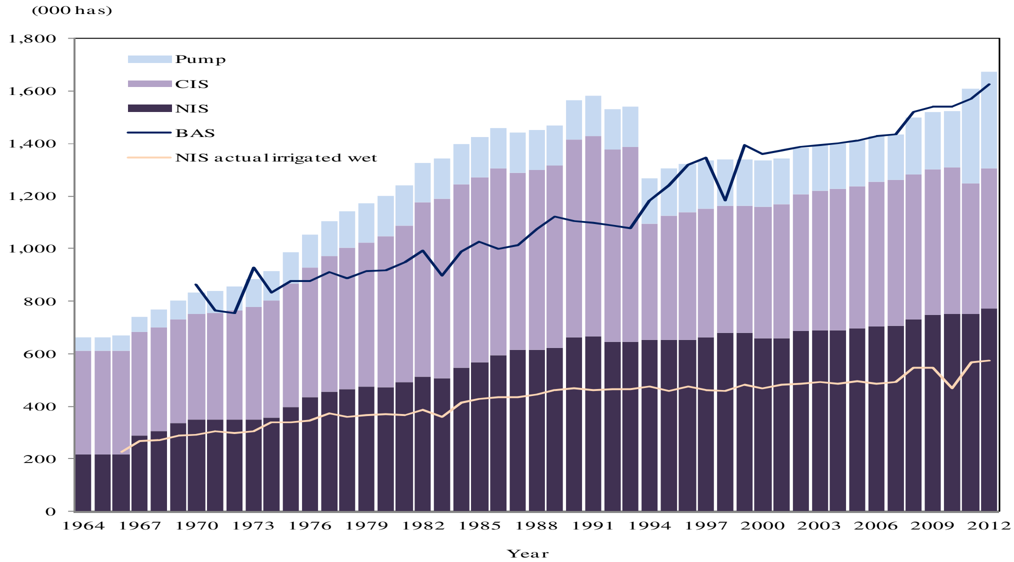
(NSO), and the Bureau of Agricultural Statistics (BAS). Figure 3-4 shows the annual irrigated area by the national irrigation systems (NIS), communal irrigation systems (CIS), and pump systems (later renamed as private irrigation systems) based on the administrative records of NIA. Irrigated area is generally defined as service area, which is the area provided with physical facilities for water delivery. The NIS systems average about 3,500 has, and range from 280 to about 28,000 has. excluding the largest two systems (UPRIIS and MRIIS with service areas of over 122,000 and 88,000 has. which have been split into districts, each district is equivalent to one NIS) as of June 2013. Because NIA is directly responsible for the construction, operation, and maintenance of NIS, data on their service area as well as actual area irrigated areas in the wet and dry seasons are generally reliable.

Both the NIS and CIS are gravity irrigation systems, but the latter are generally smaller in size and owned by farmers. NIA assists in the planning and construction of the CIS systems, but farmer beneficiaries are responsible for operations, maintenance, and repayment of the financial investment of the government. The service areas of CIS and pumps/private irrigation systems as reported by NIA were derived simply by adding and subtracting areas of systems funded through the agency based initially on a 1980 inventory of all communal and pump schemes found in the country. Following the release of the 1991 agricultural census which reported a much lower CIS irrigated area, NIA reduced its recorded CIS service area in 1994 by about a third to remove non-functioning and non-restorable systems and to take account of the conversions of some CIS to NIS and the destructions of many systems due to various calamities, including the strong earthquake and Mt Pinatubo eruption in early 1990s. NIA's record of the service area of pumps or private systems would be significantly understated because private investments in irrigation pumps have not been included.

In the mid-1960s, irrigated area by gravity systems was about 600,000 hectares with the coverage of CIS nearly twice as much as NIS. The NIS service area grew rapidly up to 1990 increasing by about 420,000 has. in 25 years. That growth may be explained largely by the completion of the largest systems with reservoirs—the Upper Pampanga River Integrated Irrigation System (UPRIIS) in Central Luzon and the Magat River Integrated Irrigation System (MRIIS) in the Cagayan Valley--, and improvements in the third largest system—Angat-Maasim also in Central Luzon as well as the construction of several medium scale systems in Cordillera Administrative Region (CAR) and Mindanao regions. Since the 1990s, growth in irrigated areas of NIS leveled off generating only about 130,000 has. in the succeeding 22 years, including the 16,200 has. of new service area added to UPRIIS with the completion of the irrigation component of the Casecnan Multipurpose Irrigation and Power Project (CMIPP).

Since the NIS and CIS were primarily built for rice production, the trends in the BAS estimates of irrigated rice crop area in the second semester (coinciding with wet season) are also shown in Figure 3-4 for comparison. While estimates of total irrigated area were similar in the early 1970s, NIA's data became significantly higher until 1994. After the reduction of NIA's CIS service area by a third, the estimates of the total irrigated area became comparable again. Since 2000, however, the BAS estimates have surpassed those of NIA and by a wide margin when the actual irrigated area in the wet season of NIS (consistently lower by as much as 25%) is used instead of its service area. It appears that by 2008, from 300 to 400 has. or as much as 25% of irrigated rice area in the second semester may be irrigated by tubewells using groundwater sources.

Figure 3-4. Trends in NIA service area and actual irrigated area in wet season of NIS, CIS, and pumps/private system and the BAS irrigated rice crop area 2nd semester, 1964-2012 (000 has).



Sources: NIA Corplan, various years; BAS.

Table 3-6 presents a recent profile of the country's irrigation systems, with some comparisons with previous years. According to the last Census of Agriculture data, close to three million ha of rice farm area is irrigated, of which about 1.4 million consists of gravity irrigation, the majority of which (0.775 million ha) are classified as national systems. A huge portion of irrigated area is covered by individual pumps, of which the Census estimate is one million ha; the remaining 0.574 million ha consists of other types of non-gravity irrigation. Over an eleven-year period, Census data show an increase of individual pump area by 374,000 ha, compared with gravity systems which increased by only 81,000 ha over the same period.

Though the implied average annual growth rate of 3 to 4% for irrigated areas under individual and other systems between 1991 and 2002 may be possible if these are largely irrigated by pumps and sprinklers, the accuracy of the estimated levels of irrigated areas for these categories may be questioned for at least two reasons. First, use of pumps will not usually cover the whole parcel and the rate of parcel coverage for pumps would likely be lower than for gravity systems. Second, a significant proportion of pumps may be used on parcels that are part of the NIS and CIS service areas. Thus, irrigation pumps may be used conjunctively on irrigated farms under gravity irrigation systems where surface irrigation water may be inadequate among tail-enders and/or during dry season.

Using additional information about farm parcels, an alternative estimate of individual pump irrigation area is provided in Table 3-3. Pump users in the Census numbered 395,000 farmers, covering an area of 854,000 ha, of which 652,000 is covered by pumps (the correction entered in Table 3-6). This is still a sizable area, just 123,000 ha shy of the total NIS. Unfortunately there is no counterpart calculation from the 1991 Census, so, we are unable to show adjusted changes over time.

Table 2-6: Irrigated area based on Census and NIA data, selected years

Year	Total	Gravity			Pumps	Individual	Others
		Total	NIS	CIS			
Census [a/]							
1991	2,296	1,275	736	539	-	626	395
2002	2,930	1,356	775	582	-	1,000	574
						(652)	
NIA [b/]							
1991	1,580	1,428	668	760	152	-	-
2002	1,387	1,213	689	524	174	-	-
2012	1,675	1305	771	534	370		

Sources: 1991 & 2002 Census of Agriculture, National Statistics Office; NIA, various years.

Since the 1990s, private investments largely funded the rapid spread of small tubewell pumps known as the Groundwater Revolution, initially in South Asia, and now also in Southeast Asia. This is also the case in the Philippines given the interdependence of surface and groundwater especially in gravity systems where conjunctive management needs to be considered.

The apparently remarkable growth in irrigated area occurred in pumps or individual systems and in other systems, which would largely be driven by private sector investments. Both types increased more than three-fold between 1980 and 1991 and by 60% and 45%, respectively, between 1991 and 2002. Total irrigated area for these two categories exceeded the sum of NIS and CIS areas by more than 200,000 has in 2002.

