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Bureaucratic incentives, path dependence, and foreign aid: An empirical institutional analysis of irrigation in the Philippines

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Abstract. At least 25 developing countries are embarking on irrigation governance reforms to address the persistent problem of poor irrigation performance. Some scholars suggest that the patterns of construction, deterioration, rehabilitation, and modernization commonly found among irrigation agencies in these countries are rational because of the time inconsistency problem of information. I argue instead, using panel data from the Philippines, that the problem of poor performance is linked to inherent incentive problems faced by public bureaucracies, how these incentives became entrenched in the path dependence of irrigation development, and how these were reinforced by incentives embedded in irrigation aid, particularly by the moral hazard problem and the fungibility of irrigation aid.

1. Introduction

1.1. The puzzle

Large-scale public irrigation systems in many developing countries are often characterized by chronic underinvestment in maintenance; rapid deterioration of infrastructure; persistently inefficient, unreliable, and inequitable water service; and reduction in service areas. As a result, irrigation projects often do not live up to their promise of increasing agricultural productivity, nor do they meet their expected economic and financial rates of return (Yudelman, 1985). Why is this the case?

Some scholars suggest that the pattern of construction, deterioration, rehabilitation, and modernization are economically and politically rational given the incentives faced by irrigation agencies and not the result of ineptness, nor a lack of knowledge (Levine, 1987). Underlying this rationality, according to Levine, are two sets of factors. The first set pertains to the combination of changes in the external environment within which these systems are embedded, the nature of the different sources of funding associated with maintenance in contrast to rehabilitation, and the fact that the benefits from maintenance (as differentiated from critical repair) occur relatively late in the life cycle of the system.

The second set, according to Levine, is that the need for rehabilitation and modernization arises not only because of the deterioration of the physical system but also because of changed values of land, water, and labor. It is this combination that drives the decision to rehabilitate/modernize, which usually occurs in a 20–30-year time frame. Because of the over-design characterizing most systems, Levine argues that the ability of farmers to adjust to decreasing system performance is not reflected in decreased incomes until the deterioration becomes serious. Coupled with the relatively

high discount rates held by many farmers in developing countries, this means that maintenance is difficult to justify economically.

Levine's arguments can be framed as a problem of time inconsistency of information – changes in the external environment; changes in the values of land, water, and labor over time – as well as the benefits from maintenance or costs of neglect occurring relatively late in the life cycle of the system. This time inconsistency of information, suggests Levine, is what makes the pattern of construction, deterioration, rehabilitation, and modernization economically and politically rational.

I argue that more than time inconsistency of information drives the present problems of public irrigation in the Philippines. These problems are rooted in the way irrigation development evolved in the Philippines. This development path is characterized by the government playing a central role in irrigation development, large irrigation bureaucracies biased towards construction, dependence upon foreign loans, and the promotion of farmer participation with patronage (Vermillion, 2002). The structure of farmer participation with patronage was entrenched by donors and national governments alike when they uncritically accepted the primacy of irrigation bureaucracies, strengthened their capacities, and augmented these structures by promoting farmer participation at tertiary canals.

1.2. Importance of study

This study is important for at least four reasons. First, it adds to Levine's argument by suggesting that the problems of persistently poor performance of irrigation in developing countries can be attributed to the path dependence of irrigation development. Second, irrigation agencies and foreign aid play a central role in this process. Yet, little is known empirically about the incentives faced by irrigation agencies, how these are shaped by foreign aid, and the consequences of these incentives. Much of the literature on irrigation bureaucracies is largely anecdotal and atheoretical, with some important exceptions, notably Korten and Siy (1989). This article provides evidence concerning (1) the problem of poor irrigation performance in the Philippines, (2) how these problems have been caused by perverse bureaucratic incentives, and (3) how these incentives in turn have been influenced by incentives embedded in irrigation aid, particularly the problems of moral hazard and aid fungibility. This empirically based approach reveals why the pattern of construction, deterioration, rehabilitation, and modernization is a rational and dominant strategy for irrigation bureaucracies and why funding rehabilitation projects is also rational for aid agencies.

Third, the expected policy payoff from uncovering the factors that impair irrigation performance is substantial. At least 25 developing countries are currently undertaking irrigation governance reforms (Vermillion, 1997). Irrigation is a vital input for poverty alleviation, economic growth, food security, and the environment in these countries. Fourth, a theoretically informed and empirically grounded analysis of institutions is important for building research-based knowledge (Saleth and Dinar, 2004). This knowledge, in turn, can help establish consensus on the diagnosis of problems and identification of solutions.

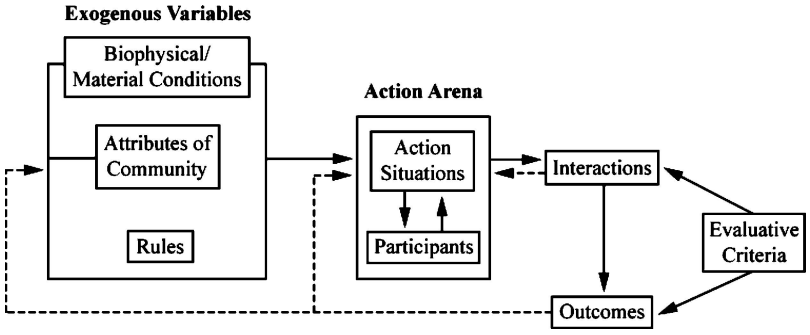

Fig. 1. A framework for institutional analysis. *Source:* Ostrom (2005:15).

1.3. Research framework

Institutional analysis requires an analyst to specify the arena that is of direct relevance to the problem being examined, the context that frames and affects that arena, and the behavioral interactions and outcomes that are likely. These elements are summarized in Figure 1.

There are several advantages to this framework. First, it has been used in a large number of empirical studies including the institutional analysis of irrigation and the relationship among aid, incentives, and sustainability (Lam, 1998; Tang, 1992; Gibson et al., 2005). Second, the framework has a multidisciplinary origin that includes economics, political science, and history, all of which are important sources of knowledge for this article. Third, the framework allows for multiple levels of analysis – from operational situations to collective choice (or policymaking situations) as well as constitutional – choice situations. Finally, the framework facilitates the analysis of strategic games or patterns of interaction among relevant players.

1.4. Case selection and justification

The National Irrigation Administration (NIA) in the Philippines was selected as a case study for the following reasons. First, NIA shares a similar history with most irrigation bureaucracies in developing countries (Vermillion, 2002). For instance, most went through similar periods of irrigation construction and incremental improvements including the promotion of farmer participation in irrigation management and the collection of irrigation fees. Like other irrigation development efforts in developing countries, NIA was mainly funded by foreign aid and politically supported by national governments during the decentralization era.

Second, and consequently, the issues that NIA faces appear to be generic to irrigation agencies in developing countries (Briscoe, 2000). These issues include the persistent problems of inefficient, unreliable, and inequitable water service; chronic underinvestment in maintenance; rapid deterioration of infrastructure; and reduction in service areas with adverse impacts on cropping intensities and productivity.

Most irrigation agencies in developing countries, like NIA, also face the challenge of transforming from a construction to a management-oriented agency.

Finally, NIA is a crucial and interesting case study. For instance, NIA has a "venerable tradition of irrigation reform" (Briscoe, 2000) and was often acknowledged internationally for its participatory irrigation management program in the 1970s and 1980s. Korten and Siy (1989) cited NIA as a model for transforming irrigation bureaucracies. Countries such as Thailand, Indonesia, India, Sri Lanka, and Nepal have benefited from the lessons learned from NIA's transformation. Likewise, the World Bank cited NIA as the finest irrigation agency in Asia and in any developing country in the world (NIA, 1990). Three decades later, Vermillion (2002) and Briscoe (2000) argue that NIA is hamstrung by a set of perverse incentives that has led to the problem of persistently poor performance. Ensuing sections clarify how this came to pass.

1.5. Data sources

Data from this study, mostly covering the period from 1990 to 2002, were obtained from various sources at NIA particularly a study on its management systems (NIA, 2001) and a study on irrigation associations (NIA, 2003). Data sets pertain to the financial, technical, and organizational aspects of NIA as well as profiles and performance of 2048 irrigation associations in 196 national irrigation systems in the Philippines. Data collection was undertaken in three phases, one each in 2002, 2003, and 2004. Quantitative data were related to and contextualized by findings from archival research, document analysis, key informant interviews, field observations, and participation in three farmer conferences in June–August 2004. Actual field observations were undertaken in 13 irrigation systems in several visits from 2002 to 2004.

