DECENTRALIZATION PUZZLES:
A POLITICAL ECONOMY ANALYSIS OF
IRRIGATION REFORM IN THE PHILIPPINES

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In the 1970's, the Philippines embarked on a program to decentralize the management of public irrigation. Early studies have shown that these reforms led to consistently positive results and earned widespread international documentation and recognition as a role model. Twenty years later, however, an examination of the program now indicates problems of poor performance.

How could poor performance occur in a system known worldwide for its major decentralization efforts? How are the incentives faced by key irrigation players linked to performance? What factors may have influenced these incentives? These questions build on the literature of decentralization, collective action, bureaucracies, foreign aid, common pool resources and irrigation institutions in developing countries.

To explain this puzzle, I hypothesize that, first, irrigation performance is linked to inherent incentive problems faced by public agencies. Second, these incentive problems can be aggravated by the incentives embedded in foreign aid particularly by the moral hazard problem. Third, I argue that performance is also a function of the incentives faced by farmers as shaped by their physical, social and institutional context.

I examine the hypothesis on bureaucratic and foreign aid incentives using panel data describing the performance of the irrigation agency. To test my hypotheses about farmer's incentives, I examined a cross section data on 2,056 irrigation associations. I

examined archives, conducted field work from 2003-2005 and employed key informant interviews, focus group discussions, photo-documentation, participant-observation and focused on conceptual and measurement reliability issues.

My findings confirm my hypotheses. I find that irrigation performance in the Philippines is characterized by a cycle of chronic underinvestment in maintenance, deterioration of facilities, poor water service, low productivity and poor farm incomes. Bureaucratic self interest drives the problem of underinvestment in maintenance and can be aggravated by incentives embedded in foreign aid. Underinvestment is also driven by farmer's incentives to free ride which differs between labor and monetary contribution. Finally, I find how different configurations of physical, social and institutional factors have different effects on farmer incentives.

The study has implications for 25 developing countries undertaking irrigation reforms and faced with the same issues of poor performance and incentive problems.

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To the Filipino farmer

Photo Credit: Engr.R. Gamboa

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CHAPTER ONE

INTRODUCTION

1.0 The Puzzle

Decentralization has emerged as a frequently recommended, all purpose solution to a large number of problems in many developing and former socialist countries. From the 1980s to the mid 1990s, national governments in 63 out of 75 developing and transitional countries have embarked on some form of decentralization (Agrawal and Ribot 1999).

A major motivation for recent efforts at decentralization has been political – i.e. as part of the democratization process as discredited autocratic central regimes in Latin America, Africa, Southeast Asia, and former socialist countries are replaced by elected governments under new constitutions (http://www1.worldbank.org/publicsector/decentralization). In China, decentralization appears to be motivated by administrative reasons – i.e. the need to improve service delivery to large populations and the recognition of the limitations of central administration. Decentralization is also increasingly being recommended as a panacea in development practice (see Ostrom 2001 for a critique). For instance, the number and scope of World Bank projects that are "community driven or community based" have increased by six fold from 2000 to 2003 (World Bank 2005).

In this dissertation, I examine a puzzle of decentralization in one country and in one sector: the operation and maintenance (O&M) of large scale public irrigation systems in the Philippines. Since the 1970s, at least 25 developing countries have embarked on

policy reforms to decentralize the O&M of large scale public irrigation systems (Vermillion 1997). The Philippines is one of the countries that pioneered in these efforts and its experience raises an interesting puzzle.

In the mid 1970s, the National Irrigation Administration (NIA) of the Philippines launched a pioneering program to gradually decentralize the construction and O&M of small and large scale public irrigation systems. Numerous independent studies have earlier shown that NIA's model – known as the Participatory Irrigation Management Program (PIM) – has led to consistently positive results in irrigation as evaluated in the 1980s and early 1990s. Canals and structures built with farmer participation were more functional and the systems more productive with greater increases in rice yields and irrigated area in the dry season compared with those systems built without farmer participation. Participatory approaches also led to a more equitable water distribution and better financial management (de los Reyes and Jopillo1989; NIA Consult 1993; Bagadion 1994a; Bagadion 1995; Meinzen-Dick et al. 1995).

The early success of the model soon gained widespread international recognition and documentation. The World Bank cited NIA as "the finest irrigation agency in Asia and any developing country in the world" (NIA 1990:57). The NIA model also attracted widespread documentation from experts and scholars, arguably one of the widest of its kind in the irrigation literature to date (see Sabio and Mendoza 2002; Briscoe 2000; Vermillion 2002; Mejia 1999; Panella 2002, 1999; Fujita et al. 1999; Raby 1997; Merrey 1996, 1994; Oorthuizen and Kloezen 1995; Wijayaratna and Vermillion 1994; Bagadion 1994a, 1995; Meinzen-Dick, Reidinger and Manzardo 1995; Korten and Siy 1989; NIA

Consult 1994a and 1994b). This keen and widespread interest about the decentralization program at NIA is summarized by the World Bank (1995) in Box 1.1.

Box 1.1 - Summary Documentation of the NIA Experience

The Case of NIA

The first and best documented nationwide program to build in participation as a cornerstone of irrigation policy occurred in the Philippines. Beginning with a pilot project in 1976, the approach was expanded in 1980 to cover all communal systems and even extended to large scale national irrigation systems. The NIA has evolved from an agency primarily concerned with construction to one committed to developing and supporting management capacities of farmer irrigation associations.

A 1993 study reported substantial improvements in performance after ownership and management responsibility were transferred to farmers: collection efficiency for service fees increased from 45 to 74 percent; recurrent maintenance costs were reduced by 60 percent and personnel costs by 44 percent; dry season yields increased by 12 percent; and, taking costs and labor contributions into account, farmer's net income increased by 50 percent. These gains were most dramatic for tail end farmers who saw major improvements in water delivery.

Source: Meinzen-Dick, Reidinger and Manzardo (1995). The World Bank Participation Source Book. The World Bank. Washington, DC.

The NIA model not only caught the attention of researchers and donors alike but also of irrigation authorities from India, Indonesia, Thailand, Sri Lanka and Nepal who imported and adapted it to their countries. By the late 1980s, NIA had become the undisputed international leader in irrigation decentralization such that the World Bank acknowledged NIA's efforts as a "venerable tradition of reform" (Briscoe 2001; 3).

As I document in later chapters, however, a contemporary examination of NIA's decentralization program after two decades and an investment of $2.12B indicate problems of poor and deteriorating irrigation performance characterized by high incidences of free riding in the payment of fees, chronic underinvestment in maintenance, unabated deterioration of facilities, persistently poor water service, and poor productivity and incomes.

For example, I find that at least 80 percent of all the 196 large scale irrigation systems are in poor condition and require major rehabilitation. Cropping intensity, a measure of the quality of irrigation service, is only 68 percent on a ten year average (1900-2000). During the same period, the incidence of free riding among farmers in the payment of irrigation fees is reported at 66 percent. Also, less than 25 percent of irrigation associations (IAs) take responsibility for the maintenance of their systems.

What explains this puzzle? How could poor performance occur in a system known and lauded worldwide for its major decentralization efforts? What are the conditions that might lead to poor performance of large scale government managed irrigation systems even after earlier efforts at decentralization? How are the incentives faced by the key players – irrigation bureaucrats, donors, farmers and politicians – linked to the problem of poor performance? What factors might have influenced these incentives? These are the questions I will attempt to answer in this dissertation.

1.1 The Evolving Definition of Decentralization

Decentralization is not a new phenomenon. Starting in the 1860s, India went through three waves of decentralization while West Africa experienced four such waves since 1917 (Agrawal and Ribbot 1999). Since the 1950's, the term decentralization has

been applied to a rapidly expanding array of institutional changes that accompanied the granting of independence to many African countries (Mawhood 1983). Ostrom, Schroeder and Wynne (1993) note that "the political leadership of developing countries tended to use the word indiscriminately to refer to any kind of institutional changes but because of the proliferation of institutional changes, a precise meaning of the term decentralization no longer exists".

Cohen et al. (1981), as cited in Ostrom, Schroeder and Wynne (1993), agrees that the term decentralization "is not one thing nor is it even a series of degrees along a single spectrum or scale". Conyers (1985) also suggests that institutional changes regarded as decentralization vary widely along the following five dimensions which she regarded as characteristic of all decentralization efforts.

- the functional activities over which authority is transferred;
- the type of authority or powers which are transferred with respect to each functional activity;
- the level or areas to which such authority is transferred;
- the individual or organization to which authority is transferred at each level; and
- the legal or administrative means by which authority is transferred.

Analyses along these five dimensions also widely characterize the study of decentralization in the public administration literature. However, Conyer's approach, while reasonable, is not related to a broader theory that identifies the factors affecting the incentives that individuals in centralized or decentralized institutional arrangements face and hence can be considered as just one of many efforts to specify the multiple dimensions of decentralization. What is needed, as Ostrom, Schroeder and Wynne

(1993) argue and to which I agree, is a more general set of dimensions closely tied to a body of theory.

1.1.1 Decentralization in General

In this dissertation, I use Rondinelli's (1989) broad definition of decentralization as the transfer of authority and responsibility for public functions from the central government to intermediate and local governments or quasi-independent government organizations and/or the private sector. Rondinelli argues that decentralization can appear in various forms – political, administrative, fiscal, and market decentralization – and has different characteristics, implications and conditions for success within countries and even within sectors.

Depending on how it is defined, scholars assert that decentralization can potentially contribute to the following (see Andersson, 2003 for a meta-analysis of the literature): (1) a more efficient delivery of public services (Oakerson 1998; Wunsch and Olowu 1995); (2) facilitate self-governance (Ostrom 1990); (3) more equitable outcomes (Maro 1990); (4) more flexible government policies (Bish and Ostrom 1973); (5) greater local institutional capacity (Rondinelli et al 1989); (6) more accountable government (Ribot 1999; Agrawal and Ostrom 2001); and (7) better match of public services to local needs (Crook and Manor 1998). However, the various conceptions of decentralization by these scholars require caution in making generalizations about the virtues of decentralization since it has different forms, each of which have different characteristics, policy implications, and conditions for success.

1.1.2 Political or Democratic Decentralization

One form of decentralization is referred to as political or democratic decentralization — the transfer of power to established local authorities who are downwardly accountable (Agrawal and Ribot 1999; Manor 1999). The direction of accountability is central to the notion of political decentralization. It aims to give citizens and their elected representatives more power in public decision making and is often associated with pluralistic politics and representative government. By implication, local authorities gain discretion in rule making within prescribed limits (Ribot 2002).

The normative argument for political decentralization is not new. The idea for the separation of powers among various units of a government was vigorously articulated by Hamilton, Jay, and Madison in the Federalist Papers No. 47 to 51. They argued essentially for the necessity of "a system that would use power to check power, through opposite and rival interests that extended to the whole system of human affairs." This view is also reemphasized by V. Ostrom (1987).

In addition to the separation of powers, the implicit assumptions behind political decentralization are twofold. First, decisions that are made with greater participation will be better informed and more relevant to diverse interests in society than those only made by national political authorities. Second, the selection of representatives allows citizens to better know their political representatives and allow elected officials to better know the needs and desires of their constituents. In essence, political decentralization helps address the problem of information asymmetry particularly the problem of preference revelation between citizens and their representatives.

Advocates of political decentralization, however, often overlook its inherent tradeoffs particularly as they seek to advance direct democracy and a representative form of government. Among the potential tradeoffs of political decentralization are as follows: First is the paradox of voting – i.e. the ambiguous meaning of the electoral mandate - is well known in literature (see Buchanan and Tullock 1962; Arrow 1963).

Second, direct democracy is associated with the problem of preference intensity and bundling which leads to minorities often bearing the costs (Bicker and Williams 2001).

Third, a representative form of government gives rise to certain incentives by the electorate and their representatives. The influence of organized and mobilized interests, for example, may lead to the problem of rent seeking and dissipation (Buchanan, Tollison, and Tullock, eds. 1980). Concentrated interests have strong incentives to monitor and lobby and thus too much weight is likely to be given to their costs and benefits (Stigler 1971). Diffused interests on the other hand have generally weak incentives to lobby and monitor and consequently too little weight is likely to be given to their costs and benefits. When diffused interests are mobilized by media attention, too much weight may be given to their costs and benefits.

Fourth, geographic constituencies motivate representatives to seek positive net benefits to their districts and in the process bargain with other representatives to get their share from the pork barrel. This process, known as logrolling, involves assembling a collection of projects that provide sufficient locally perceived benefits to gain adoption of the packages as a whole (Riker and Brams 1974). When applied to all other districts, this may result in net negative social benefits. Representatives also often solicit support from

factor suppliers in their district and while such expenditures within the district may be viewed as political benefits, they are actually social costs.

Fifth, electoral cycles faced by representatives likewise create incentives that lead to socially excessive discount rates i.e. representatives often attempt to realize tangible benefits before elections and thus tend to give too much weight to short run benefits and too little weight to long run costs (Nordhaus 1975; Alesina and Rosenthal 1995).

Sixth, the need to compete for the attention of the electorate leads candidates to "posture for public attention" through the media. It also creates the incentive to engage in "heresthetics" or the art of political strategy (i.e. agenda control, sophisticated voting and rhetoric, etc) (Riker 1986). A policy agenda strongly influenced by the pattern of media coverage, political advertising and heresthetics detracts from the idea of public policy as a rational search for ways to improve social welfare.

Thus, while the notion of political decentralization is attractive given its association with pluralistic politics and representative government, the potential tradeoffs such as the ones outlined above also need to be considered if it would have a higher likelihood of success.

1.1.3 Administrative decentralization

Another form of decentralization is administrative decentralization which refers to the redistribution of authority, responsibility, and financial resources for providing public services among different levels and forms of government (Rondinelli 1989). There are three forms of administrative decentralization – *deconcentration, delegation,* and *devolution*- each having its own characteristics.

The term *deconcentration,* which originated in the 1950s, refers to the redistribution of decision making authority, and financial and management responsibilities for public functions among different levels of the central government but which remain accountable to central authorities. Most references to decentralization in the 1950s and 1970s actually refer to *deconcentration* when central government agencies transfer executive authority to their subordinate offices outside of the national capital but considerable decision making powers were retained by central authorities.

Ostrom, Schroeder and Wynne (1993) argue that while such forms of decentralization have some potential to decrease the transaction costs associated with the highly centralized provision of infrastructure – lower costs of time, and place information - many of the expected institutional changes have not materialized. *Deconcentration i*s often considered the weakest form of decentralization because the performance of administratively decentralized agencies is likely to be similar to that of centralized agencies. The reason is that these agencies remain subject to the same set of civil service rules and thus are bound in the same administrative cultures as their counterparts in central offices.

Delegation on the other hand is a more extensive form of decentralization. It refers to the transfer of decision making authority, and financial and management responsibilities, for public functions to *semiautonomous organizations* not wholly controlled by the central government but ultimately accountable to it (Rondinelli et al.1989). This is the case when decision making authority is transferred to public enterprises or corporations, housing and transport authorities, special service districts, semi-autonomous school districts, and regional development corporations. These

organizations have a great deal of discretion in decision making and are often exempted from civil service constraints, may impose user charges, and decide on their revenue and expenditure policies.

In contrast, d*evolution* refers to the transfer of decision making authority, and financial and management responsibilities for public functions to quasiautonomous units of *local government* with corporate status. It refers to responsibilities for services to municipalities that elect their own mayors and councils, raise their own revenues and have independent authority to make investment decisions. In a devolved system, local governments have clear and legally recognized geographical boundaries over which they exercise authority and within which they perform public functions. This is the type of decentralization that underlies most political decentralization and thus has the same tradeoffs.

Devolution is advantageous because it brings citizens closer to public decisions usually making it easier for them to exercise "voice" about the quality and quantity of public goods. Devolution also permits citizens to "exit" – those dissatisfied with the policies in one jurisdiction have the opportunity to vote with their feet by moving to jurisdictions offering more preferred policies (Bickers and Williams 2001).

1.1.4 Fiscal decentralization

Fiscal decentralization - the transfer of revenue and expenditure powers from central government to local government units - is a core component of decentralization without which decentralized functions cannot be carried out effectively (Huther and Shah 1998). Fiscal decentralization can take many forms including: 1) self-financing and cost

recovery through user charges; 2) cofinancing or coproduction in which users participate in providing services and infrastructure through monetary and labor contributions; 3) expansion of local revenues through property or sales taxes or indirect charges; 4) intergovernmental transfers of general revenues from taxes collected by the central government to local governments for general or specific purposes; and 5) authorization of municipal borrowing and mobilization of national or local government resources through loan guarantees.

Under appropriate conditions, the combination of fiscal and administrative decentralization, in general, has the following advantages (Huther and Shah 1998): (1) helps alleviate bottlenecks in decision making,; (2) cuts complex bureaucratic procedures; (3) increases government officials' sensitivity to local conditions and needs; (4) helps national government ministries reach larger numbers of local areas with services; (5) allows greater political representation for diverse political, ethnic, religious, and cultural groups in decision-making; (6) relieves top managers in central ministries of "routine" tasks to concentrate on policy; (7) creates a geographical focus at the local level for coordinating national, state, provincial, district, and local programs more effectively; (8) provides better opportunities for participation by local residents in decisionmaking; (9) leads to more creative, innovative and responsive programs by allowing local "experimentation"; and (10) increases political stability and national unity by allowing citizens to better control public programs at the local level.

Fiscal and administrative decentralization, however, have their share of disadvantages (http://www1.worldbank.org/publicsector/decentralization). First, they may not always be efficient, especially for standardized, routine, network-based services. They

can result in the loss of economies of scale and control over scarce financial resources by the central government. Weak administrative or technical capacity at local levels may result in services being delivered less efficiently and effectively in some areas of the country. Administrative responsibilities may be transferred to local levels without adequate financial resources and make equitable distribution or provision of services more difficult. Fiscal and administrative decentralization can sometimes make coordination of national policies more complex and may allow functions to be captured by local elites. Distrust between public and private sectors may also undermine cooperation at the local level.

1.1.5 Market Decentralization

The most complete form of decentralization, from a government's perspective, are privatization and deregulation since they shift responsibility for functions from the public to the private sector (http://www1.worldbank.org/publicsector/decentralization). They allow functions that had been primarily and exclusively the responsibility of the government to be carried out by businesses, community groups, cooperatives, private voluntary associations and other nongovernmental organizations. This is usually accompanied by economic liberalization and market development policies.

Privatization refers to the transfer of responsibility for providing and producing public services from the public to the private sector. It can range in scope from the provision and production of goods and services based entirely on the free operation of the market to various forms of public-private partnerships in which government and the private sector cooperate to provide services or infrastructure.

Deregulation reduces the legal constraints on private participation in service provision or allows competition among private suppliers for services previously provided by the government or by regulated monopolies.

Market decentralization implies the presence of functioning markets in the provision and production of public goods. However, the effectiveness of market decentralization is limited in the case of public goods, the presence of externalities, natural monopoly, and information asymmetries. In addition, thin markets, preference problems, uncertainty problems, and intertemporal problems also limit market decentralization. This class of market failures limits the efficacy of market decentralization in a number of ways (see Weimer and Vining (1999) for a summary).

For pure public goods, market decentralization will lead to the problem of under supply for a particular good, given the difficulty of exclusion and nonrivalry of consumption. In the case of open access goods, over consumption and under investment are potential problems of market decentralization. In the presence of positive externalities, privatization will lead to the undersupply for that good while the over supply of negative externalities will likely result. Excessive deregulation of monopolies may lead to problems of undersupply and inefficiencies. Reliance on market mechanisms may also lead to the over or under consumption of experience and post-experience goods, given the challenges of estimating the *ex ante* quality of such types of goods. Furthermore, reliance on the market mechanism in the case of thin markets is likely to lead to the problem of cartelization while uncertainties in the market lead to problems of moral hazard and adverse selection, among others.

1.2 Decentralization Analytics

The preceding review of the literature showed that decentralization in general has different forms, each of which has different characteristics, policy implications, conditions for success, advantages as well disadvantages. How do we proceed then with the analytics of decentralization?

One approach is typified in Conyer's (1984) analysis of the dimensions of decentralization, an approach usually employed in the public administration literature. Conyer suggests that institutional changes regards as decentralization vary widely along five dimensions which she regarded as characteristic of all decentralization efforts. This approach however has several fundamental limitations (see Ostrom, Schroeder and Wynne 1993). First, it is *ad hoc* in character. While it allows additional descriptive discrimination, it does not necessarily develop a cumulative body of knowledge about how various institutional changes affect the incentives of participants, their resulting actions, and the effects of their cumulative behavior. Second, it is also not clear in this approach how an analyst should choose one particular dimension of decentralization over another. Third, the approach is not related to a broader theory that identifies the factors affecting the incentives that individuals in centralized or decentralized institutional arrangements face.

As an alternative approach, Ostrom, Schroeder and Wynne (1993) examine the incentives of individuals in the production and provision of a large scale public infrastructure. They conceive of incentives in terms of transformation and transaction costs under various institutional arrangements. They refer to *transformation cost*s as the costs of transforming inputs (land labor, capital) into physical outputs. They define

transaction costs as increases in transformation costs associated with coordination costs, information costs such as time and place information, and strategic costs such as free riding, rent seeking, and corruption. They used this approach to suggest why transformation and transaction costs in the construction and O&M of infrastructure would be higher in the case of a centralized national government agency that in the case of decentralized and polycentric arrangements.

I build on this approach that focuses on how certain institutional arrangements affect the incentives of actors, their resulting actions, and the effects of their cumulative behavior. With this in mind, I begin with a presumption that one dimension of a successful decentralization is the extent to which the incentives of key actors are in a *strategic fit* i.e. how these incentives are aligned and are made reinforcing of one another in the sense suggested by Hamilton, Jay, and Madison [1788] and emphasized by V. Ostrom (1987).

Analytically, the alignment and reinforcement of incentives in decentralization can be conceived of in the following manner: First, there must be a mechanism of accountability such as public and transparent information, a *res publica* or open public realm (V. Ostrom 1987). This is to enable the community to effectively monitor and contest the performance of their elected representatives and allow the community to react appropriately to that performance so that politicians and local officials have an incentive to be responsive. This proposition is consistent with the proponents of political decentralization with downward accountability.

Second, as reinforcement to the first, there must be a mechanism in decentralization by which the community can express its preferences in a way that is

binding on their representatives, usually elected officials – i.e. the community can make a credible threat so that there is an incentive for the community to participate and for politicians to be responsive. This proposition is consistent with Hirschman's (1980) notion of voice, exit and loyalty.

Third and related to the first two, for local communities to make meaningful expectations and decisions, they must be informed about: 1) the costs of services of local public goods and their service delivery options; and 2) the resources available and their sources.

Fourth and related to the third, accountability is only meaningful if those who are made to account can make credible commitments i.e. local politicians can bear the costs and deliver on their commitments. This implies that for decentralization to work, local financing and fiscal authority is linked to the service provision responsibilities and functions of the local government. This is the principle of fiscal equivalence earlier articulated by Tiebout (1956) and also related to the proportional equivalence principle between costs and benefits suggested by Ostrom (1990). It is closely related to Huther and Shah's (1998) argument about the centrality of fiscal decentralization without which decentralization efforts would not be as effective.

Finally, the instruments of decentralization -the legal and institutional framework, the structure of service delivery responsibilities, and the intergovernmental fiscal system-- are designed to support the political objectives (Huther and Shah 1998). This is also consistent with Ostrom's (1990) design principle on the necessity for a nested set of institutions for enterprises with a high degree of interdependence.

1.3 Decentralization in Natural Resources Management

Agrawal and Ostrom (2001) criticize some of the literature on the decentralization of natural resource management as paying insufficient attention as to why governments attempt decentralization and to the nature of property rights that national governments devolve to local actors. They further note that some past studies have asserted the superiority of decentralized solutions on the grounds of efficiency, equity, and sustainability without digging sufficiently into the conditions that are needed to achieve these goals.

The equity argument related to developing countries, for instance, holds that some kinds of decentralized natural resources management empowers the poor, who are primarily dependent on these resources, and enhances the security of their livelihoods. A common argument behind the so called community based resource management projects is that communities will act collectively to advance their interests when given control of decisions and resources and when working in partnership with responsive support organizations and service providers (World Bank 2005). The efficiency and sustainability argument holds that small scale, local common-pool resources such as forests, watersheds, coastal and inland fisheries, protected areas, surface irrigation and grazing lands are best governed and managed by the users themselves for motivational and informational reasons.

The motivational reason suggests that since these resources are usually salient to the livelihoods of users themselves, they are more likely than officials of a national government to have strong incentives to manage these resources efficiently and sustainably. In addition, national officials are frequently embedded in a perverse set of

incentives given their meager levels of salaries, the magnitude of the principal-agent problem, and opportunities they have for rent seeking. The informational reason has to do with the cost of obtaining information to manage these resources. Resource users in developing countries are more likely to have lower costs of obtaining, assessing, and sharing information about the resource and resource users compared to officials of the national government.

The potential pitfalls of decentralization in natural resource management, on the other hand, arise from problems of mitigating negative externalities and the capture or strengthening of power by local elites and privileged groups (Ostrom 2000; Ribot 2000; Crook and Manor 1998). Agrawal and Ostrom (2001) suggest that, even if there are effective coalitions in favor of decentralization and programs are initiated to pursue decentralization, set backs and retreats are possible in the process of implementation. These set backs arise mainly because of the limited scope of property rights that accompany many efforts at decentralization, the uncertainty of those rights, and the nature of governance arrangements to protect those rights. They assert that many decentralization proposals are limited to the assignment of operational rights for authorized users to withdraw resource units. They argue that significant operational rights such as the right to manage, exclude other users, and alienate the resource continue to be held by government agencies including collective and constitutional choice rights. Absent these rights, there is little incentive for sustainable management among resource users.

Further, Ostrom (2001) suggests that fully decentralized systems (i.e. entirely self organized at a local level) are faced with the following limitations: (1) some appropriators will not organize because, among others, the resource is not salient and /or

there is lack of leadership; (2) some self organized efforts will fail; (3) the prevalence of local tyrannies because of the domination by local elites; (4) the stagnation of communities which cling to systems that have worked relatively well in the past; (5) inappropriate discrimination based on characteristics that have nothing to do with legal rights of individuals; (6) limited access to scientific information; (7) conflict among appropriators particularly among those without access to conflict resolution mechanisms; and (8) inability to cope with larger scale common pool resources for those without access to larger scale jurisdiction.

1.4 Decentralization in Irrigation Management

In irrigation, the process of turning over some responsibilities to the farmers served by a system has been referred to as irrigation management transfer (IMT) or participatory irrigation management (PIM). The rationale for IMT has been summed up by Vermillion (1997) as follows: First, government bureaucracies lack the incentives and responsiveness to optimize management performance and farmers have a direct interest in enhancing and sustaining the quality and cost efficiency of irrigation management. When farmers are given the authority and incentives to act collectively, they are more likely to improve irrigation operations because it is in their direct interest to do so. Second, when IMT occurs in a supportive sociotechnical context, improved quality and cost efficiency of irrigation management will occur. Third, pressures to decentralize primarily stems from fiscal problems faced by national governments and decentralization of responsibilities to farmers is one way to cut the recurring costs of irrigation O&M.

1.4.1 Models of Irrigation Management Transfer

Just as there are various types of decentralization – i.e. political, administrative, and fiscal decentralization – so are there various models of IMT. These models vary in terms of their focus, scale, the management units responsible, and the scope of functions and property rights transferred to farmers. The scope of functions and property rights transferred to farmers, for instance, range from the transfer of administrative responsibilities to lower levels of administration to the full transfer of property rights and governance responsibilities of irrigation systems from government agencies to IAs.

Early models of IMT (1950s to 1970s) focused more on non-poor, market oriented, large scale, and business like agriculture as were the case of large farms in the US, Mexico, New Zealand, and Turkey (Vermillion 1997). The objective of these early models include saving government money, improving operation and maintenance (O&M) cost efficiency and maintaining or increasing productivity of irrigated agriculture. The national government usually initiated the process and the scope included full transfer of O&M and financial functions but ownership of assets remained with government.

In contrast, more recent models of IMT (1980s and 1990s) in South and Southeast Asia, Latin America and Africa have been targeted at poor, small scale, local market oriented agriculture. While the formal objectives remain the same, i.e. saving government money, improving O&M cost efficiency and maintaining or increasing productivity of irrigated agriculture, IMT has increasingly been judged a success even if it only saved government money and improved collection efficiency (Vermillion 1997). Contemporary IMT are also more likely to be undertaken under donor auspices in previously aid funded projects (Shah et al. 2002; Groenfeldt and Svendsen 2000).

In general, the scope of O&M and finance functions transferred under IMT is partial. In particular, current models of IMT differ in their operational aspects in terms of a) transfer units and their size; b) the new management unit responsible after IMT; c) the extent of functions transferred; d) ownership of assets; and e) the implementation and financing modalities adopted by donors. For some models, such as those in the Philippines (for communal irrigation), New Zealand, Colombia, Nepal (for small systems), and China, transfer units involved the entire scheme. In other models, transfer units may involve only the distributary canals as in the Philippines and Nepal (for some large irrigation systems), Sri Lanka, Nigeria, Egypt, and India, among others. The size of surface areas involved in a transfer varies from a low of 150 ha in the case of communal irrigation in the Philippines to as much as 14,000 ha in India, 25,000 ha in Colombia and 30,000 ha in Mexico (Vermillion 1997).

In terms of the new management unit, most IMT models transfer responsibilities to IAs as in the case of the Philippines, Indonesia, Egypt, Bangladesh, Nepal, India, Senegal and Colombia. In Turkey, municipal governments became the new management unit. In Vietnam, parastatal organizations became responsible while in Sudan and New Zealand, private/mutual companies assumed responsibility. In the USA, Japan, South Korea, Mexico and Taiwan, where IMT were deemed to have a generally positive impact, post transfer governance entities tended to be farmer elected boards of directors while management entities tend to be cadres of professional staff appointed by the board. In terms of the extent of O&M and finance functions transferred, IMT models in the Philippines, Indonesia, Nepal, Sri Lanka, Sudan, Nigeria, Dominican Republic, and Colombia practice partial transfer of responsibilities. On the other hand, models in

Vietnam, China, Bangladesh, Egypt, Turkey, Senegal, Colombia, New Zealand, and Mexico practice a full transfer of O&M and finance responsibilities (Vermillion 1997).

More specifically, the powers and functions that are increasingly devolved to IAs after IMT includes, in varying degrees, the following authorities: (1) make rules and sanctions, with the maximum sanction of stopping water available to the IAs; (2) make O&M plan and budgets; (3) set water charges; (4) hire or release management staff; (5) control over intake; (6) control over main canal system; (7) control over subsidiary canal system; (8) responsibility for future rehabilitation; (9) canal rights of way; (10) IA right to contract and raise funds; and (11) IA right to make profits. In terms of ownership of assets, the government retains ownership in most IMT models, with the exception of Senegal and New Zealand where assets were privatized.

1.4.2 Impacts of IMT

The evidence on the impacts of IMT is mixed. Based on a meta analysis of the literature, the impacts of IMT can be summarized as follows (see Araral 2004 for a summary): First, IMT can contribute to poverty reduction if: (1) head-tail distribution improves; (2) the effect of any increases in water costs are overcome by improvements in efficiency or water availability; (3) it leads to increased productivity as a result of expansion of cropping area, increase in cropping intensities, and crop diversification; and (4) revenue sources for farmers organizations are diversified. Overall, however, evidence of a positive impact from IMT reforms is mixed.

Second, IMT could potentially contribute to improving government finance through reduced subsidies and improved collection efficiency. Third, IMT can contribute

to improved irrigation operations, but maintenance remains a serious problem particularly for high cost systems. Improved O&M is more likely when IMT is most progressive, i.e. when ownership is transferred to farmers and when the economic value of irrigated farming is high. In larger systems, IMT is more likely to be successful when governing boards are farmer elected, management is made up of professional cadres, and legal systems can handle increasing scales of complexity. Finally, IMT can also contribute to water resource conservation when: (1) water rights and water service objectives are clear and secure; (2) water is priced as an economic good; (3) consumption is adequately monitored at the farm and basin level (i.e. use of volumetric pricing and water accounting); (4) when water conserving technologies are practiced; and (5) when IMT is most progressive.

Critics, on the other hand, argue that straightforward IMT is unlikely to work in the case of small holder African countries. Even when the supposed preconditions for success are met, i.e. supportive legal-policy framework, secure property rights, local management capacity building, and an enabling process to facilitate management transfer, Shah et al. (2002) have argued that success is more likely under large scale and high value crop farming than in small scale agriculture involving thousands of impoverished farmers. Critics also point out that governments generally have been pursuing decentralization to reduce the recurring costs of irrigation and to shift these costs to farmers. As Vermillion (1997) also suggests, IMT is now regarded a success even if it only saves money for the government regardless of its impact to farmers and to the long term sustainability of the irrigation systems.

1.4.3 Farmer Vs. Government Managed Irrigation Systems

How do the performance of farmer managed irrigation systems compare with government managed systems that are not subject to IMT? In the case of Nepal, Lam (1998) unambiguously finds that farmer managed systems consistently outperform the latter. Lam argues that the basis for high levels of performance includes a high degree of mutual trust, active participation in the crafting and monitoring of rules, and a high level of rule conformance. Lam suggests that these productive working relationships are more likely to be associated with farmer managed irrigation systems. In contrast, government managed systems are organized upon a dominance dependent relationship between irrigation officials and farmers. Such a relationship, argues Lam, yields little incentives for either officials or farmers to contribute their efforts to irrigation operation and maintenance (see also Tang 1992 for a meta-analysis of systems in several countries and Ostrom, Gardner and Walker 1994 for a comparison of irrigation, forestry and fishery institutions).

2.0 Importance of Study

This study hopes to make the following contributions to the theoretical, policy and methodological literature on decentralization, collective action, common-pool resources and irrigation in particular. First, as a study on political economy, this dissertation builds on the theory of collective action, the central subject of political science (Ostrom 1998, 2005) and a subject that lies at the heart of the political economy approach to policy analysis (Bickers and Williams 2002). I extend this approach of

political economy to a developing country context in the tradition of Popkin (1979), Wade (1988) and Ostrom (1990).

Second, as a study of public policy, this dissertation builds on the literature on decentralization - a frequently recommended all purpose solution to a large number of problems in many developing and former socialist countries. At least 63 developing and transition countries have embarked on some form of decentralization. However, the literature on decentralization suffers from the lack of specificity and grounding in empirical and theoretical analysis (Ostrom, Schroeder, and Wynne 1993). This is particularly the case in the tradition of development administration. While many scholars of decentralization attempt to describe its variants along numerous dimensions and thus allow a more nuanced understanding, this line of scholarship does not necessarily develop a cumulative body of knowledge about how various institutional changes affect the incentives of participants, their resulting actions, and the effects of their cumulative behavior. In addition, the scholarship on public policy – at least in the political science tradition – has been dominated by the stages heuristic approach to policy analysis, an approach criticized by Sabatier (1993) as being largely atheoretical and unable to generate testable hypotheses.

This dissertation will attempt to address these limitations in the public policy literature by grounding the study of decentralization in both theoretical and empirical analysis. It will empirically examine the incentives faced by participants in ongoing situations and how various contexts – historical, the attributes of participants, the institutions as well as the physical context - shape their incentives and the resulting outcomes. As a study of a multidisciplinary subject, this dissertation will draw on both

the disciplines of political science – including its subfields of theory and methodology, political economy and public administration – as well as the field of economics particularly the subfield of development economics and institutional economics.

Third, this dissertation examines the pathologies of public bureaucracies in developing countries in the tradition of Bates (1989), Gibson (1999) and Olowu and Wunsch (2004). In addition, I also show how and why incentives embedded in foreign aid such as moral hazard influence bureaucratic incentives and lead to perverse outcomes. As such, this dissertation builds on the scholarship along the tradition of foreign aid analytics by Colliers (1997,1999) and more recently by the empirical work of Gibson et al. (2005).

Indeed, while foreign aid plays a dominant role in policy making in foreign countries, little is known about how it influences the incentive structure faced by irrigation bureaucracies and the outcomes when bureaucratic and aid incentives interact. The case of the Philippines represents a crucial study since it shares a similar history with many irrigation bureaucracies in developing countries. These agencies went through periods of irrigation construction and incremental improvements including promotion of farmer participation in irrigation O&M (Vermillion 2002). Like other irrigation development efforts in developing countries, NIA was mainly funded by foreign aid and politically supported by national governments. Consequently, the issues that NIA face appear to be generic to irrigation agencies in developing countries (Briscoe 2002).

Fourth, this study is about irrigation infrastructure and institutions. The expected policy payoff of research on irrigation institutions is substantial since there are at least 25 developing countries in the process of undertaking irrigation reforms in efforts to achieve

poverty alleviation, economic growth, food security, and the environment in these countries (Briscoe 2002).

Finally, as a study of common pool resources, this dissertation took into account some of the key methodological lessons learned over the last 15 years of research in this field. The literature on common pool resources that are largely small-n case studies, rarely consider the mediated and indirect effects of contextual variables (but see Lam, 1994). They are also often limited to operational level analysis and seldom simultaneously consider collective choice analysis. This dissertation addresses these limitations in the common pool resources literature by taking into account the following lessons learned from 15 years of scholarship in this field (see NRC, 2002): (1) the need to combine large-n multivariate research with in-depth case study methods; (2) development and testing of causal models; (3) improving conceptual categories; (4) studying the effects of the historical context; (5) understanding the mediated and indirect effects of characteristics of resource, resource users and institutions; and (6) the use of multiple levels of analysis, in this case collective choice processes embedded in an international process and local processes embedded in these national-international processes.

3.0 Roadmap

I organized the rest of this study as follows. In Chapter Two, I provide an overview of the Philippines and NIA in particular as a study setting. I then sketch a chapter overview before describing the geography and climate of the Philippines. Next, I characterize the Philippine population in terms of ethnography, language, religion and social structure as well as describe the long tradition of collective action in the

Philippines – both in irrigated farming and peasant movements. This is followed by a brief discussion of the Philippine constitution, government, and economy along with the contemporary challenges to Philippine society. Finally, the history of irrigation reform in the Philippines is discussed including a detailed account of its experience in the decentralization of irrigation management.

In Chapter Three, I present my theory and methodology. I initially provide a chapter overview and lay out my research questions and hypotheses. I then examine methodological issues in social science research and issues related to the analysis of institutions in general and common pool resources and irrigation institutions in particular. The population of interest and justification for the study site is then explained followed by a discussion of data sources, the research variables, how they were coded and where they can be verified. Issues of measurement reliability are then discussed while summary and conclusions follow.

In Chapter Four, I provide empirical evidence on the problem of poor performance of public irrigation in the Philippines. I focus on key variables such as the condition of irrigation facilities, quality of water service, payment of irrigation fees, investments in maintenance, and their consequences in terms of farm productivity and incomes.

In Chapter Five, I undertake a collective choice analysis to explain the decentralization puzzle. I hypothesize that, despite well heralded efforts at irrigation decentralization reform, the problem of poor irrigation performance persisted because of the perverse incentives faced by the irrigation agency and reinforced by incentives embedded in irrigation aid, particularly moral hazard and aid fungibility. I qualitatively

test my hypothesis by examining the incentives faced by irrigation bureaucrats and donors and their strategic interactions using aggregate panel data (1990-2002) and measures of central tendency at the national level.

In Chapter Six, I shift my analysis from collective choice to operational choice with a focus on the incentives faced by farmers. I hypothesize that the problem of persistently poor irrigation performance – in particular the problem of a persistently poor record in the payment of irrigation fees - is also affected by the incentives faced by the farmers themselves. To test my hypothesis, I employ both linear and binary logistic regression models to analyze the impact of the characteristics of the irrigation systems and the attributes of user groups on the levels of monetary free riding, holding other factors constant. I also examine whether the factors that affect monetary free riding have the same effect on labor contribution.

In Chapter Seven, I extend my operational level of analysis by examining how variations in the institutional and political context of irrigation systems help explain variations in levels of monetary free riding holding other factors constant. I examine in particular how variations in land tenure arrangements, autonomy of the IA, face to face communication among farmers, and political patronage as indicated by the presence of a political dynasty could help explain variations in the levels of monetary free riding.

Finally, in Chapter Eight, I summarize my overall findings and analysis and draw some implications for policy.

CHAPTER TWO

THE SETTING

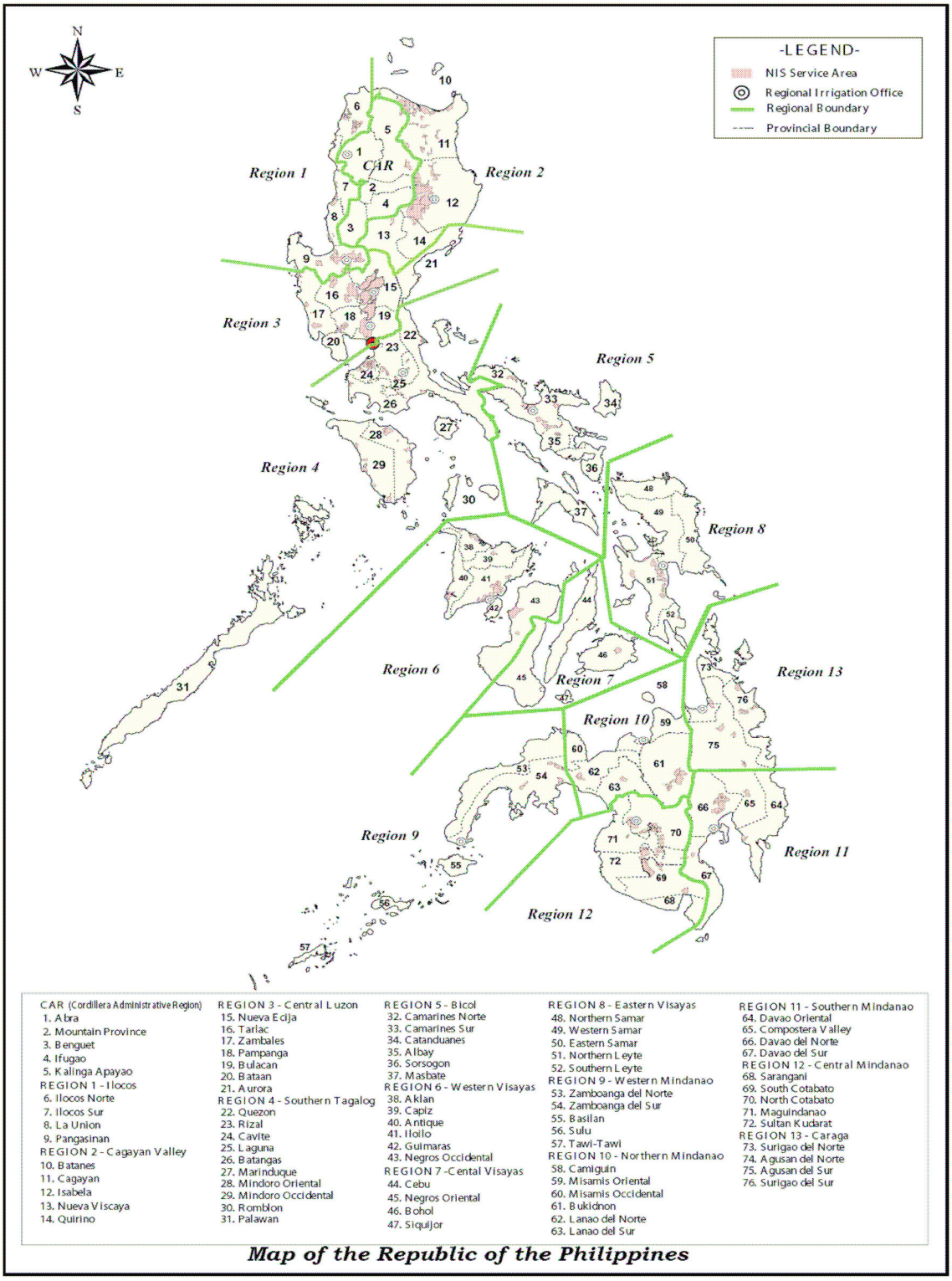
2.0 Overview

In this chapter, I broadly outline the physical context of the Philippines, the general characteristics of its population and the historical context of irrigation reforms. I first provide an overview of the Philippine geography and climate and then characterize its population in terms of ethnography, language, religion, and social structure. I then describe the long tradition of collective action in the Philippines – both in irrigated farming and peasant movements. A brief discussion of the Philippine constitution, government, economy follows, and contemporary challenges to Philippine society are outlined. The recent history of irrigation reform in the Philippines is then discussed.

2.1 Geography and Climate

The Philippines is an archipelago of 7,100 islands located in Southeast Asia (Map 2.1). It is bounded on the east by the Pacific Ocean and to the west by the South China Sea. Neighboring countries include China and Vietnam to the west and Malaysia and Indonesia to the south. The archipelago is mostly hilly and mountainous in the interior with strips of coastal plains and valleys where population centers are concentrated. The

Figure 2.1-Map of the Philippines and location of national irrigation systems



Source: NIA.

country is divided into three geographic regions: Luzon, Visayas, and Mindanao each having different ecological conditions. The Philippines has a total land area of 30,000 square kilometers, two-thirds of which are found in the main islands of Luzon and Mindanao (see Jocano 1998 from where this section is mainly drawn).