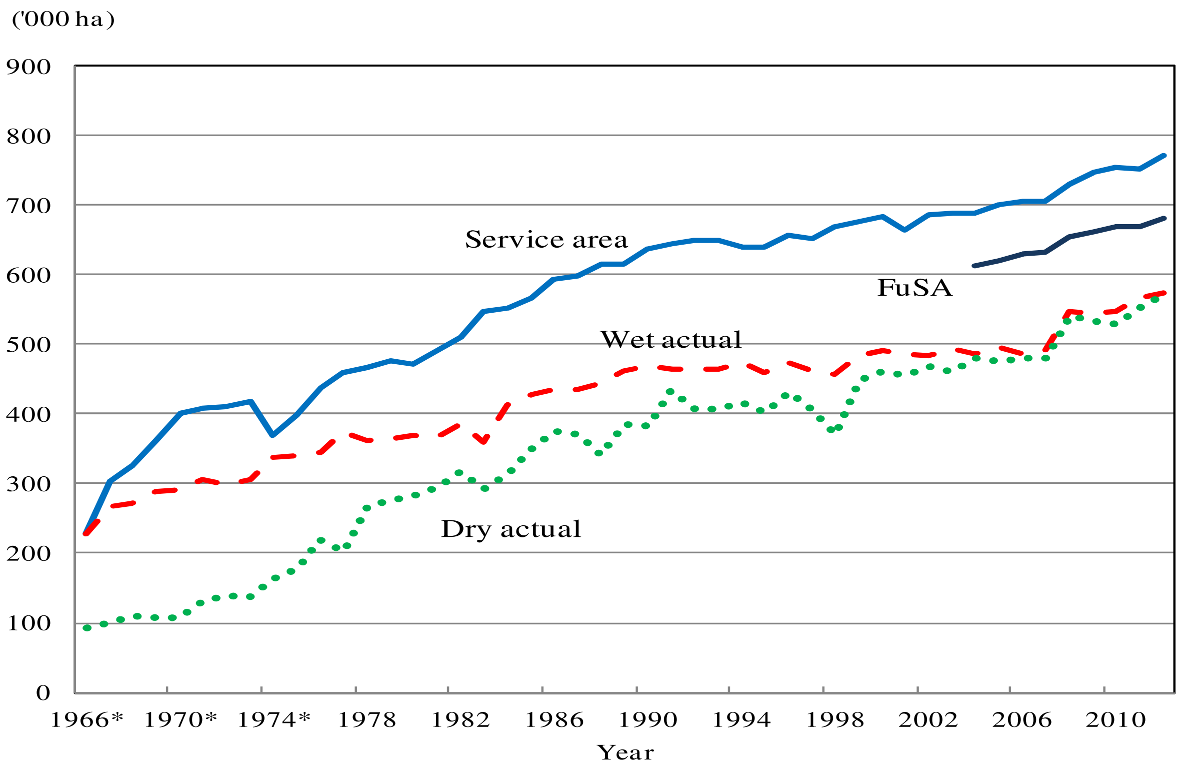
Table 2-7: Selected statistics and estimated irrigated area by pumps users based on 2002 agricultural census

	Total	Pump users		(3)/(1)
	(1)	(2)	(3)	(%)
No. of FHHS (000)	4,823	375	395	8
Farm area (000 has)	9,671	809	854*	9
Irrigated area (000 has)	2,930	618	652*	22
NIS	775	116	123*	16
CIS	582	77	81*	14
Individual	1,000	377	398*	40
Others	574	48	51*	9
Not irrigated (000 has)	6,741	191	202*	3

Source: 2002 Census of Agriculture, NSO

Figure 3-4 presents annual trends in service area, based on data from NIA. Service area nearly tripled over a twenty-year period (1966 – 1986), but growth in service area tapered off since then. Since 2004, estimates of firmed-up service area (FUSA), deducting converted lands and permanently non-restorable service areas, are shown to be significantly lower, by about 100,000 ha.

Figure 2-5: Trends in service area, firmed-up service area (FUSA), and actual service area by season, 1966 – 2012 ('000 ha)



Source: NISPER, NIA SMD, various years.

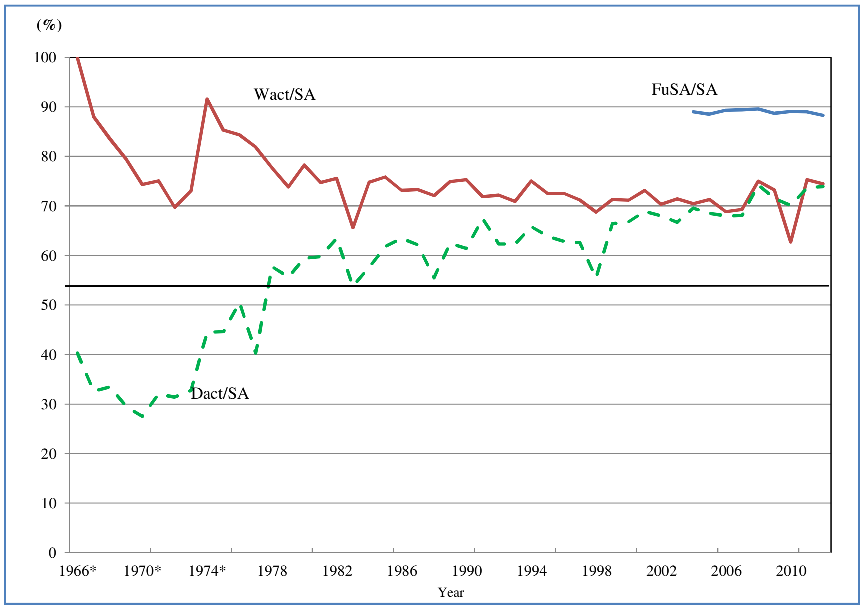
Lower still is actual area irrigated, which in the wet season was identical to service area in 1966, but then exhibited a divergence ever since; currently the discrepancy *vis-a-vis* service area is about 200,000 ha. An even greater discrepancy holds for dry season actual area, at least in the earlier years. Note that one reason for putting up an irrigation system in the first place is to obtain regular water service during the dry season, inasmuch as rainfed rice farming is feasible during the wet season. Fortunately, from an initial discrepancy of over 100,000 relative to wet season actual area irrigated, the gap has steadily fallen and in fact has been closed in the late 2000s.

Alternatively, we take the ratios of FUSA and actual irrigated area to service area (Figure 3-5). Clearly, the ability of the NIS to deliver sufficient irrigation water over the whole service area during the wet season has been declining over time. From nearly 100% in the late 1960s, the percentage of wet season irrigated area to service area decreased to about 70% in recent years. This could be due in part to the overestimation of available water supply at source during appraisal and other design mistakes, as well as to the deterioration of watersheds, siltation of river systems and irrigation canals, and other factors.

In contrast, actual irrigated area during the dry seasons increased more rapidly than service area up the early 1980s, mainly because of the construction of the reservoir system in UPRIIS and

MRIIS, as well as improvements in the Angat-Maasim Reservoir System that ensured water supply for the dry season. The percentage of dry season irrigated area to total service area doubled from 30% to 60% between the late 1960s and early 1980s; that pattern continued at a slower pace afterwards reaching 70% in recent years. Aside from the expansion of irrigation, the introduction of non-photoperiod sensitive and shorter growth duration modern rice varieties and the increasing share of NIS service area in Visayas and Mindanao where rainfall distribution is more evenly distributed within the year of NIS contributed to the growth in the dry season irrigated area.

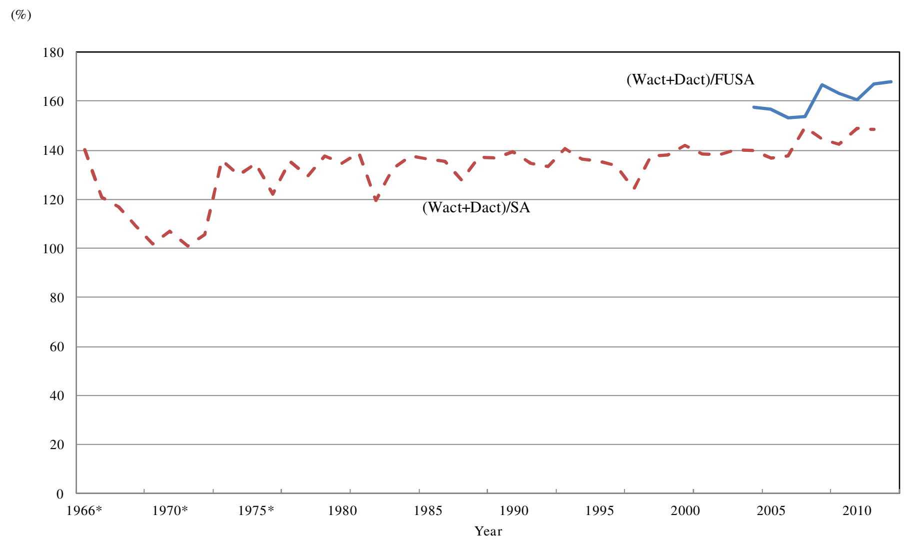
Figure 2-6: Trends in ratios of FUSA and actual irrigated area by season, to service area, 1966 – 2012 (%)



Source: NISPER, NIA-SMD, various years.

Changes in the cropping intensity reflect the rate in which a second/third or more crops are planted on the same plot of land. Figure 3-6 illustrates the trend in cropping intensity. NIA defines cropping intensity as the ratio of actual irrigated area during the wet and dry seasons to service area.

Figure 2-7: Trends in cropping intensity measures for NIS, 1966 – 2012



Source: NISPER, NIA, various years.

Since the 1970s cropping intensity has hardly changed, remaining below 150% until the late 2000s. Stagnation in the NIA cropping intensity indicator is mainly due to the decline in wet season actual irrigated area even if dry season irrigated area has been increasing. As explained earlier, these increases may be due to the combination of increase in the reservoir systems and the spread of modern rice varieties that can be grown in the dry season plus the expansion of irrigated areas in Visayas and Mindanao.

