

## Chapter 6

# Agricultural Water Management Issues in the Philippines

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**Abstract** This chapter discusses the role of water management and governance in agriculture as it affects irrigation and agricultural productivity. The governance framework discusses the various actors involved in water in agriculture and the policy environment, which, in turn, affect the irrigation development performance. The country's performance in agricultural water management is assessed in terms of area irrigated by public investments, cropping intensity, collection efficiency, and productivity impact. To improve performance and agricultural productivity, the major challenges facing national and communal irrigation systems are identified. These challenges require policy changes to address poor performance, unsustainability of systems, and weak management capacities.

**Keywords** Irrigation • Cropping intensity • Firmed up service area • Irrigation service fee • Agricultural productivity

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## 6.1 Introduction

Agriculture uses about 80.5% of water that is allocated for consumption (Luyun 2016). Irrigation investment drives higher agricultural productivity. However, recent data from the Philippines show that even with huge irrigation investments, cropping intensity (effective crop area) was not increasing in a similar pace (Inocencio 2016). Several factors were hypothesized to cause this, including lack of water. Water scarcity is seen to be a very real problem at the irrigation-system level (Nguyen 2015; Clemente 2015) and the literature has pointed to water governance<sup>1</sup> as the culprit. Natural occurrences such as shifts in historical temperatures and rainfall patterns that alter the timing and quantity of annual water flows pose ever increasing challenges to irrigation. The current short cycle of both drought and flood events cause significant agricultural damage. The “new normal” conditions are recognized, but policy and institutional responses have been slow to adjust to achieve agricultural resilience (Rola 2016).

Irrigation development and management in the Philippines has historically been the single biggest expense item in agriculture, accounting for about a third of the total since the 1960s. In the 1970s and early 1980s, as well as in recent years when world rice prices rose at unprecedented levels, this ratio was even higher at close to half of total public expenditures for agriculture. In recent years, irrigation has taken up from one-third to close to half of the Department of Agriculture (DA) budget (Inocencio et al. 2016).

Despite these efforts, irrigated area in the country is still small, thus jeopardizing food security. Siltation problems in canals of the national irrigation system (NIS) cause reduced flow capacities that deprive the downstream portion from adequate water supply (Clemente 2015). The reason, according to Clemente (2015), is lack of maintenance especially of unlined canals and poor watershed management, which results in upland erosion and siltation of the rivers and canals downstream. Siltation in the dams and canals is considered a major problem by communal irrigation systems (CIS) (Luyun 2015). Sediments occur due to forest denudation in the catchment, slash-and-burn agriculture (locally termed as *kaingin*), upland agriculture, quarrying, and lack of silt control devices in the dam.

Among the factors that cause inadequate system-level irrigation water supply is conveyance inefficiency (Clemente 2015; Luyun 2015). Conveyance inefficiency is caused by physical degradation of the system that can be due to storms/typhoons and faulty designs. It can also be caused by siltation as well as lack of maintenance brought about by limited funds, shortage of personnel, and lack of capacity to do maintenance work.

This chapter focuses on the role of water management and governance in agriculture as it affects irrigation and agricultural productivity.

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<sup>1</sup> Over the past decade, the terms ‘water governance’ and ‘water management’ have entered into the standard vocabulary of professionals and academics engaged with the water sector. The term water governance highlights a shifting state-society relationship in which the state has altered its responsibilities and/or activities related to water management and water service provision.

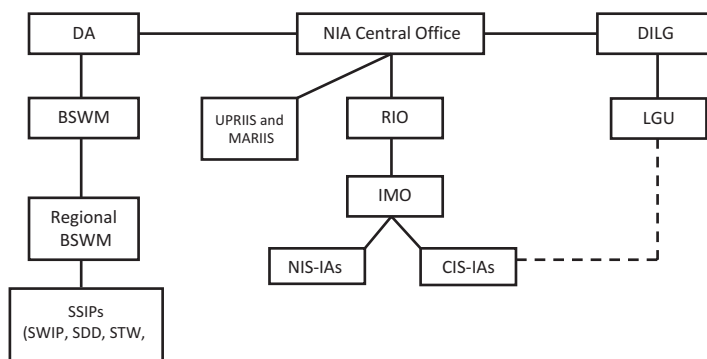
## 6.2 Governance Framework

### 6.2.1 Actors in the Agricultural Water Management Sector

There are many actors involved in water use in agriculture. For irrigation design, development/construction, management and operation of bigger systems, the National Irrigation Administration (NIA) and the irrigators' associations (IAs) are the key players, with NIA being responsible for 80% of total irrigated area. The Bureau of Soils and Water Management (BSWM) and the regional field offices (RFOs) of the DA are the other players that are responsible for small systems. These agencies established small water irrigation system associations (SWISA) to manage and operate the fully turned-over systems. Both NIA and BSWM collaborate with local government units (LGUs), which play a role in communal and barangay irrigation (Fig. 6.1).

The mandate of NIA is to plan, design, construct, and/or improve all types of irrigation projects and to operate, maintain, and administer all NIS. It could also delegate the partial or full management of NIS to duly organized cooperatives or associations. NIA also has the authority to supervise the operation, maintenance, and repair, or otherwise, administer temporarily, all communal (CIS) and pump irrigation systems wholly or partially with government funds. As a government-owned and-controlled corporation (GOCC), NIA has autonomy and authority to contract domestic and foreign loans with government absolute and unconditional guarantees. NIA is exempt from payment of all forms of taxes, duties, fees, imposts, and import restrictions.

NIA has 14 regional irrigation offices (RIOs) and irrigation management offices (IMOs) consisting of 40 clustered provinces; nine district offices, and two dam and reservoir divisions, the Upper Pampanga River Integrated Irrigation System (UPRIIS) and the Magat River Integrated Irrigation System (MRIIS). The IAs are the direct beneficiaries of completed irrigation projects/systems. An IA is an association of farmers within a contiguous area served by an irrigation system (IS).



**Fig. 6.1** Philippine irrigation water governance administration (*Source: Rola 2015*)

It is a non-profit organization that has to register with the Securities and Exchange Commission (SEC) to apply for a water permit from the National Water Resources Board (NWRB) and to enter into contract with NIA for irrigation development. An IA operating as a cooperative has to register with the Cooperative Development Authority (CDA).