The country has a tropical climate with a distinct wet and dry season almost equally distributed throughout the year. The conditions in northern Luzon are arid, while there is abundant rainfall in the island of Mindanao. Luzon and Visayas are visited by an average of 25 typhoons a year. The soil is generally fertile, the Philippines being a product of volcanic formations.

2.2 Characteristics of the Population

2.2.1 Ethnography and Language

The Philippine population, currently at 85 million, consists of 13 large lowland ethno-linguistic groups (Jocano 1998): Ilocano, Kapampangan, Tagalog, Bicolano, Waray, Pangasinense, Cebuano, Hiligaynon, Aklanon, Kinaray-a, Tausug, Maranao, and Maguindanao. There are also hundreds of other upland and coastal groups known as cultural communities that are non-Christians and non-Muslims. Linguistically, these different groups speak non-mutually understandable languages, but the language structure belongs to what scholars refer to as the Philippine sub-family of the Austronesian or Malayo Polynesian stock (Jocano 1998). The population growth rate, at 2.4, is one of the highest in the world.

English is widely spoken and serves as the official language of government. Filipino is the lingua franca, which is largely based on the Tagalog dialect spoken in the

regions in and around the national capital region. Mass media such as radio and TV are widely accessible. In addition, in urban areas, Internet access and the use of cable and satellite services are widespread. Readership of broadsheet national newspapers averaged only 36 percent in 1994, although local newspapers in local dialects also proliferate in large urban areas. The use of mobile phones is widespread among the population and is a crucial means of communication.

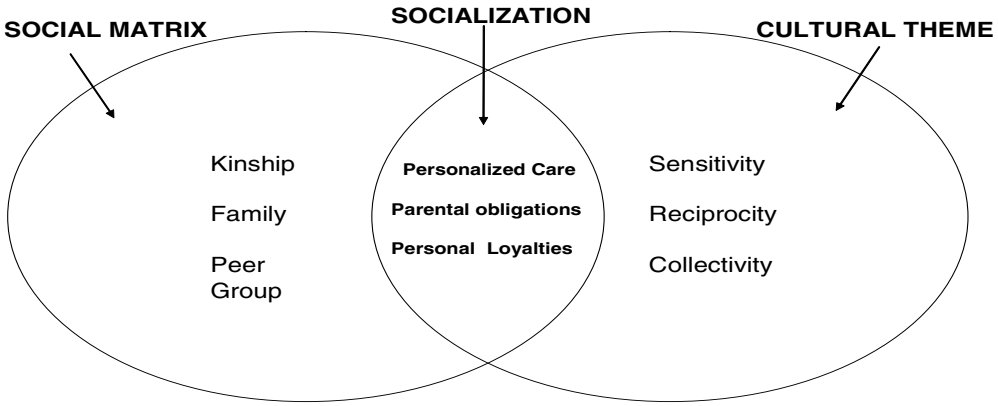
2.2.2 Religion

Eight out of ten Filipinos are Roman Catholics. Other faiths include Islam, evangelicals and homegrown faiths. Roman Catholicism was introduced by Spain in 1521 and firmly took root in the 17th century when the Philippines became a Spanish colony – the Philippines having been named after King Philip II. Islam was introduced in the southern part of the country in the 14th century along with Arab commercial ventures in Southeast Asia. By the 16th century, the Islamic faith was firmly established in the Sulu archipelago and in parts of Mindanao and was spreading in other parts of the country when the Spanish colonial regime arrived. Today, Muslims account for 5.06 percent of the population, mainly found in the Autonomous Region of Muslim Mindanao. The Protestant faith, on the other hand, was introduced by American missionaries during the American occupation period from 1898 to 1940. Evangelicals constitute 2.8 percent of the population and born again Christians are growing in numbers. Homegrown faiths, such as Iglesia ni Cristo and Aglipayan Church, account for about 11 percent of the population.

2.2.3 Traditional Social Structure

Notwithstanding the diversity in language, religion, geography and ecological conditions in the Philippines, scholars agree that there are certain basic features of the Filipino social organization that are remarkably uniform and stable. Jocano (1998), an eminent Filipino anthropologist, suggests that these unifying elements consist of a social matrix or networks, and cultural themes or norms arising from the processes of socialization (Figure 2.2).

Figure 2.2-Framework of the Traditional Filipino Social Structure



Source: Jocano (1998).

Together, these social networks and norms form the bedrock of what is referred to as social capital in rural villages in the Philippines. I suggest that understanding these norms and networks is important to understanding collective action in irrigation in the Philippines. The following sub-section summarizes the description by Jocano (1998) of what constitutes social capital in rural villages in the Philippines.

2.2.4 Social Networks

Social networks in the Philippines are primarily organized around kinship and the family. Such networks are central to understanding the Filipino social organization particularly at the rural villages. By extension, they are also important to understanding the social organization in an irrigation system. In general, kinship is important since it represents the overall framework of community relations in the Philippines. It serves as the basis for judgment that enables Filipinos, particularly at the village level of interaction, to define their relationships with one another, and to work together without difficulty. It is also regarded as the nucleus of Filipino social organization and dominates the formation, the structure and functions of Filipino institutions, relationships, values and worldview (Jocano 1998).

Specifically, kinship serves several purposes. First, it designates statuses and allocates roles to members of the group. Specific persons are grouped together and identified as *magkakamag-anak* or kins on the basis of birth, marriage, adoption, and ritual kinship. It is not uncommon for strangers to become intimate as soon as they discover that they are related to one another or have common relatives.

Second, kinship provides individuals assigned in such roles with moral and jural expectations that serve as the bases for the exercise of rights and duties to one another, and allows members to interact without much conflict. The regularity, order, uniformity, and continuity of social relations are therefore maintained through these expectations. Should individuals deviate from existing kinship rules, they take the risk of being sanctioned by other members of the group by way of ostracism, gossip, or scandal. If the

behavior is accepted, they also become the new rules of conduct specific to the position they occupy within the kinship domain.

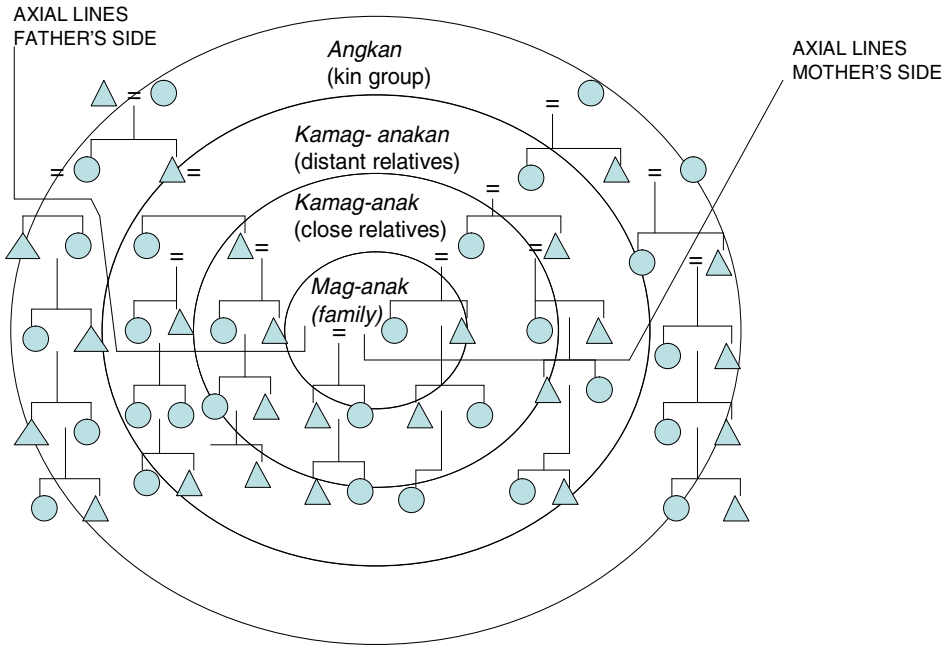
Third, kinship serves an economic function in terms of mobilizing labor for activities requiring collective effort – house building, fiestas, preparation for marriage, farm activities such as planting, harvesting, and canal maintenance, among others. Kins form the core group that contributes money, services, and other forms of assistance to help a member accomplish certain tasks or meet certain needs. Fourth, kinship serves a political purpose. Kindred members represent a block of supporters that politicians court. A word from the oldest member of a group is sometimes enough to make a candidate win or lose in many rural villages.

As a framework of relations, kinship has a narrow scope (Jocano 1998). The statuses it confers and the roles it allocates are limited to descent, affinity and ritual relations, but its influence in structuring relations and shaping behavior permeates the social system of an entire rural village. In a word, these traditional norms and networks are what make the notion of "infinite repetition cooperative strategies" in game theory possible in real life.

However, "infinite repetition cooperative strategies" among kinsmen must also be qualified. Despite expectations arising from kinship relations, an individual may still continue to have a wide range of options to emphasize those he/she wishes to maintain and de-emphasize those he/she does not want to maintain. The range and depth of personal kindred in fact is not just defined by the biological basis (through birth) or cultural basis (through marriage) of kinship but also in terms of age and residence, among others.

It is through birth that another individual is linked to another group of people having the same blood. Marriage expands the range of kinship networks by bringing together the networks from both the mother's and father's side (Figure 2.3).

Figure 2.3- Kinship Networks in the Philippines



Source: Jocano (1998).

The size of the kindred expands or contracts as the individual assumes different age levels and based on their ability to recall. For instance, children might be able to recall only their immediate grandparents, uncles and aunts, their parent's siblings, and their first cousins. As they grow older to adolescence, their social universe expands, sometimes requiring the tracing of kinship relationships. By the time they reach fifteen to thirty years old, most adult Filipinos are already involved in pan-community activities – economic, social and religious. Many are married and have children, and the need for assistance in collective work activities brings about the expansion of kindred recognition.

Residence is another important determinant of the range and depth of personal kindred and has crucial importance in understanding collective action in irrigation in the Philippines. A person may be considered a close relative only if he or she resides nearby and maintains frequent interaction with an individual and his or her family. As Jocano (1998) notes, while the degree of relationship with kin living in places outside of the village is recognized, by reason of distance, those relatives who live near are considered closer than those who live far away. The reason is that relatives who live near each other are the ones who actually cooperate in various undertakings. For instance, when reckoning the members of his personal kindred, a farmer might point out to relatives who are important to him regardless of the kinship distance. Close kins may not necessarily be reckoned as being important when he or she is from a distant place and is not particularly valuable to the farmer.

2.2.5 Norms

Embedded in the Filipino social matrix are socialization practices that define cultural themes or norms commonly found in rural communities in the Philippines. These socialization practices are forged during the passage through the life cycle. Jocano refers to three central practices, namely personalized care, parental obligations, and personal loyalties. Out of these socialization practices emerge some commonly observed norms in Filipino rural communities, namely sensitivity, reciprocity, and collectivity.

With a few exceptions, Jocano suggests ethnic groups in the Philippines share a pattern of socialization practices. These practices develop in children the commonly shared ways of thinking, believing, feeling, and acting. All of these help define in adult

life the norms or informal rules, or moral compass that govern relationships within and outside the kinship system. Understanding these informal rules is important to explaining the patterns of cooperation, or non-cooperation in an irrigation system.

Early on in life, Filipino children experience *pag-aaruga,* or tender care, which develops in the child a deep sense of emotionalism that has been described in adult life as Filipino sensitivity and hospitality. It is through these intimate child-rearing practices, according to Jocano, that a child learns the norm of *pananagutan* or obligation. Sociologists, however, suggest that this sense of obligation is more centered on the family rather than the larger community. Only when it is participated in by significant kin groups does this sense of obligation become community-centered.

Another deeply rooted norm that Filipino children are socialized into is the concept of *katapatan,* or personal loyalty, to the family and to the kinfolk. This moral obligation includes providing family and kin assistance in many forms. It is not uncommon for older siblings to put their younger siblings or relatives through school when their parents are unable to do so. It is not unusual for relatives to broker for the business interests of other relatives, if one is in a position to do so. Denying assistance to a kinsman is considered an offense against the moral standards of group relations, an insult to one's parents and a sign of disrespect for the entire kin. It is not unreasonable to argue, therefore, that the deep-seated system of patronage politics in the Philippines can be rooted from this personal loyalty to the family and kinship.

This notion of loyalty, however, is connected with the expectation of reciprocity. Those who have been helped in their time of need in turn help their benefactors in the latter's own time of need. The moral meaning of reciprocity is best expressed in the

notion of a debt of gratitude, or *utang na loob.* Individuals are expected to recognize their debts of gratitude, and this is captured in the folk saying *"matutong lumingon sa pinanggalingan"* or learning to look back at from where she came. Among Filipinos, a debt of gratitude cannot be repaid in material terms and remains with the individual as long as he lives. Transgressions of this moral norm lead to gossip, bickering, and quarrels. To be labeled as *walang utang na loob,* or an ingrate, is central in the reckoning of relationships among Filipinos.

Finally, the notion of collectivity is a central and common feature of the traditional Filipino social structure. A person who is *makasarili* (individualist) is frowned upon and is regarded as unacceptable to the group. Whatever happens to a person involves his *buong mag-anak* (whole family), *buong kamag-anak* (whole immediate relatives), and *buong angkan* (whole kin group). As Jocano notes, often collective sentiments and actions are focused on activities having to do with small groups – the family and kinship groups. A person who belongs to a peer group or barkada is metaphorically referred to as *kabaro natin* (he is one of ours), *katribo natin* (from our tribe), or *hindi natin katalo* (not a competition).

Understanding the operation of these traditional norms and networks, or broadly referred to as social capital, is crucial to understanding the likelihood of successful collective action in an irrigation system in the Philippine context.

2.3 A Tradition of Collective Action

2.3.1 Ancient Irrigation Systems

The Philippines has a long history of collective action in irrigation. Archaeologists generally agree that irrigated rice culture was first introduced in the Philippines around 2,000 years ago. The Philippine rice terraces in the mountain ranges of Northern Luzon were probably introduced by proto-Malays from South China, Indochina, Formosa and Indonesia, the first wave of immigrants, who arrived in the Philippine archipelago around 1,500 B.C during the New Stone Age Period. To date, these rice terraces, some 25,000 ha, are still operated and maintained by the indigenous population. These rice terraces have earned recognition from UNESCO as a World Heritage Site as well as being recognized by professional hydraulic engineers worldwide.

Beyer (1964), a noted anthropologist, describes the back-breaking job of terrace building as follows:

> The rice terrace, properly built, consisted first in digging out a terrace from the hillside and building up a stone wall on the edge of that terrace. The back of the wall is filled up with layers of materials carried up from river beds or brought down from the hillsides which required a great deal of labor to get into place. First, farmers level the area behind the wall so as to form a foundation. Over that, they put gravel and sand, then over that, some clay. This is to make the terrace water proof. Then inside the lining they put a foot or so of sand and then some gravel. When people in the mountainside build rice terraces, they do not build them out of river bed stones but from broken stones. But later on, nature dissolves these broken stones and they erode away. As they decay and fall out, one by one, people who own these terraces carry up the slopes round hard stones from the river which may be far down the mountainside. After filling the first hole, they may see another hole. They then bring up another round stone and fill it up again. And they do this month after month, year after year, until finally that wall is made up of round stones until there is not single broken stone in it.

The estimated human labor and the need for collective action are enormous. To terrace one hectare of mountain slope would require 10,000 cubic meters of excavation,

filling and masonry. Thus, the Ifugao rice terraces alone, which cover an area of 400 square miles, would require 103.6 million cubic meters of earthworks using bare hands and crude tools. The wonder of the terraces lies not just in hydraulic engineering but also in the artisanship of the farmers who established, maintained, redefined, and enforced a system of property rights over land and water that has lasted over 2,000 years and still remains functional today.

2.3.2 Spanish Colonial Era: 1521-1896

Spain colonized the Philippines in 1521 and stayed on for close to 400 years until 1898. During this period, the Spanish King granted lands to Spanish missionaries and the colonial government. Using forced labor and inmates, the colonial government constructed irrigation facilities in these lands to help the missionaries raise additional revenues. These irrigation facilities came to be known as "friar lands or estates". The Spaniards introduced new techniques and designs in the construction of irrigation projects that were regarded as efficient and durable. Altogether, the friar estates had a total of 27,000 hectares of land irrigated, many of which are still in operation today. In 1866, the Spanish Cortes or Spanish Court codified all rules pertaining to irrigation, and these rules were extended to the crown colonies. These rules came to be known as the Spanish Law of Waters or Ley de Aguas.

2.3.3 The Zangjeras: 1630 to Present

The Zangjera, a Spanish term for irrigation turnout, is the local name for a cooperative irrigation society commonly found in the arid Ilocos region of northern Philippines. On the basis of early reports by Spanish missionaries, these societies were established around 1630. The main purpose of a zangjera is to ensure a stable and reliable supply of water for its members that range from an exclusive group of landowners, or a combination of landowners and tenants or, in other cases, tenants only. The central feature of a zangjera is the promotion of equity and fairness norms in the allocation of costs and benefits from the irrigation system.

The operation of zangjeras is a complex enterprise involving three main tasks: water allocation, physical maintenance activities, and conflict resolution (Siy 1982; Coward 1979; Ostrom 1990; NIA 1990). Unlike irrigation in the friar lands, which used forced labor and assistance from the central government, zangjeras rely mainly on self-help initiatives among its members. The costs of construction, repair and maintenance are equally shared among members through an elaborate process of allocating costs and benefits and minimizing conflicts.

2.3.4 Peasant Movements

The tradition of collective action in rural villages in the Philippines is not only confined to irrigation. There also exists a long tradition of peasant movements in the Philippines. Numerous but sporadic peasant uprisings were recorded in the pre-20th century culminating in the 1896 revolution against Spain. This revolt was largely an

uprising in response to Spanish feudalism and peasant aspirations for agrarian reform and a more just socioeconomic system (Constantino 1958).

When the Philippines was ceded by Spain to the United States at the turn of the 20th century, onerous tenant-landlord relationships inherited from Spain persisted. Not surprisingly, peasant unrest and uprisings were also numerous during this period and communist influence was increasing. When Japan invaded the Philippines in 1941, these peasant movements became an effective base for the anti-Japanese resistance movements. After the war, they became effective advocates for rural development, particularly for agrarian reform.

The ideological roots of these peasant groups run deep. The forerunner of the longest Maoist insurgency in the world, which is still being waged in the Philippine countrysides today, had origins in the Philippine peasant movement. Less radical movements also emerged from these peasant groups and continue to have a grassroots base in rural areas, including IAs. The long history of agrarian struggles and peasant movements in the Philippines should be seen as an integral part of the political context within which irrigation associations are embedded.

2.4 Constitution, Government and Economy

The Philippines is a country with an ever-changing constitution. Since 1896, when the Philippines declared independence from Spain, the country has had five constitutions. The first, the Malolos Constitution of 1899, was the product of the declaration of Philippine independence from Spain, which gave birth to the first republic in Asia. When the United States colonized the Philippines at the turn of the 19th century,

a new constitution was enacted in 1935 to strengthen US colonial authority in the archipelago. When Marcos declared Martial Law in 1972, a new constitution (1973) was drafted to serve the ends of his dictatorship. When Marcos was overthrown by a people-power revolution in 1986, a provisional "Freedom Constitution" was adopted, followed by the popularly ratified and current 1987 Constitution.

The 1973 and 1987 Constitutions are particularly relevant in this study. It was the 1973 Constitution that provided the basis for Marcos to rule by decree. In a period of two years from 1973 to 1974, Marcos issued four Presidential Decrees that strengthened the powers of NIA and ushered in a period of aid-driven expansion and modernization of irrigation in the Philippines. The 1987 Constitution, on the other hand, in response to the excesses of the Martial Law years, included major provisions on the bill of rights, the accountability of public officers, and an emphasis on social justice and human rights. This particular provision enshrined the role and rights of people's organizations including IAs. The form of the Philippine government was patterned after the American presidential system with a bicameral legislature and the separation of the three branches of government. Moves are currently underway to shift to a federal-parliamentary form of government because of the unending gridlocks in Philippine politics.

The Philippine economy is increasingly driven by the service sector. In 2004, it accounted for 49 percent of total employment. Industry accounts for 16 percent of employment. Agriculture accounted for 15 percent of GDP in 2004, but employed about a third of the population, mostly in irrigated farming. There are a total of 4.8 million, mostly small, agricultural farms, covering 9.7 million hectares or 32 percent of the country's total land area in 2002. Rice was the top temporary crop in 12 out of the 17

regions of the country in 2002, accounting for 40 percent of the total agricultural land area. Average farm size declined from 2.2 hectares per farm in 1991 to 2.0 hectares per farm in 2002 as a result of land conversions.

2.5 Contemporary Challenges

Among the contemporary challenges facing the Filipino population include: 1) increasing population growth rates, 2) wealth inequality, 3) migration, 4) deteriorating education, 5) a weak economy and 6) chronic corruption and political uncertainties.

2.5.1 Increasing Population Growth Rates

The Philippines has one of the highest birthrates in the world at 2.34. As of 2005, the population stands at 85M; at this rate, the Philippines will see a population of 100M by 2014. The population density is 2,833 per square kilometer, but is most severe in urban areas. The capital, Metro Manila, is one of the most congested and polluted cities in the world.

2.5.2 Inequality

The problem of inequality remains widespread and deeply rooted in the hacienda system spawned by close to 400 years of Spanish colonization. Agrarian reform programs in the past have sought to correct this problem, but they were mainly concentrated in rice and corn areas. In other regions in the country, semi-feudalism remains. Some of the world's richest and the world's poorest families can be found in the Philippines.

2.5.3 Poverty

Poverty is a chronic and endemic problem. About one third of the population still lives below the poverty level, as has been the case over the past decades. The average household income in 2002 was P148,000 (about $3,000). The economy has not grown fast enough in the past decades to provide adequate employment to a burgeoning population. As a result, unemployment has been chronically high.

2.5.4 Migration

The lack of employment opportunities has been driving the migration of rural families to the cities. The urban population currently stands at 48 percent, up from 30 percent in the 1970s. Poverty is also driving overseas migration. Close to seven million Filipinos have migrated or are working overseas in both blue – and white – collar jobs. The trend is increasing and has profound social, political and economic consequences. The social cost comes in terms of broken families. Philippine foreign policy has been reshaped and the protection of overseas Filipino workers and the search for foreign labor markets are primordial concerns. Migrant groups are now an established political block, winning seats in Congress and enabling the passing of legislation allowing overseas workers to vote. The economic consequence comes in the form of sustained and hefty remittance from these workers, which in 2004 reached more than $10B. These remittances are more than the annual inflow of foreign investments and have been the main reason for keeping the domestic economy afloat. The globalization of Philippine labor also has profound implications in the rural sector and may be relevant to the questions being addressed in this study. Along with India, the Philippines is one of the world's largest supplier in the global labor market.

2.5.5 Education

As a way out of poverty, Filipinos put a premium on education. Among the household population 10 years and older, 93 percent are literate or able to read and write a simple message. However, only 84 percent are functionally literate, i.e., able to read, write and have computational skills. Public education is compulsory and free up to the secondary level. However, the quality of education is deteriorating because of government neglect and the increasing influence of commercial interests driven by the demands of the global labor market.

2.6 The History of Irrigation Reform in the Philippines

2.6.1 The Rationale for NIA

Since 1913, when the first publicly owned irrigation system was constructed, and leading up to the creation of NIA in 1964, irrigation development in the Philippines can be characterized as a sporadic undertaking with short bursts of activity and long periods of inactivity (NIA 1990). For instance, of the 282,000 hectares of service area covered by national irrigation systems constructed from 1913 to 1964, about 29 percent were constructed in 1922 to 1930, about 38 percent in 1950 to 1960, and the balance of 33 percent during the intervening years and after 1960.

Thus by the early 1960s, the issue of rice self-sufficiency has become a matter of political importance. The reason is that rice yields during that time averaged only 1.7 tons per hectare, one of the lowest in the world, and a population growth rate of 2.8, which is one of the highest in the world. Thus, with a persistent annual deficit of about 400,000 tons, the national government was faced with the problem of meeting the basic food

requirement of its population. The solution was to increase production through the expansion of irrigated areas. NIA was thus created in 1964 as a semi-autonomous, government-owned, and controlled corporation by virtue of Republic Act 3601. The powers and objectives of NIA, when it was created, were as follows:

- To investigate, study, improve, construct, and administer all irrigation systems in the Philippines.
- To investigate all available and possible water resources in the country for purposes of irrigation.
- To collect from users of irrigation systems constructed by it such fees as may be necessary to finance their continuous operation, and reimburse within a certain period of not less than twenty-five years the cost of construction thereof.
- To do all such other things and to transact all businesses as directly or indirectly as necessary, incidental, or conducive to the attainment of the above objectives.

2.6.2 The Early Years at NIA [1]

NIA's main focus in its early years was in the areas of engineering and construction since most of its personnel were engineers (Bagadion 1988). It was in these areas where its personnel gained recognition and promotion for their achievements. Talented engineers went into design and construction, while those less endowed went into operation and maintenance.

[1] See Bagadion (1988) for a detailed and comprehensive account from which this section is mainly drawn.

Yet, as Bagadion further reports, it was in operation and maintenance where NIA had the severest problems, and its greatest strategic challenge. In national irrigation systems (i.e., those constructed and owned by NIA), only about 80 percent of the service area was irrigated during the wet season and about 30 percent during the dry season. Farmers often complained of unsatisfactory service, inequitable water distribution, and production that was below expectations. NIA was always operating at a loss, given that actual collection of fees from farmers fell short of government outlays. Without subsidy, NIA could not operate its systems, yet the law provides that farmers should be paying the costs of construction, operation and maintenance (Bagadion 1988: 5).

NIA's model was in sharp contrast with those of irrigation systems in the United States and Taiwan. In study tours in those countries, NIA's managers observed that irrigation systems there were being managed by farmers' associations under government supervision. This was in contrast to the institutional arrangement in the Philippines, whereby irrigation is directly being run by the central government through NIA, and irrigation performance did not matter since the staff received their salaries regardless.

Although the law implicitly provided for farmers participation in irrigation and required them to pay for construction O&M, the organization and management of NIA was not set up to allow for this. More specifically, its structure, systems and procedures, strategies, staff, skills, shared values, and leadership styles were not attuned to meet the demands of farmer participation as the following examples will show.

First, NIA's strategy to fast-track irrigation construction ran counter to the need for a slow and painstaking effort of building farmer capacities to enable them to participate more meaningfully. Second, NIA's standard procedure for involving farmers

in irrigation planning was to post notices announcing that a system would be built, that government would manage the system once built, and subsequently charge fees to the users. Citizens were allowed to file a written protest but, if there was no opposition, NIA would go ahead with the project. Third, the structure of NIA at that time did not provide for a unit that would be responsible for organizing and training farmers. Thus, the staff and the needed skills were not there from the beginning. Fourth, the culture or shared value of farmer participation was lacking at NIA and the style and orientation of its leaders was also not conducive to farmer participation. In short, there was a strategic misfit between NIA's organization and management and the demands for farmer participation.

The emphasis of meeting engineering specifications and timetables – as committed to donors – coupled with the misfit in NIA's organization and management, had a number of adverse consequences. First, most of the IAs organized by NIA – although properly documented according to law – were largely paper organizations unable to run their affairs and manage the irrigation systems after construction.

Second, although these associations were expected to maintain these facilities, most of them did not bother to do so since they could lobby with their congressman for pork-barrel irrigation assistance. Irrigation systems thus fell into disrepair. Third, and more significantly, many irrigation projects – such as the 100,000 hectare Upper Pampanga River Project – were built in areas where there already existed farmer-built and managed irrigation systems. The previous practice of allowing farmers to construct farm ditches was abandoned to the meet specifications and timetables that have been committed to donors. NIA assumed the responsibility of constructing the ditches itself to

meet the timetables. Not surprisingly, farmers were unhappy when the systems began to operate. They complained that the canals made by NIA were not appropriate for their needs. They took matters into their own hands and created their own farm ditches and erased what NIA had earlier constructed. NIA called these practices "illegal turnouts" since they were not authorized. Studies later showed that these so-called illegal structures constituted a significant portion of the area being irrigated – about 40 percent in the case of the Upper Pampanga Project. While NIA was successful in constructing new irrigation systems, it was not as successful in their O&M. A stronger role for irrigation associations in irrigation development and management has therefore become an important concern for NIA.

2.6.3 The Growth of NIA under Martial Law

Then-president Marcos declared Martial Law on September 1972. Congress was abolished and Marcos ruled by decree. Marcos had a vision of a strong state patterned after that of South Korea, Taiwan and Singapore. Marcos called it the New Society Project whereby the State – in contrast to the oligarchic rule that had choked the country for decades – would play a central role in all spheres of development. One of the objectives of the New Society Project was to achieve self-sufficiency in rice production and for the Philippines to become a net rice exporter. Irrigation expansion is central in meeting this objective and NIA would be thrust in the forefront of this New Society Project.

Under this project, NIA found a personal patron in Marcos, who was driven by a personal desire to achieve rice self-sufficiency and fulfill a pledge for the Philippines to

become a net rice exporter. In 1974 alone, Marcos successively issued four presidential decrees (PD) that led to significant changes and rapid growth at NIA.

The first decree was PD 1067, which provided for the Water Code of the Philippines, a crucial law that NIA helped to draft, which, among others, strengthened the legal rights of irrigation associations to water. It made the right to use water appurtenant to the grantee rather than to the land, as was the case under the Irrigation Law of 1912. This provision meant that IAs could now become legal holders of water rights, which gave them full powers to allocate and distribute water in the most equitable and productive ways possible. The code also strengthened the role of IAs 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 also declared as State property and no longer to the landowner. This facilitated the granting of water rights to IAs for groundwater use.

The second decree was PD 4242 issued March 28, 1974, creating the National Water Resources Council (NWRC) with the objective of undertaking a scientific and systematic development and management of all water resources in the country consistent with the principles of optimum utilization, conservation and protection of these resources to meet current and future needs.

The third decree was PD 552, issued during Marcos's birthday on September 11, 1974, which radically amended NIA's charter. These amendments increased NIA's capitalization from P300M to P2B and authorized NIA to incur foreign loans. It also empowered NIA to administer all communal irrigation systems constructed or repaired with public funds and to recover these costs from farmers and authorized NIA to delegate partial or full management of national irrigation systems to irrigator associations.

Finally, PD 1702 was issued on July 1980, which further amended NIA's charter by raising its authorized capital stock from P2 billion to P10 billion (or a 500 percent increase). It also allowed NIA to impose a 5 percent charge for every project overhead and administrative cost to become part of its capital.

The amendments introduced by PD 552 and PD 1702 altered the incentive structure at NIA. PD 552, which amended NIA's 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 meant that NIA could now keep whatever it collected as irrigation fees from farmers as well as funds recovered from equipment rental, and administrative charges it collected from foreign projects. The understanding from budget authorities was for NIA to gradually phase out the subsidy for O&M over a five year period and thereafter to depend on collections from farmers for its O&M. PD 1702, on the other hand, increased NIA's appetite for foreign-funded projects because this provided an explicit subsidy, in the form of the 5 percent overhead charge, that helped to finance NIA's administrative costs.

According to Bagadion (1988), these amendments to NIA's charter increased the incentive for its personnel to focus on collection of irrigation fees as this meant more funds for irrigation O&M. Yet, no matter how hard NIA would work to collect irrigation fees, and even if it managed to collect 100 percent of the fees, many small national systems would still not become financially viable under its management. The reason is in the economies of scale: to operate even a small system (less than 1,000 hectares), NIA would need 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 percent of irrigation fees are collected, this would not be enough to cover staff salaries and benefits. The option of raising the fees higher than what is collected in other larger national systems was out of the question.

The solution, according to Bagadion, was to organize IAs that would then be contracted to carry out NIA's erstwhile functions, but at a much lesser cost. NIA could now just focus its attention on headworks and the main irrigation canal 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 irrigator associations.

Thus, by 1975, according to Bagadion, the policy framework for potentially strong IAs was already in place. What was lacking, however, was NIA's capacity to actually organize them. Its track record was not particularly encouraging and its attention had been focused on accelerating irrigation construction. A decision was reached, then, to engage the services of another government corporation – the Farming Systems Development Corporation (FSDC) – to do the task of organizing farmers. NIA has had a high expectation that FSDC would do the job given its earlier experience in organizing small-pump IAs. As it turned out, this arrangement proved to be more of a problem.

The arrangement was for NIA to lead in the physical construction while FSDC would be responsible for organizing farmers on the assumption that these two tasks were independent of each other. Coordinating committees at various levels (from the national to the provincial levels) were organized and regular meetings held, but this wasn't enough to solve many detailed village-level problems that cropped up on a daily, if not a

weekly, basis. The objective of having capable farmers undertaking O&M was not being realized.

Given the strategic importance of IAs in NIA's long-term objectives, its top management decided to try developing NIA's own capacity to organize farmers. In thinking about a strategy to organize farmers, the following lessons were drawn from the experience of indigenous irrigation, of which the Philippines has had a long history:

1. While it was difficult for the government to organize IAs, indigenous IAs have sprung up spontaneously and have survived over the centuries – examples of which include the more than 2,000 year-old rice terraces in the Cordillera Region and the centuries-old Zangjeras in the Ilocos Region.
2. These indigenous irrigation systems had been operated and maintained without assistance from the central government.
3. While the physical structures were not technologically complex, the institutional structure was complex. For instance, farmers had complex rules for equitable water allocation and distribution of water, for canal maintenance, for repairing rock and stone diversion weirs, and for penalizing violators and settling conflicts.
4. The best of such groups are characterized by a strong grassroots base, with leaders who are dedicated and knowledgeable about their irrigation system. Each member knew of his obligation, did the work expected of him/her under the rules of the association, and was penalized for failure to do so.
5. The main difference between these indigenous associations and those organized by government is in the farmer's role in constructing their own irrigation systems.

6. Government could not simply leave the development of communal irrigation to farmers entirely to the initiative of farmers because of the growing population and the increasing demand for food that required the expansion of irrigation. What was needed was governmental assistance that would strengthen the farmer's sense of ownership of the irrigation system rather than undermining them.

As Bagadion further notes, the basic concept for organizing farmers was for NIA to provide technical and financial assistance, but in a manner that would maximize farmer's participation in the planning, design and construction of the system as well as in its operation and maintenance. NIA's top management, however, had a number of questions: (1) How would such a participatory approach be implemented? (2) Would such an approach lead to more viable irrigator's associations? (3) If so, how could processes be developed for applying such an approach on a broad scale throughout the NIA?

2.6.4 Decentralization Pilot Projects

Starting in 1976, NIA embarked on a series of four pilot projects in communal or small irrigation systems (less than 1,000 ha) to answer these questions. College-educated community organizers were immersed in these pilot sites to facilitate community organizing. They were given intensive trainings about community organizing and in various aspects of irrigation O&M. They were then integrated with the local communities by participating in various community affairs, including farming.

Upon gaining the community's acceptance, these organizers acted as facilitators between NIA engineers and the community. They helped facilitate the legal

documentation and registration of the new association and served as a provider of information to the community regarding NIA's programs. They encouraged farmers to form various committees for various tasks in irrigation construction and O&M and in order to promote widespread grassroots participation. After several negotiations with NIA's personnel, an agreement was reached concerning the project components and the duties and responsibilities of the parties. NIA would improve and expand the irrigation system and the IA would operate and maintain the new facility and repay the cost of construction, including putting upfront an equity contribution in labor and materials equivalent to 10 percent of the total project cost. This requirement created an incentive for them to mobilize labor the counterpart and to closely monitor the costs incurred by NIA – the use of equipment, fuel and materials – as they would be the one who would eventually have to pay for these.

These pilot projects soon attracted the interest of a number of institutions, namely the Institute of Philippine Culture of the Ateneo de Manila University, the Asian Institute of Management, and the International Rice Research Institute. By early 1979, these institutions agreed to form, with NIA and the Ford Foundation, a working group called the Communal Irrigation Committee to assist NIA in improving its farmer participation program. This group was later on expanded to include other universities and research centers. This working group proved to be an instrumental catalyst in facilitating organizational reform within NIA as it helped overcome many of the obstacles inherent in bureaucratic change. Three years after the start of the pilot projects, some of the key lessons learned were as follows:

1. Enough lead time (about ten months in the case of the smaller pilot project) should be given to community organizers for mobilizing farmers prior to construction.
2. Engineers and organizers need to work closely to integrate the technical and organizing aspects into one process.
3. Agency policies and procedures that obstructed farmer's participation needed to be discarded and modified.
4. Farmers were willing to participate extensively in planning and construction and such participation enabled them to suggest canal locations appropriate for their needs. The labor and material counterpart of the farmers reduced government expenditures.

2.6.5 Scaling Up the Pilot Projects

By 1979, with these lessons on hand, NIA's management felt that the new approach could now be scaled up throughout the agency. This was to become a landmark decision in the history of NIA that launched an era in which the development of irrigator's associations would stand on equal footing with the more traditional and dominant role of construction. A decision was reached by NIA that similar learning laboratories would be expanded to all of the 12 regions nationwide to develop the capability of the regional staff in the participatory approach.

By 1981, the program was further expanded down to the provincial level with about one third of the 68 provincial offices participating. In mid-1981, the World Bank offered to fund the Communal Irrigation Development Project to roll out nationwide what

then came to be known as the Participatory Irrigation Management (PIM) Program. By 1982, all provinces nationwide were participating in the program and by 1983, the program became a standard operating procedure in small irrigation systems at NIA.

In the larger national or government-owned irrigation systems (with service areas greater than or at least 1,000 hectares), a pilot project was also launched in late 1980s funded by the US Agency for International Development (USAID). The pilot project replicated the processes undertaken in the small systems with the goal of developing associations capable of managing entire systems in the case of small national systems (below 1,000 hectares) or entire secondary canals in the case of the larger systems (3,000 ha and above). This was particularly important and pressing to NIA as the national systems constituted a major part of its O&M problems and the Budget Ministry had been increasing pressure on it to cover its O&M costs from irrigation fees.

To underscore the importance of financial viability, NIA revamped its accounting system in mid-1983, creating clear cost-centers for each of its national systems. The procedure allowed the staff in these systems to know the exact status of collections versus expenditures for their system. NIA's top management then emphasized the importance of financial viability of each system, province and region for purposes of personnel evaluation. A unit is deemed viable when its income exceeds its expenditures for O&M. This inevitably reinforced in NIA's field staff the need for developing strong IAs that could bear a greater share of the O&M activities. This perception helped promote the rapid spread of the participatory approach to other national systems.

By mid-1986, the participatory program in the larger national systems had expanded to cover some 35,000 hectares in 37 systems. In nine of these systems,

management responsibilities were fully transferred to the IAs while the other 28 were under joint management. In systems fully turned over to farmers, the IA was required to pay for the cost of construction similar to the case of smaller communal irrigation systems. In the case of joint management, NIA was responsible for the diversion weir and the upper part of the main canal while the IA was responsible for managing the rest of the system and collecting fees from the farmers. Irrigation fee collection under joint management was negotiated between NIA and the IA, with the precise revenue sharing modified to suit the conditions of the irrigation system. A typical arrangement was for NIA to give IAs 35 percent of the total amount collected up to 50 percent of the billings and 65 percent of whatever was collected beyond 50 percent of the billings.

Bagadion (1988) attributed this rapid process of upscaling the participatory program in the communal system to several factors: (1) a strong policy support provided by NIA's amended charter (PD 552); (2) the experience gained from the four years of pilot project; and (3) the support from the Communal Irrigation Committee, which ensured that field-level experience was extensively reviewed, lessons systematically extracted, new methodologies developed and agency procedures and policies amended to support the new approach.

2.6.6 Lessons Learned

Korten and Siy (1988) summarized, as follows, the key lessons from these pilot projects that they regard as important in the process of transforming NIA.

Legal Policies

Legal recognition of IAs as a precondition for their active collaboration with government in irrigation development is important. When groups of citizens are expected to carry out an important task in an organized manner on a long-term basis, their organization needs clear societal recognition. One means of conveying such recognition is for the group to exist as a legal entity.

Financial Policies

a. Cost-recovery policies motivated farmers to assume greater responsibility for irrigation development and system management. If carefully constructed, financial policies can be a powerful tool for motivating citizens to take responsibility for tasks within their capability and for compelling a government agency to treat the people it serves as respected clients.

b. The partial recovery of investment costs from farmers encouraged them to participate in key decisions, helped to curtail excessive spending, and promoted a sense of collective ownership of the irrigation facilities. The obligation to repay the cost of construction motivated the farmers on communal systems to be involved in decisions regarding what was to be built. Their perspective provided a grassroots check on the common tendency of irrigation agencies to install more sophisticated and more numerous facilities than are actually required for effective irrigation.

c. The structure of irrigation fees and amortization payments encouraged farmers to assume maximum responsibility for system O&M. Associations were given a

chance to retain a portion of the irrigation service fees if the association assumed the management of a subsection of the system.

d. NIA's status as a "semi-autonomous corporation," dependent for its routine operating budget primarily on payments from farmers, encouraged the agency to develop a service orientation toward its clients, the farmers. NIA's routine operational costs, which had to be recovered primarily by collections from farmers, encouraged NIA personnel to view farmer's as clients, whose willingness to pay was a direct function of their satisfaction with the services provided. The need to collect revenues from farmers heightened the NIA personnel's interest in participatory methods, which were an important means of achieving farmer satisfaction so clearly needed for the agency's own viability.

Organizational Policies

a. For IAs, the clear match between the membership of the organization and the command area, in the case of communal irrigation systems, promoted farmer's capacity to manage the system. The formation of IAs in communal systems followed the principle of one IA one system. All farmers served by the network of canals using the same source of water were supposed to be members of the same IA.

b. The unified authority of the NIA, with regard to irrigation development and management, contributed to the agency's ability and desire to serve farmers' irrigation needs.

Methods

a. A working group, composed of agency personnel and academics from several different disciplines, helped develop new methods and guided NIA's transformation process. The working group, called the Communal Irrigation Committee, intensively examined experience in initial pilot projects, searching for ways in which the program needed to be improved, and monitoring readiness to expand it to additional sites.

b. The expanded use of participatory approaches to irrigation development was achieved by gradually involving an increasing number of key NIA personnel in the development and refinement of new methods and procedures. The process by which the new methods were developed and introduced into the agency was as important as the methods themselves. Following a social learning perspective of organizational change, the working group encouraged substantial participation from people who would be implementing the new methods. A series of workshops and training programs were used as a forum in discussing the new participatory approaches, eliciting ideas about possible future needs and problems and airing possibilities for change.

Management

a. The addition of a cadre of community organizers broadened the capabilities of NIA and improved its relationship with farmers. The integration of a new type of personnel, the irrigation community organizer, into the technically oriented agency created a new organizational dynamic. The organizers lived in the village and insisted

that technical staff listen to the farmer's concerns. The role of the community organizer's was fully supported by NIA's management.

b. Budget systems were adjusted to support a client-responsive mode of operations. Funds for project preparation were increased, which allowed NIA to select sites with care, increasing the likelihood that assistance would be directed to sites where farmers wanted it and where real benefits could be derived from the assistance. Another budgetary reform was the allocation of the communal irrigation development budgets on a regional, rather than on a per project basis. This enabled NIA to assure farmers that once agreements had been reached regarding assistance to be provided, funds would be available to meet those agreements.

c. Clear points of responsibility for the results achieved under each project helped promote integration of the social and technical aspects of the work.

d. Performance measures for NIA personnel – such as financial viability – encouraged greater accountability to the farmers they served. Each provincial and regional irrigation office and each national irrigation system was designed as a cost center expected to achieve financial viability, i.e., income greater than expenses. The surplus or deficit of such cost centers was among the primary performance indicators for managers of those units. This yardstick permitted national-level policies to have a direct bearing on individual NIA employees, forcing them to seriously take the matter of collecting payments from their clients. It also forced agency staff to reduce operating costs by building capacities of farmer groups to assume greater responsibility for O&M. Amortization payments also helped engineers focus their attention on increasing actual

irrigated area rather than the previously dominant criteria of "generated area", i.e., potential area served by canals regardless of whether water actually reached those areas.

2.6.7 Evaluation of the Participatory Program

An independent impact evaluation of the program in communal irrigation systems confirmed the positive expectations from farmer participation. De los Reyes and Jopillo (1986) found clear evidence that farmer participation produced consistently positive results in irrigation. Canals and structures built were viewed by farmers as more functional and the systems more productive, with greater increases in rice yields and irrigated area in the dry season. Participatory approaches also led to a more equitable water distribution and better financial management.

With regards to the impact of joint system management (JSM) between NIA and IAs in large irrigation systems, Bagadion (1994a) reports the following results from a case study on the Malasila River Irrigation System (MalRIS):

- Irrigated areas under JSM increased by 12 percent during the wet season and 30 percent during the dry season; this was achieved without an increase in the amount of irrigation water distributed, which meant a more efficient and equitable water distribution.
- Crop yields in areas under JSM increased by 4.6 percent during the wet season and 11 percent during the dry season.
- Financial surplus in JSM areas increased by six-fold to P331,000 largely because of the cost savings by NIA resulting from the contracting of IAs for irrigation fee collection, canal clearing and water distribution;

- JSM enabled NIA and the IAs to establish approaches and procedures for resolving irrigation conflicts and foster other forms of cooperation that had not been possible before.
- JSM helped build the capacity of IAs to undertake O&M and enable them to build up their capital base.