3.4. Economic Performance of Foreign Assisted Projects

In Tables 3-8 and 3-9, measures of time and cost overruns, rate of actual over target irrigated area, and estimated economic rates of returns at appraisal, completion, and post-evaluation are summarized for 61 foreign assisted projects based on project appraisal, completion and assessment reports submitted to donors. Overall, the performance indicators paint a dismal trend across projects and donors. Except for Upper Pampanga River Project (UPRP) and MRMP Ia in the early 1970s and IOSP and Bukidnon Integrated Area Development (IADP) in the mid 1990s, all the projects took significantly more years to complete than expected. Close to half of the projects exceeded the 75% rate of time overrun. Some of the reasons given include natural calamities and adverse weather conditions, delays in release of funds resulting from budgetary constraints and/or bureaucratic problems, changes in design, equipment breakdown, socio-political and office management issues, peace and order problems, and so forth.

On cost overruns, only close to one-fourth of the 61 projects were completed on budget. More than one-third of the projects incurred cost-overruns of up to 50%. Close to twenty percent of the projects had at least triple their original costs at completion with Ilocos Norte Irrigation Project I and Samar Island Rural Development (irrigation component) project incurring 220% and 293% cost overruns, respectively. The high cost overrun for Upper Pampanga River Project (UPRP) was caused by the sharp devaluation of the peso in 1970 and the concomitant rise in inflation rates. The other reasons for cost overruns include changes in system design and other supporting infrastructure, higher costs of relocation resettlement of affected communities, delays in implementation, cost escalation, and others.

Not only did most of the projects suffer from significant time and cost overruns, at least 10% of the projects (4 out of 45 with data -- Angat Magat Integrated Area Development Project (AMIADP), NISIP II, Tarlac Irrigation System Improvement Project, Samar Is. Rural Development) fell short of the target new area by at least 50%. Only a little over 25% of the projects met their targets while more than half missed their target new irrigated areas to be generated by at least 10% to 49%. The performance in terms of rehabilitation was better as 15% of the 26 projects with data met their targets while over 40% of the projects exceeded their targets. Palawan Integrated Area Development I and Southern Philippines Irrigation Sector Project performed the worst by falling short of target rehabilitated area by at least 50%.

A more complete measure of performance is the economic internal rate of return (EIRR). As to be expected, the ex ante EIRR (i.e., at the appraisal stage) were all above 12%, the cut-off level for approval by donor agencies. Over 12% of the 43 projects with data, had at least 12-13% EIRR at completion. AMIADP, UPRP, Irrigation Operations Support Project (IOSP) 2, and Water Resources Development Project exceeded ex-ante EIRR by at least 25%. The IOSP project is primarily for institutional and financial support for improvement of operations and maintenance. However, more than half of the projects fell short of the appraisal EIRR by at least 10%. Post-evaluation estimates of EIRRs (after several years of operation) are available only for the 12 projects, and in only 5 out of 12 projects are the rates of returns above 12%.

Table 3-8. Profile of selected foreign assisted irrigation projects by donor - year of start and completion, actual costs, time and cost overruns, and actual area irrigated.

Donor	Name of Project	Actual year of project Start	Actual year of project Completion	**Time Overrun** (%)	Actual cost (P Mn)	**Cost Overrun** (%)	Actual area irrigated New (ha)	Actual area irrigated Rehab (ha)	**Actual/Target irrig area New** (%)	**Actual/Target irrig area Rehab** (%)
Asian Development Bank										
	Agricultural Inputs Program			143	191	-11				
	Agrarian Reform Communities Project	2000	2007	40	5,773	-20	6,791		-20	
	Agusan del Sur Irrigation Project	1975	1983	100	153	60	7,300		-16	
	Andanan									
	Simulao									
	Agusan del Sur Irrig Proj 2	1979	1993	56	689	200	5,368		-33	
	Allah River Irrigation Project	1978	1989	22	1,629	12	16,539		-12	
	Angat Magat Integrated Agri Dev't Proj	1974	1978	33	254	-5	3,810	67,078	**-58**	11
	Bicol River Basin Irrig Dev't			79	78	-6				
	Bukidnon Integrated Area Development Project	1997	2002	-29	307	-68				
	Farm-to-Market Road Component									
	CIS Component									
	CDS Component									
	Social Services Component									
	Bukidnon Irrigation Project	1979	1989	25	818	181	8,457		-26	
(with IFAD)	Cordillera Highland Agricultural Resource Mngt Proj	1996	2003	25	1,947	81				
	Cotabato Irrigation Project			179	5	3				
	Davao del Norte Irrigation Project 1	1974	1979	150	119	121	10,830		-6	
	Davao del Norte Irrigation Project 2	1977	1990	225	879	190	10,964		-27	
	Davao del Norte Irrigation Project 3	1983	1992	50	607	-6	3,699		-18	
(with IFAD)	Highland Agri Dev't Proj	1987	1994	40	674	23	1,457	521	-11	-10
	Irrigation Component				105					
	Irrig Systems Improvem't Proj 1, Northern Leyte	1991	1997	100	1,040	18	3,111	20,524	-8	-7
	Irrig Systems Improvem't Proj 2	1997	2005	60	1,720	47	3,144	12,249	289	-3
	Irrigation Sector Project	1984	1991	40	1,865	50	15,381	11,880	-43	14
	Kabulnan Irrigation & Area Dev't Project	1992	2001	80	2,207	31	8,984		-22	
	Irrigation Component (NIA)				1,950					
	Laguna de Bay Dev't Proj			63	64	42				
	Laguna de Bay Irrig Proj II			138	40	-21				
	Palawan Integrated Area Dev't Proj Phase I	1982	1991	50	1,625	141		1,781		**-60**
	Palawan Integrated Area Dev't Proj Phase II	1991	1998	40	3,455	94				
	Irrigation Component				751		2,740	1,160	-26	-12
	Pulangui River Irrig Proj	1975	1982	75	220	27	9,100	2,900	-21	
	Sorsogon Integrated Area Dev't Proj	1989	1997	33	952	45		2,049		-25
	Southern Philippines Irrigation Sector Project	2000	2010	100	3,694	-11	5,485	5,794	0	**-52**
	Calayagon CIS						190		-24	
	Can-asuhan SRIS						675		-29	
	Gibong Right Bank Extension						665		0	
	Malaig NIS						0		-100	
JICA/OECF/JBIC/Japan										
OECF	Bohol Irrig Proj I	1984	1997	160	1,571	130	4,973		0	
JBIC	Bohol Irrig Proj 2	1999	2009	25	3,463	-4	4,530	750	0	0
JBIC	Casecnan Multipurpose Irrig Power Project Phase 1	1999	2009	25	16,180	-1	16,879	65,141	-37	18
JICA	Casecnan Multipurpose Irrig Power Project Phase 2									
JICA	Ilocos Norte Irrigation Project Stage 1	1983	1995	200	1,437	**220**	8,545		-16	
JBIC	Lower Agusan Development Program -Irrigation	2002	2006	57	2,300	76	4,493		-43	
	Flood Control 1	1988	2000	140	1,155	101				
	Flood Control 2	1997	2007	67	4,402	66				
JICA	Malitubog-Maridagao Irrigation Project I	1990	2005	150	1,290	23	7,681			
JBIC	Pampanga Delta Irrigation Project	1991	2003	71	4,023	118	8,589	3,331	0	0
JICA (G)	Rehabilitation of Apron of Angat Afterbay Regulatory Dam									
JBIC	Tarlac Groundwater Irrigation System Reactivation Proj	1999	2005	100	802	29	4,627		-7	
World Bank										
	Chico River Irrig Proj, Stage I	1976	1986	150	827	32	17,910	1,497	-2	7
(with IFAD)	Communal Irrig Dev't Proj I	1983	1992	80	1,766	70	22,800	29,160	0	173
	Communal Irrig Dev't Proj II	1991	2000	80	1,363	-14	34,127		11	
	Earthquake Reconstruction Proj	1990	1997	40	4,759	-36				
IBRD/OECF	Irrig Operations Support Proj 1	1988	1992	33	1,714	19				
	Irrigation Operations Support Proj 2*	1995	2000	**0**	3,443	94	210	72,852	0	-13
	Jalaur Irrig Proj, Stage I	1977	1983	50	258	2	2,900	20,444	7	-7
(with ADB, IFAD)	Magat River Multipupose Proj (MRMP)	1974	1986	50	4,632	12	45,592	51,810	-8	-1
	MRMP Ia	1974	1977	**0**	128	99				
	MRMP Ib	1975	1983	100	684	12				
	MRMP II	1976	1982	20	3,108	3				
	MRMP III	1978	1986	167	711	56				
	Mindanao Rural Development	1999			1,548	-10		5,791		16
	Nat'l Irrig Systems Improv't Proj I	1977	1986	125	889	12	15,909	28,500	-27	3
	Nat'l Irrig Systems Improv't Proj II	1978	1987	80	997	-4	12,590	63,704	**-54**	19
	Participatory Irrigation Development Project									
	Phil. Rural Dev't Proj - IC (Mindoro Integrated Rural De	1975	1983	60	190	75	2,882	10,727	-32	0
	Samar Island Rural Dev't Proj - Irrig Component	1979	1988	80	1,308	**293**	1,009		**-50**	
	Tarlac Irrig Systems Improv't Proj	1974	1984	150	355	54	4,154	22,235	**-63**	-2
	Upper Pampanga River Project	1969	1977	**0**	841	**209**	35,152	47,317	13	3
	UPRIIS Aurora-Penaranda Irrig Proj	1973	1981	100	424	57	7,100	18,200	-17	9
	Water Resources Development Proj	1997	2005	60	2,663	10	3,249	103,880	-27	-7
	Watershed Mgt. & Erosion Control Proj	1980	1988	33	797	41	32,072		0	
OTHERS										
China	Banaoang Pump Irrigation System	2003	2011	100	2,488	86	5,232		-13	
China Eximbank	Agno River Integrated Irrigation System (formerly San Roque Multipurpose Project)Allocation for ConstructionDam and its Facilities									
IFAD	Visayas Communal Irrig & Participatory Proj	1992	2000	33	550	-1	2,613	7,796	-20	1
USAID	Libmanan/Cabusao Integrated Area Dev't Proj	1975	1981	100	83	81	3,427		-12	
ALL Projects				**65**	**99,556**	**-20**	**410,605**	**679,071**	**-21**	**-29**

Sources: NIA Project Profiles from Project Completion Reports, various reports.