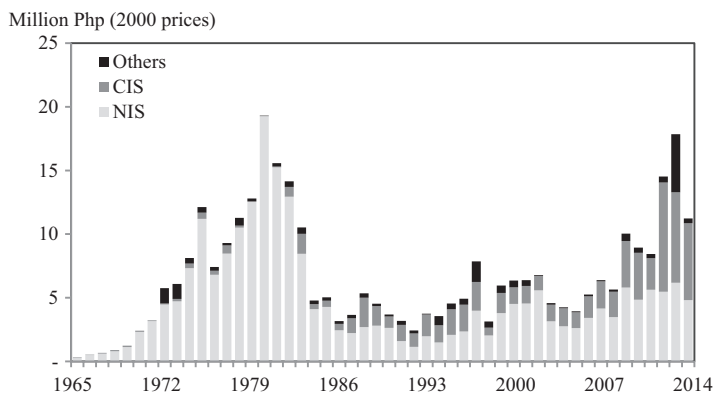
The BSWM is responsible for the design and implementation of small-scale irrigation projects (SSIPs) with LGUs and RFOs of DA and for formulating measures and guidelines for effective soil, land, and water resource utilization. SSIPs include techniques for rainwater harvesting such as small water impounding projects (SWIPs) and small farm reservoirs (SFRs); diverting flowing water by gravity such as diversion dams (DD); using stone/earth/brushwood or concrete structures (run-of-river systems); creating a reservoir to harness spring through spring development (SD) projects; and lifting water by mechanical power (e.g., shallow tubewell or STW and pump irrigation using open sources or PISOS); and the use of renewable energy (ram pumps, solar pumps, and wind pumps) (Tejada et al. 2015). The Philippines' Agriculture and Fisheries Modernization Act (AFMA) of 1997 provides for the devolution of CIS to LGUs and directs the DA to devolve the planning, design, and management of CISs, including the transfer of NIA's assets and resources in relation to the CIS, to the LGUs.

From 1974 to June 2015, the SSIPs contributed about 11% to total irrigation development. SSIPs are being operated and managed either individually or by groups of farmers within adjacent farms. Unlike the NIA systems, the SSISs, specifically SWIPs and DDs, are being operated and maintained by SWISA. SWISA is registered with either SEC or the Department of Labor and Employment (DOLE). The BSWM and DA-RFOs provide support to capacitate and strengthen the SWISAs (Tejada et al. 2015).

## **6.2.2 The Policy Environment**

### **6.2.2.1 Multiple Goals and Corporate Form**

NIA has multiple and seemingly conflicting objectives. Specifically, it is tasked with the social objective of assisting farmers through provision of irrigation service. And yet, as a corporate body, it is expected to generate income and recover costs and maximize returns. World Bank (1995) has indicated that one of the reasons government corporations perform poorly is that "no one has a clear stake in generating positive returns because there is no identifiable owner since the government can be the ministries, or parliament, or the general public." The preferential treatment of GOCCs may be contributing to the essentially weak or absent accountability (SEPO 2006). On the other hand, as a corporate body, NIA enjoys greater flexibility, particularly in its investment activities compared with line agencies. As a corporation, it has been given authority to borrow with national government guarantee. The borrowing spree had the approval of government and can be clearly seen from the 1970s to the mid-2000s with foreign funding dominating the fund sources (SEPO 2006).



**Fig. 6.2** Irrigation investment trends for national, communal, and pump irrigation systems at 2000 prices, 1965–2014 (*Source*: Inocencio 2016)

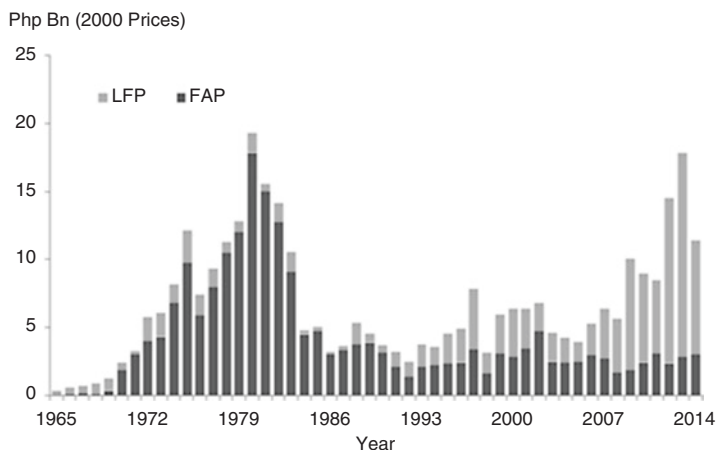
Notes: *CIS* Communal irrigation system, *NIS* National irrigation system

Irrigation investment remains the most important policy instrument that the government uses to increase productivity in agriculture and to achieve its food staple sufficiency objective. Figure 6.2 presents the trends in total public expenditure for irrigation in 2000 prices. Over the past four decades, irrigation investments peaked in the late 1970s to the early 1980s and rose again in more recent years. The increase in world rice prices in the 1970s, together with the introduction of modern rice varieties suited to irrigated conditions, raised the marginal rates of return for irrigation investments. As world commodity prices declined, yields of modern rice varieties leveled off, and as the cost of irrigation expansion increased, public expenditures declined.

In terms of trends in type of project, shifts in investments from largely NIS to more CIS in early 2000 and in more recent years (David and Inocencio 2012) are discernible. These changes are consistent with the delayed enforcement of the provisions in the AFMA (supposedly to begin in 1997) to give more attention to smaller systems and promote participation of LGUs in developing CIS.

Investment shifted from new development to rehabilitation projects, which were reported to give higher returns to investment. The rise in investments in 2008 was a response to the increase in world rice prices in 2007. This trend continued with the Aquino administration's food self-sufficiency program. More systematic analyses indicate that levels of public investments respond to short-run changes in world rice prices, as these affect marginal rates of return to irrigation investments and adoption of rice self-sufficiency instead of consideration of long-term benefits and costs (Kikuchi et al. 2001).

Also, the funding source shifted from predominantly foreign in the 1970s and 1980s to more local in recent years (Fig. 6.3). This pattern is reflective of the country's development strategy at the earlier time, when foreign funding was the key element. That period was characterized by debt-driven growth. The poor fiscal position of the country in early 2000 led it to foreign funding for irrigation projects.