2.6.8 Expansion of the Decentralization Program

By the mid-980s, with these highly positive results, NIA's participatory program had already been widely promoted worldwide and had gained international recognition and widespread documentation and adaptation in several countries. With these encouraging results and international recognition, the participatory irrigation management program in the Philippines was expanded in 1987 to cover all of the national irrigation systems. This expansion was funded initially by the World Bank's Irrigation Operation Support Program (IOSP) I and the USAID's Accelerated Agricultural Production Program. The procedures for farmer participation developed in the pilot areas were followed under these two projects – and also applied in all other irrigation projects in national systems – but two important modifications were made:

1. The catalysts for organizing the IAs were farmers trained by NIA as farmer irrigation organizers (FIO) in contrast with the previous practice of NIA hiring college graduates as community organizers. The FIO's were placed under the guidance of experienced institutional development officers of NIA. The process for organizing an IA – as fine tuned from the experiences in the pilot projects – is summarized in Annex 2.1.

2. The terms and rates for irrigation fee collection and sharing were imposed unilaterally by the NIA instead of being negotiated with the IAs.
3. Four types of contracts between NIA and the IAs were introduced in the national systems (Annex 2.2).

In the1990s, a number of follow-up projects were undertaken to further support the expansion of the participatory approach in all national systems. For instance, the Irrigation Systems Improvement Project (ISIP) I, funded by the Asian Development Bank (ADB), was launched in 1980. The communal irrigation project, which funded the expansion of the participatory approach in small systems in 1981, was followed up in 1990 with a phase 2 project. In 1993, the World Bank followed up on its earlier IOSP I Project, which funded the expansion of the participatory approach nationwide. In 1996, the ADB also followed up with phase 2 of the ISIP project and in the same year the World Bank also funded the Water Resources Development Project (WRDP). Altogether, 17 major irrigation projects were launched during the period from 1990 to 2000, worth $745M, all of them having components whereby IAs would be organized and contracted for O&M. Except for the conversion of Type III contracts into Joint System Management / Irrigation Management Contracts, few modifications were introduced in these projects.

These projects would boost the coverage of the areas contracted by NIA to IAs such that by 1994, 70 percent of the total area of large-scale irrigation systems had been contracted out to IAs, up from 25 percent in 1985. The total percentage of canal maintenance done by NIA dropped from 81 percent in 1985 to 47 percent in 1994, and the percentage of total area where irrigation fee collection was done by NIA dropped from 85 percent in 1985 to 53 percent in 1994. Interestingly, however, during the ten-

year period from 1985 to 1994, only 8,000 hectares were actually transferred by NIA to 26 IAs for their full management. This figure translates to less than 2 percent of the total service area of the national systems. Table 2.1 provides a summary of the coverage of the contractual relations between NIA and IAs from 1985 to 1994.

Table 2.1 Transfer of Irrigation Management Responsibilities to IAs, 1985 to1994

Type of Arrangement	1985		1991		1994	
	Area (ha)	No. of IA	Area (ha)	No. of IA	Area (ha)	No. of IA
Type 1-Canal Cleaning / Water Distribution Contract	58,390	239	151,027	472	154,626	493
Type 2 – Irrigation Fee / Water Distribution Contract	34,774	107	100,680	348	112,314	474
Types 1 and 2 a. Sharing of collections fixed b. Negotiated sharing of collections NIA and IA	 24,008 20,986	 69 53	 99,276 8,750	 385 22	 142,245 39,452	 474 100
Type 3 – Full Turnover Contract	4,823	15	11,617	33	12,399	41
Total	142,923	483	371,350	1,260	456,536	1,319
Service area (ha)	567,160		637,318		646,519	
% covered by contracts with IAs	25%		53%		70%	
% of canal maintenance by NIA	81%		57%		47%	
% of area where collection was by NIA	85%		65%		53%	

Source: Bagadion 1995; NIA Consult for 1984 and 1991.

2.6.9 The Irrigation Policy Environment in the 1990s

In the 1990s, the irrigation policy environment was also undergoing structural reforms. In 1991, the Local Government Code of the Philippines was 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 irrigation associations and recognizing their role in the operation and maintenance of public irrigation systems.

In 1997, a landmark legislation – the Agriculture and Fisheries Modernization Act or AFMA (Republic Act 8435) – was passed. Among the salient provisions of the law with regards to irrigation are as follows: (1) recognizing the role of IAs and (2) reiterating NIA's mandate to gradually turn over the responsibilities for O&M in secondary canals and all farm facilities of all national systems to irrigation associations. 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 been using 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 the national systems, the full turnover of irrigation management responsibilities had materialized in only 15 percent of IAs and mostly involving smaller, less viable systems.

2.6.10 Summary

Like most developing countries, modern irrigation in the Philippines went through several phases. The first phase can be characterized as a capital intensive, government-sponsored expansion phase that occurred during the period of the "green revolution" and during the Marcos martial law years in the mid-1970s to the mid-1980s. During this period, NIA's charter was amended, its capitalization increased by more than 33 times and its staff by 9 times, the role of IAs was recognized, and water were rights defined. During this period, irrigated areas grew from 742,447 ha to 1,436,880 ha, an increase of

93 percent or an annual average growth rate of 7.19 percent, which is 3.5 times faster than the international annual growth rate of 2 percent a year for the same period (NIA 1990). It was during this period that NIA gained international recognition as the finest irrigation agency in Asia and the developing world.

The second phase of modern irrigation in the Philippines was the incremental improvement phase during the mid-1980s to the present. During this period, the role of NIA in irrigation development was largely accepted and uncritically questioned. The type of irrigation projects during this period took the existing incentive structure and modus operandi of NIA as given and did not adequately examine alternative governance modes of providing irrigation to farmers. In fact, during this period, the role of NIA was reinforced by the national government and donors alike by building its capabilities through staff training, new irrigation technologies, equipment outlays, information and decision support systems, and other managerial and technical improvements.

These capabilities were further augmented by organizing IAs to serve as NIA's contractors in the collection of irrigation fees and O&M of irrigation systems. The Philippine model of decentralized irrigation management followed an incremental, voluntary approach. The transfer was first done at the tertiary canals for IAs with service areas up to 200 ha and these could then federate at the secondary level. For some minor (1000 ha) and medium-scale systems (2000ha), the IAs could federate up to the level of the entire system. In large irrigation systems, farmers' control was effectively limited in tertiary canals while NIA retained control of main and secondary canals. Most of the irrigation systems turned over by NIA to farmers were those below 1,000 ha. Thus, after more than 25 years since the so-called participatory irrigation management program was

launched, and for which NIA gained international acclaim, no more than 15 percent of the total irrigation service areas in the Philippines were actually effectively transferred to farmers.

NIA's model of IMT in the large-scale irrigation systems constituted two distinct types. One is administrative decentralization, particularly the *deconcentration* of provision responsibilities – i.e., the transfer of decision-making authorities over O&M functions to lower levels of the NIA hierarchy - and the *privatization or contracting out* of the production of O&M services to IAs. This is the case for 85 percent of the irrigation systems where IAs were organized and contracted by NIA to serve as its agents in O&M. Under this set up, there is an upward flow of accountability as the IAs are accountable to NIA as contractors, and regional field offices are accountable to the NIA central office. These IAs are not autonomous on matters of rule making and they have little control over the irrigation infrastructure and finances, O&M, conflict resolution, the right to withdraw water, and most importantly, the right to exclude non-members or non-payors from receiving irrigation services.

The other model can be properly described as *political or democratic* decentralization. In this set up, the authority, responsibility, and accountability for irrigation O&M are fully transferred to the farmers through their IAs who are downwardly accountable to their members. These IAs gain autonomy and discretion from NIA in rule making and enforcement and they have full control over the irrigation infrastructure and finances, O&M, conflict resolution, the right to withdraw water, and most importantly, the right to exclude non-members or non-payors from receiving irrigation service. How these two types of IMT models – administrative decentralization

through deconcentration, and privatized O&M vs. political decentralization – would matter in terms of performance, and how they matter given variations in the physical and social contexts of irrigation systems is the subject of chapters six and seven.

CHAPTER THREE

THEORY AND METHODOLOGY

3.0 Overview

In this chapter, I lay out the theoretical and methodological components of my dissertation. I begin with an overview of the theoretical issues related to my research puzzle of decentralization and poor performance in large scale irrigation systems in the Philippines and then discuss my research hypotheses to explain this puzzle. I then present an operational definition of my key variables followed by discussion of research methods including a description of the study population, justification for the study site, data sources, and methods of data collection as well as issues of measurement reliability and how they were addressed. I then discuss my analytical methods by briefly examining methodological issues in social science research, in the analysis of institutions, common-pool resources, and irrigation in particular and then discuss my own analytic approach. I conclude by discussing issues related to the validity of inference and how they were remedied.

3.1 Theoretical Discussion

In this section, I examine the theoretical debates that seek to explain the factors that influence the incentives of three key players in large scale public irrigation systems in developing countries: irrigation bureaucrats, donors, and farmers. My focus on the incentives faced by these key actors and the factors that shape their incentives is central to my analysis.

I first examine the rationale for the creation of irrigation bureaucracies and an explanation of the incentives facing irrigation bureaucrats in developing countries. I then examine the role of foreign aid in irrigation development, the kinds of incentives that might be embedded in this type of aid, and how these incentives might influence the behavior of irrigation bureaucrats. Finally, I examine the theoretical debates that attempt to explain the conditions that facilitate or constrain the ability of farmers to deal with collective action problems in the O&M of irrigation systems.

3.1.1 Irrigation Bureaucracies: Rationale and Incentives

The economic rationale for government intervention in irrigation – and thus the creation of irrigation bureaucracies – has been justified on the following grounds (Subramanian, Jagannathan and Meizen-Dick 1998): (1) the lumpy capital requirement needed in irrigation infrastructure for which the government would have the comparative advantage of mobilizing; private capital markets are more likely to undersupply irrigation infrastructure given the high risks and low return characteristics of most agricultural systems; and (2) the existence of externality problems stemming from excessive water extraction and environmental impacts such as increased salinity.

The political rationale for government intervention in irrigation, on the other hand, is based on the perceived strategic importance of water in terms of affordable, and secure food supply, in improving the health and productivity of water users and ensuring positive environmental impacts of water services.

Scholars have suggested that public bureaucracies, however, are faced with several inherent incentive problems (Weimer and Vining 1999). These problems include:

(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 a 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, 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.

Limited competition is another inherent problem faced by public bureaucracies (Weimer and Vining 1999). 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. Incentives to innovate, however, do exist in public agencies. Professional prestige and career advancement are some of these incentives but they do not operate as consistently as the profit motive or a threat to the survival of the private firm.

The problem of limited competition - and thus the public policy rationale for creating governmental irrigation bureaucracies – arises because of the following characteristics of providing irrigation systems in developing countries (Subramanian, Jagannathan, and Meinzen-Dick 1997): (1) the lumpy capital investment required for irrigation infrastructure and the ostensible comparative advantage that national

governments have in mobilizing such capital; (2) private capital markets that 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.

Ex-ante controls and the inflexibility of the civil service system is another inherent problem facing public agencies (Weimer and Vining 1999). 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 make it difficult to weed out the incompetent and unproductive (Johnson and Libecap 1989).

Scholars of bureaucracies, particularly those who study the power of bureaucracies in the decision making process, suggest that one of the main characteristics of the modern state has been the manner in which bureaucratic power has increased by serving itself rather than the public interest. Public choice theorists in particular are concerned with the rationale and motivations of administrative agencies and government departments. Tullock (1975) laid the basis for this debate on the dangers of the power of bureaucracy and the politicization of economic and public policy. Public choice scholars such as Niskanen (1973) examined this debate using neoclassical economic models, while Downs (1967) employed theories of psychological motivation. A fundamental assumption employed by these public choice theorists is that the study of politics, policy-

making, and bureaucracy should be based on the same set of assumptions which were used to explain the behavior of the firm – self-interest.

Niskanen (1973), for instance, suggests that just as firms seek to maximize profits, those who work in bureaucracies seek to maximize their budgets and the size of their bureaus as this is the only way they can maximize their self-interest. The growth of budgets and the size of the bureau are the primary ways in which bureaucrats maximize their own utility. Unlike firms in competitive markets that attempt theoretically to maximize the difference between marginal returns and marginal costs, public bureaus do not know even in theory what the gains are and thus can only increase their marginal benefits by increasing the size of the bureau's budget. This bureaucratic behavior is made possible because politicians themselves are pressured into making promises to increase public spending.

Downs (1967) on the other hand uses psychology to understand bureaucratic behavior. Like Niskanen, he begins with the assumption that decision making in bureaucracies is informed by self-interest. He argues, however, that the motivations of individuals are diverse which gives rise to different kinds of bureaucrats. He classifies bureaucratic motivation as either being pure self-interest (power, money, prestige, convenience) or mixed (personal loyalty, desire to serve public interest, pride in performance of work etc). Just as there are various kinds of bureaucrats, according to Downs, so are there different kinds of bureaus depending on where they are in the bureaucratic life-cycle.

Critics of public choice models of bureaucracies, however, point to the major difficulty, from a methodological view, of empirically testing or falsifying the standard

economic model. They argue that empirical research on the question of budget maximization has not yielded the kind of evidence that would support this theory (Lewin 1991).

3.1.2 Incentives in Irrigation Aid

Irrigation aid plays a central role in irrigation development in developing countries, yet little is known about how it influences the incentive structure faced by irrigation bureaucracies. There is extant literature on foreign aid (see Gibson et al. 2005) and two problems are particularly relevant in my study: the problem of moral hazard and aid fungibility. The problem of moral hazard and aid fungibility arises from the dependence of irrigation agencies on foreign aid and the difficulties of using aid as an incentive for policy reform. Moral hazard generally refers to postcontractual opportunism (Gibson et al. 2005) while fungibility occurs when a borrower uses aid to replace internal budgets that should have otherwise been programmed for that purpose (Auer 2005).

Collier (1997, 1999) summarizes the difficulties of using aid as an incentive for policy reform. Collier conceives 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, cited in Gibson et al. 2005) notes that a donor's offer of aid for policy reform does not necessarily induce a supply response from recipients for several reasons. 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, the costs to defaulting on the promises of policy reform due to moral hazard are small. 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. Therefore, officials working for aid agencies 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,* August 5, 2000 cited in Gibson et al. 2005).

3.1.3 Incentives of Farmers: Conditions for Collective Action

Scholars of common-pool resources and collective action suggest multiple variables as being theoretically relevant in answering the puzzle of collective action in common pool resources (Agrawal 2001; Baland and Plateau 1993; Ostrom 2001; Wade 1988). These variables have been broadly categorized in terms of the physical characteristics of the resource, the attributes of resource users and institutional arrangements.

The physical characteristics of the resource influence the difficulty of exclusion and nonrivalry, and thus the costs of monitoring and enforcement. For instance, public goods are characterized by difficulty of exclusion which enables actors to free ride. Common-pool goods, on the other hand, are characterized by a difficulty of exclusion and rivalry that lead to the problems of congestion and overuse in addition to potential free riding (Ostrom and Ostrom 1977). The costs of monitoring a resource and the behavior of resource users may also be affected by certain physical characteristics of a resource such as: (1) stationarity; (2) storage capability; (3) clarity of boundaries; and (4) resource scarcity (see Agrawal 2002; Uphoff, Wickremasinghe and Wijayaratna 1990; Sengupta 1991; Ostrom, Gardner, and Walker 1994; Baland and Plateau 1993; and Wade 1988 for a discussion of these variables).

In the irrigation literature, scholars debate how water scarcity, cropping intensity and infrastructure condition, the size of the irrigation area and the distance of irrigation systems from market centers influence the levels of cooperation and free riding among farmers. I examine each of these theoretical arguments below.

Water scarcity and cropping intensity

There is agreement among scholars that self-organization among farmers would be unlikely unless they perceive that irrigation water is relatively scarce, water flow is moderately predictable, and the irrigation area is moderately sized. Agrawal (2002) suggests that water scarcity and collective action are related in a curvilinear manner. This view is also held by Uphoff, Wickemasinghe, and Wijayaratna (1990) who suggest that, using data from Sri Lanka, farmers are more willing to manage and maintain systems when water is neither extremely scarce nor extremely abundant but is only relatively scarce.

Size of Irrigation Area

Wade (1988) suggests that the smaller and more clearly defined the boundaries of the common pool resources, the greater the chances for success of collective action. Conversely, the larger the size of the irrigation area, *ceteris paribus,* the higher the cost of monitoring and enforcement and hence the likelihood of free riding. Meinzen-Dick et al. (1997) notes, however, that irrigation scholars sometimes do not differentiate between the size of the irrigation area and the number of farmer appropriators. This leads to problems of conceptual validity since an irrigated area may have large numbers of farmers owing to small farm holdings while another may have a large land holding but smaller numbers of farmers.

Distance from Market Centers

Agrawal (2002) notes that little attention has been paid to the role that market pressures play regarding collective action in common pool resources. The conventional view is that increasing integration with markets usually has an adverse impact on the

management of common pool resources, especially when roads begin to integrate distant resource systems and their users with markets (see Meinzen-Dick et al. 1997). As local economies become better connected to larger markets and common property systems confront cash exchanges, subsistence users are likely to increase harvesting levels because they can now exploit resources for cash income as well.

In irrigation, the accessibility of the system to markets has contradictory effects in the literature (Meinzen-Dick et al. 1997). Increasing market pressure leads to increasing anonymity among actors, which lessens mutual dependencies, looses traditional social ties, and reduces the interlinkages for possible reprisals in the case of adverse behavior (Ostrom and Gardner 1993). The result is a reduced prospect for cooperation (Bardhan 1993). It is in this sense that Agrawal (2002) posits market pressure as a predictor of group interdependence.

Another view holds that market penetration can increase the returns to irrigated farming and thereby the farmer's incentives to participate in the IA (Tubpun 1986; Jackson 1991). Meinzen-Dick et al. (1997) suggest that the impact is more determined by market structure rather than the degree of commercialization. Irrigation systems with low labor market activity are more likely to rely on direct participation and labor in-kind contributions from members. IAs in these areas are more likely to be multipurpose social organizations. In contrast, irrigation systems closer to highly commercialized areas, and thus benefiting from higher labor market activity, are more likely to employ specialists for daily operations with members making cash contributions. Associations in these areas are more likely to be more specialized. These studies, however, deal largely with free riding in terms of labor contribution but not with monetary contribution.

In addition to the effects of the physical characteristics of the irrigation system on the levels of cooperation, scholars also debate how the following variables influence the levels of cooperation among farmers: age and origin of the IA; poverty levels among farmers; size of the user group; salience of irrigated farming; gender composition of the IA; land tenure; communication; and IA autonomy.

Age and Origin of the IA

Various scholars view the age and origin of the IA as important factors in explaining collective action. The conventional view is that in general, the older IAs patterns of interactions have had more time to be established as shared patterns of understanding. As Meinzen-Dick et al. (1997) suggest, members know what to expect in older IAs whereas members of newer IAs are less certain about whether cooperation with other farmers will be reciprocated. This view is supported by Fujita, Hayami and Kikutchi (1999) who postulate that a high level of collective action is less likely when the history of irrigated farming is short. A contending view is that the age of the irrigation system has no statistical significance on levels of collective action (Ternstrom 2003). The origin of the IA – whether self organized or organized by the irrigation agency – is also postulated to affect the likelihood of collective action among farmers. It is generally easier for irrigators to have a sense of "ownership", i.e. a personal stake in the IAs, if it started spontaneously among themselves than if outsiders brought in the idea (Ostrom and Shivakoti Eds 2002; Meinzen-Dick et al. 1997; Lam 1998)

Poverty

There is scant literature – empirical and theoretical - on the effects of poverty on collective action in common pool resources. A close examination of the working papers and publications of the collective action and property rights (CAPRi) program of the Consultative Group on International Agricultural Research (CGIAR) yields little reference to the links between poverty and collective action. Whether collective action is difficult due to unsolved problems of collective action is an open question that is yet to be addressed adequately. More to the point, how is income poverty linked to social dilemmas such as appropriation and provision problems in common pool resources and public goods? Similarly, how do these social dilemmas contribute to poverty?

The paucity of research in this area is surprising since the poor are more likely to be dependent upon common pool resources than the well off. The same can be said regarding the literature on collective action in irrigation even though most farmers dependent upon irrigated farming are relatively poor and the operation and maintenance of irrigation systems in developing countries is increasingly being transferred to small, poor farmers. Under what conditions would a large group of small, heterogenous, and impoverished farmers be expected to successfully operate and maintain a large scale irrigation system where national governments have failed? Yet, underlying the panacea of decentralization in irrigation (as well as in other common pool resources) is the implicit assumption that these groups of farmers can do what the national government has failed to do.

Of the available literature, Ternstrom (2003), building from the work of Dasgupta (1993), comes closest to examining the empirical links between poverty and collective

action. Ternstrom suggests that the likelihood of cooperation will be greater if the resource users are relatively well off rather than if they are very poor but greatest of all in groups of users just managing to get the food they need. When users are poor, the poorest will not cooperate and when the users are rich, the richest will not cooperate. She concludes that wealth inequality makes cooperation less likely.

Group Size

The effect of the size of user groups on collective action remains a complex and controversial issue. Group theory and conventional thinking suggests that collective action among farmers is difficult as group size increases. Olson (1965) argues that unless the number of individuals in a group is quite small, or unless there is coercion or some other special device to make individuals act in their common interest, rational self interested individuals will not act to achieve their common or group interest. As group size increases, Olson argues, individuals will conclude that their marginal contribution will not affect the likelihood that the good will be provided and therefore do not make such contributions. Another factor, Olson suggests, is that increased group size leads to higher transaction costs, particularly the cost of coming to an agreement. Weissing and Ostrom (1991) find that an increase in the number of irrigators increases the rate of stealing water, *ceteris paribus*.

In irrigation, Tang (1992) suggests that all other things being equal, it would be easier to organize and maintain collective action in irrigation systems of smaller sizes with smaller numbers of users. Shah et al. (2002), examining small holder agriculture in Africa, suggests that a group of five large and homogenous farmers would have far fewer

problems of collective action than a group of 1,500 farmers with substantial heterogeneity. Fujita, Hayami, and Kikuchi (1999), using data from the Philippines, also conclude that collective action in irrigation is difficult to organize given the large size of the IA, among other factors.

A contending view on the significance of group size is postulated by Ternstrom (2003) who argues using an empirical study from Nepal, that group size (which varies from 7 to 100 farmers in her study) does not seem to make any statistically significant difference in cooperation. As other scholars also note, group size and heterogeneity, do not seem to have as strong as an effect as previously thought and much depends on the ingenuity of farmers to devise institutions, potentially at multiple levels, to deal effectively with size and heterogeneity.

Club theory can inform the debate on group size since IAs have characteristics of a club – a voluntary group (in the case of most IAs) deriving mutual benefits from sharing one or more of the following: production costs, membership characteristics or a good characterized by excludable benefits (Sandler and Tschirhart, 1984, quoted in Meinzen-Dick et. al 1997). Olson (1965) adds that when certain resource users, the so called privileged group, have enough wealth and stake, they will contribute to the solution of a collective action problem even though there are free riders who do not contribute.

However, as Meinzen-Dick et al. (1997) argues, group size represents a tradeoff between potential economies of scale and increases in transaction costs. On one hand, farmers have incentives to maintain a critical size for purposes of economies of scale in the maintenance of the irrigation system. On the other hand, increase in group size leads

to an increase in transaction costs because of the reduced observability of actions. Increase in anonymity reduces the effects of social pressure. "Rough mental accounts" become less important which induces farmers to invest less in reputation (Ellikson, quoted in Baland and Plateau 1994). Furthermore, in large groups, the incentive to deviate increases given that the marginal social cost of individual defection is negligible compared with the marginal private gains.

For other scholars such as Chamberlain (1974), Hardin (1982), and Frohlich and Oppenheimer (1970), the effects of group size on the likelihood of cooperation is contingent on how other variables are affected by changes in the size of a group.

Salience

One reason for the decentralization of natural resource management is the argument that when the livelihoods of households are salient to the resource, these households are more likely to have the incentives to efficiently and sustainably manage these resources compared to those otherwise less dependent on them.

Wade (1988) suggests that salience or high levels of dependence by group members on the resource system, is an important condition which facilitates collective action in a common pool resource such as an irrigation system. Baland and Plateau (1996), however, did not consider salience as an important factor but instead paid more attention to external forces such as aid, enforcement and leadership.

Agrawal (2002) attempted to synthesize the works of Ostrom (1990), Wade (1988), and Baland and Plateau (1996) on which factors facilitate collective action in common pool resources and provide supplements to the set of substantive factors already

identified by these scholars. Agrawal argues essentially for the need to include the role of markets, demography, and the state as explanatory variables but, again, his synthesis and supplementary arguments do not regard salience of the resource as being important to collective action. Ostrom et al. (2002), however, are more explicit when they argue that salience is one of the three main conditions for collective action in the local common pool resources. They argue that the resource must be salient enough to the users that they are willing to invest time and energy to create new institutions.

Gender

Some scholars postulate that gender may influence cooperation because women and men respond differently to one another in group interactions and discussion (Stockard et al. 1988) because they differ in understanding and reacting to one another (Cadsby and Mayne, 1998), because they respond differently to certain types of resources (Sell et al. 1993), or that men's and women's brains are simply different (*Time Magazine*, March 7, 2005).

Public goods experiments, however, report mixed findings. On one hand you have a group of scholars who suggest that women are more likely to cooperate than men. Van Lange et al. (1997) suggest that there seems to be a weak but reliable relationship between gender and social motives such that the percentage of prosocials or cooperators is slightly higher among women than among men while that of proselves (individualist and competitors) is higher among men. Nowell and Tinkler (1994) find that all-female groups are more cooperative than either all male groups or mixed gender groups. In

mixed groups, women are more likely to cooperate than men especially when communication is permitted (Stockard et al. 1988).

Another view holds that, in a same sex, four person public goods game, men contributed at higher rates compared to women (Brown and Hummels 1993). Others find no influence of group gender composition on contributions to a public good nor did they find a gender effect when money was the resource (Sell et al. 1993 quoted from Kopelman et. al. 2002). Overall, Kopelman et al. (2002) conclude that gender may have an influence on cooperation in social dilemmas but its effect may be small and variable.

In the empirical literature, Meinzen-Dick et al. (1997) analyzed the ways in which gender issues affect property rights and the use of natural resources in developing countries. Drawing on examples from developing countries worldwide, they examined the informal practices of resource use, usually involving multiple uses by multiple users. They suggest that traditional systems of access to land, water, and trees reflect complex dynamics among community members that must be understood in order to design successful policy interventions concerning natural resources.

They further suggest that property rights, access to resources, and relationships among multiple users were significantly affected by gender differences. For example, cultural norms differentiated the ways in which women were allowed to use a forest ─ such as for gathering fruit ─ from men's activities, such as harvesting logs. These gender differences in access to resources significantly affect natural resource usage in four main areas: (1) environmental sustainability; (2) efficiency of resource use; (3) equity of resource allocation among users; and (4) empowerment of users, particularly women.

Land Tenure

A vast amount of literature exists on land tenurial rights and collective action in natural resource management. Among the themes that emerge from the literature are as follows: (Meinzen-Dick, et al. 2002; Place and Otsuka 2001).

- The complexities of property rights and the components of tenure security;
- The need to understand property rights and collective action as dynamic institutions that change in response to a number of factors including population density, resource scarcity, and market access;
- The importance of property rights and collective action between socially differentiated groups;
- The commonly held view in the literature that secure land tenure creates incentives for farmers to invest in the long term, thus increasing the incentive to cooperate. Incidences of free riding, therefore, are more likely to decrease as the ratio of farmers in an irrigation system with secure tenure increases, *ceteris paribus.*

Coward (1986) suggests that property rights – such as the ownership of irrigation facilities and/or water rights - form the basis for the relationships among irrigators, which then become the social basis for collective action among farmers in performing various irrigation tasks. This view is supported by Yoder (1994) who reports that, in the case of communal irrigation in the Philippines, Indonesia, and Nepal, those who have contributed to system construction own shares in the system's infrastructure and water rights, along with corresponding responsibilities for ongoing maintenance.

Meinzen-Dick et al. (1999), however, suggest that property rights are not a sufficient condition for collective action. They cite the case of farmers in Pakistan and India who often do not acknowledge ownership of the water courses because they do not value the property and did not participate in its creation or financing.

Communication

The role of face-to-face communication in social dilemma situations is open to considerable theoretical and policy debate. Non-cooperative game theory predicts that communication will make no difference in the outcome of social dilemmas. According to this view, communication is 'cheap talk'. The ability to communicate is not essential and unlikely to change results unless individuals involved can call on external agents to enforce agreements. As Hobbes (1960) puts it:

> the bonds of words are too weak to bridle men's ambition, avarice, anger, and other passions, without fear of some coercive power; which in the condition of mere nature , where all men are equal and judges of the justness of their own fears, cannot possibly be supposed *(Hobbes [1651] 1960, 89-90).*

For Harsanyi and Selten (1988), the decisive question is whether players can make enforceable agreements and it makes little difference whether they are allowed to talk to each other. They add that even if players are free to talk and negotiate an agreement, this fact will be of no real help if the agreement has little chance of being kept. An ability to negotiate agreements is useful only if rules of the game make such agreements binding and enforceable.

Yet in various experimental settings, communication has been shown to be an effective mechanism for increasing joint outcomes in collective action situations (see Ostrom et al. 1994). In a meta-analysis of more than 100 public goods experiments, Sally

(1995) finds that communication has a positive and significant influence on cooperative behavior. Reviewing the experimental literature on communication, Koppelman et al. (2002) find that among the numerous hypotheses on the effects of communication on cooperation, two consistent explanations emerge: (1) group discussion enhances group identity or solidarity; and (2) group discussion elicits commitments to cooperate.

Findings by Ostrom and Walker (1992) suggest that communication leads to the offering and extracting of promises and reinforcement of prior normative expectations. They conclude that it is possible to have "covenants without a sword" even when players make repeated anonymous and private decisions and breaking verbal agreements dominates keeping them. Falk et al. (2002) also suggests that face-to-face coordination acts as a coordinating and sanctioning device that may elicit cooperative behavior in the presence of reciprocal preferences.

Autonomy

One of the fundamental design principles for self-governing irrigation systems is the minimal recognition of the rights to organize (Ostrom 1990). Meinzen-Dick et al. (1999) add that while this principle may be sufficient for IAs with little external involvement, IAs that interact with government agencies in market oriented settings need a more formal legal definition of rights and responsibilities. These additional provisions, they suggest, include the recognition of the IA as a representative of farmers in dealing with external agencies, the right to mobilize resources from their membership and other sources, and the ability to open and operate a bank account and obtain credit and ownership of irrigation facilities and/or water rights.

Lam (1998) also finds IA autonomy as a key predictor of irrigation performance. He argues that the basis for high levels of performance includes a high degree of mutual trust, active participation in the crafting and monitoring of rules, and a high level of rule conformance – features found among autonomous farmer managed irrigation systems in Nepal.

In the case of India, Wade (1988) as well as Baland and Plateau (1996) implicitly suggests the importance of IA autonomy when they argued that locally devised access and management and the ease of their enforcement as being critical to local collective action. Ostrom (2002) is more explicit in her argument that autonomy is one of the three major conditions that facilitate collective action among user groups in common pool resources.

Summary

To summarize, Ostrom et al.(2002) argue that there are three basic conditions necessary for resource users to create and sustain effective resource management institutions. First, the resource must be salient enough to the users that they are willing to invest time and energy to create new institutions. Second, users must have the autonomy to devise and change rules. Third, at least a subset of users must be able to engage in direct communication with each other, including the opportunity to bargain. Given these conditions, the likelihood of appropriators will organize, which institutional design they will choose and the performance and survival of that design, is a function of the specific characteristics of the resource, the resource users, and the repertoire of institutional rules considered. Research in common-pool resources, however, has shown that no single

institutional form is best at maintaining resources across a wide range of physical and social conditions.

3.2 Research Hypotheses

In Chapter One, I posed the following general puzzles: First, how could poor performance occur in a system known and lauded worldwide for its major decentralization efforts? Second, what are the conditions that might lead to the poor performance of large scale government managed irrigation systems even after earlier decentralization efforts? Third, how are the incentives faced by the key players – irrigation bureaucrats, donors, farmers, and politicians – linked to the problem of poor performance? Finally, what factors might have influenced these incentives?

To answer these puzzles, I advance three hypotheses derived from the theoretical discussions which examine the incentives faced by key irrigation actors in strategic games. The first two hypotheses focus on collective choice processes at the national level that are embedded in international processes, i.e. how incentives of a public bureaucracy such as NIA are shaped by incentives embedded in foreign aid and how these are linked to the problem of poor performance. The third set of hypotheses focus on local processes that are also embedded in larger national and international processes i.e. the factors that shape the incentives faced by farmers in different physical and social contexts given that they are also embedded in the incentive structure of NIA and foreign aid.

Hypothesis 1: The problem of persistently poor performance in large scale public irrigation systems is linked to the incentive structure faced by public irrigation agencies. Irrigation agencies characterized by perverse incentives are more likely to be associated with persistently poor irrigation performance.

Hypothesis 2: Irrigation aid is characterized by the problems of moral hazard and aid fungibility. Irrigation agencies dependent on irrigation aid are more likely to face perverse incentives and hence poor irrigation performance.

Hypothesis 3: The problem of poor performance in large scale public irrigation systems is linked to the problem of collective action among farmers – particularly the problem of free riding. I hypothesize that the incentive to free ride among farmers is influenced *independently as well as configurally* by the characteristics of the irrigation systems, the attributes of the farmers as well as the micro-institutional context. Based on the theoretical discussion, I summarize in Table 3.1 the hypothesized effects of each of these factors.

Table 3.1 - Hypothesized Effects of Predictor Variables on Free Riding

Variables	Hypothesized Effects
1. Water scarcity	Collective action among farmers would be unlikely unless they perceive that irrigation water is relatively scarce, *ceteris paribus.* One would expect that water scarcity and monetary free riding are related in a curvilinear manner.
2. Infrastructure condition	Poor irrigation infrastructure increases the uncertainty of reliable water service which increases the likelihood of defection and disagreement and increases the costs of monitoring, adjudication, and enforcement. One would expect a higher level of free riding in irrigation systems with poorer infrastructure conditions, *ceteris paribus.*
3. Distance from market centers	In irrigation systems closer to market centers, traditional social ties that bind farmers into mutual dependencies are loosened; farmers acquire greater exit options through the labor market; and actors increasingly become less known to each other. One would expect a higher level of free riding in irrigation systems close to market centers compared to those in more remote areas, *ceteris paribus*.
4. Size of irrigation system	As the size of irrigation service area increases, the cost of monitoring and enforcement increases and thus leads to a higher level of free riding, *ceteris paribus.*
5. User size	As user size increases, monitoring and enforcement costs increase because of reduced observability of actions. Increase in anonymity also reduces the effects of social pressure. Furthermore, in large groups the incentive to deviate increases given that the marginal social cost of individual defection is negligible compared with the marginal private gains. In sum, one would expect a higher rate of free riding as user size increases, *ceteris paribus.*

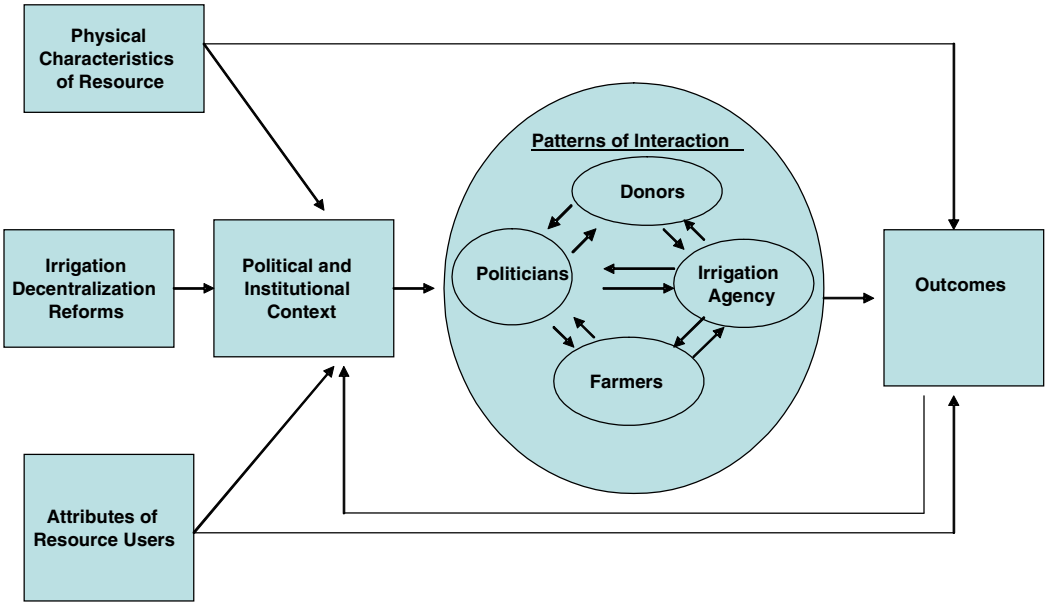
6. Gender	The proportion of prosocials is slightly higher among women than among men. One would expect a lower level of free riding as the proportion of women members in the irrigation association increases, *ceteris paribus.*
7. Origin of IA	Self organized IAs have a stronger sense of identity and are more likely to have developed norms that promote trust and reciprocity, thus lowering the costs of monitoring and enforcement. One could expect a lower level of free riding among self organized IAs, *ceteris paribus.*
8. Age	Older and more experienced associations have more opportunities to develop shared understanding which lowers the costs of monitoring and enforcement. One would expect a lower level of free riding among older irrigation associations, *ceteris paribus.*
9. Poverty	Very poor groups of farmers, given their subsistence conditions and small size of farms, have little resources to pay for irrigation fees. One would expect a higher level of free riding in IAs with a higher proportion of poor members, *ceteris paribus.*
10. Salience	As the salience of irrigated farming to the livelihoods of farmers increases, the incentive to cooperate also increases thus reducing the cost of monitoring and enforcement and hence one could expect a lower level of free riding, *ceteris paribus.*
11. Patronage	Farmers embedded in a regime of political patronage expect politicians to bail them out from financial liabilities in return for their support. This creates an incentive to free ride. IA's embedded in a system of political patronage – where political dynasties are fairly established - are more likely to have higher levels of free riding, *ceteris paribus*.

12. Autonomy	The incidence of free riding is more likely to be lower if the IA is given the autonomy to govern and manage the irrigation system, *ceteris paribus* – i.e. it has full control over the irrigation infrastructure and finances, O&M, conflict resolution, right to withdraw water and most importantly the right to exclude nonmembers or nonpayors from receiving irrigation service.
13. Communication	Face-to-face communication enables participants to build trust and reputations and establish norms of reciprocity. The incidence of free riding is more likely to decrease as face-to-face communication becomes frequent, *ceteris paribus.*
14. Tenure	Secure land tenure creates incentives to invest in the long term, thus increasing the incentive to cooperate. The incidence of free riding is more likely to decrease as the ratio of farmers with secure tenure increases, *ceteris paribus.*
15. Election	The incidence of free riding is more likely to decrease - *ceteris paribus* - if members can hold their leaders accountable through holding regular elections.

3.3 Research Framework and Definition of Variables

I organized my research around an adaptation of the institutional analysis and development (IAD) framework (Figure 3.1).

Figure 3.1 - Research Framework



Adapted from Ostrom 2005 and Gibson et al. 2005

Figure 3.1 suggests that outcomes in irrigation (in terms of the physical condition of irrigation facilities, payment of irrigation fees and labor contribution among farmers, investments in maintenance, water service and productivity, and incomes) are *directly and configurally* affected by the physical characteristics of irrigation systems and the attributes of resource users. It also suggests that outcomes are affected by the incentives and the resulting patterns of interaction among the key players in irrigation – irrigation bureaucrats, donors, farmers, and politicians. The incentives of these actors, in turn, are shaped by the political and institutional contexts which in turn are shaped by the physical characteristics of irrigation systems, the rules-in-use, and the attributes of resource users.

I focus in particular on irrigation decentralization reforms and how these have shaped the institutional context, the incentives that were created, and their links to irrigation outcomes.

I adopted this framework for two reasons. First, I wanted to address a major problem of research in irrigation decentralization that overlooks the incentives of other key players in the irrigation game such as donors, politicians, and the irrigation agency – and how strategic interactions among these players are linked to outcomes.

Second, I wanted to address a problem in empirical research on common-pool resources. This problem pertains to the over reliance on linear models to estimate the effects of predictor variables on some outcome variables (Bardhan and Johnson 2002). This has led to conflicting findings in the literature which suggest that user size, heterogeneity, and the poverty of user groups may be positive, negative, linear, or curvilinear depending on contextual factors. The use of the framework allows for the examination of the mediated and indirect effects of the institutional context on the characteristics of the resource and resource users.

In this framework, I define outcomes in terms of two categories. The first category pertains to aggregate measures of irrigation performance at the level of the irrigation system for all of the 196 large scale systems in the Philippines over a 10 year period (1990 to 2000). This aggregate category of outcomes includes the physical condition of infrastructure, responsiveness of water service, the overall incidence in the payment of irrigation fees by farmers, the adequacy of investments in O&M, and eventually the impacts on farm productivity and incomes. To explain this category of outcomes, I focused on the incentives faced by the irrigation bureaucrats, how these were

shaped by incentives embedded in irrigation aid, and how the historical context of irrigation decentralization reforms also shaped these incentives.

The second category of outcomes pertains to the operational level of analysis, i.e. at the level of the farmers. I focused on the incidence of free riding among farmers in terms of the payment of irrigation fees and labor contribution to group work. I defined the physical characteristics of the irrigation systems in terms of water scarcity, the area of the irrigation system, and its proximity from market centers. I defined the attributes of resource users in terms of the age of the IA, the size of appropriators, gender distribution, the extent of entrepreneurship among IAs, the salience of irrigated farming to the livelihoods of farmers, the incidence of poverty among farmers, and the origin of the IA. Finally, I defined the micropolitical and institutional context in terms of the extent of political patronage, a particular boundary rule such as land tenure arrangements, scope rule such as the extent of autonomy enjoyed by an IA, a particular information rule such as the frequency of face to face communication, and a specific aggregation rule such as the holding of elections. How each of these conceptual variables are defined and measured in this study is summarized in Table 3.2.

Table 3.2 - Operational definition of variables

Variable Code / Description /Type	**Coding and Measurement**
FREERIDE Free riding in the payment of irrigation fees Dependent variable (DV)	Measured by the proxy variable unpaid irrigation fees. Unpaid irrigation fees = total fees collectible less actual collection. Higher values suggest higher incidence of monetary free riding.
GROUPWORK (DV)	Average attendance in group work as proxy of labor contribution; coded as 1 if attendance is > 75% of IA membership; 0 otherwise; lower values, higher free riding in labor contribution.

SCARCT Water scarcity Independent variable (IV)	Coded as 1 if water scarcity in an irrigation system is frequent; otherwise, coded as 0.
CROPINT (IV) Cropping intensity	Cropint= $\frac{\text{Irrigated Area (Wet) + Irrigated Area (dry)}}{\text{Total Service Area}}$ X 100
AREA (IV) Irrigation service area (IV)	Size of the irrigation service area (in hectares) under the responsibility of the irrigation association
DISTANCE (IV) Distance of irrigation system from market center	Coded 1 if irrigation system is more than one hour away from economic and political centers; 0 otherwise.
INFRACON (IV) Infrastructure Condition	Infracon = $\frac{\text{No. of functional infrastructure}}{\text{Total no. of infrastructure in a system}}$ X 100 Infrastructure includes head works, turnouts, canals and roads at all levels of the system. Functional defined in terms of engineering standards.
AGE (IV) Age of IA	Age is coded as 1 if IA ≥ 10 years old, 0 if otherwise as reckoned from date of incorporation with the Securities and Exchange Commission.
USERSIZE (IV) Number of appropriators	User size is measured by the number of farmer appropriators at the level of the turnout service area (tertiary canals).
GENDER (IV) Women members of IA	Gender = $\frac{\text{No. of women IA members}}{\text{Total no. of IA members}}$ X100
ENTREP (IV) Entrepreneurship	Measured by the per capita net worth of the IA (Pesos, 2002).
SALIENCE (IV) Salience of farming	Measured by the proxy variable gross farm income Salience = annual gross income (in '000 pesos) of a household from irrigated farming in 2002.
PVRTY (IV) Poverty Level	Measured by the proxy variable of farm size; smaller farms, greater poverty level.
ORIG (IV) Origin of the IA	Origin = coded as 1 if IA existed before the NIA irrigation system (i.e. self organized); coded as 0 if otherwise.
PATRON (IV) Political Patronage	Patronage = coded as 1 if there is a political dynasty in the province which has been in power for at least 30 years; coded 0 otherwise.
TENURE (IV) Land Tenurial Rights	Tenure = $\frac{\text{No. of farmers with secure land tenure}}{\text{Total number of farmers}}$ Farmers with secure tenure refer to landowners and mortgage holders.
ELECT (IV) Frequency IA Elections	Coded as 1 if regularly conducted (once a year), otherwise coded as 0.

COMM (IV) Frequency of face to face communication	Coded as 1 if structured meetings and face-to-face communications are held once in two months among the turn-out service area groups (smallest unit of IA) and the IA Board of Directors; coded 0 if otherwise.
AUTO (IV) Autonomy of the IA in governance / management	Autonomy = coded as 1 if IA holds the right to access, manage, withdraw water, to exclude others as well as autonomy in fiscal matters; also measures if IA is federated at all levels of system; Coded 0 otherwise.