* IOSP II actual year of completion is 2000 based solely on the loan closing date from the ICR. Full development however was targeted on 2003.

Table 3-9. Measures of economic performance of selected foreign assisted irrigation projects by donor at project appraisaal, completion and evaluation.

Donor	Name of Project	EIRR Appraisal (%)	EIRR Completion (%)	EIRR Evaluation (%)	Actual / Estimate
Asian Development Bank					
	Agricultural Inputs Program				
	Agrarian Reform Communities Project	24	20		0.82
	Agusan del Sur Irrigation Project	18	12	7	0.67
	Andanan	18	13		0.69
	Simulao	19	12		0.63
	Agusan del Sur Irrig Proj 2				
	Allah River Irrigation Project	14	11		0.79
	Angat Magat Integrated Agri Dev't Proj	24	38	17	1.56
	Bicol River Basin Irrig Dev't	22	2	2	0.09
	Bukidnon Integrated Area Development Project	22			
	Farm-to-Market Road Component	12			
	CIS Component	50			
	CDS Component		(negative)		
	Social Services Component		(negative)		
	Bukidnon Irrigation Project				
(with IFAD)	Cordillera Highland Agricultural Resource Mngt Proj	18	20		1.09
	Cotabato Irrigation Project	14			
	Davao del Norte Irrigation Project 1	18	21	18	1.15
	Davao del Norte Irrigation Project 2	19	10		0.50
	Davao del Norte Irrigation Project 3	14	4		0.29
(with IFAD)	Highland Agri Dev't Proj	18			
	Irrigation Component				
	Irrigation Systems Improvement Project 1, Northern Leyte	27	29		1.09
	Irrigation Systems Improvement Project 2	12	12		1.04
	Irrigation Sector Project	31	4		0.13
	Kabulnan Irrigation & Area Development Project	16	18		1.10
	Irrigation Component (NIA)				
	Laguna de Bay Dev't Proj	14	2	2	0.14
	Laguna de Bay Irrig Proj II	17	6	6	0.36
	Palawan Integrated Area Dev't Proj Phase I	18	16		0.91
	Palawan Integrated Area Dev't Proj Phase II	18			
	Irrigation Component				
	Pulangui River Irrig Proj	19	12	11	0.62
	Sorsogon Integrated Area Dev't Proj	18	5		0.30
	Southern Philippines Irrigation Sector Project				
	Calayagon CIS	17	10		0.59
	Can-asuhan SRIS	19	9		0.45
	Gibong Right Bank Extension	15			
	Malaig NIS	19			
JICA/OECF/JBIC/Japan					
OECF	Bohol Irrig Proj I	15		7	
JBIC	Bohol Irrig Proj 2	19	17		0.92
JBIC	Casecnan Multipurpose Irrigation Power Project Phase 1	17	16		0.94
JICA	Casecnan Multipurpose Irrigation Power Project Phase 2	30			
JICA	Ilocos Norte Irrigation Project Stage 1	13			
JBIC	Lower Agusan Development Program -Irrigation	12			
	Flood Control 1	10		25	
	Flood Control 2				
JICA	Malitubog-Maridagao Irrigation Project I	21			
JBIC	Pampanga Delta Irrigation Project	16	16		0.98
JICA (G)	Rehabilitation of Apron of Angat Afterbay Regulatory Dam				
JBIC	Tarlac Groundwater Irrigation System Reactivation Project	20	14		0.69
World Bank					
	Chico River Irrig Proj, Stage I				
with IFAD	Communal Irrig Dev't Proj I	19	17		0.89
	Communal Irrig Dev't Proj II	19	15		0.79
	Earthquake Reconstruction Proj				
IBRD/OECF	Irrig Operations Support Proj 1	34	28		0.82
	Irrigation Operations Support Proj 2*	17	21		**1.26**
	Jalaur Irrig Proj, Stage I	20	20	20	1.01
with ADB, IFAD	Magat River Multipupose Proj (MRMP)	13	12		0.93
	MRMP Ia				
	MRMP Ib				
	MRMP II				
	MRMP III				
	Mindanao Rural Development	22	17		0.77
	Nat'l Irrig Systems Improv't Proj I				
	Nat'l Irrig Systems Improv't Proj II				
	Participatory Irrigation Development Project	25			
	Phil. Rural Dev't Proj - IC (Mindoro Integrated Rural Dev't Program)		14		
	Samar Island Rural Dev't Proj - Irrig Component	14	(negative)		n/a
	Tarlac Irrig Systems Improv't Proj	15	15	13	1.03
	Upper Pampanga River Project	14	20		1.48
	UPRIIS Aurora-Penaranda Irrig Proj	17	12	9	0.68
	Water Resources Development Proj	27	32		1.22
	Watershed Mgt. & Erosion Control Proj	18	4		0.22
Others					
China	Banaoang Pump Irrigation System	24			
China Eximbank	Agno River Integrated Irrigation System (formerly San Roque Mul	18			
IFAD	Visayas Communal Irrig & Participatory Proj	20			
USAID	Libmanan/Cabusao Integrated Area Dev't Proj	28	9		0.30
ALL Projects		**19**	**15**	**12**	**0.77**

Sources: NIA Project Profiles from Project Completion Reports, various reports.

* IOSP II actual year of completion is 2000 based solely on the loan closing date from the ICR. Full development however was targeted on 2003.

There are several reasons why estimates of EIRRs at appraisal are higher than those at completion and evaluation. For those built in the 1970s, very high world prices were used that raised the estimated benefits from irrigation investments, but as world prices dropped to their long term declining trend in real terms, the rates of returns declined accordingly. Other possible causes of lower completion EIRR include cost overruns and inability to meet new and rehabilitated area targets at project completion.

4. Findings from Case Studies

The case studies are based on a combination of field visits which included project briefings, key informant interviews, ocular inspections of some facilities. For full accounts, the readers should refer to the respective case study reports.

***The Case of Balog-balog*[5]**

The following focuses on the of the Balog-balog irrigation project. In 2010, the NIA Consult was commissioned by NIA to undertake the feasibility updating study of the BBMP Phase II as required by NEDA in order to be considered for local funding amounting to ₱15.8 Bn. The Balog-balog rapid appraisal indicates serious concerns on different aspects of project identification and preparation. Specifically, the rapid assessment observed that the project cost appears to be underestimated while benefits are overestimated. These two factors results in a higher economic internal rate of return (EIRR) which meets the government requirement of at least 15%. The rapid technical and economic analysis for the second phase of the Balog-balog Multi-purpose Project (BBMP II) in Tarlac shows design problems, too optimistic assumptions, understated cost estimates, and overestimated benefits. This proposed Phase II consists of constructing a high dam upstream the Bulsa River, extends irrigated area by 21,935 ha and accompanying facilities that is supposed to provide year-round irrigation to a total of 34,410 ha, hydropower, opportunities for fish cage aquaculture, and flood control benefits.

First, the **cost of the proposed dam structure appears to be underestimated** if compared with the other proposed dam projects with much less design storage capacities. Second, the **designed spillway capacity seems too low** having been based on a 20-year return period flood when a dam of this proposed size, the spillway capacity would be based on a probable maximum flood (PMF) of between the 100-yearr and 200-year return period. So, the risk of the dam being overtopped maybe high because of an inadequate spillway.

Third, the **reservoir sediment storage allocation appears to be under-designed** and likely to be good only for a reservoir life of 25 instead of 50 years. Fourth, the **expected best water yield of 17CMS would appear too low** compared to the service area that the project is supposed to irrigate which will require between 38 to 58 CMS, excluding water losses which could be between 30 and 40%. NIA claims that this possible shortfall can be covered by pumping groundwater at the upper face of the Tarlac Diversion Dam which is still buried in lahar. So, this supposed supplementary water will not be enough to cover the likely water deficit. Even the

[5] See full paper of Tabios, David and Duka (2013).

suggested transbasin water transfer between O'Donnell-Tarlac River basin and Talavera River basin, and Rio Chico River basin is doubtful because of the given watershed divide. The question of how (physically and economically) efficient would it be for the Balog-balog Dam project and its conveyance system to move water from one river basin to another in view of the watershed divides separating the O'Donnell-Tarlac River basin from the Talavera- Rio Chico River basins. Despite the fairly low elevations that divide these two river basins, they are still distinct and separate river basins.