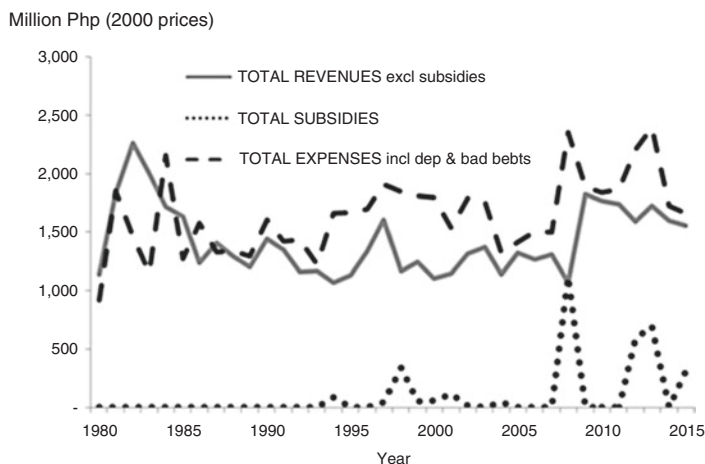
**Fig. 6.3** Trends in irrigation investments, by source of funding, 1965–2014 (*Source: Inocencio 2016*)

Notes: *FAP* Foreign-assisted projects, *LFP* Locally funded projects

The recognition of the need to reduce foreign exchange risks directed borrowings back to local sources. This fiscal policy had implications for the quality of projects and their implementation. Foreign funding appeared to have certain implementation rules and standards from the conception of a project up to completion. Local funding, however, appears to have had fewer requirements and less stringent rules and accountability.

### 6.2.2.2 Capital Cost and O&M Recovery

NIA's mandate to develop and construct irrigation systems requires huge capital and yet, it has not recovered the cost of investment, except for CIS. In lieu of recovering capital costs for NIS, the government funds the capital requirements of NIA through the annual national allocation provided in the General Appropriations Act. Where internally generated funds mostly composed of ISF are insufficient, the national government also subsidizes NIA's operating costs (Fig. 6.4). Because of the capital needs of NIA, it enjoys guaranteed loans. All these policies create a moral hazard problem since there is no incentive to be efficient and collect all dues as there is practically no threat of bankruptcy. Also, NIA is in a bind because it cannot exclude farmers who do not pay the ISF from getting water even if the unpaid irrigation fees or administration charges are considered as "preferred liens, first, upon the land benefited, and then on the crops raised thereon. NIA has preference over all other liens except for taxes on the land which cannot be removed until all fees or administration charges are paid or the property is levied upon and sold by the National Irrigation Administration." The seemingly inconsistent policies contribute to poor performance of NIA.



**Fig. 6.4** NIA corporate income and expenditures at 2000 prices, 1980–2015 (*Source* of basic data: NIA 2016a)

In the case of SSIPs, the BSWM does not recover any capital cost. For O&M, the SWISAs collect from members.

The present policy on subsidy is biased in favor of NIS. The government fully subsidizes the construction and about half of the O&M costs of these systems. In the case of CIS, farmers are required to finance the operation and maintenance as well as contribute 10% of the cost of construction and repay the balance without interest within 50 years. Another option is to pay 30% of the chargeable cost (in cash or in the money value of labor, materials, and supplies) during the construction or rehabilitation period and then the CIS is turned over to the IA.

The heavy subsidy on NIS and CIS has been the primary disincentive to the judicious choice of irrigation technologies. Such inequity in subsidy increases farmers' demands for NIS relative to the more cost-effective irrigation technologies and discourages private sector participation in irrigation development.

## 6.3 Agricultural Water Management Performance Assessment

### 6.3.1 Irrigation Development

NIA's development program largely focuses on NIS and CIS. The NIS are irrigation systems with minimum service areas of 1000 ha, the biggest reaching over 130,000 ha. Management of NIS systems is by NIA and IAs. There are 232 NIS with a total service area of 815,308 ha (or 732,774 ha firmed-up service area) benefiting a total of 595,325 farmers as of December 2015. The three largest NIS with

massive reservoirs operated in combination with run-of-the-river gravity irrigation systems account for about a third of total NIS service area. The remaining two-thirds are mostly run-of-the-river gravity irrigation, except for six medium and large-sized NIS that pump water from large rivers.

The CIS are those whose service areas fall below the 1000-ha threshold. The total service area of CIS continues to be sizeable at about 603,106 ha or a firm-up service area of 578,455 ha, benefitting a total of 391,918 farmers as of December 2015. While many CIS started as private initiatives, most of them have been receiving government support for the cost of rehabilitation and new construction. Most CIS are constructed by NIA, but the IAs are responsible for the management and maintenance of the systems. At least 95% of CIS are gravity systems obtaining water from rivers or streams. However, few have been given funding support for medium sized pumps to also abstract and distribute water from rivers. As of end of 2015, the national systems comprise 43.6% of total irrigated area; the communal systems, 35.6%; private irrigation systems, 10.8%; and other government-assisted systems, 10%.

While the government started to promote the adoption of pump irrigation in the 1950s, recent data indicate that at least 90% of pump irrigation used by rice farmers have been purchased privately, and even more so for pumps used for non-rice cultivation.

Table 6.1 gives the potential irrigable area, by region, as of December 2015. The estimates indicate that there is still much potential left. However, it should be noted that these estimates only considered contiguous areas of 100 ha or more with slopes not exceeding 3%. Included are areas that have been converted into non-agricultural uses. Important determinants of irrigation potential such as water availability and existing land use were not considered. If water availability and economic feasibility will be factored in, these estimates would likely be overestimates. From Luyun (2015), many CIS are already in areas with slopes between 3% and 8%. This information implies that there are potential irrigable areas in steeper slopes.

David (2009) reported the rapid deterioration of the gravity irrigation system service area in the Philippines. The deterioration rate of about 70,000 ha/year in the total NIS and CIS service areas during the pre-AFMA years (1992–1996) earlier reported by David (2003) had increased to about 134,000 ha/year during the post-AFMA years of 1998–2004 (David 2008, 2009). This trend accounted for the very slow annual rate of increase of only about 10,000 ha/year in the actual NIS and CIS service areas. This is in spite of massive efforts of rehabilitating an average of 124,597 ha/year and constructing new irrigation facilities at 19,285 ha/year during 1995–2005. Ella (2015) reported the same findings. He noted that the net increase in total irrigated areas from 1985 to 2014 is only 294,939 ha or just 10,170 ha/year. This rate increased for the period 2009–2014, showing a net increase in total irrigated areas of 168,130 ha or 33,626 ha/year. However, for the same period, new area generated is only 224,316 ha and total area restored is 298,840 ha. The sum of new areas generated and areas restored minus actual irrigated areas for the same period