3.4 Research Methods

In this section, I describe my research methods in terms of my study site, population, data sources and data gathering, and measurement reliability issues as well as how they were addressed.

3.4.1 Population and Study Site

I chose the Philippines as a study site for a number of reasons. First, irrigation development in the Philippines shares a similar history with that of many other developing countries (Vermillion 2002). For instance, most Asian countries went through similar periods of irrigation construction and incremental improvements in varying degrees, including farmer participation and collection of fees. Like the Philippines, irrigation development in these countries was mainly funded by foreign aid and politically supported by national governments during the period of the "green revolution" in the 1970's. Thus, the irrigation issues that the Philippines face are generic to developing countries in Asia (Briscoe 2002).

Second, in addition to the similarities shared by NIA with other irrigation agencies, NIA's experience with irrigation decentralization is a crucial and interesting case study.

Finally, the Philippines is also an ideal study site since a considerable data base on irrigation exists, compiled by NIA over the years, that is accessible to the researcher. My familiarity with irrigation institutions and the political, economic, and social context in the Philippines as well as my experience with IAs were also valuable.

3.4.2 Data Sources and Data Gathering

Data used in the study came from several sources: (1) from archival records at the NIA headquarters and its field offices; (2) from the government's National Statistics Office (NSO) and Bureau of Agricultural Statistics (BAS); (3) from participant observations in the field, discussions with key informants, and participation in three major farmer and NIA conferences; and (4) from local government units particularly their Municipal Agriculture Office. Data collection was undertaken in several phases: from mid-May to late July 2002; mid-May to mid-July 2003 and mid-May to early August 2004. Field validation of results and supplementary data gathering was undertaken from July 6 to July 24, 2005. Figures 3.2 to 3.10 provide some photo documentation of my field work.

Figure 3.2-My fieldwork involved actual visits to 13 irrigation systems from 2003 to 2005, often by motorbike and public transport. The purpose of my field work was to observe actual conditions, validate data collected from the NIA central office to check on measurement reliability, validate findings from statistical analysis, and obtain insights from NIA staff and farmers.

Quantitative Data

Empirical evidence came from data sets collected from various departments at NIA. Data access was made possible because of NIA's enlightened and long standing policy of allowing public access to its records. The highly professional assistance by NIA staff to the researcher was crucial in accessing the data sets. Research assistance from a former NIA staff member proved invaluable in navigating the huge NIA bureaucracy and linking up with key informants and data sources.

There were two types of data sets obtained from NIA. The first set, covering the period from 1990 to 2000, pertain to aggregate panel data describing the characteristics and performance of NIA as an organization and those of the 196 national irrigation systems. These include data on the financial, technical and organizational aspects of NIA, the performance of irrigation systems, the physical condition of irrigation facilities, as

well as the overall profile of IAs in national irrigation systems. These data sets were mainly used in Chapters Four and Five.

The second set pertains to cross section data (2002) covering the entire population of 2,056 IAs in all of the 196 national irrigation systems nationwide. This data set describes the physical characteristics of the irrigation systems, the characteristics of irrigation associations and farmers, as well as key institutional and political variables.

Qualitative Data

Qualitative data came from archival research, key informant interviews, participation in farmer conferences, and from field observations. Archival research was primarily undertaken at the library of NIA in the summers of 2003 and 2004 and was facilitated by the professional assistance of NIA's librarian and research assistants. The archival research, which covered the periods from 1964 to 2003, focused mainly on two types of documents: 1) irrigation project loan documents; and 2) administrative and legal documents pertaining to the creation and operation of NIA since1964.

Substantial insights were also obtained by participating in three farmer conferences organized by NIA held on June 19, June 25, and July 30, 2004. These conferences involved experience sharing among 250 farmer leaders representing 200 IAs (or about 10 percent of total). Valuable comments were also obtained from key informants among farmer leaders and from current and former NIA staff and consultants who were involved in the participatory program over the years.

Figure 3.3 - In the course of my field work, I attended numerous IA meetings involving officers and members. Many insights were obtained from these meetings that shed light on my quantitative analysis. Photo above is a meeting with the Board of Directors of the BEDUCAS IA, Libuganon River Irrigation System, Davao del Norte Province. July 2005.

3.4.3 Measurement Reliability

To determine the reliability of the data sets obtained from NIA, two rounds of ground-truthing were undertaken. The first round – undertaken during the summers of 2003 and 2004 - involved the following 13 irrigation systems drawn from purposive sampling (see Map 1 in Chapter 2 for relative location of sites visited): Sta. Maria River Irrigation System in Laguna Province (June 2003); Balanac River Irrigation System in Laguna Province (May 2004); Baco and Bucayao RIS (2 systems) in the province of Oriental Mindoro (June 2003); RIDA RIS in Albay Province (June 2003); Tigman, Hinagyanan, and Inarihan River Irrigation Systems (3 systems) in the province of Camarines Sur (June 2004); Angat and Maasim River Irrigation System (2 systems) in the province of Bulacan (August 2004); and Lasang, Libuganon and Kipaliku River Irrigation Systems (3 systems) in the province of Davao Norte (June 2004).

The focus of the ground truthing was to establish the quality and independence of the data sets within a reasonable degree of confidence. This was done by determining, based on the sampled irrigation systems, if NIA had a compelling incentive to systematically bias reporting of performance indicators and whether there is strong enough evidence to support this belief. For instance, a determination was made regarding the primary source of the data sets and whether the rewards of the NIA staff responsible for coding them was tied to a particular measure of performance. A determination was also made on whether there were any political pressures to report particular performance measures. The main findings from the first ground truthing were as follows:

First, a primary source of NIA's data sets comes from reports filed by its field technicians particularly by the Water Resources Facilities Technicians (WRFTs). These technicians are locally hired village leaders who live and work in the villages adjoining irrigation systems. They have at least a high school degree ─ some with college degrees. The technicians – being farmers in the irrigation systems themselves ─ have an intimate knowledge of the physical characteristics of the system as well as the characteristics of the farmers and the IAs. In the 13 irrigation systems that I visited, the average number of years a technician has worked in that system is 18 years with a minimum of 12 and a maximum of 24 years.

The technician's length of experience and their intimate knowledge of the irrigation systems and its farmers (being residents of the irrigation system) add a great deal to the confidence one can attribute to the data sets. The field technicians assert that they know the irrigation system and the IAs "by heart" (see Annex 3.1 for a list of key informants).

The problem of intercoder reliability on the other hand is minimized with the simplicity and straightforward coding of the variables and the use of common guidelines prescribed by NIA. The practice of cross checking by supervisors adds to the veracity of the reports. The reports of NIA's technicians can also be verified independently from the Secretary of the IAs or from publicly accessible and extensively kept records by the IA (see Figure 3.4).

Figure 3.4 - The Secretary of the IA showing the various records being kept at the IA level which has served as a basis for NIA's data base about IAs and which I extensively used for this study. I referred to these IA records to verify reports obtained from NIA headquarters. LALIK Irrigation System, Davao Norte July 2005.

Second, the variables examined in this study can be considered as local common knowledge and easily verified among farmers and field technicians. For instance, the size of the irrigation system, water scarcity, proximity to markets, infrastructure condition, age of the association, size of user groups, entrepreneurship among IAs, frequency of holding elections, and communication are all local factual knowledge that were easily verified during ground truthing (see Figures 3.5-3.7)

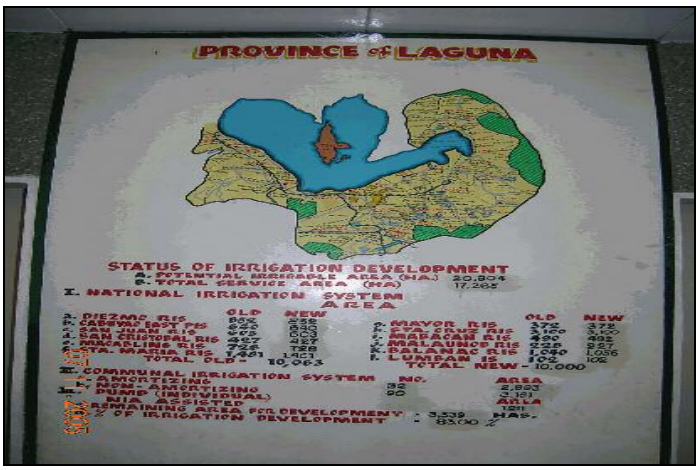


Figure 3.5

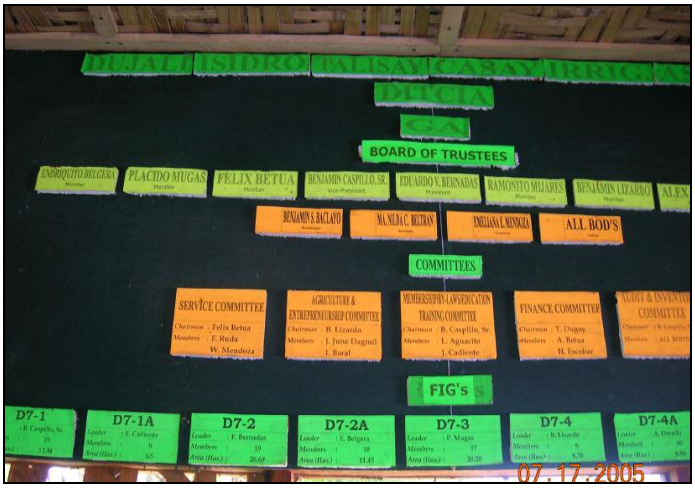


Figure 3.6

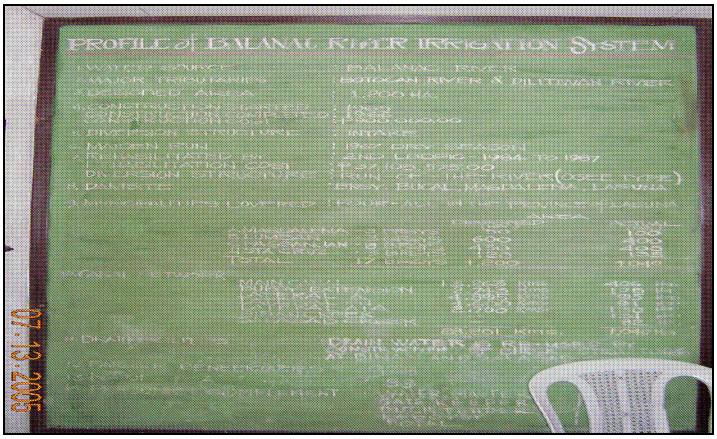


Figure 3.7

Figure 3.5 to 3.7 – Much of the information I obtained about irrigation systems and IAs are public knowledge. Profiles of the irrigation system and the IA are publicly posted at the offices of IAs. Above picture shows the engineering, financial organizational and hydraulic data for several IAs. July 2005.

Third, I find no compelling evidence to suggest that the field technicians of NIA are motivated by, or are actually engaged in a large scale and systematic effort to bias data collection. For instance, the performance of IAs is not part of the performance evaluation criteria of NIA's technicians (See Annex 3.2). Promotions among technicians are very rare and if they do happen, they are not tied to the performance of the irrigation system. Promotions may occur if there are vacancies and if budget permits, which in the case of NIA is rare. Technicians seldom move up the career ladder and the performance of the IA is not a signal of their competence. The key signal for a technician to be promoted to the next level in NIA's career ladder is a college degree – a requirement that most technicians cannot meet since most of them were high school graduates, have little opportunity to go to college, or consider themselves too old to go to college.

Fourth, in my ground truthing, I made an effort to the extent possible to verify directly from the primary sources of data compiled by NIA. Table 3.3 shows a list of sources where NIA's primary sources of data can be verified.

Table 3.3 - Measurement Reliability: Sources for Data Verification

Variable	Sources for Data Verification
FREERIDE	Actual collection of fees can be verified from audited financial statements at the accounting office of the irrigation manager. Total irrigation fees collectible can be verified from the list of irrigated and planted areas from operations staff.
GROUPWORK	Can be obtained from the database of the Institutional Development and the Electronic Data Processing Departments of NIA.
SCARCT	Hydrology database can be verified from the Systems Management Department at NIA.
CROPINT	Actual crop intensity can be verified from the operations reports of field technicians and irrigators associations. Maps are used to plot actual areas irrigated.
AREA	Can be verified from IA records and the Systems Management Department of NIA.
DISTANCE	Can be verified from the Institutional Development

	Department of NIA's Regional Offices (2004).
INFRACON Infrastructure Condition Independent variable	Can be verified from the NIA-JICA infrastructure inventory survey (2002) and the NIA Systems Management Department (NIA-SMD).
AGE	Can be verified from IA records and from the IA database of NIA Institutional Development Department.
USERSIZE	Can be verified from the records of the irrigation superintendent's office and IA records.
GENDER	Can be verified from the records of the irrigation association and from the IA Inventory Survey (2002).
ENTREP	Can be verified from IA records and the IA Inventory Survey (2002) of NIA.
SALIENCE	Can be verified from IA reports to NIA and double checked with the Municipal Agriculture's Office.
PVRTY	Can be verified from the IA records and double checked with the records of the irrigation superintendent's office and the municipal assessor's office.
ORIG	Author's survey (2004) of NIA staff involved with IAs.
PATRON	Can be verified from Congressional records and from a study of the Philippine Center for Investigative Journalism (1999).
TENURE	Can be verified from the records of the IA and the office of the irrigation superintendent.
ELECT	Can be verified from the records of the IA and reports of the water resources facilities technician, NIA's staff in residence at the system.
COMM	Can be verified from the records of the IA and reports of the water resources facilities technician of NIA.
AUTO	Can be verified from the records of the IA and double checked with records of the NIA Institutional Development Department.

Fifth, I find that irrigation superintendents (IS), who are professional engineers, are evaluated in terms of the performance of an irrigation system – primarily by their efficiency in collecting irrigation fees (see Annex 3.1 for the list of key informant Irrigation Supervisors/Assistant Supervisors). Top performers are given awards and recognition and are assigned challenging assignments. Poor performers on the other hand are threatened with non-supervisory work that is professionally looked down upon by colleagues.

On the surface, the IS have strong incentives to submit inflated performance reports. However, a closer examination of accounting and auditing procedures reveals an elaborate and robust system of checks and balances with regard to the submission of financial reports. For instance, managers cannot simply report a high level of irrigation fee collection in order to signal good performance. They would also have to actually remit the amount reported and subject the reports to financial audits at multiple levels of the bureaucracy. They will be in trouble if their financial reports do not reconcile with actual remittance. Because of the already precarious financial condition at NIA, the timely remittance of collection has always been an overriding concern. It is not in the interest of the IS either to under-report collections since this will reflect on their performance. This robust system of checks and balances helps ensure that the measurement of dependent variable in the study – the extent of free riding as measured by the amount of unpaid irrigation fees – is not systematically biased.

Figure 3.8 - Meeting with the irrigation supervisor and staff of the LALIK Irrigation System in Davao del Norte Province, July 2005.

Thus, based on the overall results of the first ground truthing, one can conclude with a reasonable degree of confidence that the data sets obtained from NIA as employed in this study are not systematically biased and that measurement errors are presumed to be random.

To validate my findings and double check the veracity of the coded data sets, I did a second round of ground truthing in the summer of 2005. I revisited two irrigation systems (Balanac River Irrigation System on July 17, 2005 in Laguna province and Libuganon River Irrigation System on July 21,2005 in Davao Norte province) and discussed the results of my statistical tests with key informants from NIA and IAs. I also reexamined the coded data sets, as far as practicable, to determine if there were coding errors particularly for observations with outliers. Unusual and influential data – drawn from results of regression analysis – were particularly subjected to a closer examination to rule out the problem of coding error.

3.5 Analytic Methods

In this section, I discuss the analytic methods I employed in the study. I begin with a brief examination of the analytic issues related to social science research, institutional analysis, common-pool resources, and irrigation institutions in particular. I then lay out my analytic approach followed by a discussion of general and specific issues related to validity of inference and how they were addressed.

3.5.1 Analytic Issues

Social Science Research

King, Keohane, and Verba (1994) (hereinafter KKV, 1994) summarize the following issues regarding research design in the social sciences. First, in general, the scholarly literature in quantitative political methodology and other fields of social science statistics treat existing data and their problems as given. As a result, these literatures largely ignore research design and instead focus on making valid inferences through statistical corrections to data problems. This approach slights the advantage of improving research design to produce better data in the first place, which almost always improves inferences more than the necessarily after-the-fact statistical solutions.

Second, both the quantitative and qualitative literature has problems insofar as explicating and unifying the logic of inference. For instance, KKV argue that the quantitative literature focuses too little on research design and its language seems arcane if not impenetrable. Qualitative research on the other hand uses language to describe their methods which are diverse, inconsistent in jargon and methodological advice, and not always helpful to researchers. There is therefore a need for a common vocabulary or at least a coherent language to help foster communication about these important issues among all social scientists.

Third, the differences between qualitative and quantitative traditions are only stylistic and are methodologically and substantively unimportant. KKV argue that there is only a single logic of inference and that researchers need to understand the more specific rules and procedures that follow from an explication of this logic.

Finally, both qualitative and quantitative social science seeks to develop and evaluate theories. Theory evaluation is the use of hard facts of empirical reality to form scientific opinions about the theories and generalizations that are the hoped for outcomes of research. Theory is used to generate observable implications and then systematically applies publicly known procedures to infer from evidence whether or not the theory implied is correct. Their logic of theory evaluation, KKV argues, stresses maximizing leverage - explaining as much as possible with as little as possible – as well as minimizing bias, reporting uncertainty of their conclusions, and seeking out rival hypothesis.

Institutional Analysis

Institutional analysts face a number of challenges: 1) institutions have multiple definitions; 2) institutional variables are latent or unobserved variables; 3) analysis requires multiple disciplines, a coherent framework, and multiple levels of analysis; and 4) the analysis should account for the configural effects of institutions (Ostrom 1999).

Empirical tools to study institutional change are also numerous. These include quantitative tests of hypothesis (Libecap 1996), simple models (Winiecki 1996), cross-sectional analysis (Stone, Levy and Paredes 1996), historical narratives (North and Weingast 1996), longitudinal dynamic analysis (Krueger 1996) and use of general equilibrium (Alston and Ferrie 1996).

In addition, institutional analysts in general, and scholars of irrigation institutions in particular, have at their disposal the following variety of tools to study institutions.

- Statistical analysis to estimate the significance of institutional variables. Examples of application include the use of tabular and descriptive statistics (Vermillion et al. 1996; de los Reyes and Jopillo 1986; Siy 1982), inferential statistics using maximum likelihood estimation for categorical dependent variables (Long and Freese 1997; Lam 1998) and Ordinary Least Squares for linear models (Saleth and Dinar 2004) to estimate the significance of irrigation variables;
- Comparative case studies to illuminate propositions and help develop theories of institutions (Ostrom 1990; North 1990);
- Analytic narratives to study the evolution of property rights and the impact of international events on domestic institution (Bates et al. 1994);
- Meta analysis of multiple case studies to obtain a rich empirical base of CPR institutions (Ostrom 1990; Lam 1998; Tang 1989; Schalager 1990);
- Historical narratives, participant observation, key informant interviews, focused group discussion, and archival research to account for changes in property rights among the Masai in Africa (Mwangi, 2003);
- Path analysis to illustrate how transaction costs are exorbitantly high in developing countries with weak, missing, or corrupt institutions (de Soto 2000);
- Experimental studies where one rule at a time is changed so as to measure changes in strategies and outcomes (Ostrom, Gardner and Walker 1994; Cardenas 2003; Eggertson 1990; McGinnis (ed) 2000);
- Constitutional levels of analysis (V. Ostrom 1997); macro approaches like general equilibrium (Alston and Ferrie 1996);

- Use of game theory to model institutional outcomes (Eggertson 1990; McGinnis, ed. 2000; Holzinger 2003; Ostrom, Gardner, and Walker, 1994; Ostrom and Walker 2003);
- The use of linguistic analysis has been suggested by V. Ostrom (1980) and Commons (1950) to the extent that rules are a language based phenomena
- Use of integrated modeling to study the role of institutions in complex adaptive systems.

Alston, Eggertson and North (1996) caution, however, that empirical analysis cannot capture all the complexity of institutional change. They therefore suggest the following guidelines in the conduct of institutional analysis: 1) the scope of analysis should be selective; 2) analysis should be framed in terms of one or a few central theoretical concepts; and 3) treatment of time varies — sometimes institutional change can be analyzed with the help of cross sectional data, comparing institutional arrangements across space with differential histories. In other cases, scholars use longitudinal data for comparative statics or in an attempt to analyze a dynamic process; and 4) the character of empirical studies in institutional change varies with the nature of the political and social systems that are investigated.

Common Pool Resources

In a synthesis of knowledge and questions after two decades of intensive research on the commons, the National Research Council (2002) suggests the following directions for research in common pool resources:

- Case study research using methods of focused and structured case comparison, theory driven evaluation, and mining of case studies will continue to play an important role in discovering variables that might have been missed.
- Expand the use of multicase comparative methods for investigating contingent hypotheses.
- Development and testing of empirically supported causal models integrating experimental methods, formal models of game theory, and field research using multicase and multivariate data sets. Attention needs to be paid to the quality and independence of data on theoretically relevant variables as well as the development of time series for individual cases to allow for panel analysis.
- Increase emphasis on triangulation.
- Improve conceptual categories by refining and combining concepts and increasing resolution.
- Refine the knowledge that all institutional regimes must accomplish certain key tasks such as creating common understanding, agreement on rules, as well as monitoring and enforcement, among others.

Irrigation Institutions

Vermillion (1997) summarizes various research design issues related to the performance evaluation of irrigation institutions particularly on irrigation management transfer (IMT). He suggest that most studies: 1) are biased in favor of efficiency criteria and how government finance is affected; 2) rely heavily on data from agency offices; 3)

are prone to problems of self selection of respondents; and 4) are single case studies and thus have limited generalizability.

3.5.2 Analytic Approach in this Study

I examine my research hypotheses at two levels of analysis – at the level of collective choice and at the level of operational choice. Current studies on decentralization seldom address these two levels of analysis simultaneously. My first hypothesis ─ i.e. the problem of poor performance in large scale public irrigation systems ─ is linked to the incentive structure faced by public irrigation agencies. I employ collective choice analysis by focusing on the incentives of irrigation bureaucrats and donors and how these are linked generally to the problem of persistently poor irrigation performance. To qualitatively test this hypothesis, I examine descriptive statistics and panel data from 196 irrigation systems nationwide covering the period of 1990 to 2002 for which data is available. I also examine archival records from NIA – primarily data about irrigation projects and loans, legal documents, as well as financial, personnel and organizational records – to historically understand bureaucratic incentives and behavior and how these are linked to poor irrigation outcomes. My unit of analysis is the NIA and the aggregate performance of the 196 public irrigation systems in the Philippines. My choice of performance measures are based on the guidelines of the International Water Management Institute (IWMI). These measures include the physical condition of the irrigation systems, water delivery, collection of irrigation fees, investment for irrigation maintenance, as well as farm productivity and incomes. I then examine how the history of irrigation development and the incentives embedded in irrigation aid played a role in

reinforcing the perverse incentives faced by NIA and how these are linked to the problem of persistently poor irrigation performance.

For my second hypothesis – i.e. how the problem of poor performance is linked to collective action problems faced by farmers – I shift my focus to operational choice analysis. Here, I focus on the problem of free riding among farmers particularly in the payment of irrigation service fees and the provision of labor counterparts for irrigation O&M. I chose to focus on these two specific measures since both are critical to the problem of irrigation performance. For instance, the payment of irrigation fees determines the adequacy of investment in irrigation O&M which in turn affects the condition of infrastructure and hence the level of water service. The amount of labor contributions, on the other hand, is important in, among others, the quality of irrigation canals.

I use a cross section data from the entire population of 2,056 IAs in all of the 196 large scale public irrigation systems in the Philippines. My purpose is to understand how variations in the physical characteristics of irrigation systems, the attributes of the farmers and the microinstitutional context could explain variations in the free rider's problem in irrigation. I employ both descriptive and inferential statistics including correlation analysis, classical linear regression model (CLRM), and binary logistic regression model (BLRM). The potentials and limitations of these models are more fully explained in subsequent chapters where these methods were employed.

3.5.3 Validity of Inference and Remedies

The validity of inference in political science research is a matter of degree depending on one's school of thought. Political scientists from the rational choice school are challenged by the problem of reliability with their willingness to sacrifice nuance for generalizability and detail for logic (see Cook and Levi eds. 1999). Game theorists employ matrix games or game trees because of their parsimony. They clearly demonstrate a given strategic structure of a game and are very good models of basic types of collective action problems. Consequently, they reveal a great deal of information on how collective action problems can be minimized (Holzinger 2001).

On the other hand, scholars from the cultural approach tradition maximize the importance of internal validity, context, and qualitative measures as they describe the constellation of particular cases and minimize the value of generalist research expectations. They interpret particular events, decisions, and patterns, eschewing the need to tie explanations to general principles. The most important threat, therefore, is one of external validity.

Finally, scholars from the structuralist school are faced with the problems of external validity - or the ability to generalize beyond the case being observed - as they struggle to offer universal theories that include causal accounts. They also face the problems of reliability as they grapple with the requirements of case selection and how best to move from the particular analysis to the set of cases about which they seek to theorize.

This study combines some of the elements taken by the rational choice, cultural approach, and the structuralist traditions in political science. From the rational choice

tradition, I employed the stylized assumption about utility maximization and behavior in strategic situations but relax the assumptions about information processing capabilities. I assume, for example, that farmers are interested in maximizing their profits and minimizing losses subject to inherent risks in farming. I also assume that project officers of donor agencies are interested in maximizing the size of their loan portfolio. Similarly, I assume (and in fact showed) that irrigation bureaucrats are primarily interested in the survival of the irrigation agency, an assumption asserted by public choice theorists. I also showed how these bureaucratic incentive problems are aggravated by the incentives embedded in irrigation aid such as moral hazard and aid fungibility and how the configuration of these incentives impact the behavior of farmers. Finally, I also assume (and show) how politicians are primarily interested in the preservation of political and economic dynasties and how this incentive might be linked to incentive problems faced by farmers.

From the cultural approach tradition, I employ a case study approach with NIA as a unit of analysis. NIA's case is discussed in Chapters 4 and 5. Using this approach, I interpreted particular events, decisions and patterns deduced from archival records but at the same time tie these observations to general principles in what is known about pathological bureaucratic behavior in developing countries. I also used illustrative case studies among IAs to probe the results of my regression analysis.

From the structuralist tradition, I examine a host of structural variables – the physical characteristics of irrigation systems, attributes of resource users and the microinstitutional context – to understand the factors driving collective action situations in irrigation systems. This line of analysis is presented in Chapters 6 and 7.

Issues of validity and reliability of inference, in general, are addressed in this study using the guidelines suggested by King, Keohane, and Verba (1994) regarding the logic of scientific inference. First, the science in social science implies: (1) using observable implications to connect hypothesis and data; (2) explaining as much as possible with as little as possible; (3) reporting uncertainty; and (4) skepticism and rival hypothesis. Second, the rules for constructing causal hypothesis includes (1) falsifiability; (2) internal consistency; (3) careful selection of dependent variables; (4) maximizing concreteness in terms of measurement (to address the problem of construct validity); and (4) stating the hypothesis in as encompassing a way as possible.

More specifically, Shadish, Cook and Campbell (2002) raise the following particular points on the issue of validity. First, assessing validity always entails fallible human judgments. Validity judgments are not absolute and various degrees or approximations of validity can be invoked. Second, validity is a property of inferences, not of designs or methods. Randomized designs are not necessarily internally valid as they may also suffer from problems of low statistical power, sampling error, or differential attrition. They suggest that there is no method that guarantees the validity of an inference. Third, validity can be understood in terms of the following typologies: (1) construct validity; (2) external validity; (3) internal validity; and (4) statistical conclusion validity. I discuss each of these in the following sections.

Construct validity

Construct validity refers to the degree in which inferences are warranted from observed persons, settings, and cause effect operations sampled within a study to the

constructs that these samples represent (i.e. you are measuring what you purport to measure).

There are several threats to construct validity in my study but the more relevant ones are concerns about the inadequate explication of constructs. I address this issue by employing theory driven analysis and maximizing concreteness in concept measurement subject to data availability. For instance, I initially used an index measure of IA functionality constructed by NIA to measure the magnitude of collective action among farmers. However, my subsequent investigation in the field led me to conclude that a functionality index of this type suffers from both construct validity as well as measurement reliability.

I found in my field work that many NIA personnel were not adequately trained to collect the data. Although there were guidelines, there were still many interpretations of what the indicators meant. Many do not have the logistical resources to visit the IAs and some reports were just prepared at NIA offices at the district levels.

There were motivation issues as well. For instance, the main motivation for collecting the index is to comply with reporting requirements set by the central office particularly. Many NIA field staff reason that even if the index data was collected and that IA performance is known by management, little help is forthcoming because of budget problems and because capacity building of IAs is not a priority. The central office also requires its field offices to rate the performance of the IAs for the purpose of selecting outstanding IAs. Since the objective is to select the outstanding IAs, the tendency for NIA field staff is to do a cherry picking among IAs i.e. they choose their favorite IAs that stand a good chance of being a candidate in the search for outstanding

IAs. Inordinate attention therefore is given to these good IAs. Given these serious limitations, the remedy was to drop this index in favor of a more concrete and reliable measured indicator, namely, payment of irrigation fees as a proxy measure of free riding.

In another case, I initially adopted the inverse of cropping intensity as a proxy measure of water scarcity but there were questions about construct validity. The remedy was to find a more direct and concrete measure of water scarcity during my second round of field work by obtaining water data from the hydrology unit at NIA (i.e. from the Engineering and Systems Management Department) instead of relying on the proxy measure.

Yet in another case, I operationalized the concept of free riding using as proxy variable the proportion of unpaid irrigation fees. However, this has raised the issue of whether free riding behavior among farmers would be different if the input required is labor instead of a monetary contribution. The remedy was to deconstruct the concept of free riding in terms of monetary contribution *and* labor contributions, both of which can be measured concretely. The additional data on labor contributions was also obtained during the second round of ground truthing in the summer of 2005.

Redefining these questionable measurements helped to strengthen construct validity for my study. However, there are certain variables that are inherently challenging to measure. One example is the use of distance of an irrigation system from market centers as an imperfect proxy for market pressures and hence exit options for farmers. This approach was earlier used by Agrawal and Yadama (1997) in the case of forest communities in India. It is imperfect since it is possible that market pressures may also exist even in remote areas depending on what type of market is in question. For instance,

proximity to market centers or urban areas create pressures on the labor market where young workers prefer to work in relatively high paying manufacturing and service jobs rather than work as farm laborers. In remote areas, market pressures may still exist principally in regard to material input and output markets since rice is largely a commercial crop in the Philippines. I did account for these considerations in my interpretation of the regression analyses.

External validity

External validity refers to the validity of inferences about whether the cause-effect relationship holds over variation in persons, settings, predictor variables, and outcome variables (Shadish, Cook, and Campbell 2002). Context-dependent mediation is one potentially relevant threat to external validity in my study. This simply means that an explanatory mediator of a causal relationship in one context may not mediate in another context. I address this issue by employing interaction effects analysis, a method which allows for a contextual analysis of the effects of one variable over a range of other variables.

Statistical conclusion validity and internal validity

Statistical conclusion validity refers to the validity of inferences about the correlation (covariation) between the dependent and independent variables. It is concerned with errors in assessing statistical covariation. Internal validity, on the other hand, refers to the validity of whether observed covariation between an independent and

dependent variable reflects a causal relationship as those variables were manipulated and measured. It is concerned with errors in causal reasoning.

These two are related in that even while statistical analysis is impeccable, errors of causal reasoning may still lead to the wrong causal conclusion. Conversely, even when a study is properly implemented as a randomized experiment, statistical errors can still occur and lead to incorrect judgments about statistical significance and misestimated effects size. Internal validity therefore depends crucially on statistical conclusion validity.

The following are some of the threats to internal validity that are relevant in this study, particularly in the case study about NIA: (1) ambiguous temporal precedence or the lack of clarity about which variable occurred first. This may lead to the confusion about which variable is the cause and which is the effect; and (2) the effects of history i.e. events concurrently occurring with decentralization reforms – the treatment variable – could cause the observed effect of poor irrigation performance. I address these potential threats by closely examining the history of irrigation development and NIA through extensive and intensive archival records (see Chapter 2 Section 2.7 and Chapters 4 and 5).

On the other hand, the relevant threats to statistical conclusion validity and how they were remedied are as follows: (1) low statistical power; this problem is addressed by using large N (2,056 IAs in all of the 196 large scale public irrigation systems in the Philippines); and (2) violated assumptions of statistical tests; these assumptions are tested and discussed in the Annex 6.4.

CHAPTER 4

THE PERFORMANCE OF PUBLIC IRRIGATION IN THE PHILIPPINES (1990-2001)

4.0 Overview

In this chapter, I review the performance of public irrigation in the Philippines in terms of the physical condition of irrigation facilities, water service, payment of irrigation fees by farmers, investment in maintenance, and farm productivity and incomes. Molden et. al. (1998) recommended the use of these indicators based on the following criteria. First, the indicators should relate to phenomena that are common to irrigation and irrigated agricultural systems. Second, where land is a constraint relative to water, as in the case of the Philippines, output per unit land is a relevant indicator. Third, the set of indicators is small, yet reveals sufficient information about the system. Fourth, the indicators relate to outputs and are bulk measures of irrigated agricultural systems and show gross relationships.

In this chapter, I present evidence to support my hypothesis that the performance of irrigation in the Philippines can be described as a vicious cycle characterized by 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 particularly at tail end sections of the system.

Figure 4.1 provides a schematic overview of the chain of relationships that lead to and support this vicious cycle.

Figure 4.1 - Vicious Cycle Problem of Public Irrigation in the Philippines

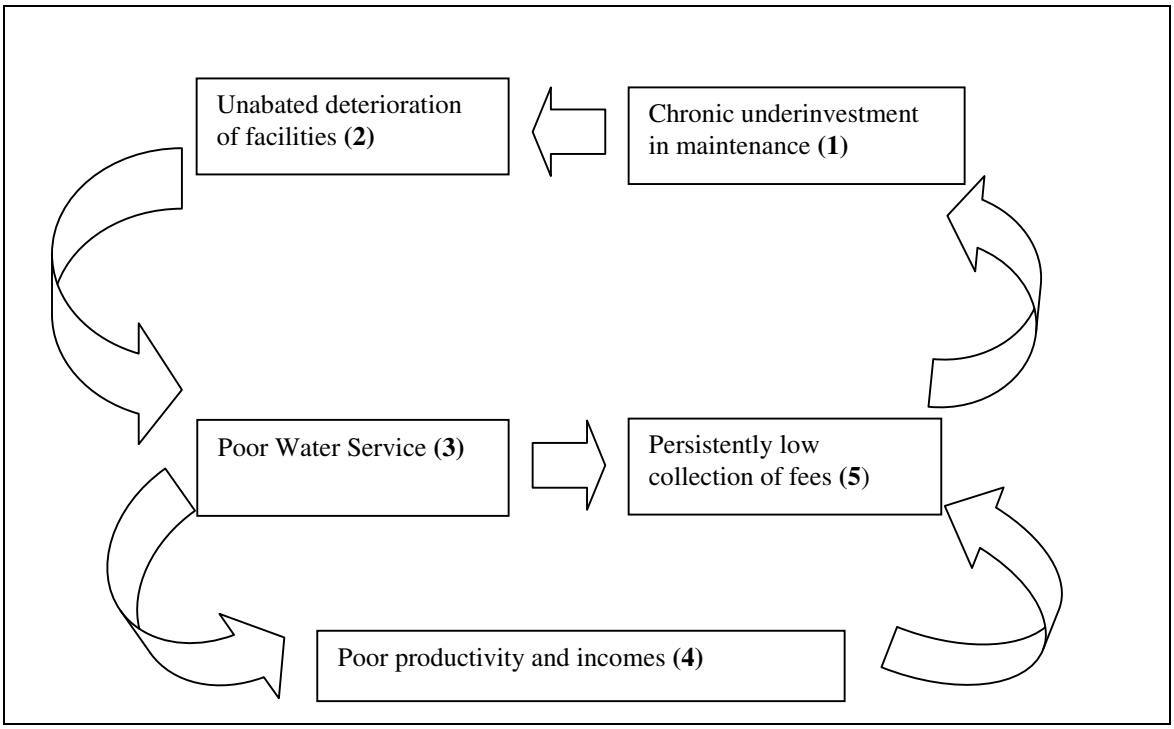


Figure 4.1 suggests that the problem of poor productivity (and hence poor income among farmers) can be traced to several reinforcing factors. First is the problem of chronic underinvestment in irrigation maintenance which leads to the unabated deterioration of irrigation facilities as indicated by the poor condition of head works and water control structures, main and lateral canals and access roads.

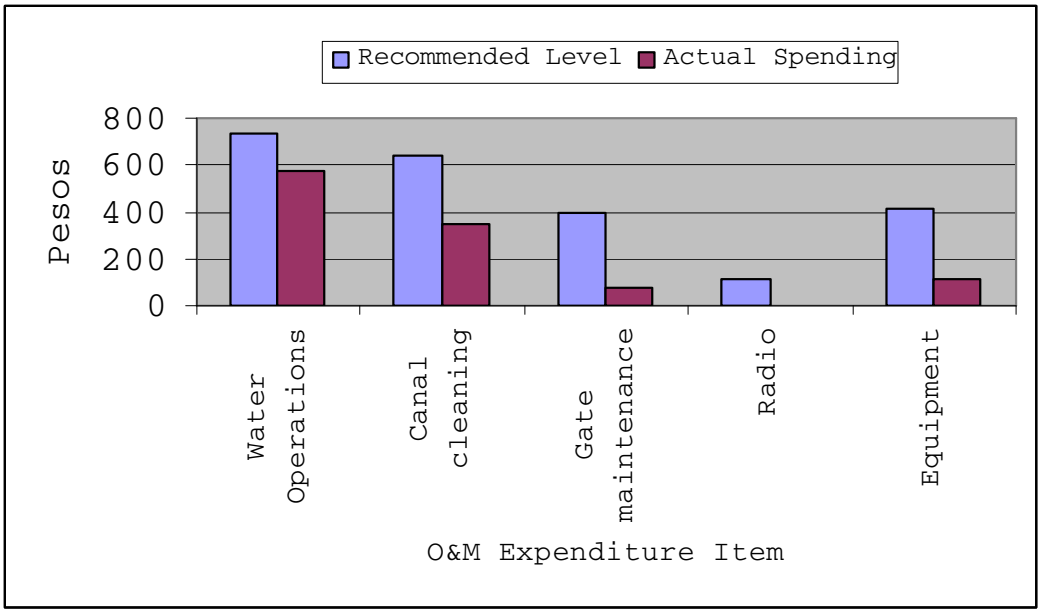
When water control facilities are not working properly, farmers ─ particularly at the tail ends of the irrigation canal ─ do not receive adequate, timely and regular supply of water. This contributes to the problem of poor overall productivity (and incomes), and consequently low motivation for farmers to pay their irrigation fees. Persistent water supply problems lead to persistently low collection of irrigation fees by the National

Irrigation Administration (NIA), which further aggravates the problem of chronic underinvestment in irrigation facilities – and the vicious cycle goes on. The evidence in support of this vicious cycle argument is presented in the following sections.

4.1 Chronic Underinvestment in Maintenance

The problem of chronic underinvestment in O&M is clearly indicated in Figure 4.2, which showed that underinvestment is particularly a problem in water operations, canal cleaning, gate maintenance and investment in mission critical communication facilities and equipment.

Figure 4.2 - Magnitude of Underinvestment in O&M/ Ha, (2002)



Source: Asian Development Bank Study on Irrigation Cost Recovery: Philippines (2002)

In 2002, for example, the level of actual spending for water delivery operations was 21 percent below recommended levels. Actual spending for canal clearing – a crucial activity – fell short by 38 percent of the desirable level. Gate maintenance – another

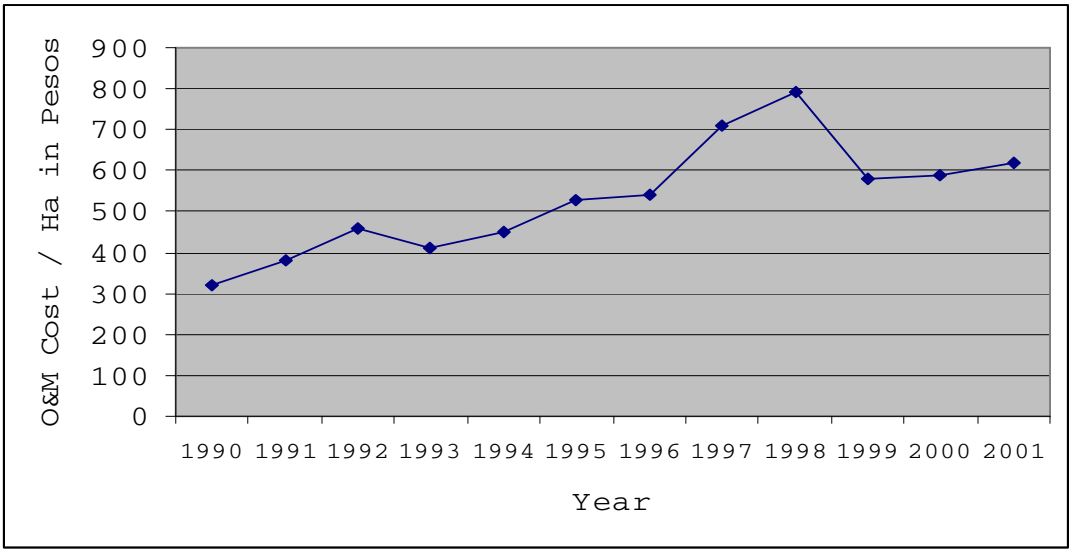
crucial component to keep irrigation operations efficient – also fell short by as much as 75 percent below recommended levels. NIA has not also been investing adequately for communication facilities that could help improve overall coordination in irrigation management. This trend has been with NIA since the early 1990s when the national government reduced NIA's subsidies and required it to raise its own operating funds from irrigation fees collected from farmers.

Chronic underinvestment in O&M is not only a problem associated with NIA. Irrigation associations also (IAs) also generally do not bother to repair and maintain the tertiary canals for which they are responsible. For instance, only about 8 to 25 percent of the 2,056 IAs nationwide fully implemented their repair and maintenance plans (JICA 2002). During the farmer conference I attended, farmers report that typical maintenance problems include dumping of garbage in canals, erosion of canal embankments by livestock (carabao and ducks) on furlough in canals, unauthorized withdrawal of water, unauthorized construction of check dams, planting of trees and vegetables along river banks that choke water ways, among many other problems. In more urbanized areas, small buildings are constructed on top of canals and the canal used as a dumping site.

Persistent underinvestment in routine maintenance has the effect of exponentially increasing maintenance costs as routine work that is neglected leads to increasing cost overtime. Figure 4.3 illustrates the growth in real price of the unit cost of irrigation O&M per hectare from 1990 to 2001. The chart shows that from 1990 to 1998, the unit cost of O&M increased by as much as 166 percent to about Pesos 800 per hectare. Levine (2004, personal communication) has suggested that this cost escalation is due to the fact that irrigation facilities continue to depreciate from frequent use. I agree with this argument

but I further suggest that the cost of repair and rehabilitation substantially increases if minor repairs were not undertaken that would lead to major rehabilitation work**.**

Figure 4.3 - Unit Cost of O&M, per hectare (1990-2001) (Real prices, In Pesos)



Source: NIA archival data

As Figure 4.1 shows, chronic underinvestment in minor repair and maintenance leads to a bigger problem: the unabated deterioration of physical facilities, the evidence of which is presented in the next section.

4.2 Unabated Deterioration of Physical Facilities

There is a clear and strong evidence of unabated deterioration of irrigation facilities in national irrigation systems (NIS) in the Philippines. Overall as of 2002, approximately 80 percent of the 196 NIS are in need of rehabilitation and/or improvement. More than 50 percent of control structures for both lateral and main canals and more than 60 percent of main and lateral canals are in need of rehabilitation such as desilting, reshaping, and heightening of embankments. Seventy four percent of the 13,

967 km of irrigation service roads are in need of rehabilitation. Overall, the magnitude of the problem would clearly suggest a pattern of chronic underinvestment in irrigation maintenance.

Table 4.1- Condition of Physical Facilities (As of 2002)

Type of Facility	Total	Percent Needing Rehabilitation
1. Head Works	145 units	34%
2. Main Canal	3,917 kms	61%
3. Control Structures Main Canal	11,423 units	53%
4. Lateral Canal	10,299 kms	63%
5. Control Structures Lateral Canal	39,949 units	56%
6. Service / Access Roads	13,967 kms	74%

Source: NIA archival data

The problem of unabated deterioration of facilities is further compounded by the tropical conditions in the Philippines that make irrigation maintenance particularly challenging. Monsoon rains and frequent typhoons – on an annual average, about 28 typhoons – continually erode earthen canals, reduce the lifespan of concrete structures and promote vigorous growth of weeds that choke waterways. Degraded watersheds also accelerate sedimentation downstream and a frequent source of flooding that affects downstream irrigation facilities. Thus, without substantial investment in maintenance, it is very difficult to keep irrigation systems under good working condition.