Fifth, **the assumed cost of O&M appears too low** for two reasons: (1) the recommended amount by the ADB funded study on cost recovery (Shepley, et al. 2000) is at least 70% higher than the NIA Consult's assumed cost for regular O&M of ₱2500 per ha, both costs in 2009 prices; and (2) no allowance was made for the cost of risks from typhoons and other natural calamities that will certainly and regularly be experienced in Tarlac, requiring expenditures for repairs and rehabilitation if the economic life of 50 years is to be attained. David and Inocencio (2011) found the average number of years before the first expenditure for major rehabilitation of NIS to be only nine years.

Sixth, the **expected flood protection benefits of Balog-Balog Dam for Tarlac cities and towns may not be realized** as expected. Without the dam, the 600 MCM flood volume coming from Bulsa River, and the 300 MCM flood volumes from O'Donnell River and local inflows between Balog-balog Dam and Tarlac City, result in about 1200 MCM flood volume to reach Tarlac City towards Gerona. With the Balog-balog Dam, at best, about 600 MCM flood volume will reach those cities if 425 MCM will be contained by the dam, assuming the dam is empty at the time of the floods. The Balog-balog Dam with an associated 282 sq.km. drainage area can only control about 30% and not 50% of the expected flood volumes. A more comprehensive flood benefit analysis of a reservoir requires flood modelling and simulation of various flood scenarios and damage-cost analysis conducted based on the flood simulation results. It appears that this was not done at all in the Balog-balog feasibility study.

Seventh, the **proposed installed generating capacity of Balog-balog hydropower plant may be too large**. The estimated capacity is 43.5 MW, combining a 29 MW and 14.5 MW plant according to NIA Consult hydropower simulation study with a 650 MCM reservoir storage design. A quick check shows that with an average flow discharge of 17.14 and an average operating head of 83.76 m (NIA Consult 2010), and a plant efficiency of 90%, the hydropower generating capacity should be 12.8 MW. If the hydropower plant is operated for peaking purposes, say 10 hours a day, then the resulting capacity generated is 30.7 MW, which is about the proposed capacity rated at 29 MW. For the case of the currently proposed reservoir volume of 425 MCM, then the hydropower potential generating capacity would be definitely lower at 28.08 MW.

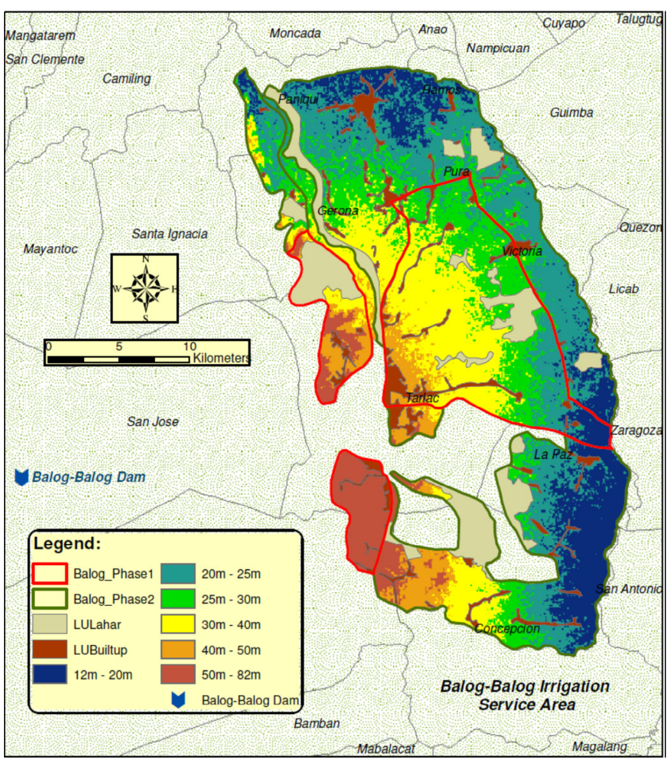
The question here is whether or not the 43.5 MW plant is the proper size given the proposed reservoir volume, or would installing a 29 MW hydropower plant be more efficient. It may be noted that the cost of the 14.5 MW hydropower plant (machinery, installation and other peripheral costs) can range from ₱700Mn to ₱900Mn, indicating potential cost savings if a smaller plant will be built instead.

Eighth, **the *ex ante* economic evaluation of the BBMP II erroneously assumes that crop areas in Tarlac that are not currently irrigated by gravity irrigation systems are rainfed**. For palay, the Bureau of Agricultural Statistics (BAS) reported that after a dip in irrigated area in

1991, the ratio had risen to more than 95% by 2012, while cropping intensity also increased to 170 %. The same BAS data indicate that for 2010 and 2011, the share of gravity irrigation to total irrigated area was only about 10% as pumps accounted for nearly 90%, largely through private ownership and rental market. Pump irrigation is also used for vegetables and other high value crops, and sometimes also for corn and sugarcane. Consequently, estimations of net agricultural benefit of BBMP II based on comparing yields (and profits) under irrigated and rainfed conditions would significantly overestimate benefits. The appropriate economic analysis to undertake is the comparison of social profitability of BBMP II to that of shallow tubewell pumps (STWs). Understandably, farmers in the area would support public investments in BBMP II because the irrigation service fees to be paid constitute only about 10% of the cost of irrigation service.

Ninth, **design area is likely overestimated**. Among national irrigation systems, the area over which the distribution network of irrigation has been built (or service area) is on the average about 80% of the design areas in recent years (David and Inocencio 2011). Based on the GIS map of the Balog-balog Irrigation System, the estimates of total design area (footprint), total non-irrigable areas (i.e., built-up areas, lahar area, fish ponds and fish pens, roads/streets, flooded areas, and others such as grasslands), and net irrigable area for Phases 1 and 2 would be close to the reduced design area of 34,410 has. However, the actual irrigated area may be expected to be significantly less than the current design area for several reasons (see Figure 4-1). First, rapid urbanization of the province will continue, and thus built up area will increase over time. Second, the relatively high cost of land in the area as population density increases and farm size declines will make farmers less willing to give up their right of way for the construction of irrigation canals and roads, especially when there is a choice of continuing to use STWs or planting sugarcane or corn, as commonly experienced in similar type of setting. Third, construction of more irrigation canals and accompanying roads will lower service area. Fourth, flooding has not been properly accounted for in the wet season and may even worsen. Fifth, limited supply of water from the reservoir for reasons pointed will reduce dry season irrigated area significantly, unless supplemented by STWs.

Figure 4-1 Landuses in Balog-balog Multipurpose Project II service area



Source: Tabios (2013).

A serious lapse that bloats BBMP II design area is the overlap with the design areas of the Casecnan Irrigation System (CMIPP Phases 1 and 2), the existing Upper Pampanga River Irrigation System, and the service areas of the 70 deepwell pumps installed under the Tarlac Groundwater Irrigation System (TGISRP). Ironically, the TGRISP and the Casecnan Irrigation Component were funded by the Japanese government under the same Central Luzon Irrigation Project's Loan Agreement signed in 1998. The overlap in design areas indicates double counting of potential benefits.

A pilot study of 19 deepwell pumps under the World Bank funded Tarlac Irrigation System's Improvement Project that was completed in the early 1980's already indicated the non-viability of deepwell pumps which had to be shutdown because of high power charges that farmers were not willing to pay. In the case of the TGRISP, only 40 out of the 70 deepwell pumps were reported to be functional, though a rapid appraisal of these units shows that only half of these were actually operational but at significantly less than full capacity. When the Casecnan Phase II is completed and if Balog-balog irrigation system is built, then even the remaining 20 deepwells will not be used as farmers shift to the highly subsidized gravity irrigation system.

Tenth, **benefits from fishery are overstated**. Fishery benefits are estimated to be about ₱1.1 billion per year, about one third of the estimated benefits from crop production. Such optimistic estimate of benefits is based in part on the belief that tilapia production using fishnet cages has been successful among fish cage operators in the Magat Dam Reservoir in Isabela. The fact is that the fisherfolks in this reservoir have already abandoned their fish cage operations and transferred downstream. Water level in their own fishponds can be better controlled; but since fishery competes with agriculture in the use of land and water, cost of production is higher. Overall, there has been no successful large-scale commercial fish cage production in irrigation reservoirs that has been reported in the country. With fluctuations in water levels and strong winds during typhoon seasons, velocity of water tends to exceed 0.4 m/s, the upper limit recommended by FAO (1984), causing loss of feeds and washing out of fish cages.

The financial viability of the intensive tilapia production at stocking rate of 60 fingerlings/cu m three times per year (as opposed to the 5 to 10 fingerlings optimum stocking density in non-intensive tilapia culture) is highly questionable. During the dry season when there are low flows, there must be a low oxygen exchange rate in the reservoir since the water levels must be maintained enough for power generation. Yet, no artificial aeration during the fishery operation was budgeted. Nor are there any allowance for the risk of fish kill due to natural calamities, low concentration of dissolved oxygen, and water pollution. The harvesting yield based on BFAR estimates (2008) is also overoptimistic. In Taal Lake where intensive tilapia culture is practiced, fish farmers do not harvest at full capacity equal to the initial stocking density, because overstocking results in stunted growth or harvestable sizes are highly variable (Masser 2008). In practice, the farmers harvest the large ones first, then the small ones are returned to the cages for further growing. This practice will increase the culture period as well as lessen the actual harvest.