**Table 6.1** Status of irrigation development and potential based on 3% slope, as of December 2015 (in '000 ha)

Region	Estimated total irrigable area (1)	Firmed-up service area					Irrigation development (2)/(1) (%)	Potential area for development (1)–(2)
		NISs	CISs	PISs	Others	Total (2)		
CAR	97	14	50	25	4	93	96	5
1	263	48	54	21	51	174	66	89
2	457	152	57	46	21	275	60	182
3	481	196	70	9	20	295	61	186
4A	86	21	19	6	2	49	57	37
4B	139	19	35	14	12	80	58	59
5	239	23	74	25	16	138	58	102
6	190	47	37	15	15	114	60	76
7	46	12	26	4	2	44	95	3
8	84	24	38	6	3	71	84	13
9	75	17	24	2	4	47	62	28
10	114	26	26	6	4	62	54	52
11	147	36	26	1	3	66	45	81
12	286	64	36	3	10	113	39	173
ARMM	156	26	20	0.09	0.295	46	29	110
CARAGA	159	30	26	3	7	65	41	94
Total	3020	755	616	188	173	1731	57	1288

ARMM Autonomous Region of Muslim Mindanao, CARAGA Caraga Administrative Region or Region 13

Source: NIA (2016b)

showed total areas which deteriorated to be 355,026 ha or 71,005 ha/year. Despite huge irrigation investments, the data showed that the rate of deterioration is faster than the establishment of new systems.

### 6.3.2 Cropping Intensity

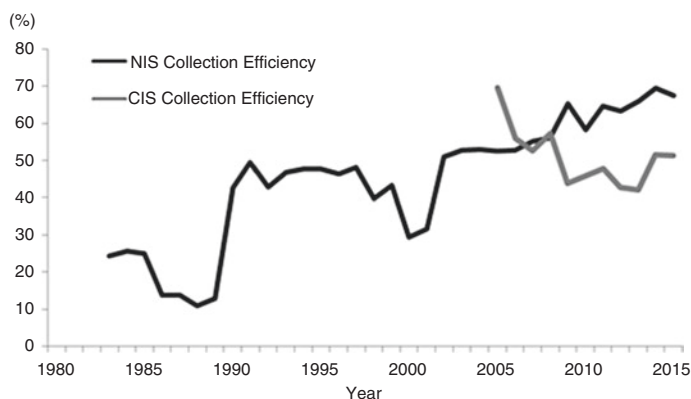
Irrigation increases cropping intensity, which is affected by seasonality of water supply. Availability of water the whole year round allows for a second or third cropping. Water scarcity leads to a decline in irrigation water supply, thus affecting cropping intensity. This is caused by several factors that may be beyond the control of NIA – e.g., sectoral water allocation (priority for domestic use over irrigation in cases of water crisis); watershed degradation, and climate change.

The national average cropping intensity is defined as the ratio of area actually irrigated for all seasons (including the 3rd and ratooning) to firmed-up service area (FUSA). CIS shows some increase from 122% in 2012 to 128% in 2015. The NIS, on the other hand, shows the same modest growth from 147% to 156% (Table 6.2). Given the investments poured into NIS, CIS growth appears better.

**Table 6.2** Cropping intensity (%) in the Philippines, by irrigation system

	2010	2011	2012	2013	2014	2015
NIS	147	112	159	147	146	156
CIS	ND	ND	122	129	134	128

Sources: NIA (Various years)



**Fig. 6.5** Trends in collection efficiency in NIS and CIS, Philippines, 1965–2015 (Sources: NIA Various years)

Low cropping intensity is due to over assessment at the design stage of the individual system service area relative to what is actually irrigated and available water supply (World Bank 1992). Overestimation of service area results from failure to account for built-up areas, flooded areas during rainy season, and elevated areas that cannot be reached by gravity irrigation. In more recent years, flooding during the wet season has reduced substantially the irrigated area for that season and, correspondingly, cropping intensity (Inocencio et al. 2016). The lack of water supply due to declining water intake from degraded watersheds has largely reduced the irrigated area in the dry season (Clemente 2015). Rivers and creeks, the major water sources of CIS, produce extremely low flow or at times no flow at all during the dry season.

### 6.3.3 Collection Efficiency in Irrigation Systems

The collection efficiency (Fig. 6.5) is defined for NIS as the ratio of current ISF collections to current collectibles, while for CIS, it is the ratio of current amortization payments to current collectibles; these show opposite trends. The collection efficiency for NISs was below 50% until the early 2000s, but it started rising in 2003 to more than 60% in more recent years. ISF collections are used for O&M of the

systems and to partly cover the operations costs of the IMOs and the RIOs. For the CIS, the amortization collection rate has been declining since 2004, which should be alarming, given the declining share of total revenues from CIS. This pattern could imply much reduced efforts at collection and/or a less effective collection strategy.

The trends in actual cost of NIS O&M compared with recommended/desirable levels and with ISF collectibles and collections at 2000 prices revealed two key concerns: (a) the recommended O&M cost is much higher than the current collectible ISFs, implying that, even with 100% collection efficiency, the ISFs would not be able to cover the recommended O&M; and (b) the actual O&M seems to stay close to the actual ISFs collected – i.e., actual collection seems to determine how much O&M will be done rather than the desired level of O&M. The historically poor O&M spending may partly explain why the increasing investments in irrigation development, FUSA, and actual irrigated area and irrigation intensities hardly improved over time.

The ISF collection from NIS for the 1983–2015 period averaged only 43% of the total collectible. It is interesting to point out that this was approximately the same as the percentage of the service area actually irrigated during the dry seasons of the same period. It is quite clear that NIA should improve the efficiency and performance of its NIS if it has to increase its ISF collection.

### ***6.3.4 Irrigation System Governance***

Irigators' associations are supposed to govern the irrigation system, for both NIS and CIS. The primary aim of the two systems is to provide irrigation water to association members at the time it is most needed.

The performance of IAs is based on NIA's functionality rating based on parameters related to O&M performance, organization, financial performance, and organizational discipline. Results of the functionality survey are used in the search for outstanding IAs at the provincial, regional, and national levels. This provides good motivation to IAs and their members. It also helps NIA in identifying appropriate strategies to enhance IA capabilities. The rating is done through discussions/consultation with IAs. The overall rating of IA functionality is an aggregation of four major factors: O&M with 40% weight; financial performance, 30%; organization, 15%; and organizational discipline, 15%. O&M indicators include O&M planning and implementation, and performance such as annual cropping intensity, irrigated area vs programmed area, status of irrigation facilities and structures, yield, and collection efficiency. Financial performance includes income generation and fund utilization and viability index. Organization includes information on membership, meetings, and recording/filing system. Organizational discipline includes attendance in meetings and group work, holding of regular elections, conflict resolution, and imposition of discipline.