Figure 4.4 - Irrigation canal clogged by water hyacinth which, if left uncontrolled due to poor maintenance, leads to poor water service

Photo Courtesy of Engr. Renato Gamboa, NIA (2004)

Figure 4.5- Tropical conditions in the Philippines are favorable to robust growth of weeds that choke waterways and make canal maintenance particularly difficult. Farmers in the picture are clearing a canal of weeds.

Photo Courtesy of Engr. Renato Gamboa, NIA (2004)

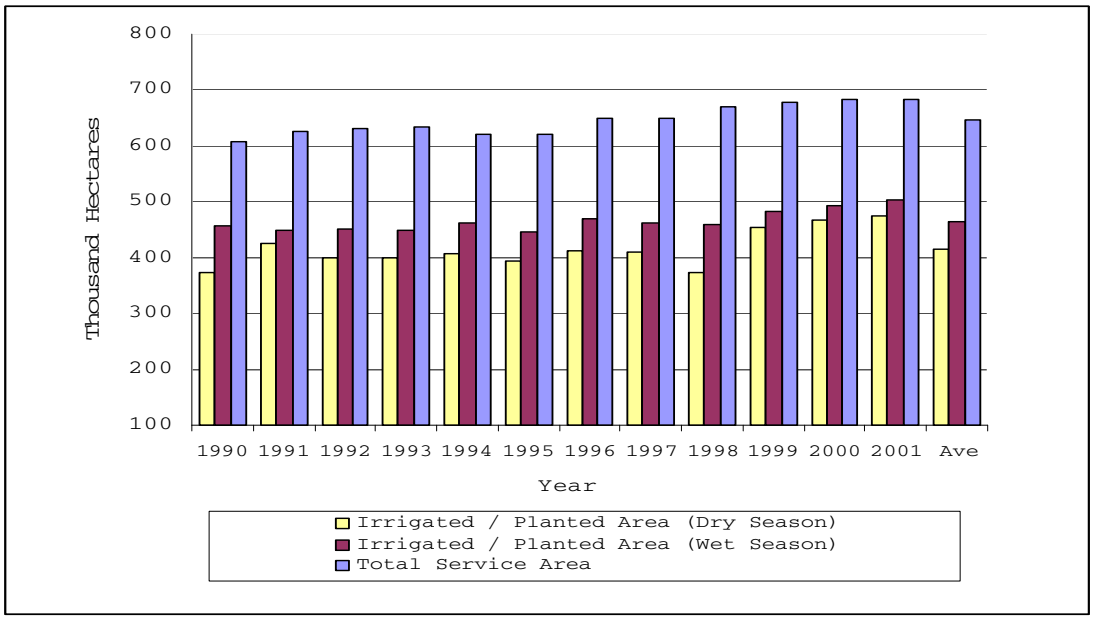
Figure 4.6 – Degraded watersheds and the tropical condition in the Philippines accelerate the sedimentation of irrigation canals and the need for frequent and costly desilting. Picture shows desilting of the main canal of the Dujali irrigation system in the province of Davao Norte.

Photo courtesy of Engr. Alejandro Alberca, NIA-LALIK RIS (2005)

4.3 Persistently Poor Water Delivery

The unmitigated deterioration of physical facilities often leads to persistently sub-optimal water delivery, particularly at the tail end of systems, where farm holdings are at their farthest point from the head gate. As indicated in Figure 4.7, over the last ten years, on average, the actual irrigated area is only 71 percent of the total irrigation service area. There are also other factors that affect water delivery such as the availability of water supply particularly during summer months but the fact that water distribution has not significantly improved even during the wet season suggests that the problem is attributable to the poor condition of the irrigation infrastructure. Figures 4.8 to 4.13 illustrate the challenge of water delivery in a large scale system.

Figure 4.7- Designed Service Area vs. Actual Irrigated Area, '000 ha (1990-2001)



Source: NIA archival data

Figure 4.8 - A schematic illustration of a large scale irrigation system showing its main components: a river, a dam that channels water to a main canal that can stretch anywhere from 10 km up to 60 km, control structures that channel water to various secondary canals that may stretch up to 100s of kms and finally control structures that channel water to their final destination in a farmer's field. Source: NIA

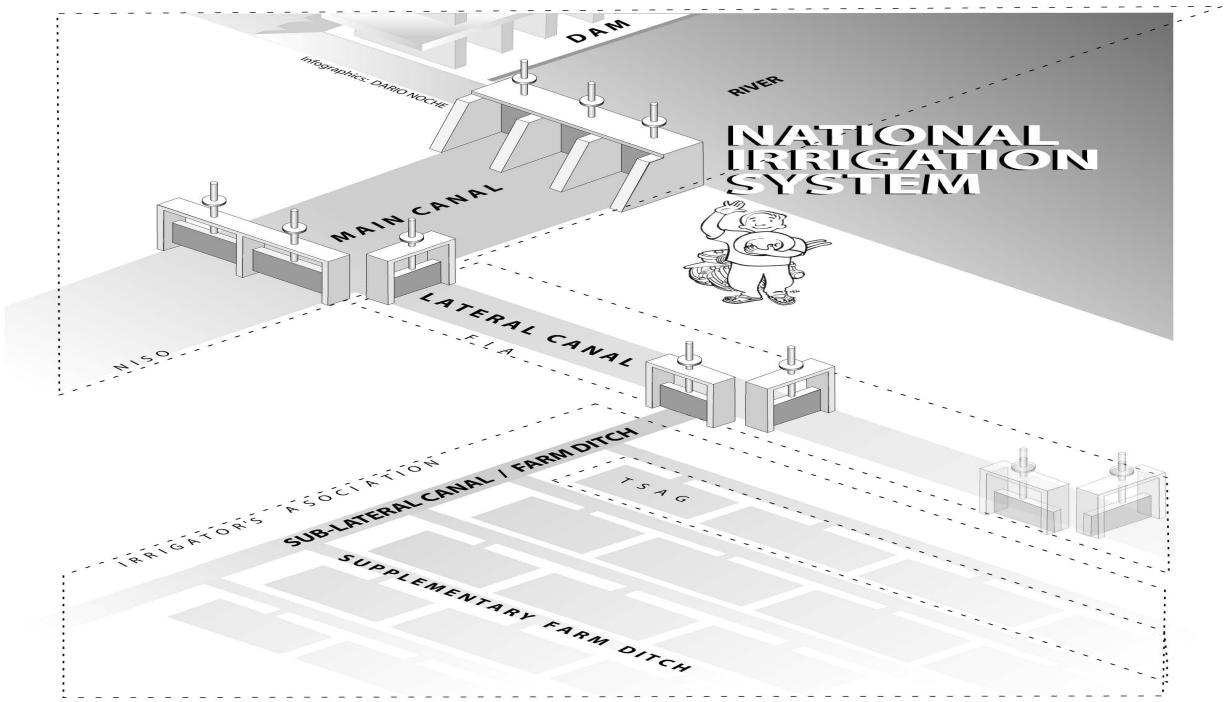


Figure 4.9- Below is an example of a major dam that spans about one km wide and services an irrigation area of 30,000 ha. NIA operates and maintains 145 units of smaller sized dams that can irrigate anywhere from a few hundred hectares to as much a 40,000 ha. Thirty four percent of all such structures by NIA are in need of major rehabilitation.

Photo taken during 2004 field work at Angat-Maasim River Irrigation System

Figure 4.10-From the dam, water is diverted to a main canal through these water diversion structures

Photo taken during the May – August 2004 field visit to AMRIS System

Figure 4.11 – Picture of a main irrigation canal with little water supply. NIA operates and maintains 3,971 km of main canals, of which 61percent are in need of rehabilitation as of 2002.

Photo taken by author during the July 2005 field work in LALIK system

Figure 4.12 – From the main canal, water is diverted to secondary canals through these lateral canal control structures. NIA operates and maintains about 51,000 units of these structures, at least 53 percent of which are needing rehabilitation.

Photo taken by author during the May – August 2004 field work in AMRIS

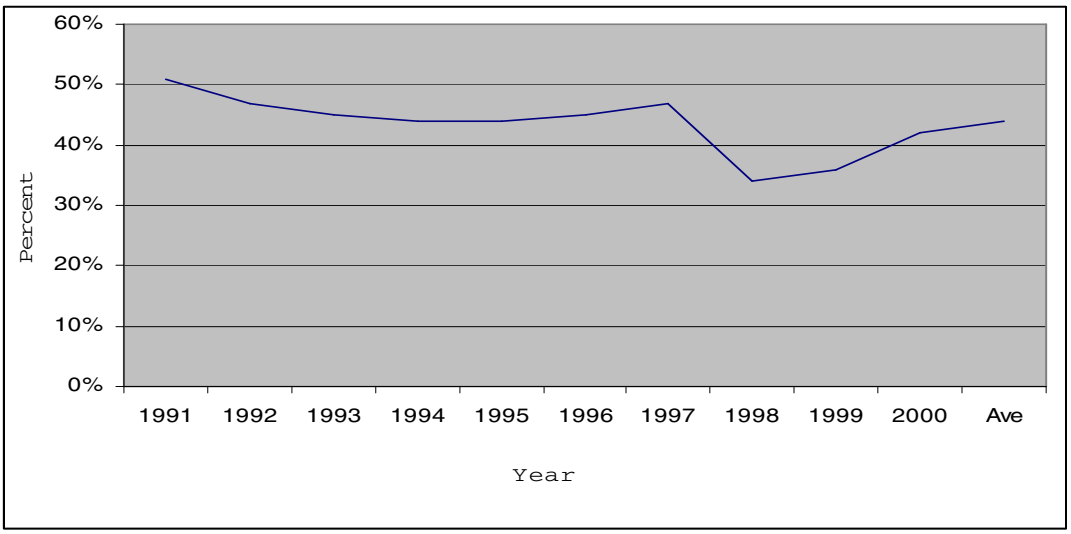
Figure 4.13 – From the secondary canals, water is channeled to tertiary canals such as this one and finally to a farmer's field. Farmers are responsible for the maintenance of these tertiary and field canals. Only about 25% of IAs in public irrigation systems bother to implement O&M plans for their canals indicating a major incentive problem.

4.3 Persistently low collection of fees

The persistently poor delivery of water due to poor infrastructure condition eventually leads to farmer dissatisfaction, particularly at the tail ends, and hence reduced willingness to pay for irrigation fees. This is indicated in Figure 4.14 which shows that fee collection over a 10 year period from 1991 to 2000 averaged only 44 percent, with a maximum of 51 percent in 1991 and a minimum of 34 percent in 1998. The lowest rate in 1998 can be attributed to a campaign promise by then President Estrada to abolish the collection of fee. The campaign promise was half-heartedly carried out by NIA as it would directly affect its budget and create confusion among farmers who have been used to paying irrigation fees since the 1970s. In early 2000, Estrada was ousted by a people power revolution on charges of corruption, cronyism and mismanagement. A new regime

came to power and reinstated the collection of irrigation fees, which explains the upswing in 2000.

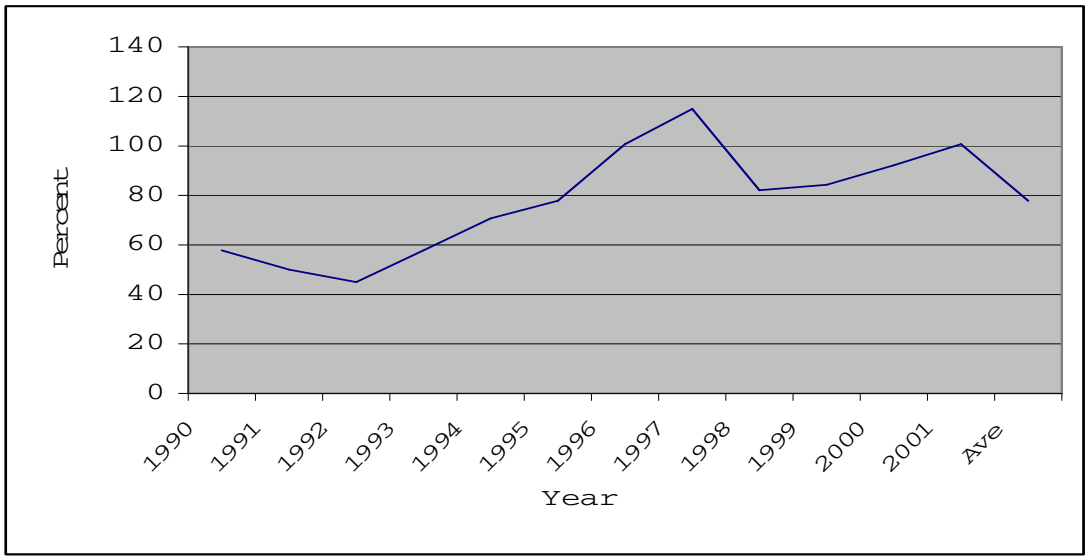
Figure 4.14- Irrigation Service Fees Collection Efficiency, Current Account (1991-2000)



Source: NIA archival data

Farmer dissatisfaction, however, is only one of several major reasons why farmers are reluctant to pay irrigation fees. Another reason, as discussed below, has to do with the moral hazard problem that binds farmers with NIA. For instance, besides a weak incentive to pay for current accounts, farmers are also not paying their back account - fees owed by farmers to NIA for irrigation services already delivered to farmers such as irrigation service fees. On a ten year period (1990-2001), back accounts from farmers averaged 80 percent. (Figure 4.15)

Figure 4.15 - Irrigation Fees Back Accounts (1990-2001)



Source: NIA archival data

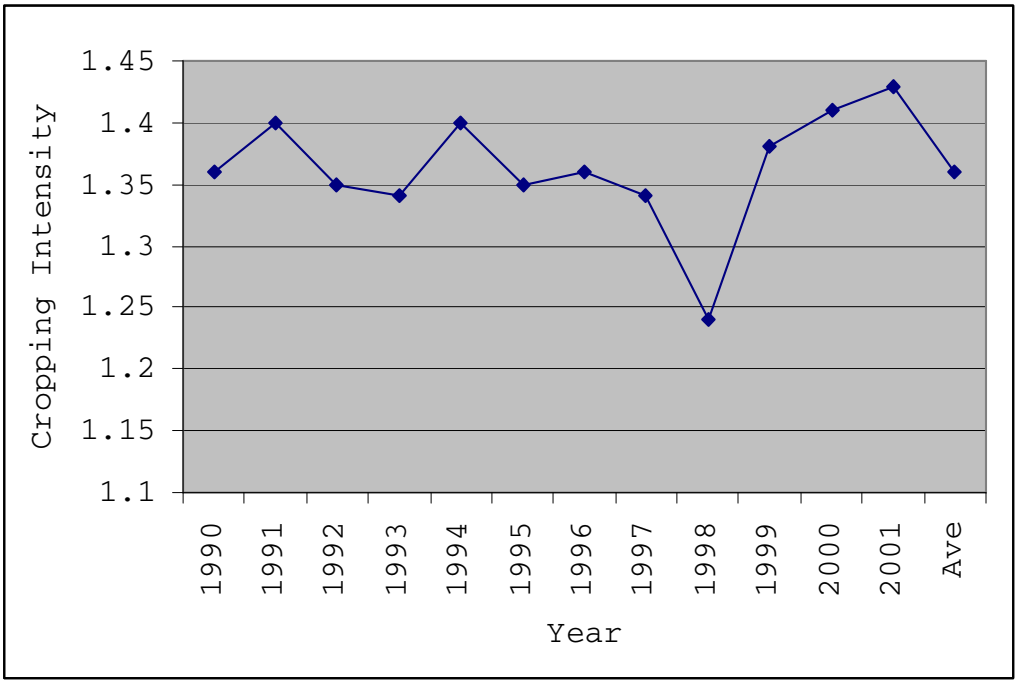
In early 2004, NIA estimated that some 567,041 farmers have outstanding balances with the agency totaling Pesos 6.67 Billion ($125.9M). In early 2003, NIA launched a program to collect these outstanding balances by way of a compromise agreement i.e., farmers can clear their account for a proportion of what they actually owed. A year later, only 1.5 percent of all the farmers with back accounts with NIA have settled indicating a major incentive problem in the payment of irrigation fees.

This poor result actually masks a deeper incentive problem between IAs and NIA – the problem of moral hazard. I found out in my field work that farmers would tend to wait for NIA to condone these unpaid irrigation fees since NIA has done this is the past and farmers expect NIA to do it again in the future. This behavior is strengthened by the fact that NIA has a history of a not so credible enforcement of rules – for various reasons explained in chapter six - over the non-payment of fees.

4.5 Poor Productivity and Incomes

Poor water service eventually impacts productivity and farmers' income. For instance, as seen in Figure 4.16, productivity - measured in terms of cropping intensity (CI)[2] over a ten year period (1990-2001) nationwide - ranged from 1.24 to 1.43 - with an average of 1.36. This is about 68 percent of the ideal rice cropping intensity of 2 per year. This is just about the same intensity compared to the national average in the early 70s (Gamboa 2004). Cropping intensity dropped precipitously in 1998 due to the El Nino drought which caused the temporary stoppage of operations of a major system.

Figure 4.16 - Farm Productivity (Measured in Cropping Intensity) (1990-2001)

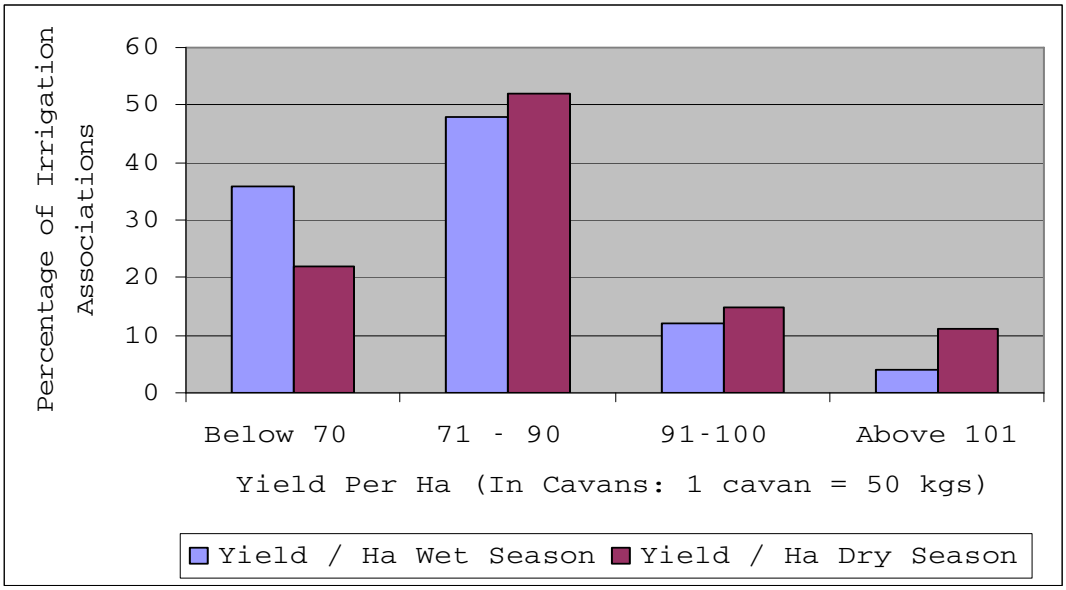


Source: NIA archival data

[2] Cropping intensity 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.

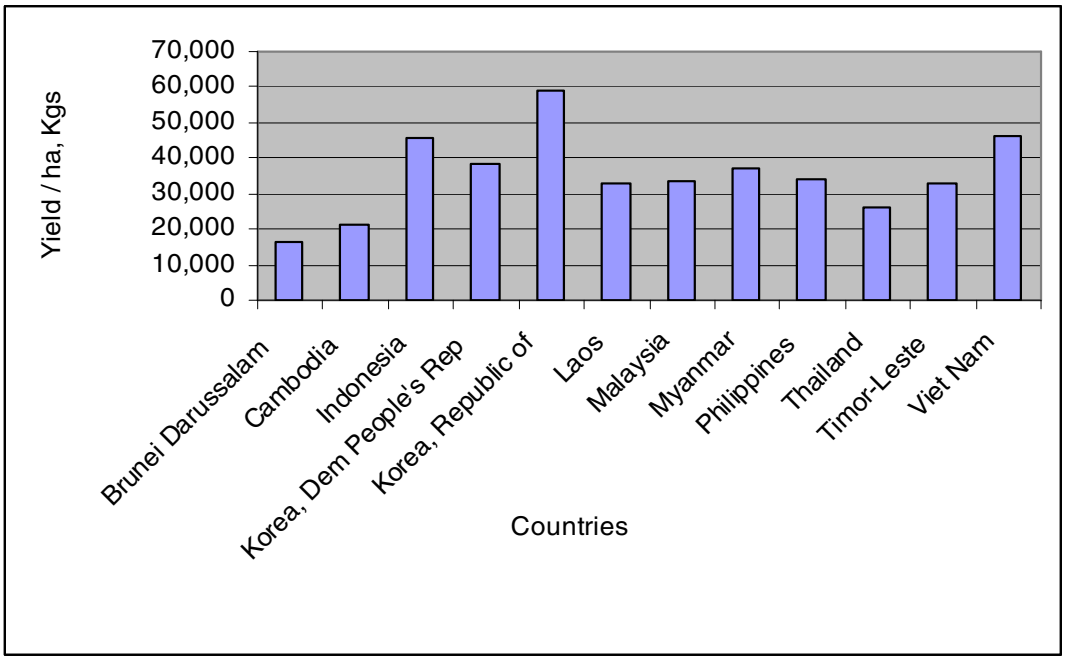
Besides cropping intensity, another measure of farm productivity is output per unit area. This is an appropriate impact indicator given that in the Philippines, land is a constraint relative to water. Figure 4.17 shows that only 10 percent of all irrigation associations in the nation's 196 national irrigation systems have productivity above 5 tons / ha while 50 percent have productivity levels between 3.5 to 4.5 tons per ha. Overall productivity in the Philippines lags behind a number of comparable countries in Southeast Asia (Figure 4.18) such as Indonesia, Vietnam and Myanmar. Not surprisingly because of poor productivity, at least 60 percent of all IAs in the Philippines have relatively low paddy farm incomes (i.e., below P20,000/ha/season or about US$370 at the rate of US$ 1 = P54) (Figure 4.19)

Figure 4.17 - Farm Productivity In Terms of Yield Per Ha, In Cavans (2002)



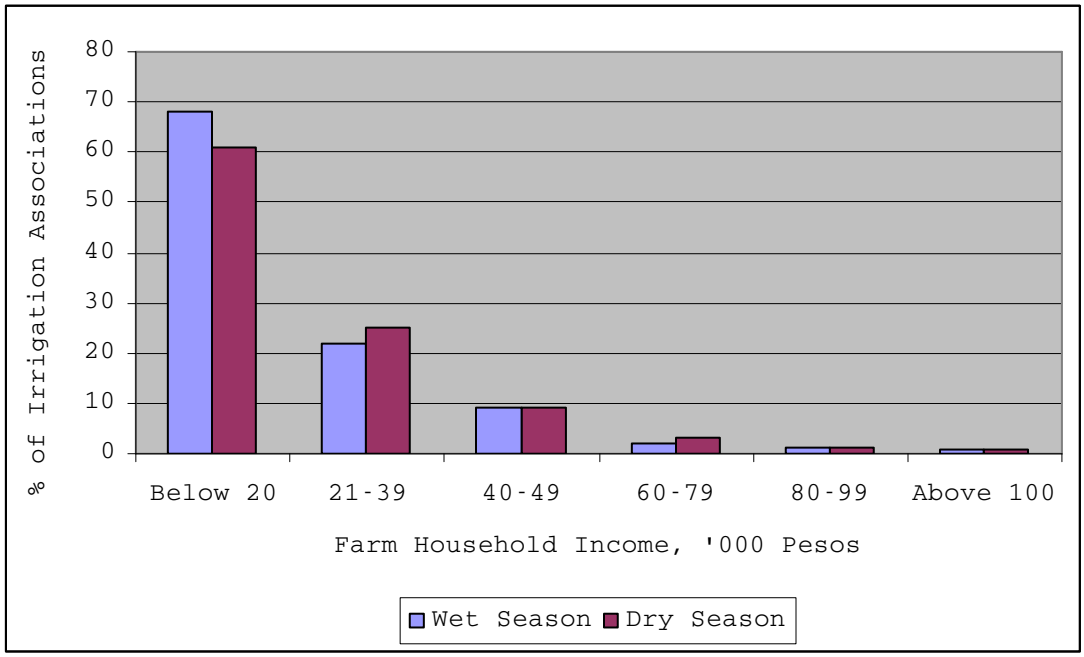
Source: NIA archival data

Figure 4.18 - Comparative Productivity of Paddy Irrigation in Southeast Asia, Kg/Ha



Source: FAO Stat: http://www.fao.org

Figure 4.19 - Distribution of Farmer Incomes, per ha, by season, in Pesos (2002)



Source: NIA archival data

4.6 Summary

I have shown in this chapter ample evidence to suggest that large scale public irrigation in the Philippines can be characterized by five elements which are related in a vicious cycle. First, I showed the pattern of chronic underinvestment in irrigation maintenance: the level of actual spending for water delivery operations was 21 percent below recommended levels; 38 percent below recommended levels for canal clearing and 75 percent for gate maintenance. This pattern of chronic underinvestment deteriorated in the early 1990s when the Department of Budget and Management reduced national government subsidies to NIA and required it to raise its operating expenses from receipts of irrigation fees from farmers.

Second, this pattern of chronic underinvestment in irrigation O&M has the effect of further increasing the unit cost O&M in subsequent years as minor repairs left unattended leads to major rehabilitation. Chronic underinvestment also leads to a much bigger problem in terms of the unabated deterioration of facilities. As I have earlier shown, approximately 80 percent of the 196 NIS are in need of rehabilitation and/or improvement; more than 50 percent of control structures for both lateral and main canals and more than 60 percent of main and lateral canals are in need of rehabilitation such as desilting, reshaping, and heightening of embankment and 74 percent of the 13, 967 km of irrigation service roads are in need of rehabilitation. These figures – which materialized over a period of years - clearly speak of a pattern of chronic underinvestment in irrigation maintenance.

Third, the unabated deterioration of irrigation facilities eventually leads to the problem of persistently poor water service – particularly at the tail ends of the system - as

indicated by reduction in irrigation service areas. I have shown that, on a 10 year average from 1990 to 2000, actual irrigated area was only 71 percent of the designed area suggesting a problem of poor water delivery and by implication farmers are reluctant to pay irrigation fees. I find that, on a 10 year period, the payment of irrigation fees only averaged 44 percent with a maximum of 51 percent in 1991 and a minimum of 34 percent. Farmers are also reluctant to pay their back accounts. As of early 2004, only 1.5 percent of farmers availed of the compromise agreement launched by NIA in 2003.

Fourth, because of persistently poor collection of irrigation fees, NIA's financial condition is substantially affected. On a ten year period (1990-2000), the ratio of NIA's operating income to operating expenses averaged 73 percent – i.e. its collection of irrigation and other fees were not able to cover its operating expenses which were instead subsidized from other sources. Given this poor financial condition at NIA, it comes at a no surprise why the pattern of chronic underinvestment in maintenance and unabated deterioration of facilities has persisted over the years leading to persistently poor water service leading.

Fifth, poor water service, particularly at the tail end of systems, eventually has an adverse impact on productivity in terms of cropping intensities, yield and farm incomes. Over a ten year period (1990-2001) nationwide – cropping intensity ranged from 1.24 to 1.43, about the same intensity in the 1970s.

In the next chapters, I will explore the plausible causes of the problem of chronic underinvestment in maintenance by examining the incentives faced by NIA as a public agency and how these incentives are shaped by incentives embedded in irrigation aid.

CHAPTER FIVE

COLLECTIVE CHOICE ANALYSIS: BUREAUCRATIC INCENTIVES, FOREIGN AID AND IRRIGATION PERFORMANCE

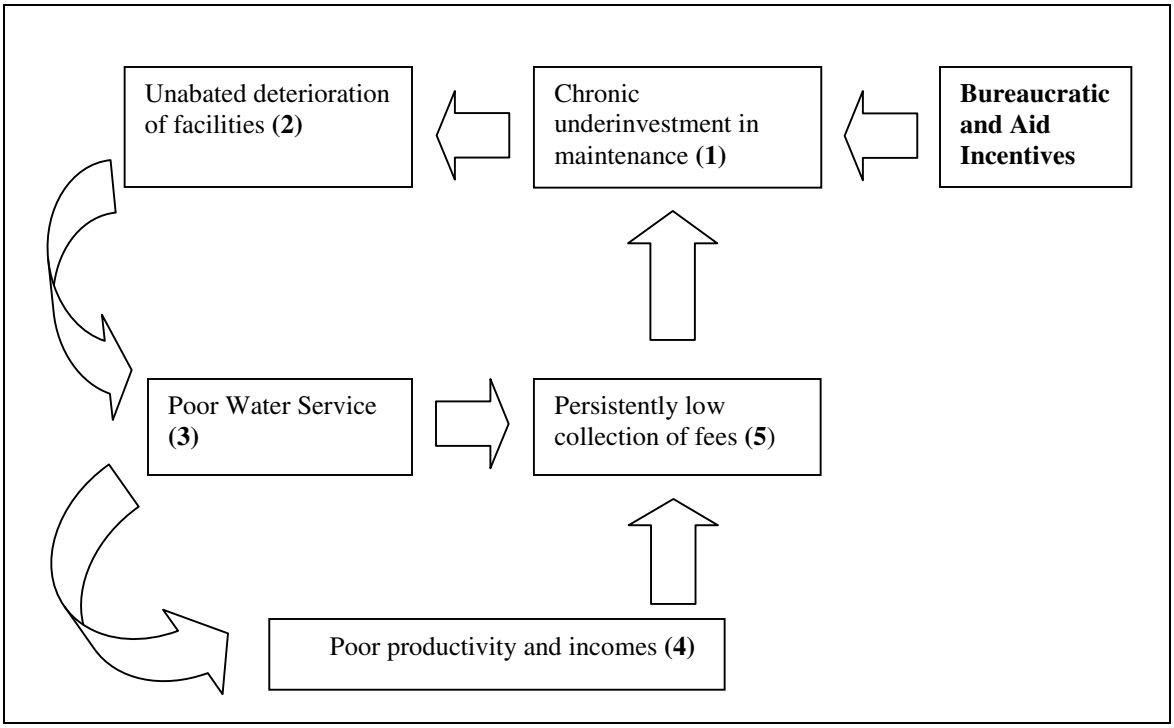
5.0 Overview

In chapter four, I argued and illustrated that the performance of irrigation in the Philippines can be described as a vicious cycle problem characterized by: (1) chronic underinvestment in maintenance; (2) unabated deterioration of facilities; (3) persistently poor water service; and (4) persistently poor payment of irrigation fees by farmers (see for example Figures 4.1, 4.2, 4.7, 4.14 and Table 4.1).

What explains this puzzle? How could poor performance occur in a system known and lauded worldwide for its major decentralization efforts? What are the conditions that might lead to poor performance of large scale government managed irrigation systems even after earlier efforts at decentralization? How are the incentives faced by the key players – irrigation bureaucrats, donors, farmers and politicians – linked to the problem of poor performance? What factors might have influenced these incentives?

In this chapter, I try to explain this puzzle by looking at how the incentives faced by irrigation bureaucrats might have led to this situation and how these incentives in turn were shaped by incentives embedded in irrigation aid (Figure 5.1).

Figure 5.1- Bureaucratic and Aid Incentives and Irrigation Performance



My arguments proceed as follows: First, I will argue and show that NIA has a strong incentive to under invest in the maintenance of irrigation systems because the deterioration of irrigation infrastructure can be used to justify new loans from donors for capital intensive investments in rehabilitation. Here, I will show evidence of the extent of deterioration of irrigation facilities due to underinvestment in maintenance and evidence of NIA's incentive to pursue irrigation rehabilitation projects.

Second, I argue that these new loans for irrigation rehabilitation provide direct and indirect subsidies to NIA that enables it to survive a precarious financial condition. Here, I will show how precarious NIA's financial condition is and explain how this is linked to the problem of an oversized and aging bureaucracy with well entrenched interests struggling for agency survival. I will also show why NIA has an incentive to

allow farmer participation with patronage in a limited number of irrigation systems because of bureaucratic interest and explore what consequences follow.

Finally, I argue and show that donors are happy to provide capital intensive "brick and mortar" rehabilitation loans to NIA because this is good for the donor's loan portfolio. These loans are attractive in terms of straightforward design and are quick to disburse. I also argue that NIA and its donors are bound in a moral hazard problem that creates incentives for donors to be lax in the enforcement of loan provisions on O&M and for NIA to routinely promise adequate funding for O&M but face only negligible cost for non-compliance. I argue that the confluence of these perverse bureaucratic and aid incentives is what drives the problem of chronic underinvestment in maintenance.

5.1 Why NIA Under Invests in Maintenance

In this section, I will argue and show that NIA has a strong incentive to under invest in the maintenance of irrigation systems. In chapter four, I described the magnitude of underinvestment in irrigation maintenance in the Philippines. I showed that actual spending for water operations was 21 percent below recommended levels while spending for canal clearing was 38 percent below recommended levels. The problem was more severe for a critical aspect of irrigation performance - gate maintenance – in which actual spending fell 75 percent below recommended levels (see Figure 4.2 in chapter four). In Table 4.1 of chapter four, I also showed the consequence of underinvestment in maintenance. For instance, 61 percent of the 3,917 km of main canals and 63 percent of 10,300 km of secondary canals are in need of major rehabilitation. In addition, at least 53 percent of the 11,423 water control structures along main canals are in need of

rehabilitation and another 56 percent of the 39,900 units of control structures in secondary canals are in need of rehabilitation. This evidence clearly points to the magnitude of underinvestment in maintenance.

Underinvestment in maintenance is a dominant incentive for NIA since the deterioration of irrigation facilities helps justify *new* loans from donors for capital intensive rehabilitation projects. If this conjecture is correct, then we expect to see the irrigation portfolio at NIA to be dominated by rehabilitation projects funded by donors. Let us examine the evidence.

As Table 5.1 shows, since 1991 to 2002, about 51 percent of national irrigation systems have undergone or are undergoing major rehabilitation. In addition, beginning 2006, rehabilitation plans for donor funding are already underway in the next several years to cover 100 percent of the 644,000ha of NIA's irrigation systems nationwide (see JICA/NIA 2001 Report on the Study to Strengthen NIA's Management System Vol. II)

Table 5.1 - Major Rehabilitation Projects at NIA (Since 1991)

Project	Period	Scope (Ha)	Percent
1. Casecnan Irrigation Component	1997-2004	61,884	9.61%
2. Bago RIS Rehab Project	2003-2008	12,777	1.98%
3. Aganan River Irrigation Project	1993-1995	4,550	0.71%
4. Angat Afterbay Project	2002-2003	29,374	4.56%
5. Jalaur Irrigation Project	1997-1998	21,760	3.38%
6. Palawan Integrated Area Project	1991-1998	7,396	1.15%
7. Southern Philippines Irrigation Project	2000-2006	12,630	1.96%
8. Grain Sector Loan Irrigation Project	2001-2006	16,456	2.56%
9. Highland Agriculture – Irrigation	1996-2003	1,325	0.21%
10. Irrigation Operation Support II	1993-2000	95,944	14.90%
11. Water Resources Devt. Project	1997-2002	66,332	10.30%
TOTAL			51.31%

Source: NIA archival data

This evidence, along with those in chapter four (see in particular Figures 4.2, 4.7, and 4.14 and Table 4.1) clearly establishes a pattern of behavior by NIA characterized as the tendency to "build, neglect and rebuild" irrigation systems. This is the same observation made by Vermillion (2002) in the case of other irrigation bureaucracies in Asia particularly in Sri Lanka and Indonesia.

5.2 Why NIA has the Incentive to Build, Neglect and Rebuild

What explains NIA's incentive to build, neglect and then rebuild irrigation facilities? One reason is that these new loans for irrigation rehabilitation projects have provided NIA implicit and explicit subsidies that have enabled the agency to survive a precarious financial condition and have kept it afloat. During the last decade of the 20th century, NIA struggled financially and was preoccupied with its own survival as an agency. Now it is important to explain how these rehabilitation projects have kept NIA financially afloat.

5.2.1 A Struggling Agency

In chapter three, I discussed the various inherent incentive problems faced by publicbureaucracies including the pro blems of principal-agency, valuation of outputs, limited competition and the inflexibility of the civil service system. Like many public bureaucracies in developing countries, NIA is faced with the same set of incentive problems.

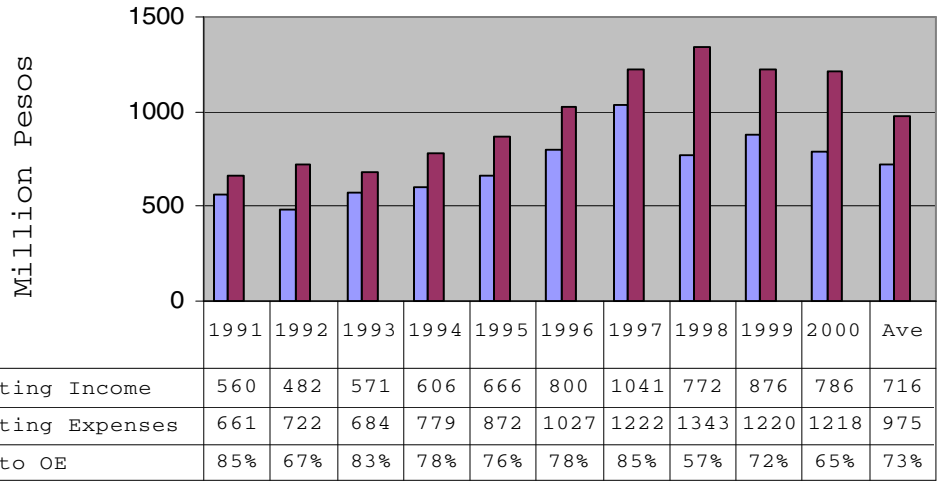
The most compelling evidence in support of the bureaucratic self interest hypothesis about NIA is its de facto mission statement that one can find throughout its offices nationwide (Box 5.1).

Box 5.1-NIA's De Facto Mission Statement

"Service for Survival: Do Our Best for NIA's Best"

This statement can be construed by outsiders as a rally call for NIA staff to build commitment to the organization and to emphasize a sense of purpose and urgency. The problem is actually the survival of NIA as an agency and the careers of thousands of its staff. The reason: NIA has been struggling financially, unable to keep revenues and expenses in line. Figure 5.2 clearly illustrates the financial problems faced by NIA.

Figure 5.2 - NIA's Overall Financial Status, In Million Pesos (1991-2000)



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Ave
Operating Income	560	482	571	606	666	800	1041	772	876	786	716
Operating Expenses	661	722	684	779	872	1027	1222	1343	1220	1218	975
% OI to OE	85%	67%	83%	78%	76%	78%	85%	57%	72%	65%	73%

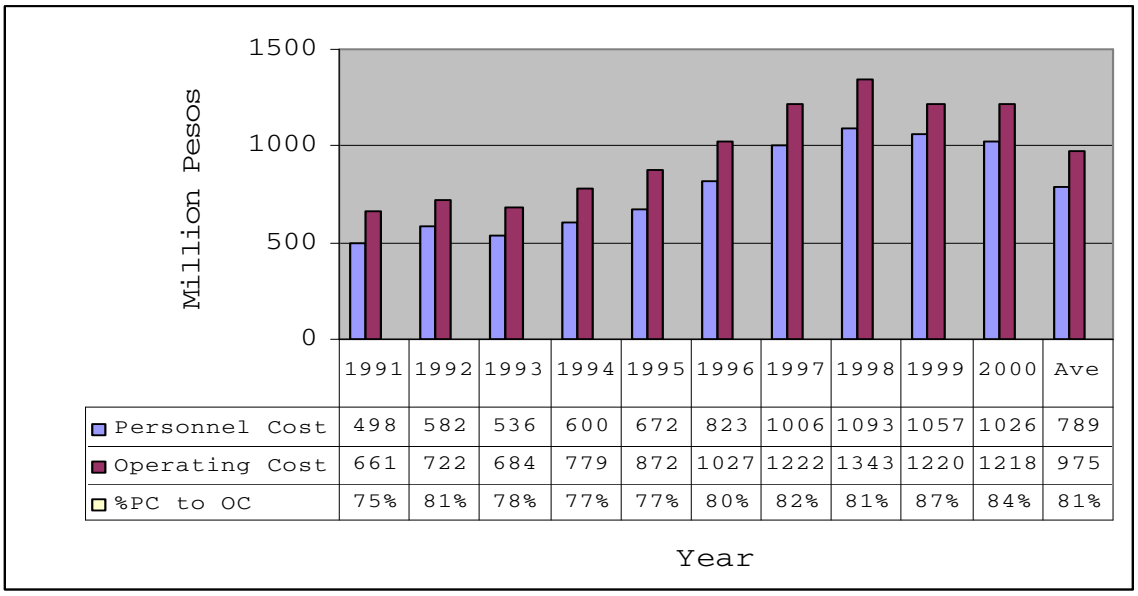
Source: NIA archival data

From 1991 to 2000, on average, NIA's operating income was 73 percent below its operating expenses. In 1991 and 1997, the ratio of operating income to operating expenses was as high as 85 percent but deteriorated to 57 percent in 1998 when NIA's income sharply dropped. During this period, then populist President Joseph Estrada sought to abolish the payment of irrigation fees for which NIA depends for a substantial part of its income. From this period until 2000, NIA struggled financially as the ratio of operating income to operating expenses decreased to an average of 66 percent. President Estrada was later ousted from power by a popular revolt because of charges of corruption and nepotism. The payment of irrigation fees was subsequently restored in 2002. I will explain in the sections that follow that this persistent budget deficit between operating income and expenses is actually covered up by implicit as well as explicit subsidies from foreign assisted projects which help explain NIA's incentive towards foreign aid.

5.2.2 Oversized Bureaucracy

A major reason why NIA is in a state of precarious financial condition is because of an oversized and aging bureaucracy. Personnel costs were always at least 75 percent of the operating cost of the agency. On a ten year average, the ratio of personnel cost to operating cost averaged 81 percent (Figure 5.3). Personnel costs rose absolutely (as did total costs) from 1991 to 1998. As total costs fell in the final three years of the decade, personnel costs did not fell as rapidly.

Figure 5.3 - Ratio of Total Personnel Cost to Total Operating Cost, Million Pesos (1991-2000), Real Prices

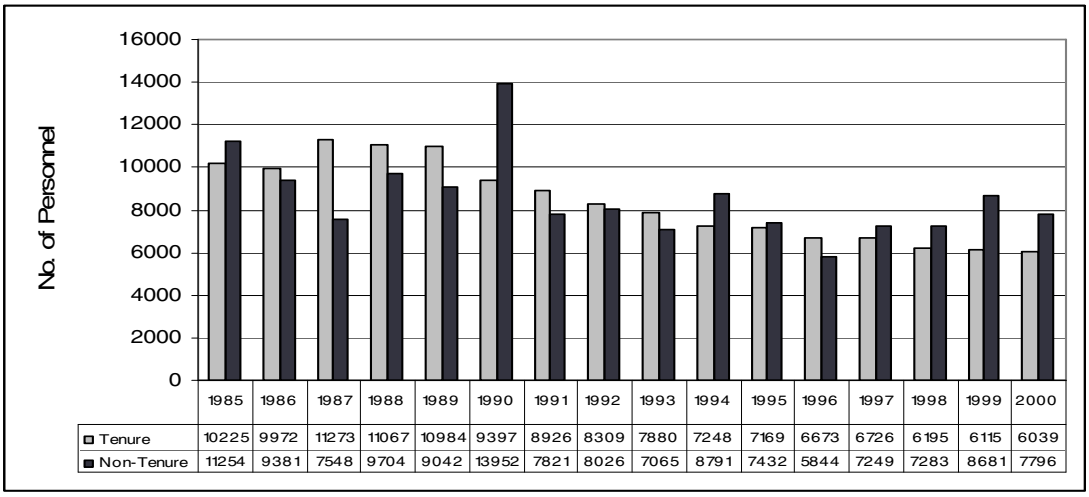


	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Ave
Personnel Cost	498	582	536	600	672	823	1006	1093	1057	1026	789
Operating Cost	661	722	684	779	872	1027	1222	1343	1220	1218	975
%PC to OC	75%	81%	78%	77%	77%	80%	82%	81%	87%	84%	81%

Source: NIA archival data

In chapter two section 2.6, I noted that the initial construction and improvement phases of irrigation development in the Philippines created a large bureaucracy which rapidly became oversized once the initial phase was passed. At the height of the construction phase in 1978, NIA had a workforce of 37,599 individuals. While the size has steadily dropped over the years, the permanent staff has fallen at a slower rate than the part-time staff. During 1998 to 2000, NIA's total staff averaged around 13,500 (Figure 5.4). The number of tenured staff peaked in 1987 at around 11,200 and has since declined to about 6,000 in 2000. This reduction occurred through a very slow process of staff attrition, hiring freeze, and optional and early retirement imposed by Budget Department in 1990.