Eleventh, **some economic and even financial prices used in the analysis are too high**. Two sources of overestimation of benefits are the use of relatively high nominal exchange rate; and degree of overvaluation of the peso assumed in the estimation of the shadow exchange rate. The nominal exchange rate which was ₱48 to $1 at the time of the study declined to about ₱44 to $ 1 by 2012; and given the positive outlook of the Philippine economy, the nominal exchange rate is expected to appreciate even further to ₱37 =$1. The shadow exchange rate was derived by assuming a 20% degree of undervaluation of the exchange rate which was the low end of the

20% to 30% estimate by Medalla (1979a) for the 1970s, when trade and foreign exchange rate policies were quite restrictive. With trade liberalization and floating of exchange rate starting in the 1980s, a later estimate of Medalla et al. in a 1990 report, but referring to the late 1980s, indicate the degree of foreign exchange rate undervaluation to be in the order of 20%. However, Bautista's (2003) estimate of the undervaluation dropped down to only 5%, so the shadow exchange rate adjustment should now only be about 5% of the nominal exchange rate.

Also, the benefits from the proposed project will likewise be overestimated due to the relatively low market wage rate assumed and the high rate of adjustment used to convert nominal wage rate to shadow wage rate. Based on its own farm survey, the BBMP II feasibility study assumed the market wage rate in 2009 to be equal ₱145 per day; while the average market wage rate officially reported by the Bureau of Agricultural Statistics for the same year was higher at about ₱190 per day. The estimate of shadow price of labor or wage rate (SWR) is influenced by the price of output valued at its social opportunity cost (Medalla 1979b). The declining trend in the protective structure of the economy due to trade and foreign exchange liberalization that lowered distortions in the exchange rate has likewise reduced distortions in wage rates. The 60% discount applied on market wage to derive the SWR in the feasibility study, which was based on Medalla's estimate of SWR during the period when the degree of undervaluation of the exchange rate was in the order of 20% to 30%, would have to be reduced drastically, as the distortion in the exchange rate was reported to have dropped down to 5% by the year 2000 (Bautista 2003). The result would be to raise project cost and reduce benefits from the project.

Lastly, **the assumption on standard economic life of 50 years is too long**. This is compounded by low allocation for operation and maintenance and replacement cost of certain equipment, as well as failure to account for risks of damage from major typhoons and other natural disasters. In the case of the Upper Pampanga Integrated Irrigation System, the first large, modern system with a reservoir, a major rehabilitation had to be carried out only 25 years after its construction (David and Inocencio 2011). A number of World Bank project performance appraisal reports (various years) indicate that 30 years would be a more realistic estimate of economic life of irrigation systems.

The rapid appraisal argues that the degree of bias in the estimation of the various costs and benefits components for BBMP-II is larger than the variations considered in the sensitivity analyses. The review of the feasibility study of BMPP II raises doubts on the economic rationale for allocating public resources to the project even if a lower threshold of social opportunity cost of capital of 10% is considered.

Accounting for Discrepancies in Design and Irrigated Areas of AMRIS, Pampanga Delta and Casecnan Irrigation Systems[6]

Aside from Balog-balog, the team also visited Angat-Maasim River Irrigation System (AMRIS) (Bulacan), Pampanga Delta (Pampanga) and Casecnan or UPRIIS District V.

Actual irrigated area of AMRIS has been less than the design area of 31,400 ha at 75% during

[6] Refer to the full report of Tabios (2013) for details.

the dry season and even lower at 55% during the wet season. Overlaying Google, elevation and AMRIS network maps, we found the reasons for the discrepancies. First, about 3,500 ha of the total area have elevations of at least 19 meters (m) which cannot be irrigated with water from the Bustos Dam, with a maximum crest elevation of 18.5 m. Second, in the last few years, the built up or urbanized areas total about 4,500 ha. Thus, roughly, at least 8,000 ha of the original AMRIS design area cannot be irrigated. For the wet season, an additional 5,500 ha of the area with elevation below 7 m would be flooded reducing the wet actual irrigated area to a little over half of the design area.

The Pampanga Delta irrigation system with a design area of 11,540 ha was completed in 2002. The water source for this system is the Pampanga river which is diverted through the Cong Dadong dam diversion structure. The Cong Dadong dam has an elevation of 8.6 m, fixed length of 850 m, and movable length of 150 m. Its height is 1.3 m, scour sluice gate width is 36.5 m, intake water level is 8.5 m, and 20.18 cubic meter per second (CMS) maximum intake discharge. In short, the water supply from Pampanga river would be adequate to irrigate the entire design area, even if we assume an 80% dependable flow (although the river flows for over 300 days a year) of 108 CMS. Following AMRIS, using the high estimate of 0.00167 CMS per ha water requirement for irrigating paddy, the average daily water requirement would only be about 19.3 CMS for the Pampanga Delta design area.

Analyzing the historical service areas of Pampanga Delta irrigation system, the actual wet irrigated area is only about 1,000 ha or 8% of the design service area while during the actual dry irrigated area is about 30% of the design area. Using Google and elevation maps, we roughly establish that the built-up or urbanized area to be about 1,043 ha, fish ponds total 1,645 ha, areas above 8.5 m elevation (thus above Cong Dadong Dam) about 3,000 ha, and areas below 3 m elevation (flooded during the wet season) about 950 ha. However, despite these adjustments there should still be about 4,940 ha out of total design area that would be irrigable. Yet, the maximum actual dry season irrigated area is only about 3,500 ha while the actual wet season irrigated area about 1,000 ha (even much less recently). Two possible explanations for these (as gathered from discussions with NIA personnel) are: 1) there are locally elevated paddy areas that cannot be reached by water (by gravity) which require land grading or cutting; and, 2) downstream water users may not be get water due to over allocation or extraction upstream.

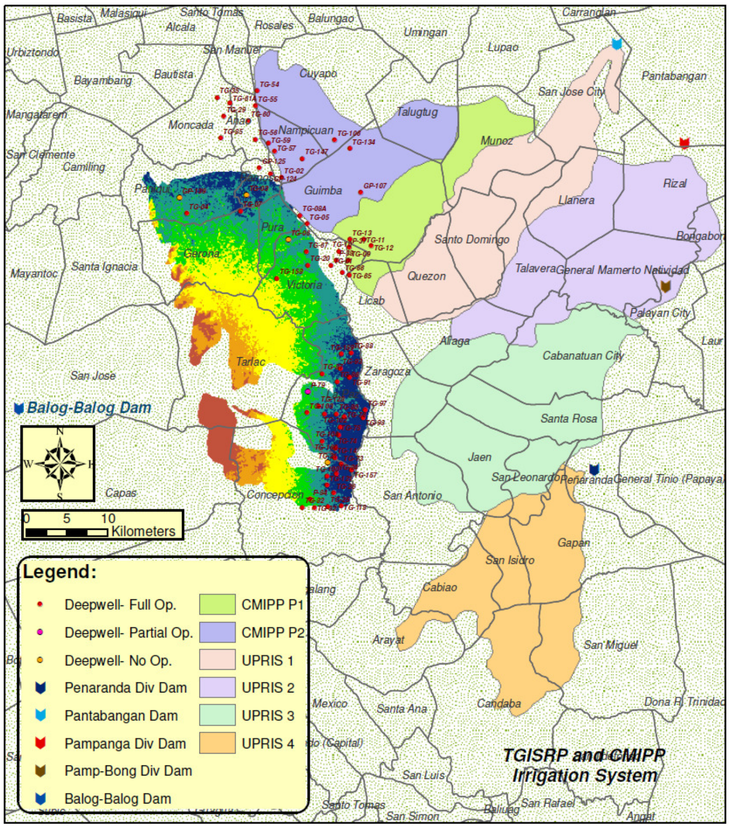
The Casecnan project has two phases. Phase I includes the creation of 16, 879 ha of new service areas in San Jose, Munoz, Guimba and part of Victoria from the water source diverted from Casecnan through the 29.24 km super diversion canal (SDC); the rehabilitation of 10,041 ha of the communal irrigation system (CIS) and small water impoundments (SWIP) in Guimba, Cuyapo, Nampicuan and Talugtog; and rehabilitation of 55,100 ha of UPRIIS. Phase 2 includes the full development of the 10,041 ha which have been the rehabilitated CIS/SWIP areas in Phase I; the rehabilitation of 10,280 ha of the Casecnan service area currently classified as rainfed; and the rehabilitation of the 40,000 ha of UPRIIS service area not covered in Phase I.

Note that part of the Tarlac Groundwater irrigation system (TGISRP) service area with about 20 deepwell pumps would be in the service area of Casecnan. With operating cost for the pumps too high, irrigators associations would want to convert to cheaper “gravity” irrigation from Casecnan irrigation project.

Overlaying several maps to estimate land use taking into account key physical features total non-irrigable and net irrigable areas for Phases 1 and 2 were estimated. We came up with net irrigable area of 14,162 ha for Phase I and 23,077 ha for Phase II. These estimates would roughly corroborate the potential or design area estimates of the proponents of Casecnan Phases I and II of 16,879 ha and 20,321 ha, respectively.