#### 6.3.4.1 NIS Irrigators' Associations

The NIS scheme has been established and is being maintained by the NIA. In this type of irrigation system, farmers have to pay ISF to cover O&M expenditures. The ISF is payment for the delivery of irrigation water services rendered by NIA to be paid by the beneficiaries of NIS. This fee is used primarily to finance the continuous operation of the IS. Rates are based on the IS development scheme (run-off-the-river, reservoir, and pump), the crops planted, and season (Nguyen 2015).

Rice farms with yields of 40 cavans/ha or less are exempted from paying the ISF. The fees collected by NIA should cover the costs for O&M. NIS farmers are not paying for capital outlay. Consistent with the current trend of devolved management of irrigation systems in other countries and to make viable the rationalization or staff reduction of the agency, NIA has been preparing the IAs to take on greater responsibilities through an irrigation management transfer (IMT) scheme for NIS. The IMT transfers the responsibility and authority for the management of irrigation systems from NIA to IAs. This process may include transfer of decision-making authority (governance) or transfer of ownership of infrastructure (considered in privatization), or transfer of water rights from government to water users' associations (FAO 2001). The IMT may also be turning over partial management responsibilities – e.g., water delivery, canal maintenance, and paying for irrigation services such as that followed in the Philippines. The goal is for the NIS under the IAs to be self-managed just like the CIS.

There are four models of IMT or transfer of NIS O&M responsibilities from NIA to NIS IAs (Table 6.3). Operation and management of turnouts and farm-level facilities is the inherent responsibility of the IA. As of 2014, IMT accomplishments involved models 1 and 2 (95% of IAs) and were very minimal for models 3 and 4 (Table 6.3). This rate raises concern if devolving management of NIS has reached a sufficient depth since Model 1 is limited only to maintenance of canals and Model 2 to management of lateral canals, remote from the system's complete turnover.

For NIS, a study (Clemente 2015) in Luzon revealed that most IAs have moderate performance levels; only 12% show high performance, and these are found at the upstream parts, which receive adequate water supply. Downstream IAs show low performance. The study cites that, even without much technical data on flows that are included in the analysis, water delivery is one major factor causing low performance.

#### 6.3.4.2 CIS Irrigators' Associations

CIS has been established either by farmers or by the NIA. CIS farmers pay for the capital outlay and irrigation fees for maintenance. Management is turned over by NIA to the IA for O&M (Lauraya and Sala 1995; Jopillo and de los Reyes 1998). CIS farmers use the less formal and customary rules in governing irrigation water. The legal mandate that AFMA provided was for the LGU to take charge of the CIS investments and oversee the CIS IA operations.

**Table 6.3** Status of irrigation management transfer (IMT) of NIS as of October 31, 2014

IMT model	Description	IAs involved (no.)	Percentage
Model 1	Maintenance of canals delegated to IA; IA is compensated based on canal area maintained and existing labor rate	1192	49.69
Model 2	Turnover of management of lateral canals to IA; IA gets a share of ISF collected; typical ISF sharing: NIA: 70%, IA:30%	1103	45.98
Model 3	Turnover of management of main and lateral canals to IA federation (headworks/dam not included); IAs get a share of ISF collected; typical ISF sharing: NIA: 70%, IA:30%	77	3.21
Model 4	Complete turnover of irrigation system to IA; IA pays NIA a rental fee at a rate of 75–100 kg of dry palay per ha per year	27	1.13
Total		2399	82.98
Total NIS IAs organized		2891	

Source: NIA (2016c)

The AFMA mandated that the DA, particularly through the NIA and the Agricultural Training Institute (ATI), in collaboration with the Department of Finance (DOF) and the Department of Interior and Local Government (DILG), conduct a capability-building program to enable LGUs to independently and successfully sustain the CIS. This program for the LGUs was supposed to incorporate components for technical and financial assistance, logistical support, and training. This task, however, was not accomplished due to lack of coordinated efforts to improve the technical capacity of the LGUs and the lack of political will to implement the AFMA provisions. There has really been limited capacity building for LGUs and IAs. For CIS, 80% of the IAs organized had achieved complete turnover of irrigation systems (Table 6.4).

Among functionality indicators, a study (Elazegui 2015) in Luzon indicated that O&M and finance are common weak points among CIS IAs. O&M involves different activities such as minor repair, routine maintenance, emergency repair, and annual repair. IAs do not include all of these in their collection targets, as they usually refer to canal cleaning for their O&M activity. Moreover, NIA's financial assistance to CIS projects is for the main diversion and main conveyance facilities. Farm-level facilities (e.g., turnouts) are not included in the project cost and have to be developed by the farmers. Thus, even if collection efficiency is high relative to amortization payments, the IAs find it difficult to collect other dues from their members (Elazegui 2015).

**Table 6.4** Status of CIS turnover, as of October 31, 2014

Mode	Description	IAs involved (no.)	Percentage
CIS Turnover			
Complete turnover of irrigation system to IA for O&M	Generally, IA contributes 10% equity during the construction period and pays NIA amortization fee of the direct cost of construction of the project for a period not exceeding 50 year; IA has the option to contribute equity equivalent to 30% of the project cost, and the rest of the project cost is considered fully paid	4267	80.18
Total CIS IAs organized		5322	

Source: NIA (2016c)