Figure 5.4 Size of the NIA Bureaucracy: Number of Staff by Tenure (1985-2000)

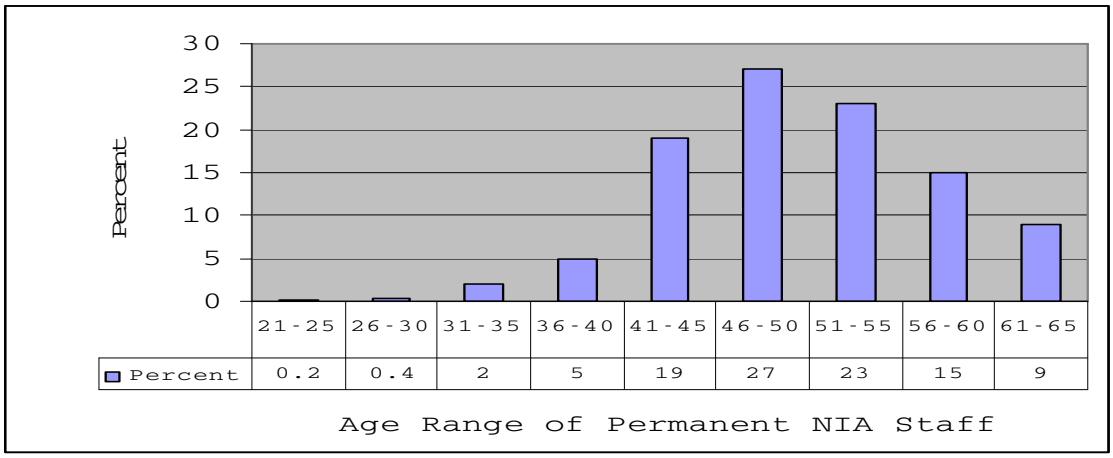


	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Tenure	10225	9972	11273	11067	10984	9397	8926	8309	7880	7248	7169	6673	6726	6195	6115	6039
Non-Tenure	11254	9381	7548	9704	9042	13952	7821	8026	7065	8791	7432	5844	7249	7283	8681	7796

Source: NIA archival data

A consequence of the hiring freeze by NIA is an aging staff structure (Figure 5.5): 74 percent of tenured staff are 45 years old or older, and have worked with NIA for an average of 20 years. Given the few exit options for this group in the labor market, their dominant incentive, not surprisingly, would be to protect their job security and await for their retirement. This situation helps explain NIA's high personnel costs.

Figure 5.5 Age Structure of NIA's Permanent Staff (as of June 2000)



	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65
Percent	0.2	0.4	2	5	19	27	23	15	9

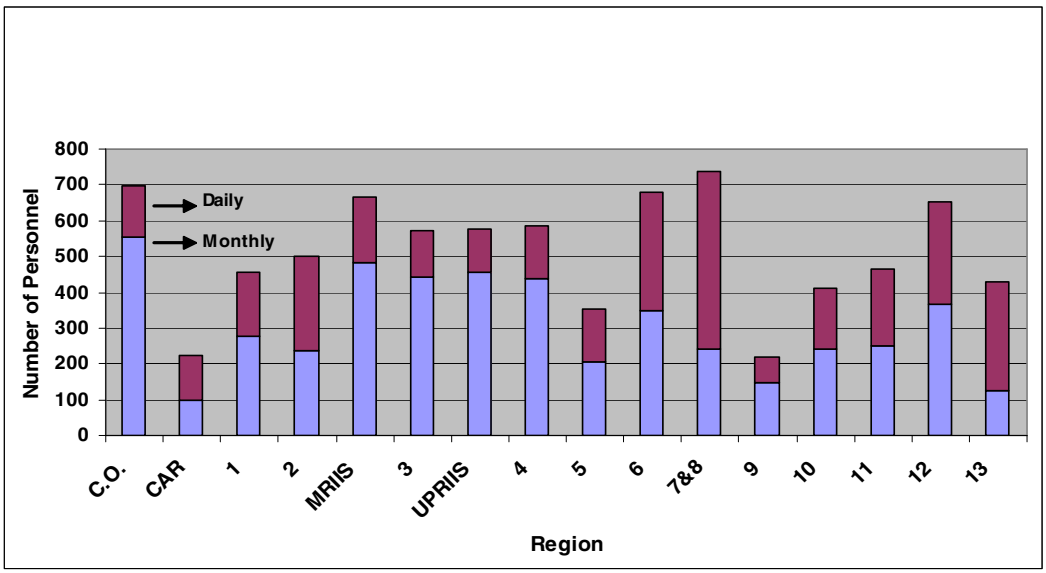
Age Range of Permanent NIA Staff

Source: NIA archival data

But while the number of tenured staff at NIA has been on a decline since 1989, NIA has resorted to the practice of rehiring retired staff as well as temporary staff but on a long term basis. In fact, many of these non-tenured staff have been with NIA for more than 10 years. Since 1997, there are more non-tenured staff at NIA compared with tenured ones, roughly at a ratio of 1.36:1. NIA prefers to hire these non-tenured, long term staff because they cost less (i.e., they are not entitled to benefits).

Figure 5.6 shows how various regions and offices of NIA have come to rely on non-tenured staff. As the Figure 5.6 indicates, six out of 14 regional offices of NIA employ at least 50 percent non-tenured staff and another five regions employing at least 30 percent non-tenured staff.

Figure 5.6 - NIA's Reliance on Non-tenured (Daily) Staff by Office, as of 2002



Source: NIA archival data
Notes: Monthly Staff are tenured staff; Daily Staff are non-tenured staff; CO – Central Office; CAR – Cordillera Region; MRIIS – Magat River Irrigation System; UPRIS – Upper Pampanga River Irrigation System

This practice of hiring non-tenured staff has rendered the attrition policy ineffective – i.e., while the number of tenured staff at NIA has declined, they were

actually replaced by temporary staff, so the change only occurred in the composition of staff tenure but not staff size. For instance, in 1995, NIA's total number of staff was about 14, 500 and in 2000, NIA still has 13, 700 staff, a decline of 800 over a five year period. While tenured staff has declined thru natural attrition (retirement), retired staff were eventually replaced by more non-tenured staff.

While the total number of tenured NIA staff has declined overtime, still the agency is oversized relative to its functions. An independent study funded by the Japan International Cooperation Agency (JICA) and carried out by a team of international consultants found the problem of staff redundancy particularly serious (JICA 2001). The study, entitled "A Study to Strengthen NIA's Management System," undertook an intensive and extensive organization and management diagnostics of NIA at all levels of the bureaucracy. According to the Final Report, staff redundancy occurs when different units duplicate the same functions as others. Redundancy also occurs when departments are retained despite the loss of their functions due to technological changes or that their functions can be obtained at a more cost effective manner through contracting of the private sector (JICA 2001). The Report notes that NIA's central office, for example:

> "is performing the same functions as the regional offices and project management offices in terms of monitoring of operation and maintenance, preparation of feasibility studies and detailed design, monitoring of irrigation field offices, procurement of materials and equipment and processing of appointments, among others. ……..Such duplication of functions has become particularly costly given the decreasing number of projects due to funding constraints" (JICA 2001, pp.23).

Furthermore, the study finds that "as much as 50 percent of staff at the NIA central office can be considered redundant and their elimination will not cause considerable loss to NIA's effectiveness" (JICA 2001, pp. 24). More revealing is the

finding that close to 60 percent of NIA's staff are actually employed in the O&M of large scale irrigation systems, a function that can be and has been performed by IAs. A detailed breakdown of the JICA Report on staff redundancy is found in Appendix VII of Vol. II of the Final Report on the Study to Strengthen NIA's Management System (October 2001).

The JICA study concluded that NIA's current set-up was more appropriate twenty years ago during the first phase of irrigation development than it is under contemporary conditions. This phase in irrigation development, which I described in the latter sections of chapter two, can be characterized by capital intensive, government sponsored expansion phase, which occurred during the period of the "green revolution", and during the Marcos martial law years in the mid 1970s to the mid 1980s. During this period, NIA's charter was amended, its capitalization increased by more than 33 times and its staff by 9 times, the role of IAs were recognized and water rights were defined. During this period, irrigated areas grew from 742,447 ha to 1,436,880 ha, an increase of 93 percent or an annual average growth rate of 7.19 percent, which is 3.5 times faster than the international annual growth rate of 2 percent a year for the same period (NIA 1990). It was during this period that NIA gained international recognition as the finest irrigation agency in Asia and the developing the world.

In the last decade, however, NIA has been faced with the problems of persistent budget deficits, declining revenues, technological advances in water management, an increasing role for private sector participation in irrigation construction and a changing policy environment that mandates decentralization to local governments and IAs.

As earlier discussed in chapter two, the irrigation policy environment in the Philippines underwent structural reforms. In 1991, the Local Government Code of the

Philippines was passed which granted local government units 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 O&M of public irrigation systems. In 1997, the Agriculture and Fisheries Modernization Act or AFMA (Republic Act 8435), a landmark legislation, was also passed with considerable implications to NIA and IAs.

NIA's current internal organizational structure does not seem to be in step with these changes in the policy environment and as seen in NIA's de facto mission statement - "Service for Survival: Do Your Best for NIA's Best" - it has become increasingly concerned with its survival as an agency over the years.

5.2.3 Participation with Patronage

The precarious financial condition of NIA has prompted it to adopt cost cutting measures by decentralizing irrigation O&M in a number of small irrigation systems. NIA's primary motivation is summed up as follows in its 1990 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 and reduced conflict over water distribution. (*NIA, 1990: 104)*

This policy in the 1990s remains consistent a decade later. It represents a bias towards a limited role for IA participation and treats IAs as mere labor contractors. This is evident in Table 5.2 which shows a consistent decline in funding for activities to strengthen IAs from 1999 to 2001. For instance the number of farmer participants in IA

trainings dropped by 59 percent between 1999 to 2001 and the number of IAs receiving support from NIA dropped by 50 percent during the same period. This support from NIA is particularly crucial given the complex process of organizing, mobilizing and strengthening IAs (see Annex 5.1),

Table 5.2 - How NIA Supports IAs (1999 to 2001)

	1999	2000	2001	% Change
1.0 IA Training				
Number of batches	2,790	1,284	845	-70
Number of participants	69,756	38,528	28,931	-59
2.0 NIA Staff Training				
Number of batches	984	8	160	-84
Number of farmer participants	24,608	192	4075	-83
3.0 Support to IA strengthening				
Number of IAs	1,651	931	832	-50
Area covered (ha)	485,702	326,700	209,269	-57
Number of farmers	295,091	226,474	136,702	-54

Source: NIA archival data

The low level of support that NIA provides for IAs is reflected in a report about their viability. In 2001, the Japan International Cooperation Agency (JICA) funded an independent study to assess the viability of IAs (see JICA Study on IAs Final Report 2003). The study finds a number of issues concerning the viability of IAs, including the following: (1) lack of a definitive policy on IAs; (2) defective by-laws; (3) limited entrepreneurial capacity; (4) unclear policy about irrigation management transfer (IMT); and (5) lack of support systems. These findings are elaborated below.

Lack of a definitive policy on IAs

The assessment about IAs in early 2000 stands in contrast with assessments in the 1980s which carefully documented NIA's efforts to build IA capacity (see

section 2.6 of chapter 2 for a detailed account; see also Korten and Siy 1988). Old timers at NIA lament that NIA's top management is no longer as strongly committed to IA development as compared with the 1980s when it was a central management issue.

The absence of a specific law or policy on IA organization and operation has limited their development into sustainable groups. Existing policies provide NIA with sufficient authority to form IAs but these policies are faced with the following limitations: (a) they do not ensure NIA's sustained capacity to develop and not just organize IAs; b) they do not provide mechanisms to ensure IA organizational and financial viability; and c) they do not ensure the long term O&M of the systems especially in the national irrigation systems. All these have a direct bearing on the sustainability of the IAs and of the NIS facilities and services.

Unclear Policyon Irrigation Management Transfer

The absence of formal operational guidelines on the implementation of the IMT has led to varying interpretations of the role and responsibilities of IAs. Moreover, without the actual transfer of assets and water rights to farmers, NIA's version of IMT has not promoted a real sense of ownership among the IAs. These have resulted in weak IMT contracts between NIA and the IAs including lack of self-sustaining mechanisms and problems with compliance.

Lack of support systems

A major part of NIA's policy in support of IA development is the implementation of its institutional development program (IDP). IDP for IAs covers organizing farmers,

farm productivity enhancement, systems O&M and preparation for management turnover. However, NIA's institutional strengthening programs have been limited in terms of content, quality and reach and continued to focus on physical O&M of the irrigation systems, water distribution, ISF collection, basic financial management and mono-cropping practices. This traditional program orientation has continued the dependency of IAs on NIA's support and failed to encourage them to evolve into more viable organizations. Despite its limited resources for institutional capacity building, NIA's IDP has been highly dependent on internal funds and donor support for institutional development. It has not significantly mobilized resources for technical, marketing and financial support for the IAs from other institutions.

Defective IA Charters

The current charters of IAs, as generally prescribed by NIA, are problematic for the following reasons: a) they are restrictive in nature in terms of qualified membership; b) they limit expansion in membership due to lack of incentives and benefits; c) they lack jurisdictional authority over the system considering that IA organization is based on shared residential cluster rather than on hydrological considerations; d) they are deficient in financial sustainability mechanisms given focus on O&M and collection of irrigation fees; e) they do not encourage compliance since there are no sanctions and penalties for faulty and inactive members; and f) they lack regular monitoring and evaluation mechanisms.

For example, most IA charters, particularly in irrigation systems still owned and controlled by NIA, limit membership to land owners. The charters tend to state

that membership in an IA is voluntary and limited to any of the following: a) agricultural lessee; b) amortizing owner; c) owner cultivator; and d) other lawful possessor of agricultural land situated within the irrigable service area who is actually engaged in farming. However, the widespread problem of tenancy and other practices has led to a condition whereby it is the tenant and farm-workers who till the farm and reside in the villages. These actual tillers are, however, not recognized as legal members of the IA since they are not land owners.

In addition, IA by-laws in general restrict IA membership to the household head, which is usually male. For this reason, even though housewives also contribute to farming activities, IA's remain dominated by male farmers. Only less than 30 percent of IAs have women members because of this restrictive provision.

Expansion in IA membership is also limited because of inadequate incentives for non-members to participate. In the systems I have visited and based on farmer feed back during the IA conferences I attended, the problem of adequate incentives for non-members to participate stood out as a common issue. As long as farmers pay their irrigation service fee, they will get their share of water. The main benefit to formally joining the IA is the opportunity to work as a paid laborer of the IA, which is a contractor of NIA for the O& M of the system. Provisions for enforcement in IA by-laws are also weak, as indicated by the low proportion of IAs who enforce their O&M plans and collect irrigation fees from farmers.

Another important defect of current IA by-laws can be seen in the legal status of IAs. NIA generally intended the IAs to be non-profit organizations with no stock

ownership so they can focus on O&M and fee collection activities. Because of this organizational stature, IAs have become highly dependent on O&M fees and collection from irrigation service fees as sources of income. They are also constrained to undertake internal fund generation activities such as savings and capital build up because they are supposed to be non-profit entities. Consequently, they have limited capacities to engage in other entrepreneurial activities and have not diversified into other types of more profitable crops. Moreover, IAs have limited access to credit because of difficulty or failure in meeting borrowing requirements of financing institutions particularly the putting up of equity capital for income generating projects. In the next sections, I will discuss how these defects in IA by-laws, the lack of IMT and more definitive IA policies are manifested in numerous consequences.

The Consequences

Looking back twenty years since NIA's decentralization program was undertaken, the full transfer of irrigation management to farmers in national irrigation systems occurred in only 28 percent of the 2,056 IAs nationwide and 13 percent of the irrigation service area. Most of IAs were given limited rights and little authority to manage the systems other than serve as NIA's contractors. This kind of relationship between NIA and IAs has had several consequences as seen in Table 5.3.

Table 5.3 -Irrigation Associations Facts and Figures (as of 2002)

PARTICULARS	NUMBER	Percent of Total
IAs ORGANIZED		
No. of IAs Organized	5,532	
No. of Farmer-Members	683,491	
Area Covered, ha	1,086,539	
IAs REGISTERED		
No. of IAs Registered	4,978	90%
No. of Farmer-Members	641,047	94%
Area Covered, ha	1,030,617	95%
O&M CONTRACTING		
No. of IAs with O&M Contracts	3,559	71%
No. of Farmer-Members	372,617	58%
Area Covered, ha	241,691	23%
NIS-IA Functionality (2002)		
Functional	366	21%
Moderately functional	480	29%
Poor / non-functional	807	50%
NIS-IA Membership (2002)		
< 29% of potential members	99	4%
30-59%	1971	95%
> 60%	7	1%
Total	2077	100%
NIS-IA Net worth (Pesos, 2002)		
< P 59,000	1899	93%
60,000-100,000	65	3%
> 1000,000	73	4%
Total	2037	100%

Source: NIA-Institutional Development Department

The first consequence of this type of relationship between NIA and the IAs is that 93 percent of all IAs have an average net worth of less than 59,000 pesos ($1,030 in 2005 prices), an amount that barely pays for routine maintenance and rehabilitation work. This is because the IAs were primarily organized by NIA to serve as its agents for O&M, and thus their financial base is primarily dependent on labor contracts from NIA. Not surprisingly, only 8 to 25 percent of IAs implement their O&M plans (JICA 2003, pp. 3-13)

Second, this patron client relation stunts farmers' abilities to govern their irrigation systems. For instance, according to the JICA study, about half of all IAs are poorly functioning or exist only in paper, while only 21 percent, by NIA's account, are considered functional (JICA 2003, pp 3-11). IA functionality is rated by NIA in terms of a composite set of criteria, including: 1) O&M (planning, implementation and performance); 2) organization in terms of membership, record keeping, holding of meetings (general assemblies, board of directors, service area meetings); 3) financial performance; and 4) organizational discipline.

Because of the poor functionality of IAs, and because the benefits of being a member are unclear, not surprisingly, farmers are reluctant to join them. Almost all of IAs (95 percent) have memberships less than 50 percent of potential members (i.e., of all the farmers in a given irrigation system, less than 60 percent bother to formally join the IA). Of those who do, less than 25 percent actually actively participate in IA activities.

Thus, when farmers do not own the irrigation system or have well defined authority, they have strong incentives to free ride in the payment of fees on the correct and often reinforced expectation that NIA will eventually forgive them. This is a moral hazard problem arising from the kind of relationship between NIA and the IAs which I described as akin to a patron-client relation.[3]

The problem of moral hazard in this case occurs when farmers have reduced incentives to pay their irrigation fees to NIA because of this patron client relationship. I have earlier shown in chapter four how the problem of moral hazard between NIA and

[3] In its original formulation, moral hazard refers to an insurance situation that reduces the incentive of the insured person. If fully insured, they can make themselves better off, and perhaps society on the aggregate will be worse off, by spending less of their own resources on loss prevention than they would in the absence of insurance. It also refers to risky situations by the insured to qualify for compensation (See Ehrlich and Becker, 1972).

IAs is clearly manifested by the magnitude of free riding in the payment of fees. For instance, over a ten year period from 1990 to 2000, some 80 percent of farmer's back accounts for irrigation fees remain uncollected. As I discussed in chapter four, NIA estimated that some 567,041 farmers have outstanding balances with the agency totaling Pesos 6.67 Billion ($125.9M). Farmers know that NIA – through its contracted IAs – would be unable to enforce the collection of unpaid irrigation fees, which further strengthens the incentive to free ride. This expectation by farmers is repeatedly proven correct – and the moral hazard problem reinforced again. In 2003, NIA announced a program providing amnesty to delinquent payors in return for partial payment of unpaid fees. The initial result of this latest effort by NIA – reported in early 20004, was not encouraging. A year after launching the compromise program, only 1.5 percent of all the farmers has settled their back accounts with NIA. Again, this indicates a major incentive problem in the relationship between NIA and farmers.

5.3 Irrigation Aid

In sections 5.1 and 5.2, I have argued and shown that NIA has strong incentives to build, neglect and rebuild irrigation systems. In this section, I argue that incentives embedded in irrigation aid help strengthen this perverse incentive by NIA. Donors are relatively happy to provide capital intensive, "brick and mortar" rehabilitation loans to NIA because this is good for the donor's loan portfolio, and because they are attractive in terms of straightforward design and are quick disbursing. I also argue and show that NIA and its donors are bound in a moral hazard problem that creates incentives for donors to be lax in the enforcement of loan provisions on O&M and for NIA to routinely promise

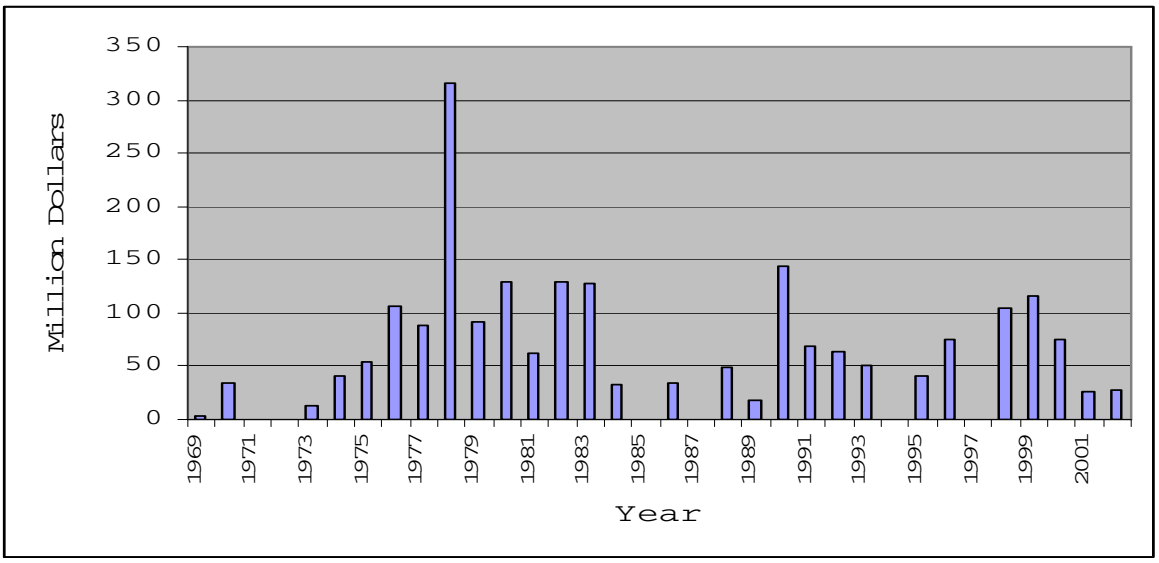
adequate funding for O&M while faced with a negligible cost for non-compliance. Finally, I argue that the confluence of these perverse bureaucratic and aid incentives is what drives the problem of chronic underinvestment in maintenance.

5.3.1 The Role of Irrigation Aid

Foreign aid plays a central and influential role in irrigation development in the Philippines, as in other developing countries, and therefore deserves a closer examination. In this and in the next section, I argue and show how incentives embedded in foreign aid (also discussed in chapter three) can aggravate these perverse incentives faced by NIA.

Since 1969, NIA has contracted foreign loans approximately in the amount of $2.2B for its capital expenditure, O&M support and institutional development projects (Figure 5.7).

Figure 5.7- Irrigation Aid in the Philippines, In Million Dollars, Real Prices (1969-2002)

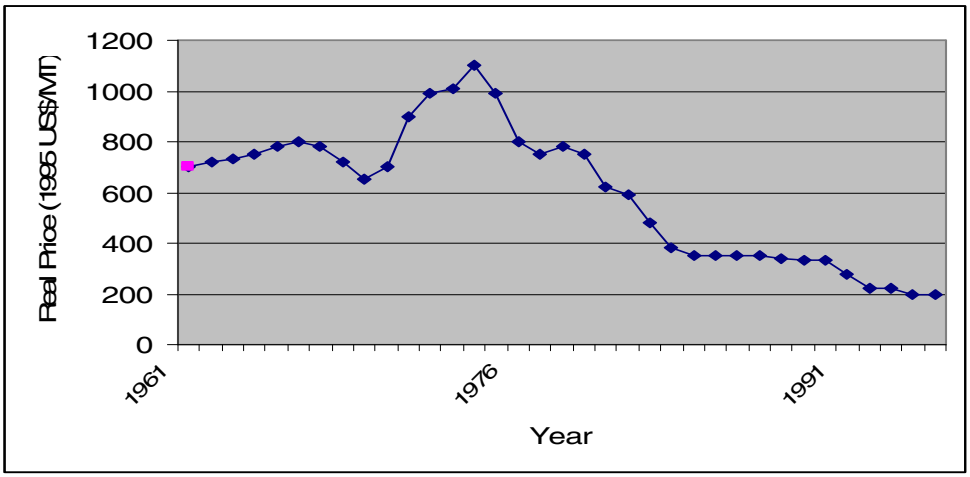


Source: NIA archival data

Practically all of NIA's capital investment projects were financed with foreign funding, particularly from the World Bank, Asian Development Bank (ADB) and the Japan Bank for International Cooperation (JBIC).

Irrigation funding from donors increased substantially from 1971 to 1983, with the highest amount of loan recorded in 1978 at $320M. However, irrigation funding conspicuously dropped from 1984 to 1989. The reason is that the World Bank recommended that NIA scale down its investment program for future irrigation projects because of the projected huge rice surpluses and declining commodity prices. Indeed, the price of rice, the basic crop grown in the Philippines, has been on a steep decline since 1976 (Figure 5.8). The World Bank's recommendation effectively signaled the end of the construction phase of irrigation in the Philippines, and ushered in the second phase of irrigation lending in mid 1980s – the emphasis on irrigation rehabilitation and improvement.

Figure 5.8 - Real World Prices of Rice (1961-1995)



Source: Fujita et al 1999.

Given the importance of aid in irrigation, the logical question then becomes: what are the incentives embedded in irrigation aid and how do these incentives impact the incentives faced by irrigation bureaucrats? I find that irrigation aid in the Philippines is mainly characterized by "brick and mortar" projects and the preference for these types of projects is a function of "business as usual portfolio game" played by donor staff. The loan portfolio game in turn is influenced by the moral hazard problem that binds donors and NIA.

5.3.2 "Brick and mortar" projects

A document analysis that I conducted covering all major NIA projects since 1990 (summarized in Table 5.4) indicate that donor funding over the years, regardless of source, focus on what can be termed as "brick and mortar" projects that emphasize construction and rehabilitation, operation and maintenance and strengthening of existing business-as-usual governance arrangements.

Table 5.4 - On-Going/Completed Major NIA Projects (1990-2002)

Name of Project	Main Components
1. Irrigation Operation Support Project II	Provision of subsidies to the operation and maintenance national systems
2. Irrigation Operation Support Project II	Rehabilitation of 17 NIS / O&M improvement / institutional development /farm support
3. Water Resources Development Project (1997-2002)	Improvement of water resources planning and management / improvement of watershed management / rehabilitation of 18 NIS (66,000ha) / institutional development for NIA and IAs / environmental improvement
4. Irrigation Sector Improvement Project II (1997-2003)	Rehabilitation of 9 NIS (12,600ha) / institutional development/ agricultural support / environmental and social improvement and monitoring
5. Casecnan Project Irrigation Component (1997-2004)	Development of new facilities for 30,000ha / rehabilitation of facilities for 105,000 / O&M improvement / institutional development
6. Southern Philippines Irrigation Sector Project (SPISP) (2000-2006)	Institutional development for NIA and LGU / farmer participation / management transfer / construction / rehabilitation of more than 10 communal systems, 10 national

	systems and 8 small reservoir/ Access roads / environmental and social measures
7. Malitubog-Maridagao Project (1990-2003)	New construction of facilities for 10,800 ha
8. Bago RIS Project (2002-2005)	Rehabilitation of facilities covering 12,777 ha
9. Grain Sector Loan - Irrigation (2001-2006)	Rehabilitation of facilities covering 16,500 ha

Source: NIA Archival Data

For instance, the purpose of two major World Bank funded projects in the early 1990s, the Irrigation Operations Support Project I and II, was to provide subsidies to the O&M of irrigation systems nationwide and rehabilitate dilapidated systems. Follow up projects in the mid to late 1990's by the Asian Development Bank also mainly focused on irrigation rehabilitation and construction. Similarly, projects funded by the Japan Bank for International Cooperation focused largely on irrigation construction and rehabilitation.

These types of projects – O&M support and rehabilitation - constituted about 39 percent of NIA's total foreign funded projects since 1969 but almost 100 percent for the 1990 to 2002 period. As noted by Briscoe (2002), 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 to farmers.

5.3.3 The Business as Usual Loan Portfolio Game

Why the preference for brick and mortar construction type projects? One consideration is the riskiness and the probability of failed implementation when introducing alternative ways of doing business. During project design, project officers must consider project risks involved and how these might affect the quality and size of his or her project loan portfolio. Brick and mortar projects tend to involve

straightforward engineering design with familiar contracting and construction supervision mechanisms. These types of loans tend to disburse quickly and are relatively easily monitored. They also generate reliable bribe revenue for contract officers. Also, aid project officers are often 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 probability 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. In addition, when the national government cannot credibly commit to pursue needed reforms, risks grow still farther. When reform efforts fail, project disbursements are stalled. This impacts the loan portfolio and careers of bank officers as disbursements are a typical indicator of staff performance. This, in brief, is the "brick and mortar portfolio game" that faces donors (see also Gibson et. al. 2005 for a discussion of aid incentives).

5.3.4 Moral Hazard Problem in Irrigation Aid

Another incentive problem embedded in irrigation aid is the problem of moral hazard - generally referred to here as post contractual opportunism - that binds NIA and its donors. As I suggested in chapter three, the problem of moral hazard in the case of irrigation arises from the dependence of irrigation agencies on foreign aid and incentives

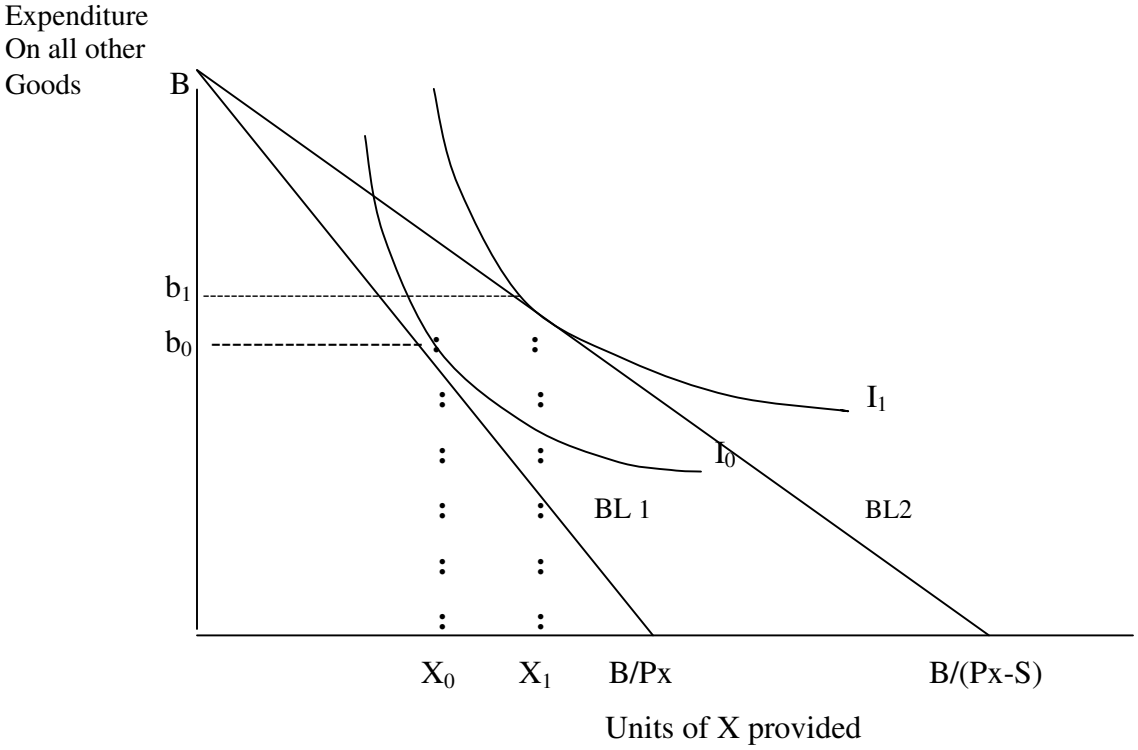
faced by donor staff (i.e. donors are in the business of disbursing aid and therefore their performance is measured by, among others, the size of their loan portfolio and rates of disbursement).

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 irrigation O&M after project completion. NIA routinely makes this promise yet the reality is one of chronic underinvestment in maintenance and deteriorating facilities as evident in Figure 4.2 and Table 4.1 in chapter four. Why is this the case?

One plausible reason is the moral hazard problem embedded in irrigation aid. Donors need NIA as a client as much as NIA needs donors. Regardless of NIA's compliance record, it can correctly expect donors to continue financing rehabilitation projects because it is in the donor's interest to increase their loan portfolio. Absent enforcement and the negligible costs of non-compliance, NIA's dominant incentive is to default on its responsibilities towards O&M as shown in Table 4.1 of chapter four.

The evidence in support of the moral hazard argument becomes clear when one analytically considers the effect of foreign aid subsidy on NIA's incentives by examining an analytic budget diagram (Figure 5.9).

Figure 5.9 - The Effect of Foreign Aid Subsidy on NIA's incentives



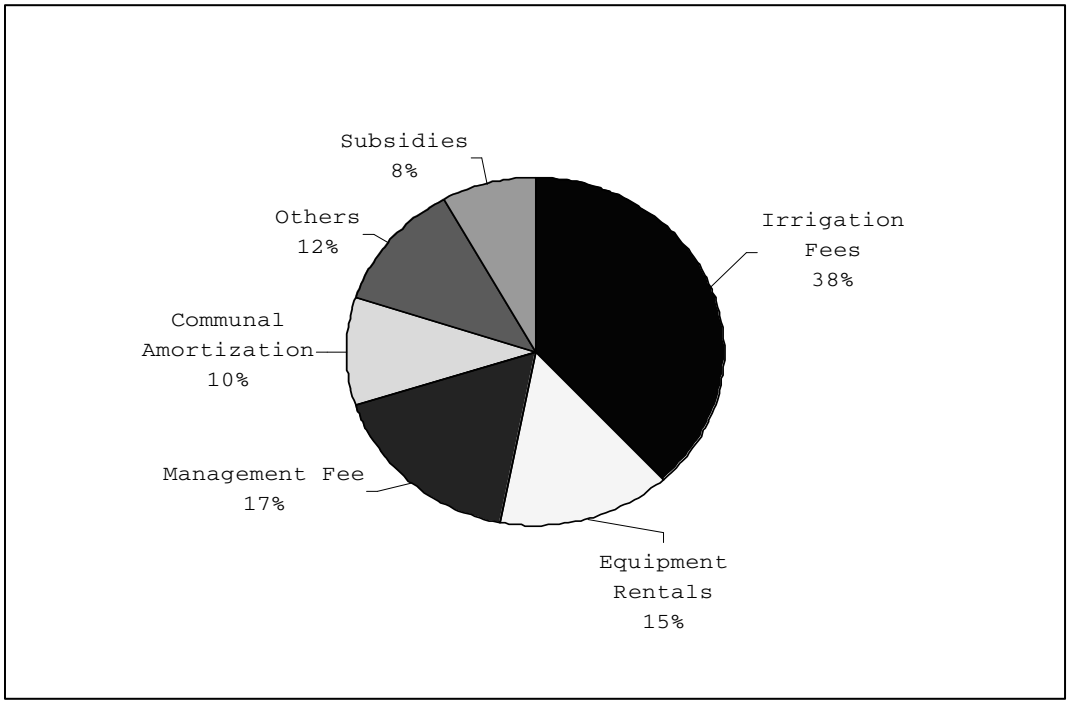
The horizontal axis shows the quantity of a good or service that NIA provides - for example irrigation O&M denoted by the variable X. The vertical axis shows NIA's expenditure on all goods other than X. The line that connects B/Px and B (i.e. BL1) represents NIA's initial budget line without a subsidy.

Given a total budget of B, NIA could do three things. First, it can spend nothing on X (irrigation O&M) and instead spend its entire budget on all services other than X. Second, it could spend everything on X and nothing on other services. Third, and more realistically, it could choose a budget allocation at any point in the budget line BL1 between these extremes. Given this budget line, assume that NIA decides to provide X_0 units of irrigation O&M denoted by X. The indifference curve labeled I_0 gives all the combinations of X and expenditures on other goods that would be as equally satisfying to NIA as X_0 and b_0 spending on other goods and services.

Suppose the national government borrows from donors to subsidize NIA the amount S for each unit of X (irrigation O&M) it will provide. This would be a matching grant because it matches NIA's expenditures for O&M at some fixed percentage. It is open ended because there is no ceiling on the total subsidy that NIA can receive from the national government. With this subsidy, NIA's budget line now shifts to the right from BL1 to BL2. The effective price that NIA sees for X (irrigation O&M) falls from Px to Px-S because of this subsidy. With this new budget line, NIA now procures X_1 units of X reaching a higher level of satisfaction indicated by indifference curve I_1. However, as a result of this subsidy, NIA also spends more on other goods and services unrelated to canal maintenance as some of the subsidy for X (irrigation O&M) spills over to goods and services other than X. The subsidy therefore becomes decategorized and the area bounded by horizontal the lines from points b_0 and b_1 shows the extent to which the subsidy to O&M spills over to goods and services other than irrigation O&M.

The illustration in Figure 5.9 represents well what is actually happening at NIA - funding for irrigation rehabilitation projects tend to be decategorized or tend to spill over to other expenditure items (Figure 5.10).

Figure 5.10 - NIA's Total Income from 1993-2002, In Percentage, By Source



Source: NIA archival data

As Figure 5.10 will show, 17 percent of NIA's total income over a 10 year period (1993-2002) is constituted by management fees which fund personnel and O&M costs at NIA's headquarters (JICA 2001). Management fees are fees that NIA charges for foreign funded irrigation projects. Every time an irrigation loan project is undertaken, NIA uses part of the loan to pay for the operation and maintenance of its headquarters. Thus, a portion of loans for irrigation rehabilitation, for example, spills over to other services not directly related to the actual O&M of irrigation systems themselves. In this case, a portion of the subsidy for irrigation rehabilitation becomes "decategorized or spills over" to other spending categories not directly related to irrigation O&M, for example, paying for salaries of staff in the headquarters who do not contribute to irrigation O&M. This is

one arrangement that gives NIA a strong incentive to borrow irrigation loans because these management fees keep the NIA central office afloat.

Second, foreign funded projects also provide equipment assets to NIA, which in turn generate equipment rental fees that finance NIA's regional offices. Equipment rental fees are fees collected by NIA when it rents out these loan-funded equipments to contractors of irrigation projects or to other contractors in the construction industry. While proceeds of irrigation loans are categorically intended for specific projects, part of the loan again spills over to other categories or they become decategorized. In the case of subsidies for equipment assets, NIA rents out these equipments to private contractors – not necessarily to be used in projects where they were originally intended to be used – in order to generate additional revenues to subsidize the salaries and O&M of regional offices. As Figure 5.9 shows, from 1993-2002 such fees accounted for 15 percent of its total income, which is primarily used for the maintenance cost of regional offices. Again, this arrangement creates a strong incentive for NIA to ensure a steady stream of foreign funded irrigation projects since these projects bring in the revenues that keep NIA afloat.

Third, rehabilitation projects bring in additional income from irrigation service fees to support the operations of NIA's Irrigation System Offices (NISOs). These fees are collected from farmers as payment for irrigation services. Newly rehabilitated irrigation systems bring in additional sources of revenues for NIA which would not have materialized when irrigation systems are non-functioning. Between 1993 and 2002, irrigation fees generated 38 percent of NIA's total income. Ideally, the revenue from irrigation fees should be plowed back from where they were originally collected so that farmers can see where their fees are going. However, these irrigation fees revert to NIA's

General Fund which is then used to pay for services other than actual O&M of irrigation systems. Farmers complain that the fees they pay are not plowed back into their systems but are instead used to pay the salaries of central office personnel.

Fourth, until 2001, foreign funding also directly subsidized the O&M of national irrigation systems, accounting for approximately 8 percent of NIA's total income (JICA 2003). These subsidies were directly used to pay for salaries of irrigation personnel and the operations of the NIA, an arrangement that only created an incentive for NIA to maintain a large bureaucracy.

Considering the above illustrations, NIA's incentive structure thus becomes clear: it has a strong motivation to under invest or postpone investments in irrigation maintenance since irrigation systems that are poorly maintained soon become candidates for rehabilitation and therefore justify capital expenditure from donors. These capital expenditures, as I have shown in Figure 5.9, generate at least 40 percent of NIA's budget – the amount that spills over or become decategorized in expenditure items other than irrigation O&M. These irrigation projects also increases the revenue base of NIA which also helps to pay for the salaries of its staff, and not necessarily being reinvested in irrigation systems where they were collected.

NIA therefore has strong incentives to maintain the current subsidy scheme provided by donors because these funds keep NIA afloat amidst a precarious financial condition. If these subsidies were to directly go to IAs or if the private sector were paid to undertake rehabilitation, NIA would not exist in its present form today (Briscoe 2000). As I have earlier explained, donors also have little incentive to alter this incentive structure because this is what motivates NIA to continue borrowing for irrigation aid.

5.4 Summary and Conclusion

In this chapter, I employed collective choice analysis and focused on the incentives faced by irrigation bureaucrats and donors. I hypothesized that the persistent problem of poor performance – particularly the problem of chronic underinvestment in maintenance - is linked to the problem of perverse bureaucratic incentives faced by NIA, which were shaped by several factors: (1) the inherent incentive problems faced by public bureaucracies; (2) by the early history of irrigation development; and (3) by incentives embedded in irrigation aid.

My findings generally confirm that, indeed, NIA's behavior is largely consistent with the bureaucratic self interest hypothesis argued by scholars of public choice. These incentive problems faced by NIA partly explain the puzzle of persistently poor irrigation performance despite the decentralization reform program in the 1980s. These incentives and behavior exhibited by NIA can be summarized as follows:

First, NIA has a strong incentive to under invest in the maintenance of irrigation systems because this justifies new loans from donors for capital intensive investments in rehabilitation. The evidence clearly shows the extent of deterioration of irrigation facilities due to underinvestment in maintenance, and NIA's incentive to pursue irrigation rehabilitation projects.

Second, I argued that these new loans for irrigation rehabilitation provide direct and indirect subsidies to NIA that enables it to weather a precarious financial condition. I showed how precarious NIA's financial condition was, and explained how this was linked to the problem of an oversized and aging bureaucracy with well entrenched

interests struggling for agency survival. I also showed why NIA has an incentive to allow farmer participation with patronage in a limited number of irrigation systems and what their consequences were.

Third, I argued and showed that donors are just as happy to provide capital intensive "brick and mortar" rehabilitation loans to NIA because this is good for the donor's loan portfolio. I also argued and showed that NIA and its donors are bound in a moral hazard problem that creates incentives for donors to be lax in the enforcement of loan provisions on O&M and for NIA to routinely promise adequate funding for O&M, and yet is faced with a negligible cost for non-compliance. I conclude that the confluence of these perverse bureaucratic and aid incentives is what drives the problem of chronic underinvestment in maintenance, which in turn drives the vicious cycle problem that characterizes irrigation performance in the Philippines.

Finally, my findings are corroborated by other scholars and individuals highly knowledgeable about NIA. For instance, Ipat-Bagadion (2004), a former NIA staff who was also a central figure in the early participatory program, essentially lays the blame on NIA's current bureaucratic culture and priorities. She laments that "NIA's current management is no longer as supportive of farmer participation as compared to the period when the program was given all out support." *(Personal communication with Ipat-Bagadion, July 2004).*

Korten (1989), one of the prime movers behind NIA's participatory program, has warned about the dangers of backsliding in reforms. Reflecting on the early bureaucratic transformation of NIA, Korten suggested that while this transformation had led to the success of the participatory program in the communal irrigation systems, it is not

necessarily a virtuous and deterministic cycle that will be carried over to the larger national irrigation systems. Korten was concerned about the possibility that the outpouring of irrigation aid in the larger systems will undermine the very foundations that led to the success of farmer participation in the smaller irrigation systems. Korten (1987) noted that foreign funded projects in the larger systems emphasized targeted increases in both the total amount of irrigation fees the NIA was to collect and the total operational expenses it was to incur. This had the effect, according to Korten, of undermining the concept of turning over responsibilities to IAs and sharing irrigation fees.

These views were shared by De los Reyes,[4] a sociologist and another prime mover behind the participatory program in the smaller irrigation systems. De Los Reyes suggests that:

> "in areas where local organizations were strong and vibrant before they were drawn into the NIA devolution program, the IAs remain strong and vibrant and might have even improved their management capacities particularly with regard to financial management" *(personal communication with de los Reyes 2004).*

She was less enthusiastic, however, about the way NIA has handled the program in the larger national irrigation systems, the ones examined in this study. She argues that NIA's organizing work in these large irrigation systems do not develop strong organizations from scratch because it is just concerned with the economics of irrigation O&M and does not concern itself with building strong social relationships among farmers.