These data inform arguments in the remaining parts of this article. The section on the overview of performance of irrigation in Philippines establishes the problem of persistently poor irrigation performance in the Philippines. The section on explaining poor performance explains the problem by putting the incentive structure of NIA into a historical context. It examines the various manifestations of perverse bureaucratic incentives prevalent at NIA and how these have been shaped by incentives in irrigation aid, such as the problem of moral hazard and aid fungibility. Alternative explanations that could have affected NIA's performance – such as the El Niño phenomenon and political populism – are also examined. In the end comes the section on summary and conclusion.

2. An overview of the performance of irrigation in the Philippines

Public irrigation systems in the Philippines can be characterized as a vicious cycle problem (Figure 2): Unabated deterioration of facilities, persistently inefficient water service, persistently low collection of irrigation fees, chronic underinvestment in maintenance, poor productivity, and consequently poor incomes of farmers.

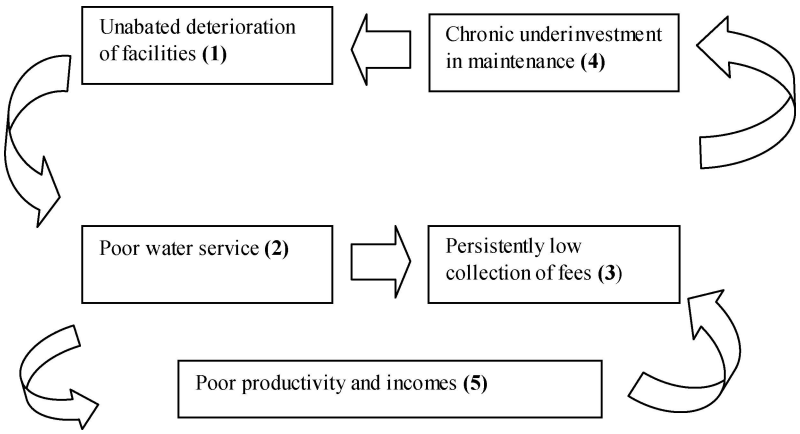

Fig. 2. The vicious cycle problem of public irrigation in the Philippines.

2.1. The empirical evidence

2.1.1. *Unabated deterioration of physical facilities*

There is clear evidence of unabated deterioration of irrigation facilities in national irrigation systems in the Philippines (Table 1). Overall, approximately 80% of the country's 196 national irrigation systems (NIS) are 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 are in need of rehabilitation such as desilting, reshaping, and heightening of embankments (NIA, 2003). The magnitude of the problem indicates chronic underinvestment in irrigation maintenance.

2.1.2. *Persistently poor water delivery*

Deterioration of physical facilities has led to a persistently suboptimal water delivery as indicated by the ratio of the actual irrigation area versus the total service area (Figure 3). On average, over the last 10 years, about 30% of the total irrigation service area was inadequately served with irrigation water, particularly at the tail ends or the

Table 1. Condition of physical facilities (as of 2002).

Type of facility	Total	Percent needing rehabilitation (%)
Headworks	145 units	34
Main canal	3,917 km	61
Control structures, main canal	11,423 units	53
Lateral canal	10,299 km	63
Control structures, lateral canal	39,949 units	56
Service/access roads	13,967 km	74

Source: NIA archival data.

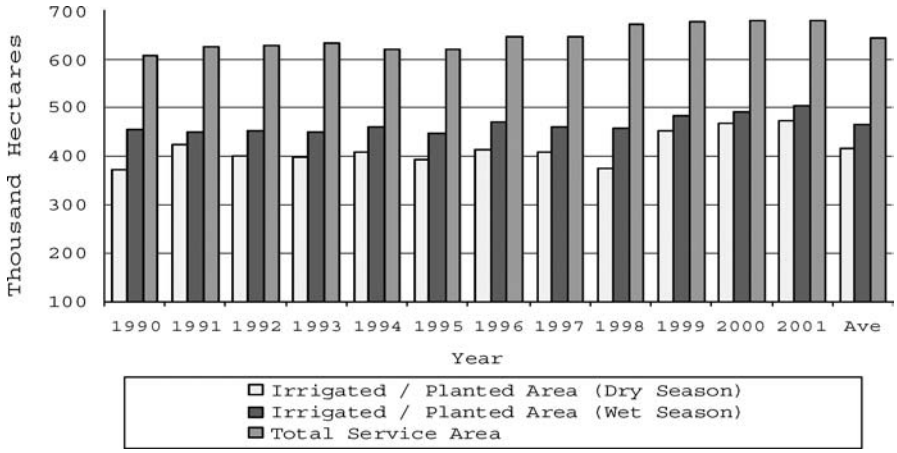

Fig. 3. Irrigation service area vs. actual irrigated area, thousand hectares, 1993–2001. *Source:* NIA archival data.

farthest point of the system. This is a significant amount, considering that arable land is a highly scarce resource in the Philippines.

2.1.3. *Persistently low collection of fees*

Persistently poor water service is a plausible cause of farmer dissatisfaction and reduced willingness to pay for irrigation fees. Fee collection over a 10-year period from 1991 to 2000 averaged only 44% with a maximum of 51% in 1991 and a minimum of 34% in 1998 (Figure 4).[1] Besides a weak incentive to pay for current accounts, farmers also refuse to pay back accounts which averaged 80% over 10 years (Figure 5).

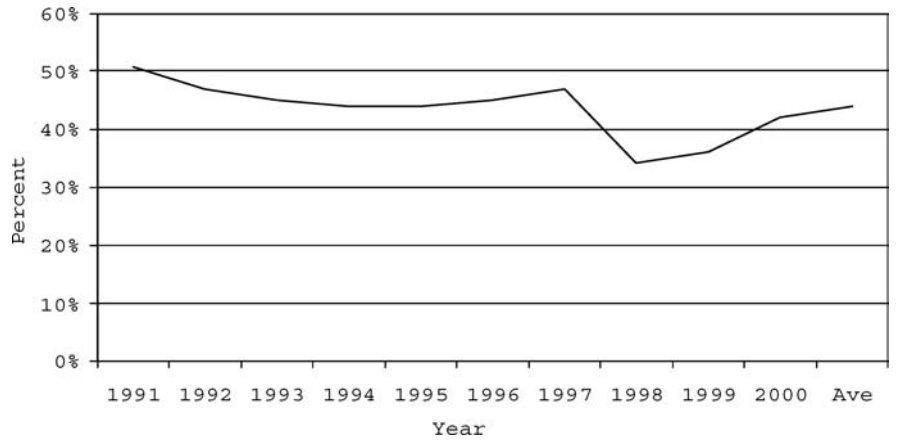

Fig. 4. Irrigation service fees collection efficiency, current account (1991–2000) *Source:* NIA archival data.

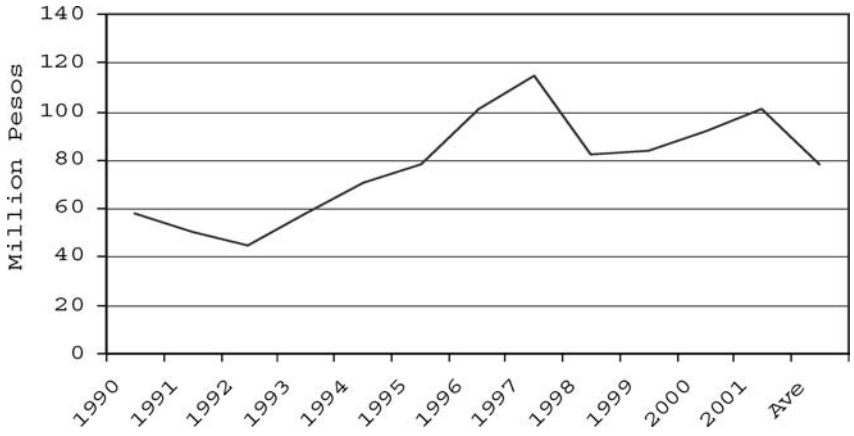

Fig. 5. Irrigation fees back accounts (1990–2001). *Source:* NIA archival data.