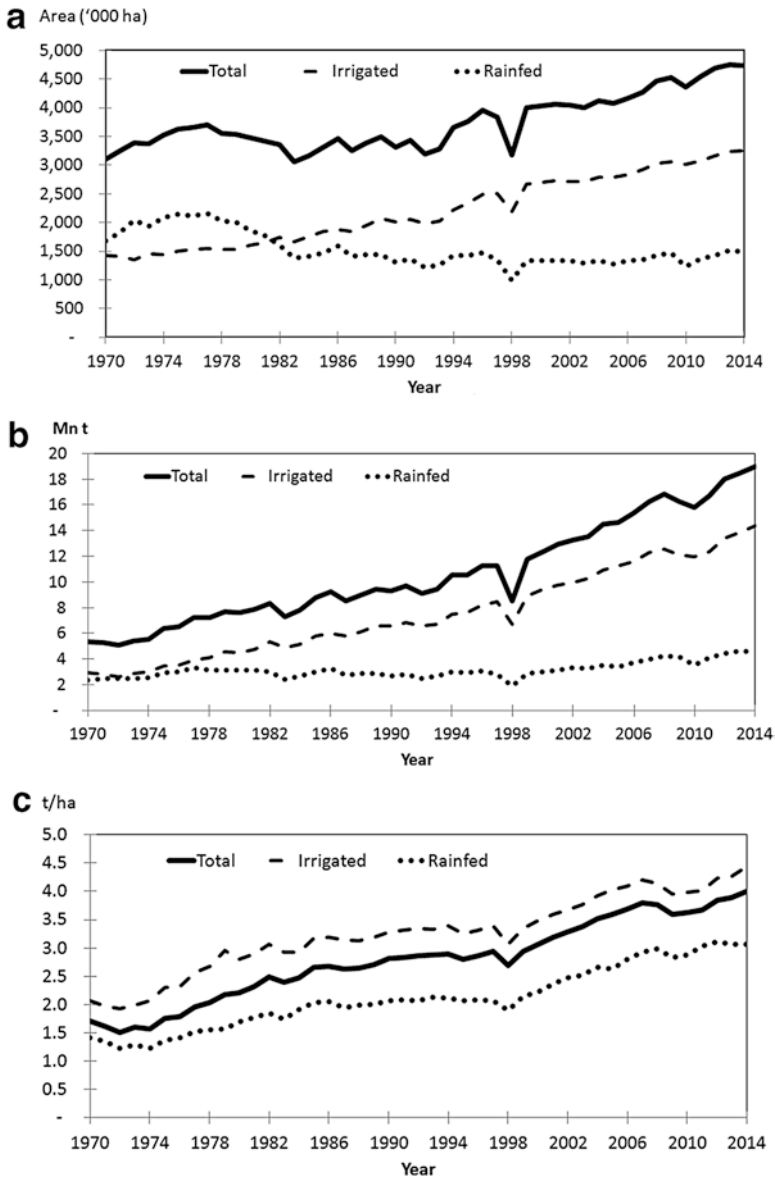
### 6.3.5 Irrigation and Rice Productivity

Irrigation increases yield and cropping intensity. With water available all year-round, some farmers can have a second or third crop. Figure 6.6 shows the comparison between rainfed and irrigated rice in terms of area, yield, and production for the 1970–2014 period. Figure 6.6a shows decreasing hectareage of rainfed rice and increasing irrigated rice areas for the same period. On average, irrigated rice has higher yields than rainfed rice, by about a ton per hectare (Fig. 6.6b). The increasing area and high yield lead to greater rice production for irrigated rice compared with rainfed rice (Fig. 6.6c). The sharp decline in production and rice area in 1998 has been attributed to the worst El Niño episode in 1997, which affected the harvest in 1998. The development of irrigation in the 1970s has resulted in substantial increases in crop yield. It has coincided with the introduction of high-yielding varieties, particularly for rice, in the Green Revolution era.

## 6.4 Policy Challenges

### 6.4.1 Low Performance of Irrigation Systems

Concerned with the continuous deterioration of the NIS and the declining water yield during dry seasons as well as the millions of pesos spent annually for desilting, the NIA proposed the inclusion of the catchment management program to address the said problems under the World Bank-assisted Water Resources Development Project (World Bank 1998). The study found that another main reason for the low performance of the systems is sedimentation in the storage area of reservoirs and dams and along canals. Sources of sediments are sidehills, drainage/creeks, side slopes of irrigation canals, and the catchment. Canals passing through foot of hills



**Fig. 6.6** Trends in irrigated vs rainfed area, yield, and production, 1970–2014 (a) Palay area (b) Palay production (c) Palay yield. (Source: PSA 2015)

planted with crops such as corn have reduced flow capacities or are rendered useless after being completely filled up by eroded or collapsed soils. Some canals passing through built-up areas serve as drainage of roads and communities. When shallow creeks are tapped for additional water, sediments are directly added into the system. However, the catchment is where the bulk of sediments came from, especially when

the forest cover has been denuded or *kaingin* was practiced and the upland area is cultivated. In combination with defective sluice gates and absence of silt control devices, this leads to severe reduction of storage capacity of most dams.

The decreasing dependable flow of surface water sources and the inability to control sedimentation are exacerbated by the prevalence of damaged or dilapidated dams, headworks, and control structures. Some of these problems are caused by typhoons but others are simply due to faulty design and poor O&M. In a study of several NIS, CIS and SWIPs in Ilocos Norte, David et al. (2012a, b) showed that the poor performance of the irrigation systems studied can be traced to their design shortcomings and undesirable design features. The very low dry-season irrigation intensity are due to design shortcomings at the headworks, including underestimation of flood flows and sediment loads, inadequate provisions for sediment control, and underestimation of reservoir inflow and outflow hydrographs. These problems are more evident in the case of the CIS, where most dams are already old, with exposed rock cores, damaged spillways, and silted storage area. Possibly due to limited funds, there is apparent neglect in the estimation of dependable flow and sediment discharge, relying on old design criteria or adopting design parameters from other systems.

#### **6.4.2 Non-optimal Cropping Intensity Due to Water Supply Seasonality**

The lack of water during dry season was one of the main reasons cited by Luyun (2015) for the low performance of CIS. Of the 66 CIS surveyed, only 22 CIS or 33% have river sources that were deemed capable of providing irrigation even during dry seasons. Four of these rivers are large enough to provide water even to large NIS and to the CIS through pumps. In 14 CIS, creeks are the major source of water. These creeks have adequate water flow for small areas during the wet season but produce extremely low flow or at times no flow at all during the dry season. Springs are the principal water sources of most CIS in mountainous regions, which, due to their usually low discharges, are supplemented by flows from creeks and runoff. Three other CIS rely on excess runoff either as the main source or in support of other principal water sources. These CIS are equipped with costly storage reservoir dams to impound water, but they can only support small areas for irrigation.

The country also has an extensive groundwater reservoir with shallow and deep well areas of about 50,000 km<sup>2</sup> and 123,000 km<sup>2</sup>, respectively. However, these are relatively underutilized for irrigation with only a 25% share of the 3737 million m<sup>3</sup> water permits granted by the NWRB in 2013. In most of the irrigation systems, farmers have shallow tubewell (STW) pumps serving as supplemental water source in times of inadequate or intermittent irrigation from the canal systems or as a primary water source for vegetables or other high-value crops. Most STWs are purchased under the farmers' own initiatives.



Reuse of wastewater for irrigation could help address water supply and improve cropping intensity. There are existing guidelines for this. Watershed degradation has posed problems on sustainability of irrigation systems. IAs apparently have none or a limited role in watershed management despite their complaints about activities in the watershed affecting their irrigation system. IAs can serve as partners in watershed management programs in collaboration with the Department of Environment and Natural Resources (DENR), the lead agency in watershed concerns. There is also the Convergence Program between DENR, DA, and LGUs. They can lobby for representation in appropriate bodies. For example, Irrigation committees may be formed within sub/watershed management councils where IAs may express their concerns.