Superimposing the service areas of Casecnan, UPRIIS and Balog-balog irrigation systems with the Agno and Pampanga river basins, it appears that the Casecnan Phase II and Balog-balog Phase II service areas are almost annex to each other (see Figure 4-2). Part of Casecnan Phase II service area would be in the Talavera river basin and another part would be in the downstream of O'Donnell-Tarlac river basin. This observation raises a similar concern as that in the case of Balog-balog on whether the transbasin water transfer (involving crossing watershed divide) would be physically feasible and efficient.

Figure 4-2 Overlapping service areas of Balog-balog, TGISRP and CMIPP



Source: Tabios, et al. (2013).

Project Planning and System Design Issues[7]

The case studies also offer some initial explanation on the causes of poor performance of national irrigation systems through desk reviews complemented by field visits. This part of the rapid assessment focused on the processes of evaluating the feasibility of irrigation projects (especially for Bohol integrated irrigation project), project selection (including evaluation of technical assumptions), detailed designing of dams and distribution network, project execution,

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[7] See full report of Moya (2013).

and operation and maintenance. A total of 14 irrigation systems were selected for this appraisal component: three are reservoir systems, seven, run-of-the-river diversion system, and four, surface pump irrigation systems. For each system, a critical review of available literature that includes project feasibility studies, unpublished and published research, project completion and ex-post evaluation reports, has been done.

With interrelated components and processes, shortcomings in the design of irrigation systems translate into operations and maintenance problems and eventually, poor system performance. Specifically, issues of inequitable water distribution, low water productivity, inefficient irrigation service fee collection, poor O&M, and dire state of the irrigation systems.

Design of irrigation systems before the 1970s used to be all about the *hardware* aspects in irrigation systems. In the 1980s, there was a change in emphasis to add software concerns to improve irrigation system performance. Project design evolved and included aspects of agriculture other than water, people and extended the focus beyond the command areas to include catchment areas. With this development, project design required close collaboration by an irrigation engineers, social scientists, economists, agriculturists, hydrologists, operations and maintenance personnel, and farmers.

A number of high profile proposed irrigation projects have been based on relatively dated (and only partially updated) feasibility studies. Design units need to make sure that design take into account and adjust for the changes over time, especially for key aspects such as water supply. Also, on-farm water losses during planning stages are grossly underestimated. Most systems had been designed using 1-2 mm/day percolation rate, measurements in the field under farmer practices revealed that this rate is about eight to 40 times lower (David, W. et al 2011).[8] Canals that had been designed and built according to the design percolation rate could not carry the irrigation supplies needed and create inflexibility in water distribution from system to farm levels. In-field water distribution facilities in sample irrigation systems have been badly designed, and they have to be modified to adapt to local realities. With more frequent occurrences of strong typhoons with heavy rains, designs have to consider increased incidence of flooding.

Engineers design irrigation systems without inputs from the operation units, which take over once the constructions are completed. This shortcoming creates problems for the latter (see Figure 4-3). For example, the design parameters stipulated in the manuals or used in the operations do not reflect field realities. Also, the provision of operating manuals at turnover of completed projects, does not guarantee that the O&M units will carry on smoothly. For example, in Bohol integrated irrigation system, according to the users will need to be simplified.

The design engineers veer toward the tried-and-tested in their approach to design. They seem to ignore the lessons from past projects in designing new irrigation systems. These practices result in persistent problems in irrigation system performance.

The procedure to firm-up design area should seriously consider a thorough and robust analysis of the characteristics of expected water supplies and head needed to command the design area. The

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[8] Gross underestimation of field soil water parameters results in seemingly larger areas that can be irrigated.

water balance analysis done for Bohol integrated irrigation system is a case in point. At the onset, the system was technically unable to irrigate the entire design area because of inadequate water supply. To address the potential water supply deficit, it was assumed at design that farmers would be well organized and be responsible for water distribution after the turnouts.

Most of the operations and maintenance problems in run-of-the-river diversion and surface pump systems are caused by the change in river courses due to sedimentation. In extreme cases, headworks are washed out or completely covered by sediments and other bed loads due to strong river flows. Resources have to be allocated every year or planting season for channelization to re-divert water to their draw or abstraction points and into the irrigation system service area. The conditions of catchments from which a system derives its water supplies are hardly monitored in

Figure 4- 3 Wrongly located and positioned turnouts in Banaoang PIS, a commonn faulty design outcome thatresults in corresponding O&M problems in irigation system

Source: Moya (2013).

order to predict changes in erosion, transport, and sedimentation. Water yield could decrease because of land use changes in the catchment.

***Case Studies on Rehabilitation Projects*[9]**

Rehabilitation and restoration projects are intended to close the gap between the actual area irrigated and the design irrigation service area, and maintain the irrigation service areas. Given that substantial government resources go to rehabilitation projects every year, part of this rapid assessment examined a sample covering three small and one large irrigation systems. Specifically, we analyzed the nature of rehabilitation and improvement works, distribution of expenditure across dam/intake reconstruction; canal lining, desilting, repair; drainage lining; provision of flow control structures; road resurfacing; and administration expenses.

From interviews and field visits, we also gathered that a number of problems in the planning, design and operation and maintenance of canal irrigation systems remained unaddressed in rehabilitation and improvement projects. The fact that even with available water supply and considerable rehabilitation efforts, the size of O&M service area actually irrigated for the past 10 years remains below 70% for the case NIS.

While adequacy of water supply for the proposed rehabilitation projects is one of the criteria used in prioritization of projects, no gauging of rivers tapped for irrigation is done by NIA. In the case of Agos, Balanac and Sta Maria irrigation systems, no measurement of river flows has been done for the past three decades. The engineers of the irrigation management office (IMO) assess the water supply adequacy for their proposed projects based on their field experiences rather than actual measurements. The higher offices of NIA in turn largely depend on the IMOs for field data and information. Hardly any revalidation of design values and assumptions (e.g., seepage and percolation rates, irrigation requirements, dependable flow) in the context of changing hydrological regime and irrigation demands, is done for purposes of planning and design of rehabilitation projects.

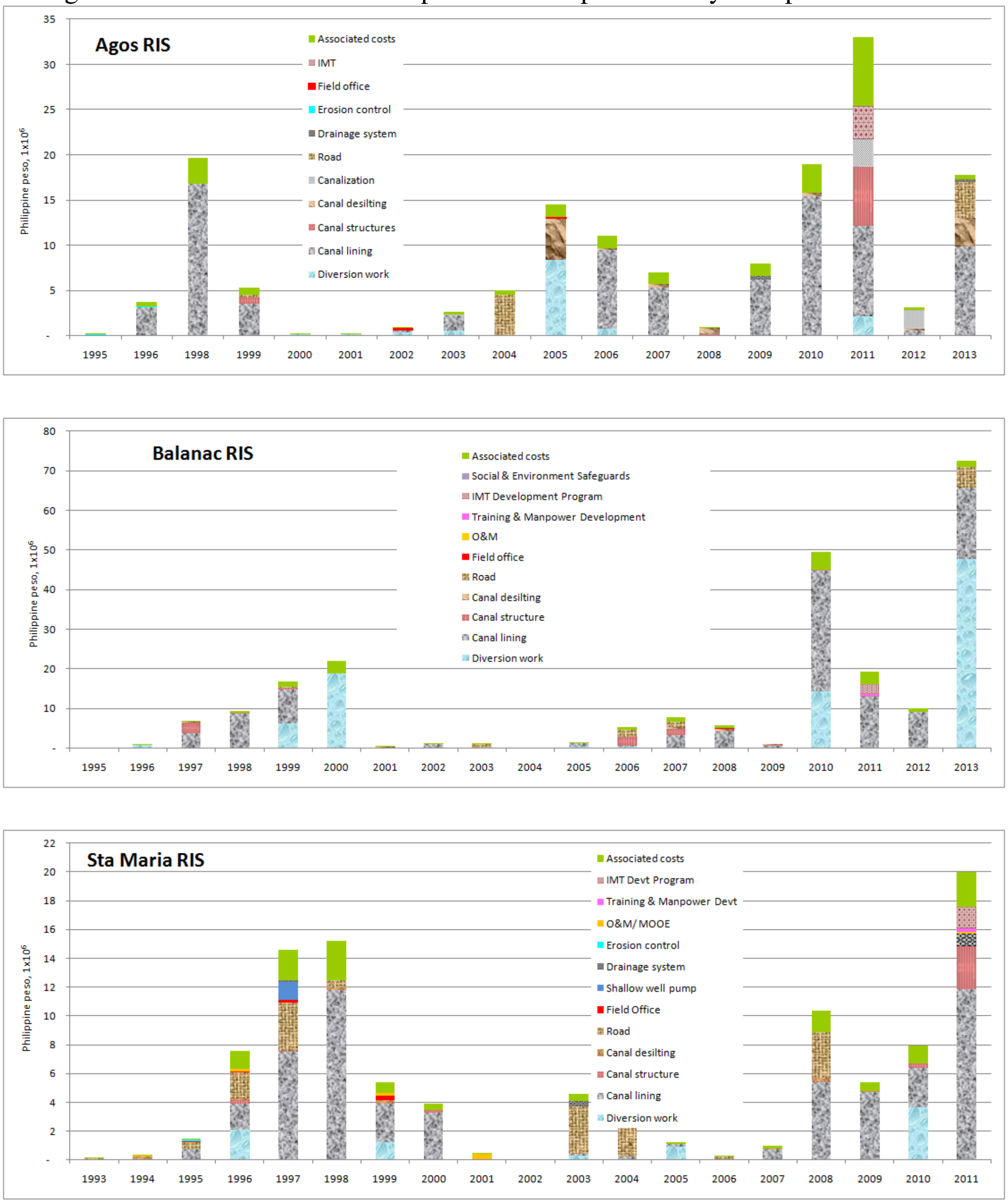
Aside from the lack of water availability measurements, there are problems that rehabilitation projects have to address. For Sta. Maria RIS, it only required fixing flow control structures and shifting the cropping calendar in order to overcome the water availability constraints.