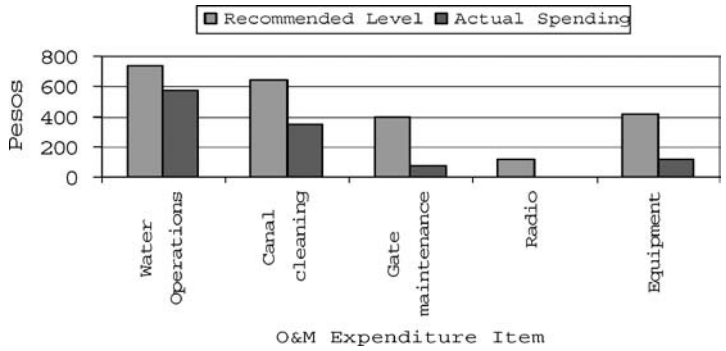

Fig. 6. Magnitude of O&M underinvestment, pesos in real prices (as of 2002). *Source:* Asian Development Bank (2002).

2.1.4. *Chronic underinvestment in maintenance*

One predictable consequence of poor collection of irrigation fees is chronic underinvestment in irrigation maintenance. The magnitude of underinvestment in maintenance is exhibited in Figure 6. The budget for water operations, canal cleaning, gate maintenance, communication, and equipment were all well below recommended levels. Furthermore, while maintenance costs increased by 87% from 1990 to 2001, the budget for operation and maintenance (O&M) declined steadily, dropping 27% from 1997 to 2002 (Figure 7).

Besides NIA's lack of incentive to adequately invest in maintenance, farmers are generally not motivated to repair and maintain the canals for which they are responsible. According to a survey in 2002, only 8–25% of the 2056 IAs nationwide fully implemented their repair and maintenance plans (NIA, 2003).

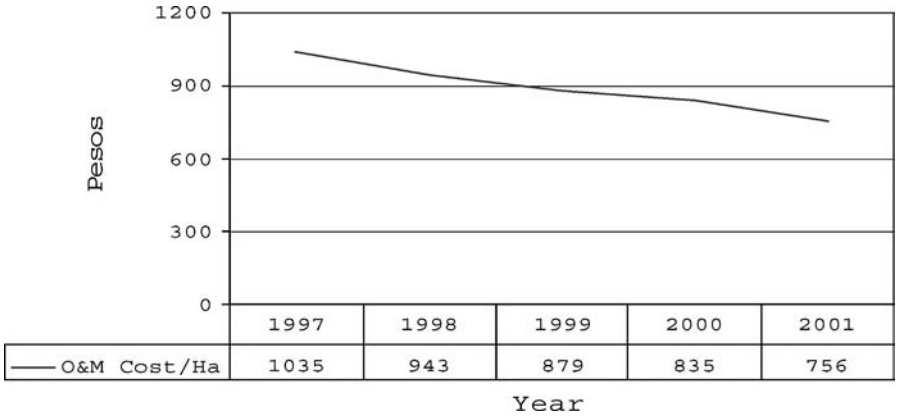

Fig. 7. Declining O&M budget per hectare, in pesos (1997–2001) (real prices). *Source:* NIA archival data.

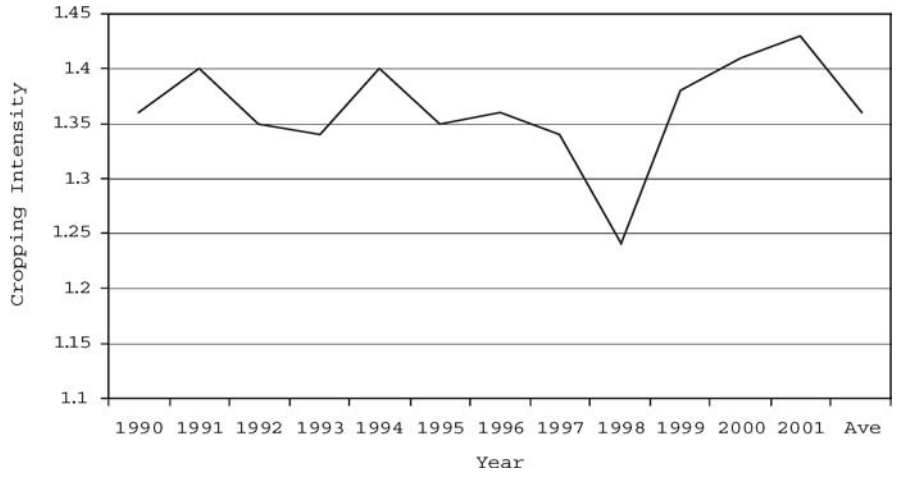

Fig. 8. Farm productivity, cropping intensity (1990–2001). *Source:* NIA archival data.

2.1.5. *Poor productivity*

Poor water service eventually impacts productivity and, by inference, farmers' income. Over a 10-year period, productivity nationwide – measured in terms of cropping intensity (CI)[2] – ranged from 1.24 to 1.43 with an average of 1.36 (Figure 8). This average has barely increased, compared to the 1.32 average in the early 1970s.[3] Cropping intensity dropped precipitously in 1998 due to the El Niño drought, which caused the temporary stoppage of irrigation operations of a major system.

Besides cropping intensity, another measure of farm productivity is output per unit area. Only 10% of all irrigation associations in the nation's 196 national irrigation systems produce more than 5 tonnes/ha, while 50% have productivity levels between 3.5 and 4.5 tonnes/ha. Rice productivity in the Philippines lags behind comparable countries such as Vietnam, South Korea, Myanmar, and Indonesia.

3. Explaining poor performance

3.1. Overview

In this section, I examine several factors that may help explain the poor performance of public irrigation in the Philippines. These explanatory factors include (1) the bureaucratic incentive structure of public agencies, (2) how bureaucratic incentives are shaped by the incentives embedded in foreign aid – particularly moral hazard and fungibility of aid, and (3) alternative explanations such as the effects of political populism and climatic factors.

3.2. The incentive structure of public bureaucracies

The public policy rationale for creating governmental irrigation bureaucracies includes the following: (1) the lumpy capital investment requirement for irrigation infrastructure and the ostensible comparative advantage that national governments have at mobilizing such capital, (2) private capital markets are more likely to undersupply irrigation infrastructure given the high risks and low-return characteristics of small-scale farming, (3) the existence of externality problems stemming from excessive water extraction and environmental impacts such as increased salinity, and (4) the perceived strategic importance of water in assuring an affordable food supply and in ensuring positive environmental impacts from water services (Subramanian et al., 1998).

Public bureaucracies, however, are faced with the following inherent problems (Weimer and Vining, 1999): (1) valuation of agency outputs and performance, (2) limited competition, and (3) ex-ante controls and the inflexibility of the civil service system. The problem of valuing performance makes it difficult to determine the optimal size of the public agency. This problem arises for two reasons. First, the marginal social value of the outputs and outcomes of a public agency – for instance food security, national security, law and order, health and safety – is not revealed through the public's willingness to pay for such goods and services. In a competitive firm, such value is revealed through the market price. Second, the problem of valuing public agency outputs arises because of the difficulty of measuring the tradeoffs from multiple and conflicting goals of efficiency and equity. Little consensus exists on how to measure such tradeoffs (Weimer and Vining, 1999).

Limited competition is another inherent problem faced by public bureaucracies. Unlike private firms which are forced out of the market for failure to produce output at minimum cost, public bureaucracies frequently survive even when they fail to do so. In addition, public agencies have weak incentives to innovate given limited competition and the fact that they are not generally driven out of existence for failure to innovate.

Ex-ante controls and the inflexibility of the civil service system is another inherent problem facing public agencies. Ex-ante controls in the form of civil service rules arise as a way for principals to monitor the behavior of their agent. These rules place restrictions on how agency heads hire, fire, reward, and punish employees. The same rules that make it difficult to fire employees for political reasons also makes it difficult to weed out the incompetent and unproductive (Johnson and Libecap, 1989).