### ***6.4.3 Need for Sustainable Source of Operations and Maintenance Funds***

The national government, in wanting to provide service to a larger populace, is less stringent on loan repayments for service-oriented cooperatives and does not impose stiff fines on delinquent and erring end-users (such as NIA farmer beneficiaries). This exacts a moral hazard problem: these service providers and end-users have no incentive to shape up and improve efficiency since the national government is on standby to bail them out and would not allow them to fail. This, in turn, leads to poor collection efficiency.

The poor financial condition of NIA arises from operational factors and inconsistent policy objectives of government. NIA is mandated to provide irrigation service, which has some social objective, which results in losses. In this case, the government is obliged to subsidize its operations. NIA's operations require huge capital investments that the government cannot afford, given its budgetary constraints, so it contributed to foreign borrowing.

Moreover, NIA's financial assistance to CIS projects is for main diversion and main conveyance facilities. Farm-level facilities, e.g., turnouts, are not included in the project cost and have to be developed by the farmers, according to the CIS Manual (NIA 1985). O&M is not included in the CIS project cost. Thus, IA collection mainly goes to amortization payments and it is difficult to collect fees for other activities. Between 2009 and 2014, average actual collection efficiency did not improve at around 40% level until 2014 when it rose to 60%. Low collection efficiency is due to attitude and perception of farmers. They claim that providing irrigation is the responsibility of the government; for NIS, farmers are paying ISF, not the cost of irrigation project. Some politicians also committed to pay the project cost but failed to do so. Other IAs claimed that there is not enough water, so they will not pay (Elazegui 2015).

Projected yields are also overestimated but water use efficiency has declined over the years. Another cause is lack of investments in recurrent costs associated with O&M activities once construction is completed (Ostrom 1990). Donors normally restrict their involvement to design and construction and view O&M as a responsibility of the recipient of the system. Routine maintenance is delayed until deterioration of the system is large enough to require rehabilitation.

#### **6.4.4 Capacity Needs for Irrigation Water Management**

NIA is mandated to provide needed capacity-building/training activities to the IAs before transferring O&M. Under its IMT program, it shall also gradually transfer the management and O&M of NIS, wholly or partially, to duly organized IAs. Likewise, NIA develops communal or small irrigation projects (CIP) or rehabilitates existing CIS with IA participation, then completely transfers to the IA the O&M of the completed CIP or rehabilitated CIS. NIA assists the IAs in establishing linkages with other agencies (both government and private) that provide support services and other assistance programs, including livelihood/small business ventures to increase farm productivity and family income. The above mandates give responsibility to the NIA to ensure that the IAs have the capacity to govern their systems. However, it does not have an explicit mandate to regulate the activities of the IAs.

The IMT program offers various schemes (models) to IA for partial or full responsibility in O&M, depending on the IA's capacity. The original target of NIA is to roll out its rationalization or organizational streamlining plan side-by-side with IMT implementation. The slow IMT implementation in 2010 was attributed to the seeming reluctance of some IAs to accept O&M responsibility unless irrigation facilities are rehabilitated or restored to operable conditions. Others argued that there are some unclear provisions in the IMT policy guidelines, notably: (1) vagueness of the concept "fair sharing of burdens and benefits," (2) computation of break-even point as basis for ISF collection sharing, (3) IAs' lack of start-up capital or seed fund to assume management, and (4) extent of IA share in the collection of back accounts (Ofrecio 2016).

### **6.5 Policy Recommendations**

To address the abovementioned policy challenges, the following policy recommendations are being proposed to improve agricultural water management in the Philippines toward better productivity and sustainability.

### ***6.5.1 Exploring Private-Public Sector Partnerships in Future Irrigation Development***

Given the perennial problem of government in funding O&M and rehabilitation and problems with the management and sustainability of irrigation systems, a study on public-private partnerships (PPPs) in irrigation was commissioned. Benabderazik and Inocencio (2013) explored the viable and effective business options for PPPs in developing and modernizing the irrigation sector in the country. Adopting the PPP scheme in irrigation will require specific answers to the following questions: (a) how PPP contractual arrangements can help to address the usual problems in public irrigation; (b) how PPPs can enhance financial viability; (c) how PPPs can avoid political interference in setting irrigation fees; and (d) how PPPs can increase the useful life of irrigation systems and break the vicious cycle of low collection of ISFs, poor maintenance, network degradation, and expensive rehabilitation. Any PPP proposal will have to make the case that the financial costs of privately funded projects are on par with those of publicly funded projects.

The efficiency gains from private sector participation stem from private experience and capacity to manage construction more efficiently and to provide more effective O&M. Its ability to structure contracts where finance and performance are entwined to promote efficient outcomes is generally superior to standard public procurement. Publicly funded projects are constrained by procurement, supervision, and decisionmaking processes. Budgeting and appropriation of allocations are complex political tasks that can reduce the ability of the public sector to react quickly and manage efficiently. In terms of O&M, the flexibility of the private sector in setting wages to attract skilled staff is generally an efficiency factor not permitted in the public sector.

Benabderazik and Inocencio (2013) proposed some options for the government to break out of that vicious cycle and provide potentially more efficient and sustainable irrigation service. The options cover financing of new and rehabilitation projects and making O&M sustainable. Specifically, in pursuing PPP projects for irrigation, the government should (a) begin with some experiments or pilots; (b) use PPPs; and (c) use the dam nexus, an expanded role of IAs, the rice policy, and social policy as entry points.

The use of experiments in irrigation sector schemes, whether technical or managerial, is proposed in order to provide more substance to the reform process. Several variations or mixes of activities can be pursued (Benabderazik and Inocencio 2013): (a) NIA in a service contract; (b) a PPP with innovative techniques for conveyance, distribution, and collection; (c) a pilot scheme to measure actual O&M costs; (d) a pilot PPP-IA project with volumetric pricing; (e) a pilot PPP in high-value crops; (f) a PPP with agricultural extension services; and (g) expansion of the role of IAs. The experiments or pilots will help develop realistic and workable guidelines, assess the likely success of proposed options, identify logistical and operational problems and

uncover potential ones, determine what resources (funds, materials, staff) will be required, and convince other stakeholders of the potential of PPPs for delivering better irrigation service.