[4] Based on a series of phone interviews and emails with Dr. Romana De Los Reyes (June and August 2004)

CHAPTER SIX

OPERATIONAL CHOICE ANALYSIS: HOW FARMER'S INCENTIVES ARE SHAPED BY PHYSICAL AND SOCIAL VARIABLES

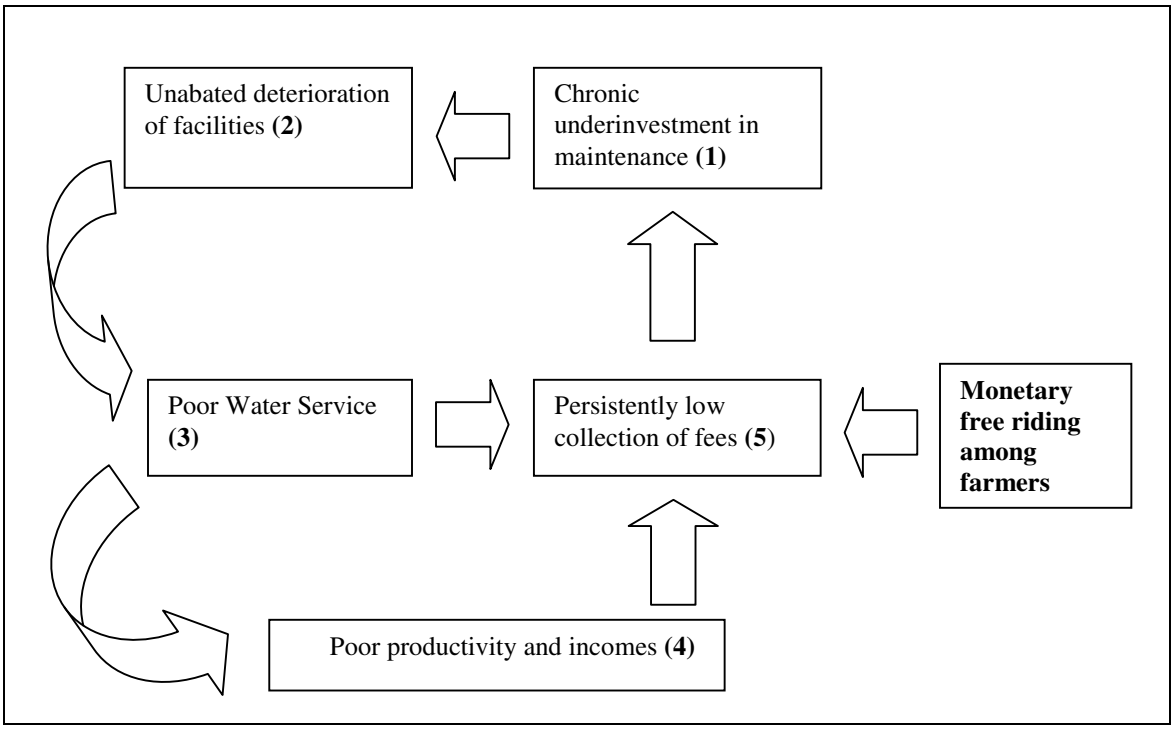
6.0 Overview

In chapter five, I argued and showed – using collective choice analysis – how the puzzle of irrigation decentralization is linked to incentive problems faced by NIA. I argued that these incentives were shaped by the historical development of irrigation in the Philippines, and reinforced by incentives embedded in irrigation aid particularly by the problem of moral hazard.

While this analysis provides a plausible explanation to the puzzle of irrigation decentralization and poor performance, it cannot adequately explain another puzzle, in particular the variation in the levels of free riding found among irrigation associations (IAs). Why do some IAs have higher levels of free riding – in terms of the payment of irrigation fees and labor contribution - compared to other IAs even though they are all subjected to the same set of collective choice incentives?

In this chapter, I shift to operational choice analysis to answer this puzzle. I hypothesize that the puzzle of irrigation decentralization and poor performance is also linked to collective action problems faced by farmers (Figure 6.1).

Figure 6.1 - Farmer incentives and irrigation performance



I focused in particular on the collective problem of free riding among farmers in the *payment of irrigation service fees and contribution of voluntary labor.* Based on the theoretical and empirical literature discussed in chapter three, I examine ─ using a linear regression model – two sets of predictor variables identified in the literature as being relevant. These factors are described below and their hypothesized effects on the levels of free riding were summarized earlier in Table 3.1:

- the characteristics of the irrigation system in terms of water scarcity, size of service area and infrastructure condition;

- the characteristics of farmers in terms of their size, age and origin of the IA, poverty levels, entrepreneurship, salience irrigated farming, proximity to markets and gender distribution.

The rest of the chapter is organized as follows. In Section 6.1, I present the findings from my statistical analysis followed by a discussion and analysis in Section 6.2. In Section 6.3, I examine whether the same set of factors that affect monetary free riding have the same effect when farmers are asked to contribute labor instead of monetary payment. Summary and conclusions follow in Section 6.4.

6.1 Summary of Findings

For ease of reference, I have organized the presentation of my findings in Table 6.1.

Table 6.1 - Organization of Findings

1. The Complexity Involved in the Operation of Large Scale Irrigation Systems	Figure 6.1
2. Descriptive Statistics of Variables Used in Tests	Table 6.2
3. Correlation analysis	Annex 6.1
4. Linear Regression Model (LRM)	Annexes 6.2 and 6.3
5. Tests for Robustness of the Linear Regression Model	Annex 6.4
6. Tests for Robustness of Binary Regression Model (BRM)	Annex 6.5

6.1.1 The Complexity of Large Scale Irrigation Systems

Operational level collective action in large scale public irrigation systems is a complex challenge involving multiple actors, functions and timeframes. Each of the actors in the irrigation system plays different roles at different scale at different time frames that make coordination a particular challenge. Figure 6.1 illustrates the scope of this complexity.

Figure 6.1. The scope of operations in large scale public irrigation in the Philippines.

Source: NIA Abbreviations: NISO- National Irrigation System Office ; FIA - Federation of IAs; TSAG-Irrigator service area groups; O&M - operation/ maintenance; CCP- cropping calendar plan; ISF- irrigation service fee; SMC- systemmanagement committee

In a large scale system, NIA primarily deals with the officers of the federation of IAs, who in turn deals with officers of member IAs, and eventually with farmer members down to tertiary canals. In terms of business planning, NIA is mainly responsible for preparing draft O&M plans, and distributing copies to federation of IAs (FIA), and concerned general assemblies. NIA is also responsible for convening the System Management Committees (SMC) composed of NIA and farmer representatives. NIA is also responsible for finalizing operation and maintenance (O&M) plans and distributing these to all concerned IAs. In terms of maintenance, NIA is responsible for the rehabilitation of main canals and head works and takes the lead in scheduling of water delivery from these head works.

From pre-irrigation activities to post irrigation works, NIA often takes the lead in coordinating the entire operation of the system, with the federation of IAs closely working with NIA, and serving as channels among IAs which eventually serve as channels to farmer members. It is through this set up that makes it possible for large scale irrigation systems (1,000 ha to 30,000 ha and involving the coordination of an equally large number of farmers and NIA staff) to function effectively.

The scope of operations in large scale systems is not only complex but the physical, social and institutional characteristics of the systems are as complex and varied as well. Table 6.2 provides a summary of key descriptive statistics characterizing the 2,056 IAs in the 196 large scale systems in the Philippines.

Table 6.2 - Descriptive Statistics of Variables Used in Tests

Variables	Description	Min	Max	Mean	Std Dev
Outcome Variables					
FREE RIDE	Monetary free riding as measured by proportion of unpaid irrigation fees by IA	0	85	42.6	19.1
GROUPWRK	Average attendance in group work as proxy of labor contribution; coded as 1 if attendance is > 75% of IA membership; 0 otherwise; lower values, higher free riding in labor contribution	0	1	0.84	0.36
Independent Variables					
SCARCT	Water scarcity, coded as 1 if frequent; 0 otherwise	0	1	0.33	0.47
CROP INT	Cropping intensity ranging from 0 to 200 with higher values indicating greater intensity	0	200	140	53.8
AREA	Size of the irrigation system under the IA responsbility, i n hectares	13	1,162	284	206
DISTANCE	Distance of the irrigation system from main economic centers, coded as 1 if > 1 hour away, else 0	0	1	0.81	0.39
INFRACON	Infrastructure condition measured by the ratio of infrastructure in functional condition, by engineering standards; higher values, more functional	7	100	55.7	23.5
AGE	Age of the IA from date of formal incorporation, coded as 1 if IA is ≥ 10 years; else, 0	0	1	0.84	0.36
USERSIZE	Number of farmer appropriators at the level of turnout service area or tertiary canals	5	618	181	110
GENDER	Proportion of IA members who are women	0	38	8.6	8.1
ENTREP	Extent of IA entrepreneurship measured by the per capita net worth of the IA (Pesos, 2002)	0	30,209	118	1008
SALIENCE	Salience of irrigated farming to farmer's livelihood measured by the annual gross household income from irrigated farming, in '000 Pesos 2002	9	89	34.5	19
PVRTY	Poverty levels measured by farm size in ha	0.1	4.3	1.44	0.6
ORIGIN	Origin of the irrigation association; coded as 1 if the IA was self organized; 0 otherwise	0	1	.02	0.14
PATRON	Political patronage, coded as 1 if there is a political dynasty in the province for at least 30 years	0	1	0.72	0.44
ELECT	Frequency of IA elections; coded as 1 if regular (once a year); 0 otherwise	0	1	0.81	0.39
TENURE	Land tenure security, measured as the proportion of farmers with secure tenure (i.e. owners/ mortgage holders)	0	100	60	24
COMM	Face to face communication among farmers coded as 1 if regular (once in two mos.); 0 otherwise	0	1	0.74	0.43
AUTO	Autonomy of the IA to govern the system; coded as 1 if IA holds the right to control water; exclude others from the system; autonomy in fiscal matters; federation at all levels;	0	1	0.14	0.35

6.2. Discussion and Analysis of Findings

6.2.1 The Effects of Physical Variables on Monetary Free Riding

Water Scarcity and Infrastructure Condition

I test the hypothesis that water scarcity and free riding are inversely related i.e., one could expect a lower level of free riding as water scarcity increases, *ceteris paribus.* The reason for this has to do with the sense of collective vulnerability associated with water scarcity, which increases the likelihood of cooperation among farmers, and hence lower levels of free riding.

My findings confirm the hypothesis that water scarcity has a negative, strong and statistically significant impact on monetary free riding. Frequent water scarcity leads to a 4.2 percent decline in monetary free riding, *ceteris paribus*, and the result is statistically significant (Table 6.3).

Table 6.3 - Effect of Water Scarcity /Infrastructure Condition on Monetary Free Riding

Predictor	Coef	SE Coef	T	P	
Constant	52.947	4.976	10.64	0.000	
SCARCT	-4.208	1.344	-3.13	0.002	***
CROPINT	-0.13100	0.01063	-12.33	0.000	***
INFRACON	0.01183	0.03024	0.39	0.696	

*** Significant at alpha 0.01
** Significant at alpha 0.05
* Significant at alpha 0.10

This finding is consistent with those of other scholars. First, in the case of South India, Wade (1987) suggests that the greater the scarcity and uncertainty of water supply and the greater the salience of the resource, the greater the likelihood that a community of cultivators will develop collective arrangements to govern their water course. Wade suggests that this finding is not just limited to water but also applies to grazing land:

when grazing land is scarce, collective action among farmers are also more likely to take hold. Second, Baland and Plateau (1996) note the high correlation between the degree of water scarcity and the level of activity among informal water associations. Third, Sengupta (1991), using data from India and the Philippines, also suggests that one of the conditions for cooperation in irrigation is that individual farmer's expectations regarding the availability of water and its productive efficiency must be high.

On the other hand, the condition of irrigation infrastructure is positively related with water scarcity. More functional irrigation facilities mean more reliable water service. One would expect a lower level of free riding in irrigation systems with better infrastructure conditions, *ceteris paribus.* My findings however show that the relationship between infrastructure condition and monetary free riding is not statistically significant, indicating that infrastructure condition per se, while necessary, is not a sufficient condition for a good water service, and may even be related in the opposite direction.

Figure 6.3 - I find that water scarcity, as expected, has a statistically strong, negative and significant effect on levels of monetary free riding (i.e., in areas experiencing water scarcity, there is a lower level of monetary free riding). A plausible explanation has to do with the fact that frequent water scarcity also increases the sense of collective vulnerability among farmers that helps create the incentives for cooperation. This finding is consistent with Wade (1988).

Size of Irrigation Area

Scholars suggest that the smaller and more clearly defined the boundaries of the common pool resources, the greater the chances of success of collective action. Conversely, the larger the size of the irrigation area, *ceteris paribus,* the higher the cost of monitoring and enforcement, and hence the likelihood of free riding Wade (1988). I test the hypothesis that as the size of irrigation service area increases, the cost of monitoring and enforcement increases, and thus lead to a higher level of free riding, *ceteris paribus.*

My regression results show that the impact of size of the irrigation system on free riding is indeed negative but small and not statistically significant (Table 6.4).

Table 6.4 - Effect of the Size of Irrigation System on Monetary Free Riding

Predictor	Coef	SE Coef	T	P
Constant	52.947	4.976	10.64	0.000
AREA	-0.010993	0.007845	-1.40	0.161

*** Significant at alpha 0.01
** Significant at alpha 0.05
* Significant at alpha 0.10

One explanation for this is that the cost of monitoring monetary free riding is not so much a function of the physical size of the system *per se* as much as the technology of monitoring irrigation payments. Indeed, one can find cases whereby a large system can be effectively monitored through computerized and regularly updated tracking of payment records while considerably smaller systems have difficulties doing so. However, for monitoring to be effective in inducing and sustaining collective action, credible enforcement must be present (Gibson, Williams and Ostrom 2005).

Figure 6.4 – I find that the size of the irrigation system has no statistically significant effect on the level of collective action. It appears that monetary free riding is not so much a function of the physical size of the system *per se* as much as the technology of monitoring irrigation payments.

6.2.2 The Effects of User Group Characteristics on Free Riding

In this section, I examine how various attributes of user groups affect monetary free riding. I examine, in particular, the following factors postulated in the literature as being theoretically relevant to the question of collective action: the age and origin of the IA, group size or size of appropriator, gender composition, poverty incidence and salience of irrigated farming. My findings are briefly discussed below.

<u>Age and Origin of the IA</u>

Various scholars view the age and origin of the IA as important factors in explaining collective action. The conventional view is that, in general, in older IAs, the patterns of action have had more time to be established as shared patterns of

understanding. As Meinzen-Dick et. al. (1999) suggest, members know what to expect in older IAs whereas members of newer IAs are less certain whether cooperation will be rewarded. This view is supported by Fujita, Hayami and Kikutchi (1999) who postulate that a high level of collective action is less likely when the history of irrigated farming is short. A contending view is that the age of the irrigation system has no statistical significance on levels of collective action (Ternstrom 2003).

The origin of the IA – whether self organized or organized by the irrigation agency – is also postulated to affect the likelihood of collective action among farmers. As Meinzen-Dick et al. (1999) imply, it is generally easier for irrigators to have a sense of "ownership", i.e., a personal stake in the IAs if it started spontaneously among themselves than if outsiders brought in the idea or imposed it on local users.

I tested the hypothesis that older and more experienced IAs have lower levels of free riding, *ceteris paribus.* My findings confirm the general expectation that the age of the IA is inversely related with monetary free riding (Table 6.5).

Table 6.5 - Effect of the Age and Origin of the IA on Monetary Free Riding

Predictor	Coef	SE Coef	T	P	
Constant	52.947	4.976	10.64	0.000	
AGE	-2.730	1.468	-1.86	0.063	*
ORIGIN	6.638	5.003	1.33	0.185	

*** Significant at alpha 0.01
** Significant at alpha 0.05
* Significant at alpha 0.10

Older IAs are more likely to have lower levels of free riding and the result is statistically significant ($p<0.10$). For every unit increase in the age of an IA, monetary free riding decreases by 2.3 percent. This finding is generally consistent with Meinzen-Dick et al. (1998) and Fujita, Hayami and Kikutchi (1999) who suggest that older IAs are

more likely to be stable as patterns of interaction have had more time to become established as shared understanding among members (i.e. they know what to expect from older IAs). In contrast, in newer IAs, members are more uncertain whether their cooperation will be rewarded.

I also tested the hypothesis that self organized IAs have lower levels of free riding, *ceteris paribus.* The argument is that self-organized IAs have a stronger sense of identity and are more likely to have developed norms that promote greater trust and reciprocity. My findings, however, suggest that the origin of the IA has no statistically significant impact on the likelihood of monetary free riding. I suggest that the norms of fairness and reciprocity engendered among self organized IAs, while helpful, are not sufficient in mitigating the incidence of free riding.

I illustrate this point by looking into how norms of equity and fairness among self organized IAs affect the rates of free riding. I examined a self organized and relatively old IA (more than 50 years old) which belonged to a group of IAs – the *zangjeras* of Ilocos Norte – which are known for their long standing tradition of observing norms of fairness and reciprocity and strong sense of collective action.

I find in this case that norms of fairness and reciprocity are helpful but not sufficient in mitigating the problem of monetary free riding given a mixed population of pro-self and pro-social farmers. This finding sheds light into the result of statistical analysis which showed that the origin of the IA ─ i.e. whether organized by NIA or are self organized ─ is not a statistically significant predictor of the levels of free riding, contrary to conventional expectations.

Self Organized Irrigation Associations in the Philippines:

The Case of the DCLC Federated Zangjeras in the Ilocos Region

The Dona Laza-Cabulalaan-Lipay-Casanicolasan (DCLC) Federated Zangjera, Inc. is an example of a self organized IA. It is also an example of how norms of equity and fairness affect the rates of free riding. The zangjera, a Spanish term for irrigation turnout, is the local name for a cooperative irrigation society commonly found in the arid Ilocos region of Northern Philippines. On the basis of early reports by Spanish missionaries, these societies were established around 1630. The main purpose of a zangjera is to ensure a stable and reliable supply of water for its members ranging from an exclusive group of land owners, or a combination of landowners and tenants or in other cases, tenants only. Its central feature is the promotion of equity and fairness norms in the allocation of costs and benefits from the irrigation system.

Zangjeras rely mainly on self-help initiatives among its members. The costs of construction, repair and maintenance are equally shared among members through an elaborate process of allocating costs and benefits and minimizing conflicts (Siy 1980; Coward 1979; Ostrom 1990).[5] For instance, zangjeras are usually divided into several field units called *sitios* each of which are composed of lands cultivated by tenants, most of whom reside in the residential neighborhood within the *sitio* rice fields. Within the *sitio* is a fixed number of membership shares called *atars*, each having a

1 The case studies by Siy (1982), Coward (1986) and Ostrom (1990) involve IAs in small scale irrigation systems. The case of DCLC involves a large scale (1,600 ha) system built by NIA and involving a federation of seven zangjera IAs. This section mainly draws from these studies.

claimant. The claimant holds the right to till the land corresponding to her share(s), and has the responsibilities and privileges that the zangjera assigns to the *atar*. The main privilege is the right to a portion of the system's water and the right to vote within the *sitio* unit and larger association. The major responsibility is to provide labor and construction materials and other resources required to operate and maintain the system.

The *atar* as a unit of land is composed of several parcels which are non-contiguous and located within different blocks of the sitio unit in a patterned arrangement meant to equitably distribute water among members. The blocks are laid out perpendicular to the source of water and thus represent differential distances from the water source. Some blocks are at the upstream of the canal while others are at the tail end. Additionally, each of the blocks is divided into strips of land again perpendicular to the source. Within a block, a parcel is allocated to each of the atars represented in the sitio. At the lower portion of each sitio, one or more parcels of land are set aside for the use of the sitio's irrigation leaders who are selected by the water users. These elaborate measures are designed to prevent abuse of power among leaders and to ensure equitable water supply for all members in cases of water scarcity. For example, in cases of water scarcity where all lands in a particular *sitio* cannot be irrigated, water users may decide not to irrigate one or more blocks within their *sitio.*

As a result, all farmers within that sitio would have their total farm size reduced proportionately since all will have a parcel of land in each irrigated block and the burden of water scarcity will not be shouldered by a few members who are

disadvantaged by location at the tail end. The rule that each farmer would have a landholding equally dispersed across favorable and potentially unfavorable sections of the irrigation zone and the collective decision not to irrigate a certain zone will have the same relative effect on all water users.

The DCLC Zangjera operates in the Labugaon River Irrigation System in Solsona, Ilocos Norte in the Northern Philippines. It has a service area of 1,600ha supporting 1,823 farmers. The federation consists of nine autonomous and self organized zangjeras. These are the *Zangjera de Matayag, Zangjera de Original, Kapitan Felix, Nagkaykaysa IA, Darasdas Centro, Kapitan Felix, Cacaloma, Dona Lasa and Sodin Tina.*

The average rate of free riding in this particular irrigation system is 25 percent compared to the national average of 44 percent. The system is located more than an hour away from Laoag City, the main economic center in the Province of Ilocos Norte. The size of the irrigation systems managed by IAs range from 30 to 302 ha with an average of 141 ha. About 66 percent of all infrastructures in the system are functional by engineering standards. Water scarcity varies from year to year but during 2002 when data was available, scarcity do not appear to be a problem. User size ranges from 45 to 389 farmers. Like most zangjeras, DCLC holds regular meetings and elections. On average, 18 percent of farmers have secure tenure (as owners or mortgage holders) while the rest are tenants, share croppers and leaseholders.

Again this fact is interesting since it is one of the lowest proportions of land ownership in irrigated lands in the Philippines where the national average is 60

percent. However this is not surprising given the scarcity of arable rice lands in the Ilocos Region. In fact, the average size of land holdings in this zangjera is only 0.78 ha or about half of the 1.44 ha national average. The *atar* system in fact evolved as a form of property rights so that farmers can deal with the problem of equity under conditions of land and water scarcity. This ingenuous form of property rights is distinctly different from the rest of the country. Yet another distinct feature of zangjeras is the organization of the *gunglo* or work teams who are responsible for irrigation turn-outs at the farm level (see Figures 6.5 and 6.6).

Figure 6.5- The Structure of a Typical Zangjera in Labugaon Irrigation

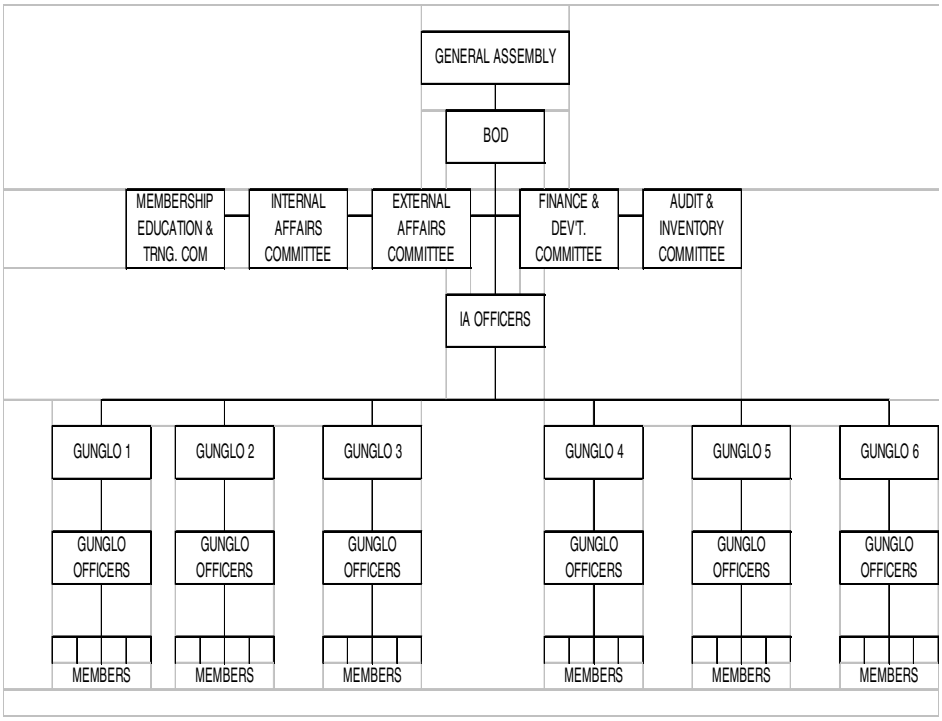
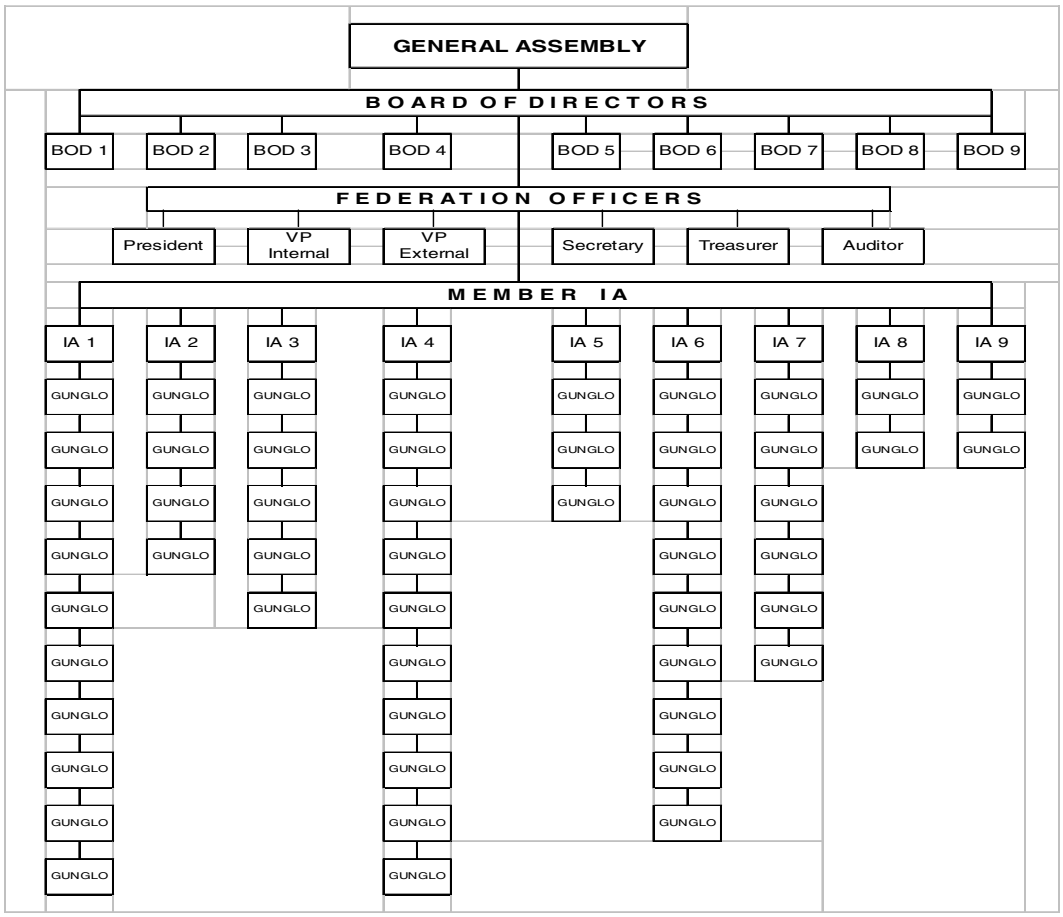


Figure 6.6- The Structure of DCLC Federated Zangjeras



Each *gunglo* is led by a *panglakayen*, or village elder, who commands the respect and authority of the farmers. The primary duty of the *panglakayen* is to see to it that the zangjera tradition of cooperation is upheld overtime. This arrangement is interesting because it stands in contrast with practices with the rest of the country whereby elected IA officers are more likely to be the economic and political elites in the irrigation system who may not necessarily command the respect akin to those of village elders. Zangjeras are also more likely to be federated at all levels of the irrigation system from the *gunglos* at the farm ditch level to the zangjera IA at the

level of the secondary canal all the way up to the federation of the zangjeras in the entire irrigation system

With these distinct features – particularly the deeply rooted tradition of cooperation, the *atar* system of land distribution, the role of *panglakayen*or village elders and the nested structure of the *gunglos*, the *zangjera* and the federation of zangjeras - it is easy to understand why the level of free riding in DCLC is one of the lowest in the country. In fact, as Cosmod (2003) reports, it is common practice among farmers in this zangjera to advance the payment of their irrigation fees. This practice is in total contrast with the rest of the country where irrigation fees are only collected and paid after harvest which allows farmers to avoid payments. In addition and quite interestingly, although 75 percent of farmers are not formal members of IAs, the incidence of free riding in this particular zangjera is only 25 percent, one of the lowest in the country compared to the 44 percent national average. This observation leads to the conjecture that norms of equity and fairness, as generally observed among zangjeras, is helpful in mitigating the rates of free riding. Yet when one examines the regression results for the entire population of zangjeras in the data set, the findings in the case of DCLC Federated Zangjeras is not sustained. In fact, the origin of the IA has no statistically significant effect on free riding.

This finding leads one to the updated proposition that equity and fairness norms are necessary but not sufficient conditions to mitigate free riding. Notice that, although, the rate of free riding among zangjeras is already one the lowest in the country, still, at 25 percent, it remains significant. This leads one to suggest that the population of farmers in the zangjeras is largely but not entirely pro-social, that norms of fairness and reciprocity

are helpful but not sufficient in mitigating free riding in a mixed population. This also suggests that factors other than norms of reciprocity and fairness may be at play in influencing the rates of free riding.

Poverty

I tested the hypothesis that very poor groups of farmers, given their subsistence conditions and small size of farms, have little resources to pay for irrigation fees. One would expect a higher level of free riding in IAs with a higher proportion of poor members, *ceteris paribus*. Surprisingly, however, there is a paucity of literature on this subject.

My findings indicate that, consistent with expectations, poverty has a moderately strong, positive and statistically significant impact on monetary free riding (Table 6.6).

Table 6.6-The Effect of Poverty on Monetary Free Riding

Predictor	Coef	SE Coef	T	P	
Constant	52.947	4.976	10.64	0.000	
PVRTY	5.298	1.600	3.31	0.001	***

*** Significant at alpha 0.01
** Significant at alpha 0.05
* Significant at alpha 0.10

My findings accord well with that of Ternstrom (2003) who finds that when users are poor, the poorest are less likely to cooperate. Why this might be the case is further explored in the following case study where I dug into the incentive structure of a typical rice farmer and closely examining and disaggregating his or her household budget. I find that because of high interest charges on loans incurred by farmers – due to the failure of credit markets in the rural areas – they would typically like to pay off their debts first before paying irrigation fees. I also find that

irrigation fees constitute about 10 percent of the net income of farmers – a relatively prohibitive amount especially for farmers already saddled with farm debts. This explains why small poor farmers on the edge of bankruptcy are more likely to forego the payment of their irrigation fees.

Poverty and Monetary Free Riding [6]

In this case study, I attempt to explain the effects of poverty on the rates of monetary free riding in irrigation by digging into the micro-economics of rice farming by examining a typical household budget of a paddy farmer (Table 6.7).

Surprisingly, very few scholars of collective action in irrigation attempt to study the household budgets of farmers. This is unfortunate because these household budgets reveal so much information about the farmer's incentive structure. This approach is different with the body mass index (BMI) approach employed by Ternstrom which is particularly useful when the question refers to absolute poverty - i.e. in terms of food deprivation - but not when the question pertains to relative income poverty, which is what I am interested in.

[6] This case study benefited from discussions with Isagani Violanta, Water Master, Balanac River Irrigation System, Sta. Cruz, Laguna, July 12, 2005 and Aquilino Baguilod, Water Master, Libuganon River Irrigation System, Carmen, Davao del Norte, July 18, 2005.

Table 6.7 – Analysis of a Farm Budget Household

Item		Unit	Unit Price P	Wet Season		Dry Season	
				Qty	Amount (peso/ha)	Qty	Amount (peso/ha)
1.	**Gross Income / ton**	ton	7,750.0	4.4	34,100	4.5	34,880
2.	**Production Cost**				25,240		19,820
2.1	Farm inputs				11,300		10,730
	- Seed	kg	17.1	80.0	1,370	75.0	1,280
	- Inorganic fertilizer	sack	432.0	9.0	3,890	8.0	3,460
	- Agro-chemicals	lit	1,670.0	3.0	5,010	3.0	5,010
	Others (10%)	peso			1,030		980
2.2	Labor (Hired)	md	100.0	40.0	4,000	30.0	3,000
2.3	Land preparation				3,630		2,000
	Plowing	md	375.0	8.0	3,000	4.0	1,500
	Paddling	md	125.0	5.0	630	4.0	500
2.4	Threshing/harvesting	sack	387.5	8.8	3,410	9.0	3,490
2.5	Tool/Equipment	no.	150.0	6.0	900	4.0	600
2.6	Loan interest	peso	20/100	10,000	2,000	-	-
2.7	ISF cost	sack	400.0	2.0	800	-	-
3.	**Net Return**	peso		-	8,860	-	15,060
	(Net return to cost Ratio)	peso		-	0.35	-	0.76

Source: 1. Bureau of Agricultural Statistics, Cost and Returns Survey

A close examination of a typical farm budget would reveal two important insights why poor farmers are more likely not to pay their irrigation fees. First, the cost of interest charges is relatively high, at around 20 percent per cropping season. As a proportion of net income, this easily amounts to 22 percent. Because of the high interest charges, farmers typically would like to pay off their debts first before

paying irrigation fees. Compared with NIA, usurious money lenders are more likely to put all kinds of pressure on farmers, such as daily visits, threats of foreclosure, engage in gossip, imposition of unbearable interest charges that will put the farmer in penury etc. The pressure to pay is particularly stronger since it is the word of honor of the farmer and the family's reputation that is on the line, there being no formal contracts. In rural villages in the Philippines, honor and reputation are held dear and is captured in the popular saying among the poor: "*mahirap nga, marangal naman*" (roughly translated as follows: poor but honorable).

Second, irrigation fees constitute about 10 percent of the net income of farmers. This is a substantial amount for a poor farmer. In addition, since poor farmers seldom have any savings, lumpy expenditures (such as medical emergencies, school expenses, village festivities, weddings / funerals) and a bad cropping season always puts the farmer on the edge bankruptcy. Given the lack of access to crop insurance and low credit, farmers when faced with tight financial situations are always tempted to delay or avoid the payment of irrigation fees. In periods of successive bad harvests, a farmer may not be able to catch up with his debts from both the usurious lenders and with NIA. These are common reasons cited by NA field staff to explain why relatively poor farmers have difficulties paying their fees.

Delayed payments of paddy sold to the National Food Authority, a government owned corporation responsible for procuring paddy produce from farmers is another source of the problem. When this happens, as it often does, paddy traders offer very low prices at harvest time but since post harvest facilities

are lacking, farmers are forced to sell at low prices. The low prices received by farmers are motivations for asking NIA to forgo collection of irrigation fees. Given the almost subsistence conditions of small farmers, NIA often forgoes collecting the fees and this contributes to the high levels of free riding.

Figure 6.7 – The relatively small size of farm holdings (average of 1.5 ha per farmer) and the high cost of farming, particularly credit which eats up to 22 percent of a farmer's net income, make farming not profitable for small farmers. Poor farmers usually prefer to pay-off their high interest loans before paying irrigation fees and this partly explains the high incidence of monetary free riding.

It is not that free riding among poor farmers is deterministic. In fact, one can find many counterfactual cases. It is a particular group of poor farmers, those already saddled with huge debts and are financially distressed, who are more likely to forgo paying irrigation fees. NIA's field staff understands this problem very well since they themselves are relatively poor residents of these villages. As I have argued, the effect of poverty is aggravated by failures in the credit and insurance markets, the lack of marketing facilities that forces farmers to sell at low prices and the size of the irrigation fee relative to their incomes. These are the composite

factors that explain the rationality of poor farmers – particularly those heavily indebted - defaulting on the payment of their fees.

User Size

The effect of the size of a user group on collective action remains a complex and controversial issue as I have discussed in chapter three. I tested the hypothesis that, as user size increases, monitoring and enforcement costs also increases because of reduced observability of actions. Increase in anonymity also reduces the effects of social pressure. Furthermore, in large groups, the incentive to deviate increases since the marginal social cost of individual defection is negligible compared with the marginal private gains. In sum, one would expect a higher rate of free riding as user size increases, *ceteris paribus.*

My findings suggest that user size has a moderate and statistically significant effect on the rates of free riding, holding other factors constant (Table 6.8). For every unit increase in user size (i.e., an additional farmer in the irrigation system), the rate of free riding increases by 0.02 percent, *ceteris paribus,* and the result is statistically significant.

Table 6.8-The Effect of User Size on Monetary Free Riding

Predictor	Coef	SE Coef	T	P	
Constant	52.947	4.976	10.64	0.000	
USERSIZE	0.02769	0.01144	2.42	0.016	**

*** Significant at alpha 0.01
** Significant at alpha 0.05
* Significant at alpha 0.10

This finding is generally consistent with expectations (i.e., that free riding and group size are positively related and statistically significant) although the size of the effect is small. One plausible explanation to this is that the effects of group size in irrigation systems are also mediated by other factors such as the federated structure of

IAs, which help break down a large group into smaller units; the age and origin of the IA which helps explain the development of norms that mitigate the effects of group size on free riding, and the credibility of monitoring and enforcement, among other factors.

Figure 6.8 – The size of IAs in the Philippines ranges from 5 to 618 members and an average of 180. I find that the size of the user group has a small but statistically significant effect on monetary free riding, which suggests that its effect could also be mediated by other factors such as the structure of the IA, its age and origin and the credibility of monitoring and enforcement. Photo courtesy of Engr. Gamboa.

Salience

One reason for the decentralization of natural resource management is the argument that when the livelihoods of households are salient to the resource, these households are more likely to have the incentives to efficiently and sustainably manage these resources compared to those otherwise less dependent on them.

I tested the hypothesis that as the salience of irrigated farming to the livelihoods of farmers increases, the incentive to cooperate also increases reducing the cost of monitoring and enforcement. Hence, one could expect a lower level of free riding when

irrigated farming is salient to the livelihood of a family, *ceteris paribus.* My findings show that salience is inversely related with free riding, as expected, *ceteris paribus*, but the result is not statistically significant, which is unexpected (Table 6.9).

Table 6.9 - The Effect of Salience on Monetary Free Riding

Predictor	Coef	SE Coef	T	P
Constant	52.947	4.976	10.64	0.000
SALIENCE	-0.03229	0.03108	-1.04	0.299

*** Significant at alpha 0.01
** Significant at alpha 0.05
* Significant at alpha 0.10

One possible explanation is the problem of conceptual validity concerning my use of gross income from irrigated farming as proxy indicator for salience. Another possibility is that the effects of salience on free riding might also be contingent on the values of other moderator variables. For example, willingness to contribute to the public good – given the salience of the resource - is one thing, but the means and capability to do so is entirely another. It is possible that, although rice farming is highly salient to the livelihoods of farmers, the marginal net returns they obtain from rice farming (as discussed in the case study above on poverty) limits their ability to make monetary payment towards irrigation fees. It is also entirely possible that those who are unable to pay their irrigation fees - for lack of financial resources - are instead able to contribute non-monetary resources, such as family labor, towards the operation and maintenance of the system. This conjecture in fact is strongly supported by evidence (see Section 6.2.4 for a detailed discussion on labor contribution).

Distance from Market Centers

Agrawal (2002, 1997) notes that little attention has been paid to the role that market pressures play in collective action in common pool resources. The conventional view is that increasing integration with markets usually has an adverse impact on the management of common pool resources, especially when roads begin to integrate distant resource systems and their users with markets (Meinzen Dick et. al. 1997). As local economies become better connected to larger markets, and common property systems confront cash exchanges, subsistence users are likely to increase harvesting levels because they can now exploit resources for cash income as well (Carrier 1987).

In irrigation, the accessibility of the system to markets has been posited to have contradictory effects in the literature (Meinzen-Dick et. al. 1997). Increasing market pressure leads to increasing anonymity among actors, which lessens mutual dependencies, loosens traditional social ties, and reduces the inter linkages for possible reprisals in the case of adverse behavior (Ostrom and Gardner 1993) and thus reducing the prospects of cooperation (Bardhan 1993).

Another view holds that market penetration can increase the returns to irrigated farming, and thereby the farmer's incentives to participate in the IA (Tubpun 1986; Jackson 1991). Subramanian et. al. (1997) suggests that the impact is more strongly affected by the structure of the market rather than the degree of commercialization. Irrigation systems with low labor market activity are more likely to rely on direct participation and labor in-kind contributions from members. IAs in these areas are more likely to be multi-purpose social organizations. In contrast, irrigation systems closer to highly commercialized areas, and thus have higher labor market activity, are more likely

to employ specialists for daily operations with members making cash contributions. Associations in these areas are therefore more likely to be more specialized (Subramanian et. al.1997).

I tested the hypothesis that in irrigation systems closer to market centers, traditional social ties that bind farmers into mutual dependencies are loosened up, farmers acquire greater exit options through the labor market and actors increasingly become anonymous. One would expect a higher level of free riding in irrigation systems close to market centers compared to those in more remote areas, *ceteris paribus.*

My findings show that, as expected, the distance of the irrigation system from a market is inversely related with the rates of monetary free riding. The farther the irrigation system is away from market centers, the lower is the rate of free riding. The result, however, is modest and not statistically significant (Table 6.10).

Table 6.10 - Effect of Proximity of Irrigation to Market Centers on Monetary Free riding

Predictor	Coef	SE Coef	T	P
Constant	52.947	4.976	10.64	0.000
DISTANCE	-1.337	1.464	-0.91	0.361

*** Significant at alpha 0.01
** Significant at alpha 0.05
* Significant at alpha 0.10

One possible interpretation of this result – which is consistent with that of Agrawal and Yadama (1997) in the case of forest resources in India - is that the physical accessibility of an irrigation system to market centers is not a conceptually valid measure of the overall commercialization of the rural economy. Indeed, one could find in the data sets relatively remote systems (those that are more than three hours away from market

centers) yet these systems are also subject to increasing market pressures through their effects on the input and output prices. Fertilizers and pesticides – produced and traded in far flung market centers- eventually find their way to these remote areas through local traders. Markets for land, labor, technology, and capital also exist in these remote systems, however informally, through local entrepreneurs.

Figure 6.9 - I find that the proximity of an irrigation system to a market center does not have a statistically significant effect on monetary free riding. It is not the geographic distance of the irrigation to the town center per se that creates market pressures but whether market forces actually operate in those remote areas. In this picture, the irrigation system is located at a considerable distance from a market center (3 hours away) but one will find here a robust market for land, labor, materials, technology and credit, albeit informally. Photo courtesy of Engr. Gamboa.

Gender

There is considerable disagreement among scholars on the role of gender in collective action. Some argue that gender distribution may influence cooperation because women and men respond differently to one another in group interactions and discussion

(Stockard et. al. 1988), because they differ in understanding, and reacting to one another (Cadsby and Mayne 1998), because they respond differently to certain types of resources (Sell et al 1993), or that men and women's brains are simply different (*Time Magazine* March 7, 2005).

I tested the hypothesis that one would expect a lower level of free riding as the proportion of women members in the IA increases, *ceteris paribus.* I find that gender composition of the IA – defined as the proportion of women members – is negatively related with the rates of free riding (Table 6.11).

Table 6.11 - Effect of Gender on Monetary Free Riding

Predictor	Coef	SE Coef	T	P
Constant	52.947	4.976	10.64	0.000
GENDER	-0.03916	0.06418	-0.61	0.542

*** Significant at alpha 0.01
** Significant at alpha 0.05
* Significant at alpha 0.10

This means that more women members in IAs tend to be associated with higher rates of free riding, but the effect is rather very small and not statistically significant. In other words, free riding in the payment of irrigation fees is no different among men and women. Interestingly, this finding is similar to the experimental results of Sell et. al. (1993) who find that there is no significant gender effect on contributions to a public good when money was the resource involved.

Figure 6.10 – Women make up, on average, 38 percent of IA members. My tests show that gender distribution has no statistically significant effect on monetary free riding, consistent with experimental findings.
Photo courtesy of Engr. Gamboa.

6.2.3 Labor contribution as alternative to monetary contribution

In the preceding sections, I examined the factors that influence the levels of free riding in terms of the *monetary payment* of irrigation service fees. In this section, I examine whether the same set of factors have differential effects on *labor contribution* among farmers. I hypothesize that while farmers may not pay their financial obligations to NIA for one reason or another, they may instead contribute labor towards the maintenance of the irrigation system.

The dependent variable I examined is labor contribution and measured in terms of the proportion of IA members participating in group work. The data set that I obtained from NIA allows me to code the variable into a binary set – coded as 1 if the average attendance in group work is greater that 75 percent of IA membership and 0 otherwise. The choice of 75 percent is arbitrary but a reasonable cut off point.

Estimation Model

A binary logistic regression model (BLRM) was employed to test my hypothesis. Logistic regression examines the relationship between one or more predictor variables and a binary response. The logistic equation can be used to examine how the probability of an event changes as the predictor variables change. One advantage of the logit link function is that it provides an estimate of the odds ratio for each predictor in the model. It is the odds of success given that a certain condition exists divided by the odds of success given that the same condition does not exist. An odds ratio is equal to 1 if no association exists.