In addition to these inherent problems faced by public agencies, public choice theorists suggest policymakers and bureaucrats are influenced by the same factors that drive the behavior of the private firm: self-interest (Tullock, 1965; Niskanen, 1973; Dunleavy, 1973; Downs, 1967; Parsons, 1995). This view suggests that bureaucrats are mostly eager to maximize their own interests rather than the public interest, implying that they seek bigger budgets and bureaus. The solution to the problem of big government, according to these theorists, is the introduction of market forces to combat bureaucratic self-interest.

3.3. The evolution of NIA's incentive structure

Since 1913, when the first publicly owned irrigation system was constructed and until the creation of NIA in 1964, irrigation development in the Philippines was a sporadic undertaking with short bursts of activities and long periods of inactivity (Bagadion, 1989). This situation was increasingly unacceptable by the early 1960s due to a looming crisis in rice sufficiency. Yields at that time averaged only 1.7 tonnes/ha, one of the lowest in the world but the population growth rate was 2.8 – among the highest in the world. With a persistent annual deficit of around 400,000 tonnes, the national government struggled to meet the population's basic food requirement. The solution was to increase production through the expansion of irrigated areas. NIA was created in 1964 as a semiautonomous, government-owned and controlled corporation by virtue of Republic Act 3601. The powers of NIA are summarized in Table 2.

NIA's initial strengths were in the areas of engineering and construction. It was in operation and maintenance, however, where NIA had the severest problems and its greatest strategic challenge (Bagadion, 1989). Only around 80% of the country's service area was irrigated during the wet season and around 30% during the dry season. Farmers often complained of unsatisfactory service and inequitable water distribution, and production was below expectations. NIA ran a chronic budget deficit as fee collection from farmers fell short of government outlays.

Although the law creating NIA implicitly provided for farmers' participation in irrigation and required them to pay for construction and O&M, the agency's organization and management were not initially set up to allow for farmer participation (Korten and Siy, 1989). Moreover, while NIA was successful in constructing new irrigation systems, it was not as successful in system operation and maintenance. A stronger role

Table 2. Powers of NIA under Republic Act 3601.

1.	To investigate, study, improve, construct, and administer all irrigation systems.
2.	To investigate all available and possible water resources in the country for purposes of irrigation.
3.	To plan, design, and construct the necessary projects to realize the objectives of irrigation development.
4.	To collect from users of irrigation systems constructed such fees as may be necessary to finance their continuous operation and reimburse within a certain period of not less than 25 years the cost of construction thereof.

Source. NIA archival data.

for irrigation associations (IAs) in irrigation development and management therefore became an important concern for NIA.

When martial law was declared in 1972, then-president Ferdinand Marcos embarked on the so-called New Society Project. Objectives of the project included achieving self-sufficiency in rice production and for the Philippines to become a net rice exporter. Irrigation expansion was central in meeting these objectives and NIA would be thrust in the forefront. Marcos became NIA's patron. In 1974 alone, Marcos successively issued the following presidential decrees that would radically change NIA.

1. Presidential Decree 1067 provided for the Water Code of the Philippines. The code strengthened the legal rights of IAs to water by making its use appurtenant to the grantee rather than to the land. This provision meant that IAs could become legal holders of water rights, affording them full powers to allocate and distribute water in the most equitable and productive ways possible. The code also strengthened the role of irrigation associations by indicating that a permit would not be granted to an individual when his or her water requirement could be supplied through IAs. Groundwater was nationalized, stripping property rights from land owners, and facilitating granting of water rights to IAs for groundwater use.
2. Presidential Decree 4242 created the National Water Resources Council, with the objectives of undertaking scientific and systematic development and management of water resources in the country.
3. Presidential Decree 552 radically amended NIA's charter (Table 3).

The amended charter provided for an implicit subsidy through the grant of annual appropriations for general administration, operation and maintenance of national irrigation systems, and studies of new irrigation projects. This allowed NIA to keep whatever it collected as irrigation fees as well as funds recovered from equipment rental and administrative charges collected from foreign projects. The understanding with budget authorities was for NIA to gradually phase out the subsidy for O&M over a 5-year period and henceforth depend on collections from farmers.

As a result of these changes, NIA personnel were motivated to increase their efforts at collecting irrigation fees as this meant more funds to allocate towards O&M. No matter how hard NIA worked to collect irrigation fees, however, and even if it managed to collect 100% of the fees, many small national systems remained insolvent

Table 3. Key amendments to NIA's charter.

1.	Increasing the capitalization of NIA from 300 million pesos to 2 billion pesos or an increase of 560 percent.
2.	Authorizing NIA to incur foreign loans.
3.	Empowering NIA to administer all communal irrigation systems constructed or repaired with public funds and to recover these costs from farmers.
4.	Authorizing NIA to delegate partial or full management of the national systems to irrigators' associations.

under NIA's management. One reason were economies of scale: to operate even a small system (less than 1000 ha), NIA needed a minimum number of personnel – an engineer, a cashier, a billing clerk, a bill collector, janitor, watchmen, ditch tenders, and causal laborers. Even when 100% of fees were collected, there were inadequate funds to cover staff salaries and benefits. The option of raising the fees higher than what was collected in other larger national irrigation systems was out of the question.

The "solution" was to organize IAs that were contracted to carry out NIA's erstwhile functions, but at a much lower cost. NIA could focus its attention on the headworks and main irrigation canals while the IAs would be responsible for the O&M of the rest of the system. This was, in fact, one of the key provisions in PD 552 authorizing NIA to delegate partial or full management of the national systems to IAs.

To develop its capacity to establish IAs, NIA embarked on a series of pilot projects – in collaboration with NGOs and universities – to organize farmers. The pilot programs on farmer participation were soon expanded nationwide, bankrolled by donors, to include the larger, government-owned irrigation systems (with service areas covering at least 1000 ha or more). The goal was to develop IAs capable of managing entire systems in the case of small national systems (below 1000 ha) or entire secondary canals in the case of the larger systems (3000 ha and above). This was a particularly important and pressing priority for NIA, as the national irrigation systems constituted a major part of its O&M problems. The Budget Ministry had also placed increasing pressures on NIA to cover its O&M costs from irrigation fees.

To underscore the importance of financial viability, NIA revamped its accounting system in mid-1983 by creating cost centers for each of its national systems. This was the third major reform at NIA that altered its incentive structure after the reforms introduced by Marcos and the launching of the participatory irrigation program. The new accounting procedure allowed irrigation staff members to know the exact status of collections versus expenditures for their system. With this change, NIA's top management began emphasizing financial viability in personnel evaluation. A unit was deemed viable when its income exceeded its expenditures for operation and maintenance. This inevitably reinforced the need for developing strong IAs that could bear a greater share of the O&M activities. These incentives helped promote the rapid spread of the participatory approach to other national irrigation systems.

By 1994, 70% of the total area of all the national irrigation systems were contracted out by NIA to IAs, up from 25% in 1985. As Bagadion (1995) reports, the total percentage of canal maintenance done by NIA dropped from 81% in 1985 to 47% in 1994, and the percentage of total area where irrigation fee collection was done by NIA dropped from 85% in 1985 to 53% in 1994. Interestingly, however, during the 10-year period from 1985 to 1994, the transfer of full management responsibilities to IAs was limited to only 8000 ha involving some 26 IAs. This constituted less than 2% of the total service area of the national systems.

In the 1990s, the agricultural policy environment in the Philippines was also undergoing structural reforms. In 1991, the Local Government Code passed, whereby local governments would assume greater fiscal authority and responsibility for local public goods including communal irrigation projects, with NIA playing the role as provider of technical assistance. In the same year, the Magna Carta for Small Farmers was passed, which reaffirmed the policy of promoting IAs and recognizing their role in

the operation and maintenance of public irrigation systems. In 1997, a landmark law – the Agriculture and Fisheries Modernization Act (RA 8435) or AFMA – was passed. Among its salient provisions with regards to irrigation are: (1) recognizing the role of IAs and (2) reiterating NIA's mandate to turnover the responsibilities for O&M in secondary canals and all farm facilities of all national systems to IAs. This provision effectively limits the transfer of irrigation systems to IAs up to the secondary canals as compared to the more broader scope under NIA's original (1963) and amended charter (1974). NIA has since used this provision to argue against the full transfer of irrigation ownership rights to farmers. Not surprisingly, by the end of 2002, some two decades since the pilot testing of participatory approaches in national systems, the full turnover of irrigation management responsibilities materialized in only about 15% of IAs and mostly involved smaller and less financially viable irrigation systems.