Another option is to exclude the cost of dams from the irrigation investment cost. In this case, the cost of dams would be treated as pure public infrastructure. For instance, in multipurpose dams that will benefit not just farmers but also other water users, the dams and reservoirs can be fully subsidized, but the cost can be shared with the LGU and/or water districts. In the case of hydropower, NIA can collect the full value of the benefits from its users while remaining in the business of administering NIS.

If PPPs are to be pursued right away, the government can begin with a management contract. This track can help improve the technical abilities of IAs in the devolution process through a mandatory alliance between a private partner and the IA. The management contract will be between NIA and the private partner. In this case, the transfer of irrigation management from NIA to the IA will be more rapid than the current format, where NIA directly trains the IA. In order to realize such a transfer, NIA could finance the operation of the private partner for the first few years. The selection of the private partner can be done through open bidding. Once the period of full subsidy is over, a reduction in the contribution from NIA would allow a progressive transfer to the IA that is being assisted by the private partner.

### ***6.5.2 Increasing Cropping Intensity with Strategies to Reuse Water***

Pursuant to Republic Act 9275, the Philippine Clean Water Act of 2004, the DA through Administrative Order No. 26 (2007) shall allow reuse of wastewater for irrigation, fertilization and aquaculture, and other agricultural uses, on the condition that generators of wastewater shall secure a discharge permit from the DENR and submit a certification of safe wastewater reuse to the DA (2007). Wastewater generators shall include but not be limited to the different primary users of livestock, agriculture, and food industrial processes (e.g., food handling, processing and manufacturing plants, sugar mills, refineries and distilleries, including biofuel production, slaughterhouses, and poultry dressing plants), aquaculture, domestic and animal sewage, and other industrial and commercial establishments.

Requirements for the permit include the quantity of wastewater to be reused; wastewater characteristics, plan on the reuse of wastewater, and baseline conditions of the surface water, groundwater and soils in the area.

Wastewater shall be subjected to a treatment process, as may be required, to achieve the quality limits before use for irrigation, fertilization, and aquaculture as secondary uses. General requirements are based on standard analytical procedures of wastewater quality for irrigation, fertilizers, and aquaculture stated in established standards in the country and abroad (i.e., DAO 34 series of 1990: Revised Water

Usage and Classification; DAO 35 series of 1990: Revised Effluent Regulations; Standard methods of examination of water and wastewater from American Public Health Association [APHA], American Water Works Association [AWWA], Water Environment Federation [WEF, and the U.S. Environmental Protection Agency [US-EPA]].

Wastewater quantity shall be determined based on requirements specific to the land application and site-peculiar conditions. The method of wastewater application shall not, in anyway, result in negative impacts to the environment. However, the DA recognizes that there are many facilities that practice reuse of wastewater that are undocumented, unregulated, and probably unsafe. These pose risks to human and animal health, crop production, and the environment.

### **6.5.3 Sourcing O&M Funds**

For NIS, farmers do not pay ISF because water delivery is not sufficient or maybe the timing of delivery is off-schedule. The problem of high siltation and quality of canals could be a reason for this. The solutions to the O&M issue may start with the design and the quality of materials of canals and other structures. This implies that even during extreme events, the structure will be strong. This means that the IAs will make sure that during turnover, the appropriate design and materials of the IS are within or even beyond standard. This will minimize O&M in the subsequent years.

For dams that are defective, rehabilitation may be requested to minimize O&M activities. If farmers cannot afford the technical advice of NIA personnel, it can tap other institutions such as state colleges or universities in the area.

Among the CIS, O&M is the primary role of the IA. However, IAs still need technical advice when the structure is damaged. Other community-based participatory irrigation water governance should be promoted in the community; for instance, residents can minimize throwing solid wastes into canals. The community should also be vigilant on thieves of staff gates and other equipment. Some successful CIS IAs have sufficiently done their O&M because they have high collection efficiency. They also pay the water master, who, more often, is also a farmer. Silt removal can also be a community-based activity.

NIA needs to exert more effort toward increasing its ISF collection. This may be done by equitable, adequate, and timely delivery of irrigation water and improved delivery of irrigated agriculture support services for higher yield and cropping intensity. Delineating the NIS irrigation service areas down to realistic levels will go a long way toward increasing unit command area water supply and improving irrigated agriculture support services. Strengthening IAs by giving them better incentives to take charge of the repair and O&M of secondary and tertiary canals will also help reduce O&M costs and improve ISF collection.

The present policies governing ISF rates should be carefully reviewed. The present rates, which were approved in 1974 and implemented starting in 1975, now fall short of the cost of repair, O&M, and rehabilitation. These rates were partly based on the capacity of farmers to pay. During times of poor harvest (less than 2.0 t/ha), farmers are exempted from the payment of ISFs. The same farmer-beneficiaries are not, however, charged higher fees during period of good harvests.

When confronted with the low level of ISF collection, officials tend to support non-enforcement on social grounds: the farmers are deemed too poor to pay the ISF. In this case, it is better to adopt an explicit exemption for poor farmers than to accept a poor collection rate, with its detrimental effect on the quality of irrigation service. This policy could be applied at the IA level, with a general assembly approval of the farmers to be exempted and a partial increase in the ISF to recover the loss in revenue. The policy could be applied by NIA based on a poverty assessment to be done by a special committee composed of social departments, the DA, LGUs, and NIA. An alternative would be to use the *Pantawid Pamilyang Pilipino* Program of the government. With this transfer in place, all users would pay the ISF, while the poorest would receive benefits from the conditional cash transfer (CCT) program. If they do not pay their ISF, CCT benefits will be cut off.

#### **6.5.4 Capacity Building for Sustainable Water Management**

NIA's IMT program for NIS is a work in progress. The current IMT models (1 to 4) are an incomplete devolution because NIA effectively still plays significant roles from management to financing rehabilitation and repairs. Giving an expanded role to IAs beyond the current IMT framework can lead to systems that are more responsive to farmers' needs or are financially sustainable. Specifically, NIA can make the IAs accountable for the rehabilitation of existing systems. A progressive transfer of rehabilitation responsibilities can be facilitated through an agreed-upon schedule of reduction in the share of costs.

With the expansion of IA roles, NIA can focus on the higher level role of supervising the devolution, managing the headwork (reservoirs, dams, and main canals), implementing volumetric charges to IAs at the head gate, and providing technical support to IAs. The IAs will take care of transferred assets, collect water fees to cover their O&M costs, and manage water efficiently and equitably. The empowered IAs will become real service providers for their members and can even hire professional personnel. For this option to succeed, NIA has to provide financial support for asset rehabilitation, if not done before the transfer; and technical support for O&M. As a transition arrangement, the IAs may need to hire professional support staff.

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