The average rate of deterioration of the irrigation facilities has been was over 135,000 ha per year. So, without the rehabilitation and restoration projects, the annual operational irrigation service area should be dropping by this much.

Figure 4-4 shows the distribution of rehabilitation expenditures by type of work. The rehabilitation and improvement projects carried out for the three NIS were mainly aimed at maintaining their respective service areas as implied in each project's reported accomplishments. They were carried out with an end view of enabling the physical system to irrigate the whole service areas. Though commonly referred to as rehabilitation, most of such projects are mainly improvement works as they involved provision for constructing physical features that were not part of the original physical infrastructure.

[9] See full report of delos Reyes (2013).

Figure 4-4 Rehabilitation and Improvement Expenditure by Component for the Case NIS



Source: NIA IMOs (2013).

Of all expense items, lining of canals has been the most frequent and most invested work. Systems officials and farmers deemed canal lining as means of improving conveyance efficiency and shortening the travel time of irrigation water. However, assessment of percolation and seepage rates, water supply adequacy and canal discharge capacity were not part of the rehabilitation projects which were intended to partly rectify design shortcomings. Canal desilting, which was relatively prevalent in Agos RIS, is the result of failure to consider the sediment load that would be expected especially for just a barrel-type intake structure like that of the Agos RIS. However, provision of a silt excluder or any other structures to trap the silt and minimize its entry into the canal network has never been considered in several past and on-going projects.

In 2010, lengthening of the diversion dam of Balanac RIS became an urgent task for the responsible IMO. The damage caused by the flood brought about by the typhoon in 2010 compromised the stability of the dam. The construction of additional dam length or segment to better anchor the dam on one side of the river bank was included in the program of works (POW) of a rehabilitation project for 2013. This lengthening of the dam will be the fourth time a dam segment will be added. The expansion of the dam of Balanac RIS is a way to rectify a design shortcoming. The typhoon underscored the need for a more reliable assessment of probable flood magnitudes for the Balanac river for purposes of planning and design of rehabilitation or improvement works. An analysis providing insights on the magnitudes of flood events associated with different chances of occurrence for the Balanac River is yet to be done. River gauging or discharge measurement has not been done since 1980.

Access roads are given more emphasis than some key physical components of irrigation systems with a higher allocation than headworks and canal structures in Sta Maria and Balanac systems. While road projects have positive externalities for the local population, they have no direct contribution to the goal of expanding the actual area irrigated.

The NIA staff interviewed recognize the benefits of farmers' participation in rehabilitation process. But farmers' involvement has been quite limited. In the case of Sta Maria RIS, the irrigators' association (IA) participates in the identification off rehabilitation needs and preparation of memorandum of agreement (MOA). It would have been ideal if the IA also participated in monitoring of construction work and acceptance of completed work. Greater participation is supposed to promote a sense of ownership and responsibility for the system.

Lastly, the rehabilitation program does not include monitoring and evaluation component. Unlike in the case of foreign-assisted rehabilitation projects where review missions go to the project sites, higher offices of NIA rely on reports from their implementing offices regarding physical progress of project implementation. Impact evaluation after full project development stage is also not part of the rehabilitation program.

5.1. Recommendations for irrigation investment policy

In the past, infeasible projects, design mistakes, and other slippages were not rectified due to: a) excessive reliance on proponent and donor design and assessment; b) insufficient independent checks in the project planning, implementation, and evaluation cycle; absence of a comprehensive basin level planning encompassing gravity irrigation within an overall context and scenario analysis of water withdrawal demands, systems. Project implementation and management of systems eventually also suffered because of the shortcomings in planning and design. These findings lead to the following recommendations:

- **Use of flawed and dated assumptions during project identification and design stage should be rectified.** Weaknesses at this stage cascade into further problems in succeeding stages of the project cycle. For example, most of the identified "potential" irrigable areas do not consider economic viability and alternatives to public gravity systems such as private groundwater and surface- pumped irrigation. In many irrigation systems, operational flexibility comes in the form of shallow tubewells within their service areas. Research on conjunctive use and management of surface and groundwater can be done in irrigation systems underlain by a well-watered aquifer.

- The formulation of appropriate design philosophy and criteria has to be put back in place. The design strategy must center on consistency among available water supply, irrigation demand, physical design of the structures, and realistic operational plan to improve water service delivery in terms of timing, duration and frequency.

- **Feasibility studies should carefully review its assumptions over space and over time**, e.g. high-resolution features of the terrain for the former, availability of water now and in the future, for the latter. Assessment of past projects ex post has shown many of the key assumptions made at the feasibility stage are flawed; had more realistic assumptions been adopted, project design and even approval decisions may have been dramatically altered.

- **There is a need to develop strong analytical capacity for independent project appraisal**. At the forefront of this should be NEDA, which needs further capacity building on project monitoring, ex ante appraisal, and ex post evaluation. The process and quality of evaluating feasibility studies has to be improved. Project appraisal should ensure more realistic design area not just based on the total physical area with 3% slope (e.g. Google maps can now be easily downloaded for quick estimates of built up areas, elevation maps for low lying and higher elevation areas should also be easily available and can be overlaid with the Google maps) and be based on consultations with operations staff/field engineers and affected communities. Feedback should be constantly provided to the NIA planning and project development staff. The DA project review system before submission to NEDA should be installed back.

- Application and use of new technologies like geographic information system (GIS) and remote sensing imagery (RSI) and hydrologic modeling to capture the biophysical and socio-economic variability in the environment that can influence the performance of irrigation system should become the norm. This track will require resources be put in R&D on irrigation development and O&M.

- In fact, considering the importance of upstream activities and the state of relevant catchments, attention should be paid to the interaction between the state of irrigation catchment area and the design of irrigation systems. River engineering should be considered in the design of future irrigation systems. An integrated river basin management has to be put in place.

- **Re-examine the lack of allocation for current operations and maintenance to balance off the bias towards rehabilitation**. The current bias towards rehabilitation appears to be at least partly the outcome of accumulated backlog in maintenance and repairs of irrigation systems. A more systematic approach to rehabilitation of irrigation systems has to be pursued. There is a need to develop a modernization plan for each irrigation system separately. Site-specific potentials and constraints to irrigation modernization need to be taken into account in the formulation of such plans. Diagnostic assessment of the physical structure and operation and maintenance of irrigation systems and field validation of design values of water balance parameters would need to be carried out to identify the constraints and to prioritize improvement options.

- **A monitoring and evaluation (M&E) system to ensure quality of construction and to assess the performance of rehabilitation projects against their stated targets would need to be put in place** to promote accountability among the parties involved in the project planning, design and implementation and to serve as a feedback mechanisms for policy- and decision makers. Strategic M&E system would require review and analysis of previous rehabilitation or intervention measures implemented to chart the more promising directions or course of actions for better performing irrigation systems. Data, hence record keeping, is a necessity in such undertakings. Involvement of the farmers and independent research groups or institutions can be helpful partners in a monitoring and evaluation process.

- As a corollary to item no. 4, also important is capacity of independent agencies which NEDA can consult especially for major investments (e.g. water resource research institutes, hydrology centers, etc.). This will likely entail the development of a full-blown irrigation and water research and development program, with core funding for water resource centers (WRCs) based in universities. Technical and socio-economic experts in WRCs can be tapped to assist NEDA in evaluations, providing rigorous and objective technical analysis to counteract vested interest and political interference. Such a research program shall also undertake large-scale and long-term assessment of water resources and utilization across multiple uses. Such a perspective is essential in master planning at the level of river basins and watershed systems towards efficient management of ground and surface water resources.

5.2. Recommendations for further research

As this assessment has been in the nature of a rapid appraisal, important pieces of information are missing in this report, which need to be addressed in further research. These include the following:

- A scaled-up analysis of rehabilitation and improvements of projects in order to better understand the issues across most projects and establish more appropriate intervention given the amounts invested in them annually;

- A detailed analysis of O&M and ISF collection and aspects of cost recovery and viability of systems;

- Role of Irrigators Associations and the progress and impact of irrigation management transfer (IMT) with, efficient governance of the irrigation sector largely hinged on the success of this program and the shift in NIA role into providing technical support and guidance;

- An assessment of the impact of political interference and rent-seeking in the prioritization and selection of irrigation projects;

- Systems specific analysis and recommendations; and

- Inventory and detailed profiling of operational (and non-operational) CIS, review and evaluation of LGU participation (or nonparticipation), and assessment of performance and impact, review and determination of appropriate role of NIA, and government's policies on CIS development and financing in terms of effectiveness of the forged partnership with LGUs, equity and sustainability.

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