To summarize, the current incentive structure at NIA can be traced to the evolution of irrigation development in the Philippines. The first phase was driven mainly by government-sponsored capital intensive projects. This phase occurred during the "green revolution" and Marcos's martial law years of the mid-1970s to 1980s. It was during this period that three key reforms were introduced at NIA: (1) move towards financial autonomy (1973), (2) introduction of the participatory irrigation management program as a way to cut recurrent O&M costs and improve revenue collection (1979), and (3) adoption of cost centers for each of the national irrigation systems to promote financial viability (1983).

During this first phase, irrigated areas almost doubled from 742,447 to 1,436,880 ha representing an annual average growth rate of 7.2%, which is 3.5 times faster than the international annual growth rate of 2% for the same period (NIA, 1990). It was during this phase that NIA gained international recognition as the finest irrigation agency in Asia and in the developing world and as an international leader in participatory irrigation management (Korten and Siy, 1989).

NIA's participatory program was widely promoted worldwide (see Panella, 1999; Raby, 1997; Merrey, 1996; Oorthuizen and Kloezen, 1995; Wijayaratna, 1993; Wijayaratna and Vermillion, 1994; Bagadion, 1995; Bagadion and Korten, 1991; Svendsen, 1992; Korten and Siy, 1989). A number of countries – such as Indonesia, Sri Lanka, Thailand, Nepal, and India – studied and adapted NIA's reforms. Various scholars have documented the positive benefits as well as some lessons learned from the international experience with participatory irrigation management (Meinzen-Dick et al., 1997).

The second phase of irrigation development in the Philippines is one of incremental change from the mid-1980s to the present. The focus was on rehabilitation, training, new technologies, information and decision support systems, and other managerial and technical improvements. Not unlike other irrigation agencies in developing countries, the expansion and improvement phases of irrigation development in the Philippines created an entrenched institutional legacy characterized by oversized and underbudgeted bureaucracies, donor dependence, and the employment of excessive numbers of underpaid staff (Vermillion, 2002).

Vermillion further notes how pressures from donors and planning agencies have prompted a number of countries such as the Philippines, Sri Lanka, India, Indonesia, and Thailand to attempt to create irrigation associations that mainly oversee tertiary

canals. He contends that efforts to encourage farmer participation are often limited to special project sites or efforts die out after a few years as government retains its decision-making authority over public irrigation systems and farmers act as supplicants to the government.

3.4. Current incentives at NIA: Empirical evidence

This section examines the manifestations and the extent to which perverse bureaucratic incentives are prevalent at NIA. I contend that despite the introduction of major reforms in the 1970s and 1980s, the fundamental problem of underinvestment has not adequately been addressed because of these perverse incentives.

3.4.1. *Oversized and inefficient bureaucracy*

The construction and improvement phases of irrigation development in the Philippines fostered an oversized bureaucracy and the entrenchment of bureaucratic interests. At the height of the construction phase in 1978, NIA had a work force of 37,599 individuals. The number of tenured staff has since declined to around 14,000 by 1992 and to about 11,000 by 2002 (Figure 9). This reduction occurred through a very slow process of staff attrition and a hiring freeze imposed by the Department of Budget and Management (DBM) in 1990. However, a policy of rehiring retired staff and other long-term contractual staff – which constituted approximately 42% of NIA's total staff – rendered the attrition policy moot. One consequence of the hiring freeze was an aging staff: 74% of tenured staff are 45 years old or older and worked with NIA for an average of 20 years (Figure 10).

These factors increased the ratio of personnel cost to operating cost, representing a 10-year (1991–2000) average of 81% (Figure 11). Not surprisingly, NIA struggled financially, barely able to keep its operating income above its operating expenses (Figure 12). NIA's precarious condition was summed up, ironically, by its unofficial mission statement posted in its offices nationwide: "Service for Survival: Do Our Best for NIA's Best."[4]

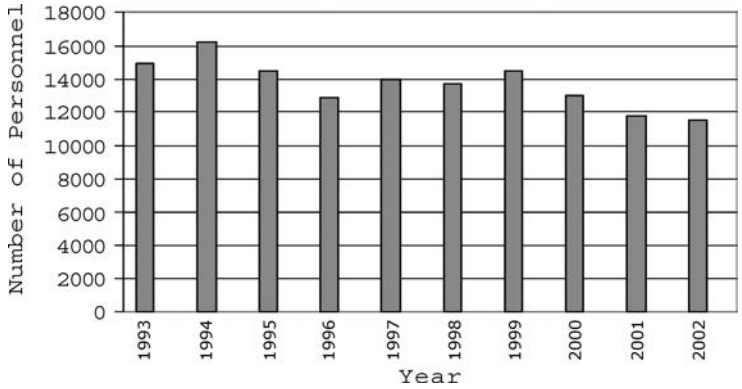

Fig. 9. Oversized bureaucracy: Tenured staff at NIA (1992–2002). *Source:* NIA archival data.

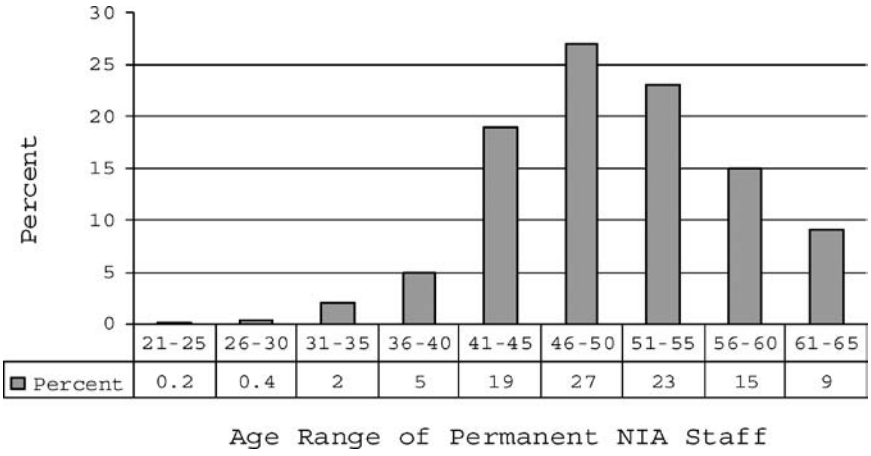

Fig. 10. Age structure of NIA's permanent staff (as of June 2000). *Source:* NIA archival data.

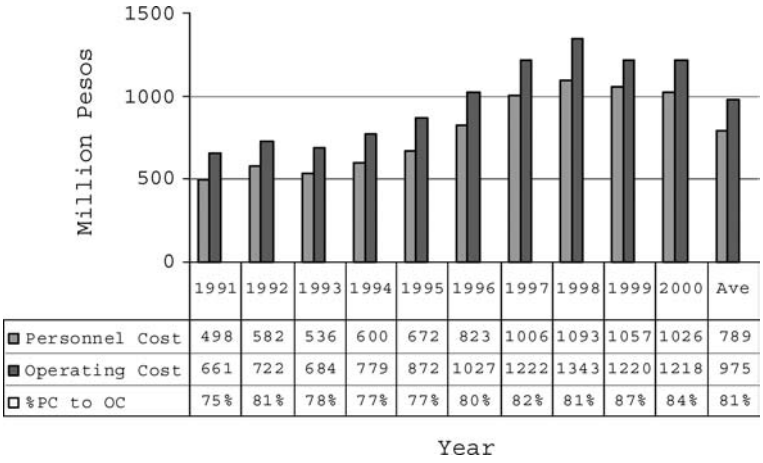

Fig. 11. Ratio of personnel cost to operating cost (1991–2000). *Source:* NIA archival data.

3.4.2. *Participation with patronage*

As discussed in the section on overview of performance of irrigation in Philippines, NIA in the 1980s was the acknowledged international leader in participatory irrigation management (Briscoe, 2000; Korten and Siy, 1989). Some of its notable accomplishments included the organization of 5,532 IAs with a membership base of 683,000 farmers. About 90% of IAs were formally registered and 71% were contracted out by NIA for various O&M activities (see Table 4).

In the late 1980s, however, the participatory program was substantially scaled back for several reasons. First, farmers were reluctant to accept responsibilities for irrigation management when systems were dilapidated. Systems fell into disrepair because of underinvestment in maintenance due to chronically low levels of irrigation

Table 4. The status of the participatory irrigation management program (2002).

Particulars	Number	Percent of total (%)
IAs organized		
Number of IAs organized	5,532	
Number of farmer-members	683,491	
Area covered (ha)	1,086,539	
Number of IAs registered	4,978	90
O&M contracting		
Number of IAs with O&M contracts	3,559	71
Number of farmer-members	372,617	58
Area covered (ha)	241,691	23
NIS-IA functionality (2002)		
Functional	366	21
Moderately functional	480	29
Poor/nonfunctional	807	50
NIS-IA membership rate (2002)		
<29% of potential members	99	4
30–59%	1,971	95
>60%	7	1
Total	2,077	100
NIS-IA net worth (Pesos, 2002)		
<59,000	1,899	93
60,000–100,000	65	3
>100,000	73	4
Total	2,037	100

Source. NIA-Institutional Development Department.

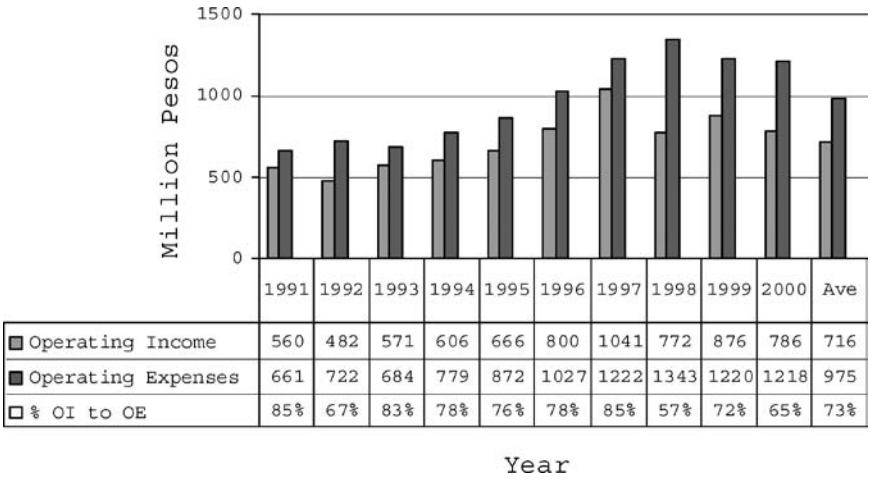

Fig. 12. NIA's overall financial status (1991–2000). *Source:* NIA archival data.

fee collection. Without foreign funding, NIA could not rehabilitate on a large scale, so the participatory program were limited to pilot projects. A second and important reason was the lack of funds – again owing to the financial condition of NIA – to compensate its personnel who would be displaced when IAs took over the central bureaucracy's responsibilities. NIA was willing to accelerate the transfer of some O&M responsibilities to farmers or completely turnover irrigation systems to IAs, but the lack of funds hampered these efforts (Mejia, 1999).

While inadequate funding was always a problem, the way tight budgets were allocated reveal priorities of NIA that effectively neglected the IAs. For instance, the funding bias against the strengthening of IAs was apparent: the number of farmer participants in IA training activities decreased by 58% in 1999–2000 and the number of IAs receiving support from NIA dropped by 49% during the same period. These trends partly explain why the internationally renowned participatory program lost its luster.

Twenty years since the program's inauguration, the transfer of irrigation management to farmers in large-scale irrigation systems occurred in only 28% of all IAs nationwide and covered only 13% of the 622,000 ha aggregate irrigation service area. The remaining 72% of all IAs had few rights and little or no authority to manage the systems. This outcome is not entirely surprising given NIA's primary motivation for involving IAs, as summarized in its 1990 Annual Report:

> *The organization of IAs is a major thrust of the agency in support of its program to attain financial stability and to improve the operation and maintenance of national systems. By involving IAs in O&M, the agency realized substantial savings in operating costs, increased irrigation fee collection, reduced conflict over water distribution. (NIA, 1990:104)*

In short, the IAs were a cost saving measure for NIA more so than institutions for devolving authority and ownership. This patron–client relationship had several consequences. First, because the IA was primarily organized by NIA to serve as its agent for O&M, its financial base was dependent on labor contracts from NIA. Thus, about 95% of all IAs in national systems had an average net worth of less than 56,000 pesos ($1000), an amount that barely pays for routine maintenance and rehabilitation work. Not surprisingly, only 8–25% of IAs implemented their O&M plans.

Second, this patron–client relation stunted farmers' abilities to govern their irrigation systems. For instance, half of all IAs (from a total of 2056) were poorly functioning while only 21% are considered functional.[5] Not surprisingly, farmers were reluctant to join IAs, as benefits to members were unclear. In 70% of all IAs, only half of the farmers in a given irrigation area formally joined the IA and, of those who do, only around 25% actually participate in the association. All told, only about 12% of all farmers in a system were actually actively involved either as officers who receive honoraria or those who were paid as labor contractors and fee collectors (NIA, 2003).

3.4.3. *Tendency to build-neglect-rebuild*

The persistently low rates of irrigation fee collection, a precarious financial condition due to a large bureaucracy, chronic underinvestment in maintenance, a strong

Table 5. Major rehabilitation projects at NIA (since 1991).

Project	Period	Scope of rehabilitation (ha)
1. Casecnan Irrigation Component	1997–2004	61,884
2. Bago RIS Rehab Project	2003–2008	12,777
3. Aganan River Irrigation Project	1993–1995	4,550
4. Angat Afterbay Project	2002–2003	29,374
5. Jalaur Irrigation Project	1997–1998	21,760
6. Second Palawan Integrated Area Development Project	1991–1998	7,396
7. Southern Philippines Irrigation Sector Project	2000–2006	12,630
8. Grain Sector Development – Irrigation Component	2001–2006	16,456
9. Cordillera Highland Agriculture Project – Irrigation Component	1996–2003	1,325
10. Second Irrigation Operation Support Project (IOSP II)	1993–2000	95,944
11. Water Resources Development Project (WRDP)	1997–2002	66,332
12. Participatory Irrigation Development Project I and II	2005–2010 proposed for funding	644,000

Source. NIA archival data.

orientation towards agency survival, and NIA's expectation of future subsidies due to the moral hazard and fungibility of irrigation aid, are reasons that plausibly explain the tendency of NIA to defer irrigation maintenance. Deferred maintenance, on the other hand, is what explains the high percentage of irrigation facilities needing rehabilitation. The picture becomes more coherent when one considers that rehabilitation and modernization of irrigation facilities require major capital inputs and thus qualify for irrigation aid (Vermillion, 2002).

Under these circumstances, NIA's dominant strategy was to pursue rehabilitation and modernization projects because this assured badly needed subsidies to keep the agency afloat. Since 1991, approximately 38% of national irrigation systems have undergone, or are undergoing, major rehabilitation (Table 5).

More rehabilitation projects are underway that eventually target all of the 644,000 ha of NIA's irrigation systems nationwide by 2010. It appears that NIA is a prime example of what Vermillion (2002) described as the tendency of irrigation agencies in developing countries to "build-neglect-rebuild." Among jaded NIA staff, these rehabilitation projects are derisively referred to as "re-have" projects because of the substantial financial opportunities they generate for rent seeking.

3.5. The role of irrigation aid

Gibson et al. (2005) and Collier (1997, 1999) summarize the difficulties of using aid as an incentive for policy reform. They conceive policy reform as the price that a borrowing government must pay in exchange for concessional loans from international development banks. Tying aid to policy reforms, however, can lead to several problems.

First, donors seek to portray aid that is contingent on policy reform as a cost of adjustment. However, if donors buy reforms with program aid, they in effect become the owners of the program. Second, there is little incentive for recipient countries to take on the responsibilities of ownership. Recipients protest loudly the conditions being imposed by donors, and hardships caused by reforms are blamed on the donor. When it is politically expedient to identify the donor as the owner of reforms, recipient country leaders are unmotivated to develop the domestic consensus needed for reform, to restructure, and to cut costs.

Third, when bargaining with donors, the recipient government's rational strategy is to appear reluctant to reform so as to wring more concessions out of the donor. Donor-negotiating teams, meanwhile, strive to maximize reform for a given amount of aid. Thus, even if the recipient government is agreeable to the reform, the incentive is to impede rather than to assist the reform process so as to ensure steady inflows of aid.

Furthermore, Collier (1999) notes that a donor's offer of aid for policy reform does not necessarily induce a supply response from recipients. First, aid alleviates the immediate fiscal or funding crisis of the recipient government. In poor policy environments, therefore, aid can delay reform and crowd out domestic investment. Second, there is no incentive to keep a promise to reform unless the recipient government itself desires reform. Often, there is no cost to defaulting on the promises of policy reform due to moral hazard. Briefly, enforcement of the terms of aid contracts is often relaxed if the recipient shows some sign of making good on promised reforms. These indications are often withdrawn by the recipient after aid has been disbursed. Finally, donors are in the business of disbursing aid and, therefore, aid officers signal their performance in terms of signed projects and disbursed funds. These conditions give rise to the "promise now but delay delivery (of promised reforms) until later" strategy adopted by leaders of some aid-recipient countries (The Economist, 2000).

3.6. Irrigation aid in the Philippines: Empirical evidence

NIA has been highly dependent on donors, and practically all of its capital investment projects have been financed by foreign funding. This is understandable given that the terms of donor financing are considerably better than what could be obtained in weak, domestic capital markets. Since 1969, NIA has contracted foreign loans of approximately $2.2 billion for capital expenditure, O&M support, and institutional development projects (Figure 13). The major donors are the World Bank, Asian Development Bank, and the Japan Bank for International Cooperation (JBIC).

From 1984 to 1990, irrigation funding conspicuously dropped, precipitated by a World Bank recommendation that NIA scale down its investment program for future irrigation projects because of projected huge rice surpluses and declining commodity prices (NIA, 1990). This signaled the end of the construction phase of irrigation in the Philippines and the beginning of the irrigation rehabilitation and improvement phase.

In general, irrigation aid in the Philippines can be characterized as follows: First, donors tend to focus mainly on "brick and mortar" projects. Second, the preference for these types of projects is a function of a "business-as-usual portfolio game" played

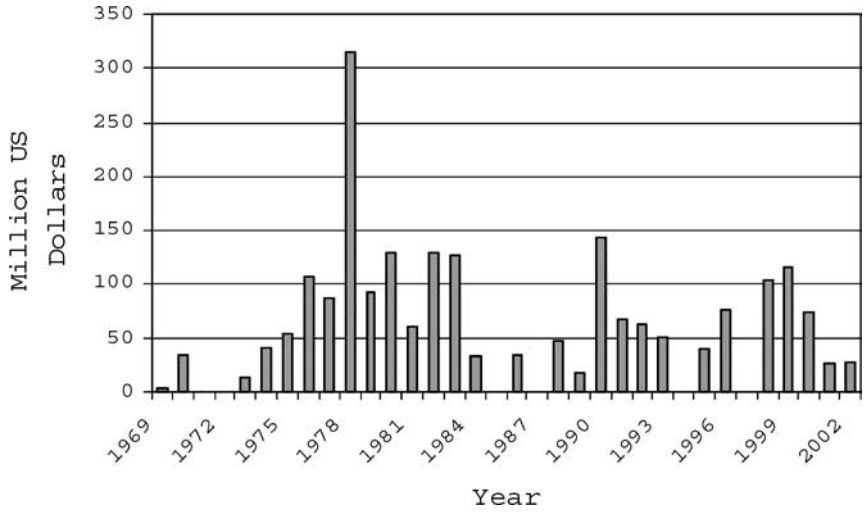

Fig. 13. Irrigation aid and modern history of irrigation in the Philippines. *Source:* NIA archival data.

by donor staff. Third, the portfolio game is affected by the moral hazard problem. Fourth, the fungible nature of irrigation aid has enabled NIA to avoid reforms.

3.6.1. *"Brick and mortar" projects*

A document analysis (Table 6) of all major NIA projects since 1990 indicate that donor funding over the years, regardless of source, focused on "brick and mortar" projects that emphasized construction and rehabilitation, O&M, and strengthening of existing business-as-usual governance arrangements.

These types of projects constituted about 39% of NIA's total foreign-funded projects since 1969 and 100% for the 1990–2002 period. As noted by Briscoe (2000), these types of projects take the incentive structure and modus operandi of NIA as given and do not adequately examine alternative governance modes of providing irrigation.

3.6.2. *The business-as-usual loan portfolio game*

Why the preference for brick and mortar construction-type projects? One consideration is that the alternatives are deemed risky and more prone to failure. During project design, project officers must consider project risks and how these might affect the quality and size of their project loan portfolio. Brick and mortar projects tend to involve straightforward engineering designs with familiar contracting and construction supervision mechanisms. These types of loans tend to disburse quickly and are relatively easily monitored. Often, aid project officers are trained as engineers and therefore are comfortable with these projects.

In contrast, projects with attached policy reform conditionalities are susceptible to greater risks and uncertainties. Reform issues go beyond the control of NIA and might involve other powerful government agencies or political actors. As the number of players and interests grow and key issues spill into the political arena, the proba-

Table 6. Document analysis of major NIA projects (1990–2002).

Name of project	Main components
1. Irrigation Operation Support	Provision of subsidies to national systems
2. IOSP II	Rehabilitation of 17 NIS (95,000 ha)/O&M improvement/institutional development for NIA/IA/agricultural support
3. Water Resources Development Project	Improvement of water resources planning and management/watershed management/rehabilitation of 18 NIS (66,000 ha)/capacity building for NIA and IAs/environmental improvement
4. Irrigation Sector Improvement Project II	Rehabilitation of 9 NIS (12,600 ha)/institutional development/agricultural support/environmental/social improvement/monitoring
5. Casecnan Project Irrigation Component	Development of new facilities for 30,000 ha/rehabilitation of facilities for 105,000 ha/O&M improvement/institutional development
6. Southern Philippines Irrigation Sector Project	Institutional development for NIA and LGU/management transfer/construction/rehabilitation of 10 communal systems, 10 national systems, and 8 small reservoir/access roads
7. Malitubog-Maridagao	New construction of facilities for 10,800 ha
8. Bago RIS Project	Rehabilitation of facilities covering 12,777 ha
9. Grain Sector Project	Rehabilitation of facilities covering 16,500 ha

Source: NIA archival data.

bility of successful reforms within the limited project life cycle – typically 5 years – diminishes.

Unattractive risk/benefit ratios will tend to discourage most project officers from pursuing novel approaches.[6] In addition, when the national government cannot credibly commit to pursue needed reforms, risks grow greater still. When reform efforts fail, project disbursements are stalled. This impacts the loan portfolio and careers of bank officers as disbursements are a conventional indicator of staff performance. This, in brief, is the "brick and mortar portfolio game" that donors face.

3.6.3. *Moral hazard problem and the fungibility of irrigation aid*

Is there evidence of a moral hazard problem in irrigation loans to the Philippines? In the case of NIA, all irrigation loans contain provisions requiring NIA to ensure adequate funds for O&M after project completion. NIA routinely makes this promise, yet chronic underinvestment in maintenance is a reality. Why is this the case?

One plausible reason is the moral hazard problem embedded in irrigation aid. Moral hazard generally refers to post-contractual opportunism (Gibson et al., 2005) and in the case of NIA works as follows: donors need NIA as a client as much as NIA needs donors. Regardless of NIA's compliance record, it can expect donors to finance rehabilitation because it is in the donors' interest to continue disbursing loans. Absent enforcement and the negligible costs of noncompliance, NIA's dominant incentive is to shirk its responsibilities towards O&M.

The evidence in support of the moral hazard argument becomes clear when one considers the highly fungible character of irrigation aid to NIA. Fungibility occurs when a borrower uses aid to replace internal budgets that should have otherwise been programmed for that purpose (Auer, 2005). Instead of relying on its own internally

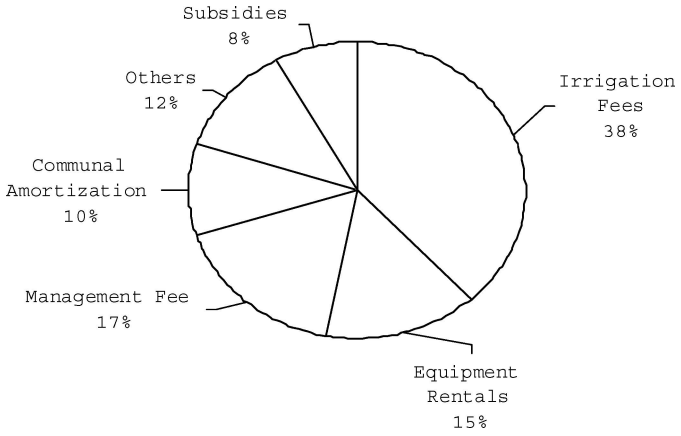

Fig. 14. NIA's total income from 1993 to 2002, in percentage, by source. *Source:* NIA archival data.

generated funds from the collection of irrigation fees, NIA has been dependent on various subsidies coming from irrigation aid. Between 1993 and 2002, 40% of NIA's internal budget depended on these fungible irrigation loans (Figure 14).

The agency's incentives come into sharper focus by examining each of its income sources. Seventeen percent of NIA's total income over a 10-year period (1993–2002) was constituted by management fees that mainly supported its central office. Irrigation aid provided equipment assets to NIA which, in turn, generated equipment rental fees that financed NIA's regional offices. From 1993 to 2002, such fees accounted for 15% of its total income. Rehabilitation projects brought in additional income from irrigation service fees to support the operations of NIA's Irrigation System Offices (NISOs). Between 1993 and 2002, irrigation fees generated 38% of NIA's total income. Until 2001, foreign funding greatly subsidized the O&M of national irrigation systems, accounting for approximately 8% of NIA's total income. Again, these subsidies were mainly absorbed by NIA.

Altogether, NIA's budget was supported by explicit and implicit subsidies via foreign aid, amounting to roughly 40% of its total budget. These subsidies partly explain why NIA was reluctant to undertake fundamental governance reforms since it had strong incentives to maintain the current subsidy scheme that kept it running.

3.7. Alternative explanations

Are there plausible counterfactual arguments to the perverse bureaucratic and aid incentives argument, apart from the information asymmetry hypothesis of Levine? In this section, I examine two factors: the effects of the El Niño phenomenon on irrigation performance and political populism.

3.7.1. *The El Niño phenomenon*

The El Niño weather phenomenon no doubt had adverse effects on the overall performance of irrigation in the Philippines – particularly on the supply of irrigation

water. In 1998, El Niño struck the Philippines. In that year, a number of large irrigation systems were unable to operate since irrigation water was diverted to augment domestic water supply.[7] Consequently, NIA was unable to collect irrigation fees for *that year*, which no doubt affected its financial status. Its operating income dropped by 28% to 750 million pesos compared to the prior year.

However, the El Niño effect is not a convincing explanation for NIA's financial condition. Even in the years prior to El Niño, NIA's finances were already precarious. For instance, 7 years prior to the El Niño effect in 1998, NIA's operating expenses were, on average, 21% higher than its operating income. A good part of this went to support an oversized and aging bureaucracy which, in the years prior to El Niño, already accounted for 82% of total costs. Even without El Niño, NIA managed to collect, on a 10-year average, only 44% of irrigation fees from farmers. Hence, the El Niño phenomenon does not convincingly explain NIA's poor finances.

3.7.2. *Political populism*

Another possible explanation for NIA's poor financial status is the effect of political populism. In mid-1998, Joseph Estrada, a populist president, was elected to office. In early 2000, Estrada ordered the abolition of irrigation fees as part of a pro-poor campaign promise. The order was not fully implemented because it meant a financial hemorrhage to NIA and confusion among field personnel and farmers. Whatever losses in operating income that NIA incurred, however, was compensated by direct subsidies by the national government. In early 2001, Estrada was ousted from office by a People-power revolt and, in that same year, the collection of irrigation fees resumed.

Overall, like the El Niño phenomenon, the effect of political populism was temporary and weak, and cannot adequately explain the already poor financial status of NIA prior to the abolition of the fees in early 2000.

4. Summary and conclusions

This article seeks to explain the problem of persistently poor irrigation performance in developing countries using the case of NIA in the Philippines. The study finds evidence that irrigation in the Philippines is characterized by a pernicious cycle of unabated deterioration of physical facilities, persistently poor water delivery, poor productivity, low levels of irrigation revenue collection, and chronic underinvestment in maintenance.

Levine (1987) suggests that the patterns of construction, deterioration, rehabilitation, and modernization commonly found among irrigation agencies in developing countries are rational from the standpoint of the problem of time inconsistency of information.

I argue that time inconsistency of information is only part of the problem. In particular, I reveal how these problems are linked to inherent incentive problems faced by public bureaucracies such as NIA. In the Philippine case, the incentive problems were manifested in an oversized and inefficient bureaucracy, the promotion of farmer participation with patronage, and a tendency to build-neglect-build irrigation systems.

While this characterization of NIA is not new and in fact is common among irrigation bureaucracies in developing countries, I have argued that these incentives

were entrenched by the path dependence of irrigation development in the Philippines and reinforced by incentives embedded in irrigation aid, particularly by the moral hazard problem and the fungibility of irrigation aid.

Path dependence implies that the direction and scope of institutional change cannot be easily or costless divorced from its early direction (North, 1990). Once irrigation agencies and their donors have gone down one path of development, the probability of reversing along that path becomes increasingly unlikely because of the entrenchment of perverse bureaucratic interests.

The expansion phase of irrigation in the Philippines in the 1970s and early 1980s was characterized by government playing the central role in irrigation development, a large irrigation bureaucracy biased towards irrigation construction and dependent upon foreign loans, as well as the promotion of farmer participation with patronage. I argued – following Vermillion's (2002) conjecture – that farmer participation with patronage became entrenched by donors and national government's alike with their acceptance of a major role for NIA. This entrenchment was reinforced by efforts to build and strengthen the capacity of NIA and augmented by gradually promoting farmer participation at low levels of the irrigation systems. Some scholars argue that this "gradualism" approach to irrigation reform partly explains NIA's current condition (Groenfeldt, 2004).

In addition, I argued that incentives that may be embedded in irrigation aid – such as moral hazard and aid fungibility – have contributed to these perverse bureaucratic incentives. Moral hazard problems involving irrigation aid have encouraged brick and mortar type construction and rehabilitation projects which, given their fungible nature, have reinforced the inherent incentive problems already faced by NIA as a public agency. I argued that the combination of these incentives have not encouraged NIA to pursue fundamental governance reforms that, in turn, drive the pernicious cycle problem of irrigation in the Philippines.

Conclusions from this study, however, are provisional. Directions for further research should focus on counterfactual analysis by (1) expanding the study to other comparable irrigation bureaucracies and examining the goals, objectives and operating modalities of different donors more closely; (2) explaining alternative or complementary determinants of public sector incentives; and (3) considering the implications, including costs and benefits, of institutional reform of irrigation agencies in developing countries.

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Notes

1. The lowest rate in 1998 can be attributed to a campaign promise by then President Estrada to abolish the collection of irrigation fees. Payment of fees was restored in 2001 when Estrada was ousted from power.
2. Cropping intensity (CI) refers to the proportion of the total service area that is actually irrigated and planted in both the dry and wet seasons. CI: irrigated and planted area (wet) + irrigated and planted area (dry)/total service area.
3. Interview with Engr. Renato Gamboa, NIA-IDD (July 2004).
4. In fairness to NIA, this slogan was originally intended to motivate its employees. The slogan might have the inadvertent effect, however, of strengthening agency self-interest.
5. To measure functionality, an IA is scored on an index consisting of the following indicators: (1) preparation/implementation of an O&M plan such as a cropping calendar, water distribution plan, maintenance and repair of facilities, and collection of irrigation fees; and (2) organizational discipline of the IA in terms of membership rates, attendance in meetings, maintenance of records, holding of elections, conduct of financial audits, imposition of sanctions, and ability to resolve conflicts.
6. The World Bank has a lending instrument – the Learning and Innovation Loan (LIL) – that recognizes the risky nature of novel approaches to lending, but this has not been deployed in the irrigation sector in the Philippines.
7. The effect is particularly pronounced in the Angat-Maasim River Irrigation System covering an area of 30,000 ha or about 5% of the total service area operated by NIA.

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