Estimation Results

The results of the logistic regression model are shown below in Table 6.12. Goodness of fit test and test for measures of association for the BLRM are reported in Annex 6.5

Table 6.12 - Binary Logistic Regression (Dependent variable is group work)

					Odds	95% CI	
Predictor	Coef	SE Coef	Z	P	Ratio	Lower	Upper
Constant	-2.53905	0.877125	-2.89	0.004			
SCARCT	0.626260	0.238345	2.63	0.009	1.87	1.17	2.98
CROPINT	-0.0047261	0.0019594	-2.41	0.016	1.00	0.99	1.00
AREA	-0.0005444	0.0013303	-0.41	0.682	1.00	1.00	1.00
DISTANCE	0.445781	0.270919	1.65	0.100	1.56	0.92	2.66
INFRACON	0.0193531	0.0053704	3.60	0.000	1.02	1.01	1.03
AGE	0.0003838	0.257438	0.00	0.999	1.00	0.60	1.66
USERSIZE	0.0018823	0.0019368	0.97	0.331	1.00	1.00	1.01
GENDER	-0.0000996	0.0113198	-0.01	0.993	1.00	0.98	1.02
ENTREP	-0.0000486	0.0001393	-0.35	0.727	1.00	1.00	1.00
SALIENCE	0.0183696	0.0053473	3.44	0.001	1.02	1.01	1.03

PVRTY	0.494853	0.265933	1.86	0.063	1.64	0.97	2.76
PATRON	-0.640761	0.221074	-2.90	0.004	0.53	0.34	0.81
ELECT	-0.557356	0.337011	-1.65	0.098	0.57	0.30	1.11
AUTO	-0.565130	0.318764	-1.77	0.076	0.57	0.30	1.06
TENURE	-0.0072153	0.0041058	-1.76	0.079	0.99	0.98	1.00
COMM	-0.375962	0.266401	-1.41	0.158	0.69	0.41	1.16

Table 6.12 can be interpreted as follows: First, irrigation systems with more frequent water scarcity are 1.5 times more likely to have higher levels cooperation in terms of labor contribution compared with systems not experiencing water scarcity, *ceteris paribus*. The result is statistically significant ($p < 0.10$). This finding is consistent with the situation when the dependent variable is the extent of monetary free riding. As I earlier explained, the reason for this has to do with the sense of collective vulnerability associated with water scarcity and increases the likelihood of cooperation among farmers.

Second, irrigation systems with higher levels of cropping intensity are not associated with levels of labor contribution. Systems with higher cropping intensities are no more likely to have higher levels of labor contribution than systems with lower cropping intensities and the result highly statistically significant ($p < 0.01$).

Third, an irrigation system closer to a market center is 1.56 times more likely to have higher levels of labor contribution compared to a system farther away and the result is statistically significant. Fourth, infrastructure condition does not appear to be associated with the rates of labor contribution. An irrigation system with poor infrastructure condition is no more likely to have higher levels of labor contribution compared with a system with good infrastructure and the result is statistically significant.

Fifth, the amount of labor contributed by farmers for collective action activities such as irrigation O&M is negatively affected by the presence of a political dynasty in the

district where the IA is operating, and the result is statistically significant. This result is consistent with the expectation about the effects of political patronage on the incentives of farmers to contribute labor for collective action activities.

Sixth, an irrigation system with higher levels of poverty is 1.64 times more likely to have higher levels of labor contribution compared with a system with lower levels of poverty, and the result is statistically significant ($p < 0.10$). Interestingly, this finding stands in contrast in a situation when the dependent variable is monetary free riding where monetary free riding is higher among poor farmers.

Seventh, the age of the IA, the size of the user group, gender, entrepreneurship and salience are not strongly associated with labor contribution (i.e. they have an odds ratio equal to or very close to one). It implies that IAs that are older, larger, more entrepreneurial, have more women members and have higher gross incomes from farming (proxy for salience), are no more likely to have higher levels of labor contribution compared with their counterparts with lower values.

Eight, the very small coefficient of land tenure security (TENURE) and its odds ratio of 0.99 suggest that it is not an important predictor of labor contribution. This finding was initially somewhat surprising since tenure was a highly significant predictor of monetary free riding. However, subsequent validation during the second round of field work reveals that it is actually the tenants and hired workers who represent the landowner in activities requiring group work. In contrast, it is the land owner who bears the cost of paying for irrigation fees.

Finally, in addition to the results of the logistic regression, I find that 84 percent of all IAs have at least 75 percent of their members contributing labor to group work

compared with the 57 percent in the case of monetary contribution. These findings allow us to conclude that free riding tendencies among farmers are different depending on whether the contribution is monetary or labor and depending upon the attributes of the user groups and the political and institutional context.

Figure 6.11 - I find that while farmers may free ride in the payment of irrigation fees for a number of reasons, the situation is different when the required contribution is labor. I find that poor farmers are 1.64 times more likely than non-poor farmers to contribute labor for collective action activities. In the picture above, farmers contribute labor to the cleaning of canals.

6.3 Summary and Conclusions

In this chapter, I examined the hypothesis that the problem of persistently poor performance of public irrigation in the Philippines is also linked to collective action problems faced by farmers. I focused on the problem of free riding particularly on the payment of irrigation service fees and the contribution of labor. I sought to explain why certain IAs have higher levels of free riding in terms of monetary and labor contribution

compared to other IAs even though all are subjected to the same set of collective choice incentives.

To answer this question, I did an operational choice analysis of the incentives faced by farmers. Using cross section data on 2,056 IAs found throughout the 196 public irrigation systems in the Philippines, I examined how two sets of predictor variables, identified in the literature as being relevant, are able to explain variations in levels of free riding among farmers. These sets of variables include: 1) the characteristics of the irrigation system in terms of water scarcity, size of service area and infrastructure condition; and 2) the characteristics of farmers in terms of their size, age and origin of the IA, poverty levels, salience of irrigated farming, proximity to markets, and gender distribution.

I find adequate evidence to confirm my conjecture that the problem of persistently poor performance of public irrigation in the Philippines is also linked to collective action problems among farmers. This is particularly the case in the payment of irrigation fees but not in the case of labor contribution among farmers. I find that variation in levels of monetary free riding among IAs can be explained by the following statistically significant predictors: water scarcity (-4.2, $p < 0.01$), cropping intensity (-0.13, $p < 0.01$), age of the IA (-2.73, $p < 0.10$), user size (0.02, $p < 0.05$), entrepreneurship (-0.0008, $p < 0.05$) and poverty levels (5.3, $p < 0.01$). Water scarcity and poverty have the strongest and statistically significant effects were water scarcity. The direction of the impact of these variables on the rates of monetary free riding is generally consistent with expectations except for the effect of land tenure security.

I also find that farmers do behave differently when the required input is labor contribution. For instance, I find that 84 percent of all IAs have at least 75 percent of their members contributing labor to group work. However, when the contribution is monetary, the average rate of free riding is close to 43 percent. I also find that the common factors that explain free riding in both monetary and labor contribution are water scarcity, cropping intensity and poverty levels. While labor contribution among farmers is relatively high, labor contribution alone is not adequate to address the problem of unabated deterioration of facilities, especially when they require material inputs for repairs which the IA cannot afford because of very limited funds.

However, the relatively high level of monetary free riding found in public irrigation systems throughout the Philippines, at a ten year average of 43 percent, is a crucial factor that drives the pernicious problem of persistently poor irrigation performance. Coupled with the perverse bureaucratic incentives faced by NIA, the persistently low collection of irrigation fees leads to the problem of chronic underinvestment in maintenance that in turn leads to the unabated deterioration of facilities and consequently to the problem of poor water service and eventually poor farm productivity and incomes. Poor returns to farming, driven by, among others, poor water service, small farm holdings, lack of credit, post harvest facilities and poor marketing infrastructure leading to low prices and high production costs, all contribute to the problem of poor incomes of farmers that in turn help explain the persistently low levels of payment in irrigation fees.

CHAPTER SEVEN

OPERATIONAL CHOICE ANALYSIS: HOW FARMER'S INCENTIVES ARE SHAPED BY INSTITUTIONAL AND POLITICAL VARIABLES

7.0 Overview

In chapter six, I surmised that the puzzle of irrigation decentralization and poor performance is also linked to collective action problems faced by farmers. I focused on operational choice analysis in particular on the collective action problem of free riding among farmers in the *payment of irrigation service fees and labor contribution.* Based on the theoretical and empirical literature discussed in Chapter Three, I examined - using a linear regression model - two sets of predictor variables identified in the literature as being relevant - the characteristics of the irrigation system in terms of water scarcity, size of service area and infrastructure condition as well as the characteristics of farmers in terms of their size, age and origin of the IA, gender distribution, poverty levels, proximity to markets, salience of irrigated farming and gender distribution.

In this chapter, I extend this operational choice analysis and consider as well how institutional and political factors such as land tenure, IA autonomy, communication and political patronage help explain variation in the levels of monetary free riding found among IAs.

I organized the rest of the chapter as follows. In Section 7.1, I discuss how various types of land tenure are associated with monetary free riding. In Section 7.2, I consider how face-to-face communication among farmers influences their incentives to free ride. In Section 7.3, I examine how IA autonomy matters in shaping farmer's incentives. In Section 7.4, I consider other plausible explanations such as the problem of moral hazard, principal agent and coordination problems. Summary and conclusions follow.

7.1 Land Tenure and Monetary Free Riding

I tested the commonly held view in the literature that secure land tenure creates incentives for farmers to invest in the long term, implying an incentive to cooperate (Otsuka and Place 2001). The incidence of free riding is more likely to decrease as the ratio of farmers with secure tenure increases, *ceteris paribus.*

Surprisingly, my results do not support this conventional view. I find that the effect of land tenure security - defined here as the proportion of IA members with secure tenure (i.e. landowners and mortgage holders) - is positively related with free riding although the effect is small but statistically significant (Table 7.1).

Table 7.1 - Effect of Land Tenure on Monetary Free Riding

Predictor	Coef	SE Coef	T	P	
Constant	52.947	4.976	10.64	0.000	
TENURE	0.12239	0.02193	5.58	0.000	***

*** Significant at alpha 0.01
** Significant at alpha 0.05
* Significant at alpha 0.10

This finding deserves a closer examination not only because it contradicts the conventional view but, more importantly, because land tenure is usually the main criteria for defining the boundary rules in the irrigation system, at least in the case of the

Philippines. As is well-known in the common-pool-resources literature and in irrigation in particular, boundary rules are important variables affecting collective action outcomes.

One possible explanation why free riding increases with land tenure security is the possibility of moral hazard arising from the operation of *informal* land markets in rural areas in the Philippines. Recall in earlier discussions that a dynamic land market - both formal and informal - is at work in irrigation systems in the Philippines. Moral hazard in informal land markets often results in disagreements - *post hoc* - between contracting parties over who should be responsible for the payment of irrigation fees in the case of amortized lands. This often happens when such payments are interrupted or stopped because the cultivator is unable to make such payments. A farmer selling his/her farm to another farmer does not have the incentive to declare that such land has a lien attached to it in the form of arrears in irrigation fees. This is particularly true when arrears become prohibitive considering that, in a typical farm household budget, irrigation fees alone eat up 10 percent of the farmer's net income. The new owner may simply disclaim any outstanding dues while the past owner may have already sold the land without NIA knowing.

Yet another dimension of this informal but dynamic land market in irrigated areas is the high level of leasing. As is often the case, landowners and lessees can disclaim responsibility for paying irrigation fees for certain years (Raby 1997). This high incidence of leasing contributes to the problem of free riding. Land fragmentation and intra-familial conflicts which are also common also lead to non-payment of irrigation fees.

Weak and absent institutions regulating a dynamic informal land market can explain a good deal of how land tenure eventually aggravates the problem of free riding. The pervasive practice of informal land exchange, which is characterized by weak or non-existent documentation and contractual guarantees, often aggravates post-contractual opportunism.

This is actually part of a bigger problem in that there is the lack of a formal and updated land registry in irrigation systems in the Philippines with which to record liens and other obligations – although irrigation laws provide that liens will be imposed on land titles that renege on the payment of irrigation fees. Absent this updated and formal registry, there is little way for NIA or the IA to systematically monitor land ownership or usufruct transfers that come with a dynamic informal land market. Without the land registry to serve as a monitoring instrument of ownership transfers, there is little credible enforcement to talk about and the incentive to free ride or renege on obligations becomes strong.

Furthermore, the high cost of enforcement – the investigation and documentation of cases, filing of formal complaints, issuance of summons and notices, hearing and adjudication and all the requirements of a due process – often exceeds the costs of the contested amounts. Unless the amounts to be recovered are substantial, NIA has little incentive to file individual cases involving a large number of small farmers given the high costs of enforcement. When added up, however, these small cases mean substantial amounts to NIA.

Yet another puzzle that needs to be explained is the finding that farmers with more secure tenure are more likely to free ride in the payment of fees. The

widely held view among scholars is that secure tenure creates the incentives to lower discount rates, to invest in the long term and cooperation is more likely. A plausible answer, suggested by Hayami and Otsuka (1991), can be found by closely examining the dynamics of land reform in the Philippines, how these dynamics shaped the incentive structure of former tenants-now-turned land owners - and how their incentive as land owners has a moderately positive and statistically significant effect on levels of free riding.

7.1.1 Land Reform Dynamics and Free Riding [7]

In 1972, a massive land reform program in rice and corn areas was launched by Marcos as part of his martial law project. The program redistributed property rights in land, regulated land rents, fixed amortization payments and thereby transferred substantial wealth to former share tenants. To avoid the emergence of a form of new tenancy, land reform beneficiaries were not allowed to lease their lands to tenants.

Alongside land reform, programs to improve productivity were launched. This included expansion of access to credits and crop insurance, expansion of irrigation areas, price and marketing support, use of high yielding varieties and fertilizers, improvements in post harvest technology and construction of farm to market roads. As a result, paddy yields more than doubled from less than two tons/ha in the early 1970s to about four tons/ha in the mid-1980s.

Together with fixed land rents and amortizations, the dramatic increases in yield and price subsidies created a windfall for land reform beneficiaries (Otsuka

[7] See Hayami and Otsuka (1991) from where this discussion mainly draws from.

1991). As a result of higher incomes, they were able to initiate non-farm businesses such as small trades. Many farmers were able to send their children to school, the result of which is a higher preference for urban and leisure occupations to the detriment of the supply for farm labor. Out of this emerged a high demand to substitute hired labor for the erstwhile family labor in rice farming operations.

Because of the prohibition to lease lands to tenants, the new landowners adapted new forms of labor contracts to fill in the decreasing supply of family labor. Traditionally, rice farming depended on short-term labor contracts hired on a daily wage basis. These contracts covered seasonal activities such as rice transplanting and harvesting. The introduction of shorter varieties necessitated the regular weeding of the farm and thus the introduction of a new contractual arrangement called "gama". In such an arrangement, workers obtain exclusive harvesting rights and receive shares over the areas that they were responsible for weeding.

Other farm activities that are more difficult to monitor and require care and judgment, such as fertilizer and chemical application and water control, are left to the farm owner. These activities are spread out during the three months of the cropping season and they can be unpredictable. To reduce the costs of supervision, as well as reduce labor effort on the part of the owner, it is often more efficient to have a tenancy contract with a worker who will be responsible for all tasks in farming in return for a fixed share of the harvest. From a transaction-cost perspective, this makes perfect sense. Instead of hiring casual, short-term labor to do the periodic and sensitive tasks, a land owner is better off engaging in long-term labor contract in order to reduce the cost of searching and monitoring associated with short term labor. These long term labor

contracts are essentially founded on a patron-client relationship and can be regarded as a form of semi-tenancy arrangement (since full tenancy is prohibited under the law). This form of contractual arrangement is known as "*kasugpon*g" in the northern and central parts of Luzon, the main rice producing regions in the Philippines. In the vernacular, "*kasugpong*" means "a helper within the family" (Hayami and Otsuka 1991).

The *kasugpong* type of labor contracts or semi-tenancy arrangement is appealing to landowners: they can now withdraw from the hard work of rice farming and still get to keep their land titles and retain the lions share from rice harvests. This wealth-induced detachment is conceptually different from the wealth induced exit options argued by Bardhan and Johnson (2002), for the reason that rich farmers in irrigation systems in the Philippines – as the general case – do not totally exit from irrigated farming. Reasons are varied: sentimental; speculative (particularly in systems close to urban centers); economic (large-scale rice farming when integrated with post harvest and marketing can still be profitable); as a retirement hobby; a form of insurance and for a host of other reasons.

Indeed, wealth-induced detachment makes adherence to and enforcement of norms more difficult. This detachment is one plausible explanation why there is a positive and statistically significant relationship between secure land tenure and a high incidence of free riding.

7.2 Communication and Monetary Free Riding

Ostrom, Gardner and Walker (1994) argue that the effect of communication in common-pool-resource (CPR) situations is open to considerable theoretical and policy debate. One view holds that words alone are frail constraints when individuals make

private, repetitive decisions between short-term, profit-maximizing strategies and strategies negotiated by a verbal agreement. Yet in both empirical and experimental settings, communication has been shown to be an effective mechanism for increasing joint outcomes in social dilemma situations. To explain this theoretical anomaly, scholars hypothesize that communication facilitates the following behaviors in common-pool-resource dilemma situations: 1) offering and extracting promises, 2) changing expectations of other's behavior, 3) changing the payoff structure, 4) reinforcement of prior normative expectations and 5) the development of group identity.

I tested the effect of frequent face-to-face communication on the rates of free riding in the payment of irrigation fees. Although attendance in meetings of large groups could potentially have a free rider's problem as well, I find that 74 percent of all IAs do have regular face to face and organized meetings. My regression analysis indicates that communication – defined in this study in terms of the frequency of face-to-face meetings among members and officers of the IA – has a negative and statistically significant correlation with the incidence of monetary free riding, *ceteris paribus.* For every unit increase in the frequency of holding face-to-face meetings, the levels of free riding decrease by 3.17 percent (Table 7.2). This finding is consistent with both the theoretical and empirical literature.

Table 7.2 - Effect of Face-to-face Communication on Monetary Free Riding

Predictor	Coef	SE Coef	T	P	
Constant	52.947	4.976	10.64	0.000	
COMM	-3.176	1.587	-2.00	0.046	**

*** Significant at alpha 0.01
** Significant at alpha 0.05
* Significant at alpha 0.10

Figure 7.1 – I find that face to face communication among farmers, such as the meeting shown above, has a moderately negative effect on the incidence of free riding and the result is statistically significant. For every unit increase in the frequency of holding face-to-face meetings, the levels of free riding decreases by 3.17 percent. This finding is consistent with theoretical expectations on the effects of face to face communication in social dilemmas. (Photo courtesy of Engr. Gamboa)

7.3 IA Autonomy and Monetary Free Riding

One of the fundamental design principles for self-governing irrigation systems is the minimal recognition of the rights to organize (Ostrom 1990). Meinzen-Dick et al. (1997) add that while this principle may be sufficient for IAs with little external involvement, IAs that interact with government agencies in market-oriented settings need more formal legal definitions of rights and responsibilities. These additional provisions, they suggest, include the recognition of the IA as a representative of farmers in dealing with external agencies, the right to mobilize resources from their membership and other

sources, ability to open and operate a bank account and obtain credit and ownership of irrigation facilities and/or water rights.

I tested the hypothesis that the incidence of free riding is more likely to be lower if the IA is given the autonomy to govern and manage the irrigation system, *ceteris paribus* – i.e., it has full control over the irrigation infrastructure and finances, O&M, conflict resolution, the right to withdraw water and most importantly the right to exclude non-members or non-payors from receiving irrigation service.

I find that autonomous IAs with clearer and wider scopes of property rights over the irrigation system indeed have lower levels of monetary free riding (Table 7.3).

Table 7.3 - Effect of IA Autonomy on Monetary Free Riding

Predictor	Coef	SE Coef	T	P	
Constant	52.947	4.976	10.64	0.000	
AUTO	-5.238	1.474	-3.55	0.000	***

*** Significant at alpha 0.01
** Significant at alpha 0.05
* Significant at alpha 0.10

This finding is consistent with the assertions by Coward (1986), Yoder (1964) and Agrawal and Ostrom (2001). In fact, of all the predictor variables I have examined, IA autonomy had the strongest impact on free riding. Specifically, monetary free riding among autonomous IAs is 5.2 percent less compared to non-autonomous IAs and the result is highly statistically significant ($p < 0.01$). I surmise that this variation in free riding is related to the variations in the features of the autonomous and non-autonomous IAs in the Philippines, as elaborated in Table 7.4.

Table 7.4 - Distinction Between Autonomous and Non-autonomous IAs

Features	Non-autonomous IAs	Autonomous IAs
1. Boundary rules		
1.1 IA Membership	Voluntary membership and is limited to landowner and household head, typically male.	Usually mandatory and includes all cultivators regardless of tenure and not limited to household head.
1.2 Physical boundary under IA responsibility	In general, based on shared residential cluster. NIA resorted to this arrangement primarily because of administrative considerations. Federated IAs are typically weak and exists mostly on paper.	Based on multiple-hydrologic boundaries: i.e. at the level of the turn-outs, at the level of the service areas covered by the tertiary canal; then federated at the level of the entire system.
2. Scope rules	Limited mostly to tertiary canals, occasionally to secondary canals. IAs are limited as non-stock, non-profit organizations. System governance – including rule making and enforcement and fiscal powers - is vested with NIA and IAs serve as labor contractors. NIA is reluctant to encourage IAs to become multipurpose organizations since IAs might lose focus on the primary tasks for which they were organized and contracted by NIA i.e. to serve as labor contractors in the O&M of systems and collection of irrigation fees. IAs have little or no fiscal powers. More importantly, enforcement is weak, inconsistent if not absent. NIA, in general, suffers from the problem of credible enforcement because of the moral hazard problem with farmers.	Covers the entire system devolved to the IA IA has full governance authority including rule making, adjudication and enforcement as well as full fiscal powers. IA is non-stock, non-profit; in addition, IA has option to become a cooperative type organization
3. Authority Rules	Defined by NIA through contractual agreement with IA. IAs basically serve as NIA's labor contractors.	Defined by IA members
4. Aggregation rules	At the system level, through the Joint System Management Committee consisting of NIA and IA representatives.	Voting and consensus building; at the system level, through the Joint System Management Committee consisting of NIA and IA.

5. Payoff rules	Liability rules apply only to the IA jurisdiction; benefits from IA membership is not specified in IA by-laws; in the disposition of irrigation fees – IA's control is limited to its share of the collection which is often allotted to salaries for IA members working as laborers.	Defined by IA members.
6. Perception of rule fairness and legitimacy	Widespread questions about rule fairness and legitimacy. Some common anecdotal evidence from my field work: "NIA often does not pay the IAs on time"; "The contract between NIA and IAs is one sided in favor of NIA. IA's have little leverage". "The payment of irrigation fees is a one way street. Only NIA benefits from the irrigation fees. Farmers don't feel that what they pay for actually goes back to them."	Free riding is seen as an offense committed against fellow farmers. Autonomous IAs, being farmer governed, are more likely to be consistently sensitive to issues of legitimacy and fairness regardless of the level of irrigation fee collection unlike NIA. Questions about rule fairness and legitimacy are not as serious and widespread compared with non-autonomous IAs.
7. Strategic interdependence and common understanding	Interdependence between NIA and IA creates strong moral hazard problems when farmers view NIA as a patron. Since NIA owns the system, free riding is seen as an offense committed against NIA rather than against fellow farmers. The reputation effect is not strong. Farmers often try to second guess NIA's policies and its resolve to enforce those policies. Non-autonomous IAs suffer from the moral hazard problem- i.e. the expectation that NIA would condone uncollected irrigation fees because of the difficulties of collection. This expectation was reinforced in 2001 when NIA, in collecting back-accounts, launched a program providing amnesty to delinquent payors in exchange for reduced fees. Earlier in 1988 bills were filed to abolish the fees. Again in 1999, then President Estrada ordered the abolition of the irrigation fees but failed to do so after he was ousted from power.	Members of IAs have strong strategic interdependence given their collective sense of vulnerability i.e. IA cannot expect NIA to come to their rescue. Strategic interdependence increases the role played by social norms and networks.

Figure 7.2 - I find that autonomous IAs have lower levels of free riding compared with non-autonomous IAs and the result is statistically significant. In the photo above, an autonomous IA shows off the awards and recognition it has received including the Most Outstanding IA Award nationwide.

While autonomous IAs, indeed, have generally lower levels of free riding when compared with non-autonomous IAs, there are some challenges that autonomous IAs have difficulty in surmounting. In the next section, I show that while farmers may be successful in addressing one form of collective action problem such as equitable water distribution, they have great difficulties surmounting the problem of providing for a lumpy investment in a public good (i.e., rehabilitation of the irrigation system).

7.3.1 IA Autonomy, Water scarcity and Production Function

Amburayan River Irrigation System (AmRIS) is an example of how autonomous IAs resolve the problem of equity in water allocation in times of water scarcity through the practice of downstream first water rotation. AmRIS has a total service area of about

1,450ha serving some 2,000 farmers. AmRIS spans the boundaries of four municipalities - Sudipen, Bangar, Luna and Balaoan - in the Province of La Union in the arid northern part of the Philippines, about seven to eight hours by public transport from Metro Manila. The main economic center, San Fernando, is less than an hour away. The system is made up of 27 lateral canals approximately 38 kms in total length branching out from the main canal that in turn runs about 10 km.

Six IAs operate in AmRIS – *Balaoan-Luna, Basufia, Lateral G & G1, Lusiris, Mannalon Ti Turod and United Farmers*. Collectively, they are federated as the SUBALUBA Federation of IAs (Figure 7.3). User size ranges from 218 to 375 farmers per IA. Land holdings are quite small, ranging from a third to only as much as half hectare owing to the problem of land scarcity, the province being mainly a coastal plain and a mountainous interior. About 90 percent of the farmers, however, own their farms. Water scarcity is a problem in AmRIS given the arid conditions in this part of the country. Two other factors compound this problem. First, the nearby watersheds that feed the Amburayan River are densely populated and increasingly degraded. Siltation of the river bed - which makes the channels shallow - is a growing concern. Second, poor infrastructure condition plagues AMRIS. Only about 41 percent of all the infrastructure facilities in the system are in good working condition. This means that water delivery is problematic, particularly at the tail ends of the system.

Water scarcity and the salience of rice farming prompted the six IAs to organize into a federation and agree among themselves on a set of rules for water allocation, maintenance and repairs as well as finances and fees. They also agreed among themselves on mechanisms for monitoring, enforcement and conflict resolution. These rules were

then unanimously adopted by all farmers and laid down as part of the IA and Federations By-Laws.

By-Laws of the SUBALUBA Federation of IAs

Cropping Calendar and Pattern of Planting:

a. The Federation shall implement a downstream start of seed sowing and transplanting at the level of the main canal.

b. The IA, to complement the Federation's effort, shall implement a downstream start of seed sowing and transplanting at the lateral level. Similarly, the same shall be implemented at the level of the TSA.

c. The farmers shall provide the TSA Leaders the information on the crops, varieties, dates of seed sowing and transplanting and extent of area planted and irrigated in his farm. The farmer shall also report information and extent of crop damages and as well as quantity of production.

d. The TSA shall collect data and information for the list of irrigated and planted area (LIPA) which shall be submitted weekly to the IA level until the whole TSA area is fully seed sowed and transplanted. The TSA leaders shall report crop damages as it occurs and decision for exclusion from irrigation shall be decided at the IA level after conducting the necessary field verification. Exclusion and exemption from ISF payment shall be subject to approval of Federation President and Irrigation Superintendent.

e. The Federation, IA and TSA organizations shall set penalties and sanctions for the violation of the cropping schedules. Federation shall penalizes IAs, IA penalize TSAs and TSAs the farmers, members and non-members. Penalties for non-members shall be stiffer or heavier to encourage their membership to the IA.

Water Delivery and Distribution:

f. The Federation shall manage the delivery and distribution of irrigation water at the main canal. The opening and closing of the head gates of laterals at the Main Canal shall be delegated by the Federation to the concerned IAs.

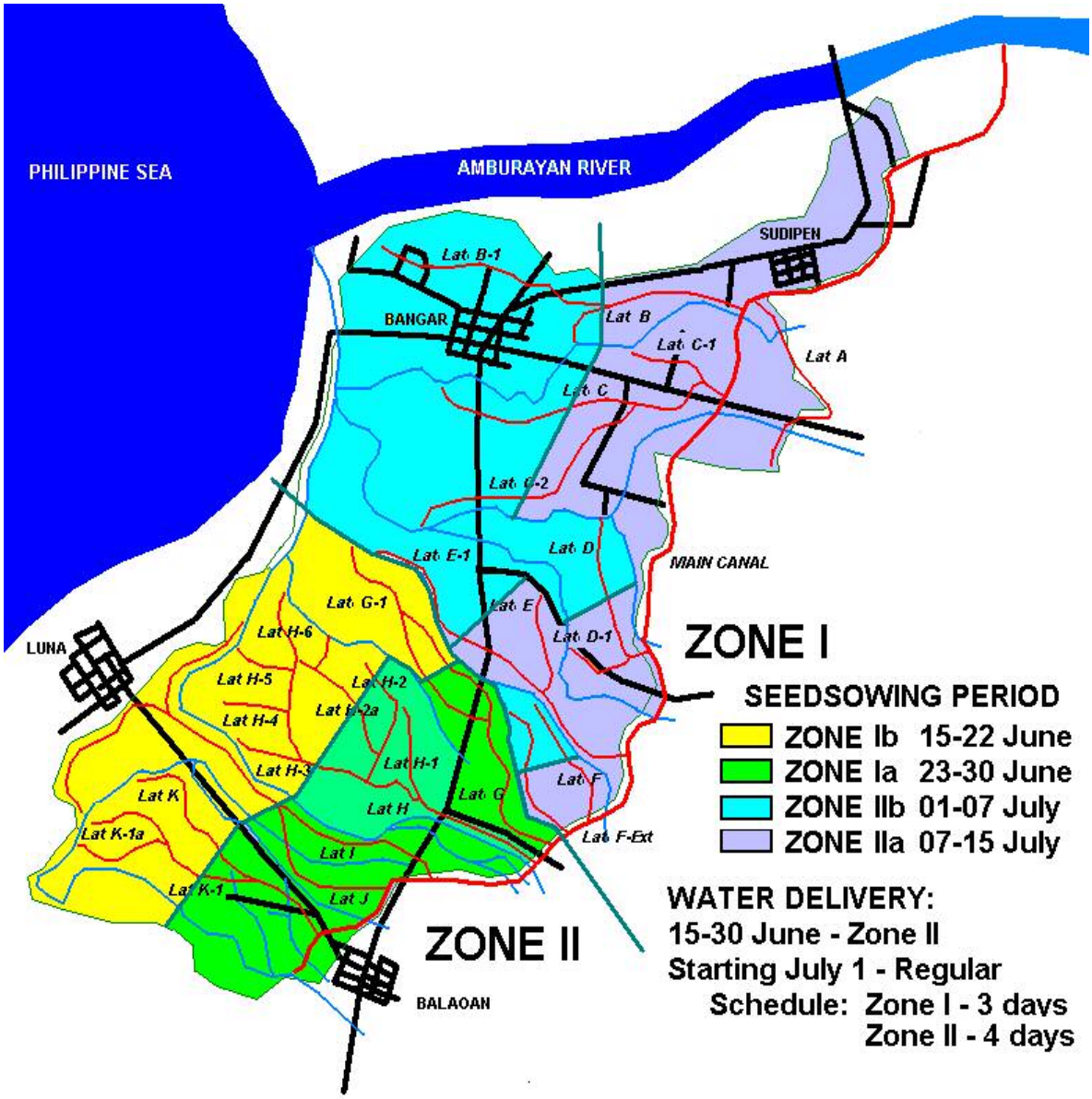
g. The IA shall manage the delivery and distribution of irrigation water at the lateral canals. The opening and closing of the head gates of sub-laterals and turnouts shall be delegated by the IA to the concerned TSAs. The TSA shall manage the distribution of irrigation water within the TSA area.

h. The Federation shall implement a downstream start of water delivery and distribution. To complement the Federation's effort, the IA shall also implement a downstream start of water delivery and distribution at the lateral level. The downstream start of distribution shall be implemented.

The Federation, IA and TSA organizations shall set penalties and sanctions for the violation of the rules, regulations and schedules of water delivery and distribution. The Federation shall penalize IAs for violations in the operation of Main Canal, IA penalize TSAs for violations in the operation of the laterals, and TSAs penalize the farmers, members and non-members, for their violations whether within the TSA, lateral and/or main canal. Penalties for non-members shall be stiffer or heavier to encourage their membership to the IA.

As can be seen in Figure 7.3, the tail ends of the system are the first to receive water.

Figure 7.3-Layout Map of the Amburayan River Irrigation System, Wet Season 1999-2000 Source: Engr. Renato Gamboa



The farmers have agreed among themselves on an elaborate cropping calendar to ensure that water allocation is fair and equitable to all farmers. The timing of seed sowing was the key variable that was adjusted by farmers. The tail-enders will sow their seeds first. This means that they will receive water first for purposes of land preparation.

Once they have seeded their fields, water flow would now be diverted to the head-enders. Once they have finished seeding, water would then be diverted back to the tail-enders who would now commence their transplanting. Once this is done, water can then be diverted again to the head-enders for them to start their transplanting. Since everyone is guaranteed that they will get their fair share of water as a matter of schedule, this allocation rule has been fairly stable. These findings are consistent with the earlier findings by Wade (1988), Baland and Plateau (1996) and Sengupta (1991) on the ability of autonomous or self-organized IAs to minimize social dilemmas arising from water scarcity.

Farmers at AmRIS have also agreed to a set of rules for monitoring and enforcement. As indicated in their by-laws, the federation will monitor and penalize the IA, the IA will monitor and penalize the turn-out service area groups (TSAGs) that in turn will monitor and impose sanctions to individual farmers, members and non-members alike. Since the allocation rules and calendar are widely known, compliance monitoring is relatively easy. There is an inherent incentive for farmers, TSAG officers, IA leaders and federation officers to be monitoring compliance to ensure that the problem of observability referred to by theorists is not a big issue. This *common knowledge* is sufficient to induce coordination and self-enforcement on a wide scale throughout the 1,450 ha system with 1,900 farmers (Figure 7.4).

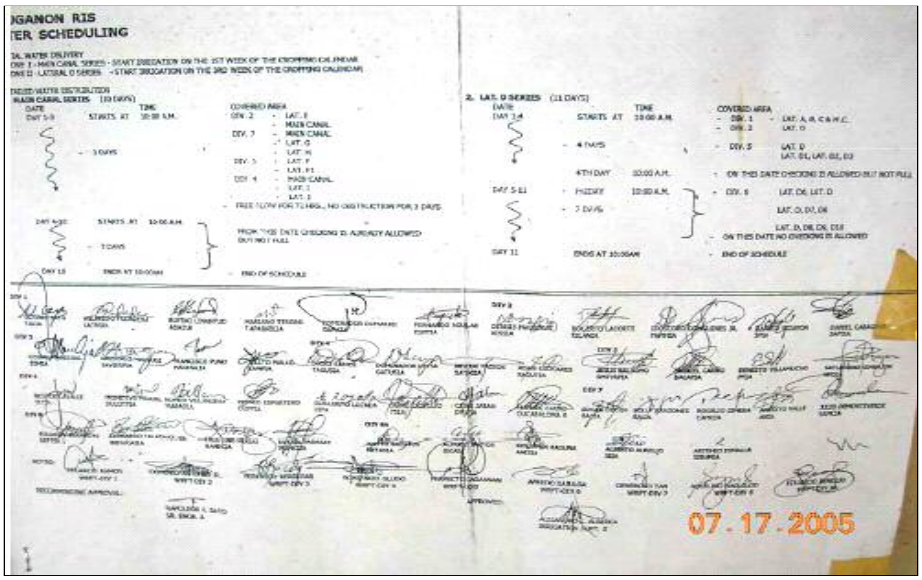
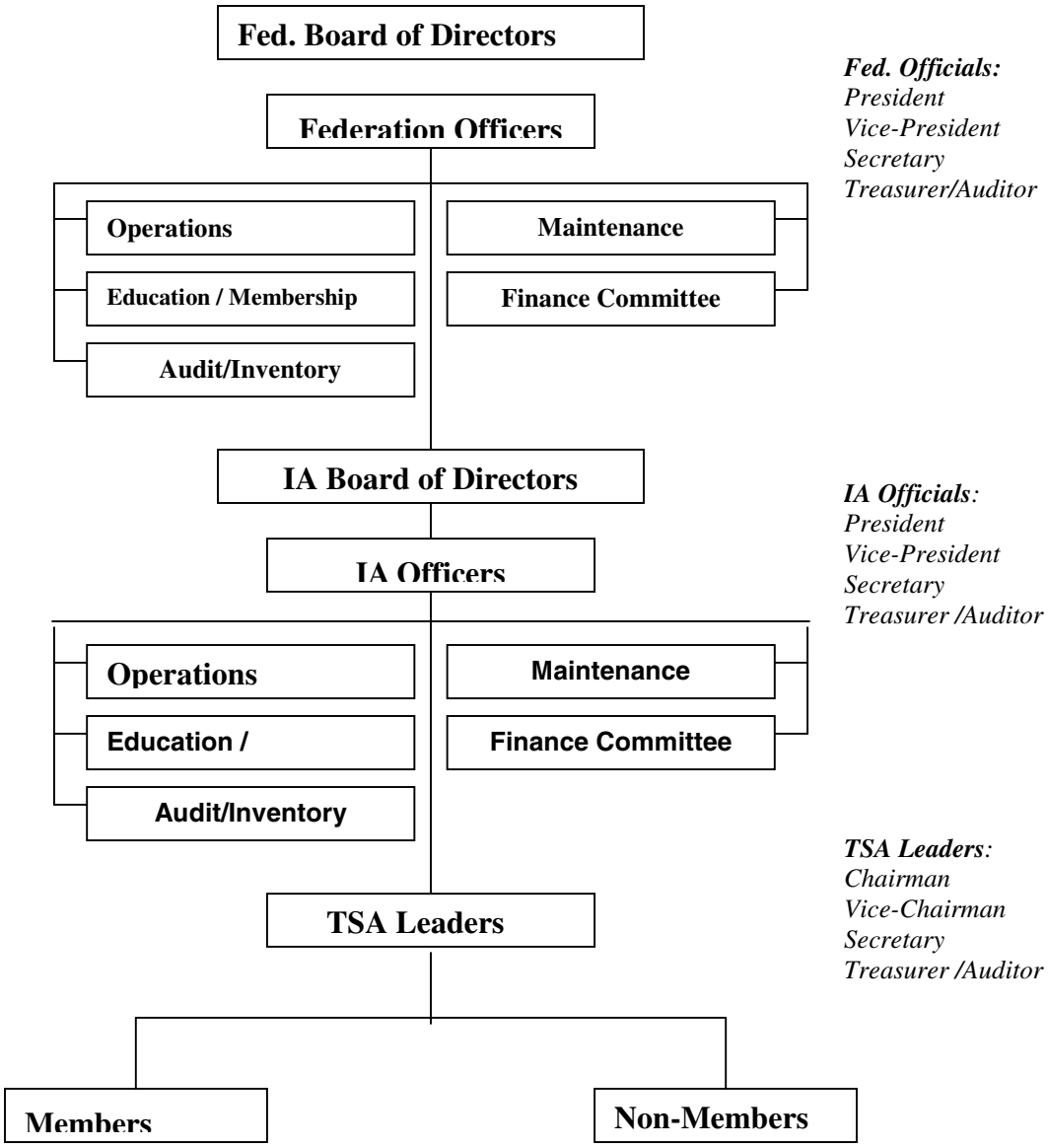


Figure 7.4 – To resolve the problem of coordination and the dilemma of water allocation, some IAs have devised ways to formalize such agreements (such as that in photo) and make them as widely known as possible. Public knowledge of schedules and water allocation are key to solving the coordination / allocation problem in large-scale irrigation. A defection in these rules is easily monitored because of the interdependent nature of water scheduling and allocation.

Common knowledge about rules helps ensure that monitoring and enforcement costs in AmRIS are relatively low. Although the challenge of coordination in large-scale irrigation systems is certainly a non-trivial matter, the federated structure of AmRIS allows for the equitable sharing of transaction costs (see Figure 7.5). Under this setup, the federation is responsible for the main canal, the IAs the lateral canals and the TSAGs the tertiary canals. This clear assignment of responsibilities, the density of monitoring mechanisms and the common knowledge about rules and schedules certainly enhances coordination and accountability.

Figure 7.5 - The Federated Structure of the SUBALUBA Federation of IAs, Amburayan River Irrigation System, Sudipen, La Union



Source: NIA.

This is not to imply, however, that the problem of free riding in the form of payment of irrigation fees is non-existent in AMRIS. In fact, it is a problem. And a puzzling problem at that, in light of their success in mitigating the problem of equitable allocation amidst water scarcity. More to the point, the rate of non-payment of irrigation

fees at AmRIS runs at a high of 60 percent compared with the 44 percent national average. What explains this variation?

There appears to be a number of plausible factors: poverty, tenure, and infrastructure condition. Poverty incidence in AmRIS is quite high given the very small land holdings of farmers (from 0.35 to 0.5 ha). In addition, the condition of infrastructure at AmRIS – with only 41 percent of the structures meeting engineering standards – is another plausible reason. Given the lumpy investments required to undertake a major rehabilitation of AmRIS, farmers there are effectively faced with a decelerating production function.

This means that for the benefits of a well-functioning irrigation facility to be fully realized, a critical mass of farmers would have to contribute towards the major rehabilitation cost. SUBALUBA is an autonomous IA and therefore cannot expect to be bailed out by NIA, although it is possible for NIA to rehabilitate the system, but this cost will also be passed on to the IA as part of its amortization.

Given the fairly homogeneous composition of farmers in AmRIS (in terms of land holdings, poverty levels, salience of farming and ethnic origins) and the initial step-wise production function characterized by the major rehabilitation of the system, it is not surprising therefore that this empirical finding fits with theoretical expectations.

Marwell and Oliver (1993 quoted in Ostrom 2005) suggest, for instance, that a large group of relatively homogeneous individuals facing a decelerating production function would unlikely provide for the public good (in this case the rehabilitation of the irrigation canals and facilities) or if it will be provided, the result is sub-optimal, consistent with Olson's predictions. The reason is that these types of players would have

great difficulties getting over the initial period where returns to them would be negative before it generates net gains, if ever. As I have earlier discussed, impoverished farmers are often on the financial margins, surviving from one form of debt to another. This is particularly true in the case of AmRIS, since the very small size of farms makes it difficult, if not nearly impossible, to turn in a decent profit from rice farming given the lack of economies of scale in operation. Given the low commercial viability of farming in AmRIS, the prospect of generating enough revenues from irrigation fees alone is low.

In conclusion, this case study has shown that while farmers may be successful in addressing one form of collective action problem (equitable water distribution), they had great difficulties surmounting the problem of providing for a lumpy investment in a public good (rehabilitation of the system) given the homogeneous characteristics of the population, the problem of poverty and the shape of the production function they face.

7.4 Political Patronage and Monetary Free Riding

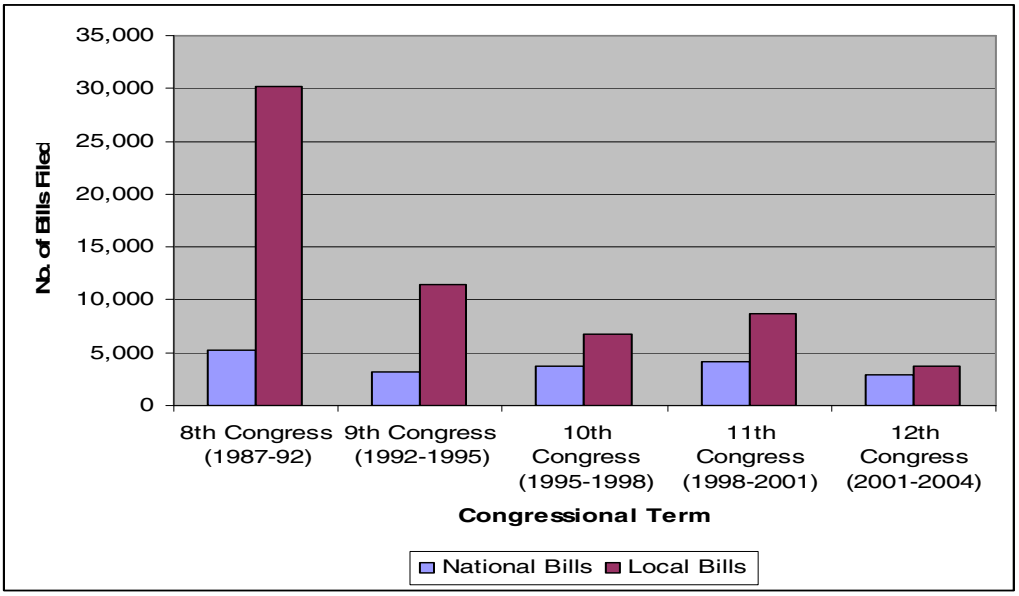
There is a widely held expectation that IA's embedded in a system of political patronage - where political dynasties are fairly established - are more likely to have higher levels of free riding, *ceteris paribus*. The expectation is that poor farmers would expect politicians to bail them out from financial liabilities in return for their continued support of political dynasties.

It is a truism that the utility function of most politicians is to maximize the chances of their reelection by pandering to the interests of their constituents. It is also typical for scholars of political science in developing countries to suggest that the

organizing principle of legislative life is the struggle for spoils. The Philippines is a classic example.

As Coronel et al. (2003) describe it, the horizons of law makers are narrow, restricted within the confines of their immediate self-interest. The Philippine Congress as a body, argues Coronel, is obsessed with what individual legislators can wangle for themselves and their constituents. Coronel et al. note that 71 percent of members of the House of Representatives spend more than five hours a day attending to callers in their offices. Mostly they attend to constituents looking for a job, financial help for emergencies, scholarships, financial contribution to fiestas and other favors. The primacy of local concerns by the House of Representatives is evident when one examines the proportion of local bills filed vis-à-vis national bills (Figure 7.6).

Figure 7.6 - Proportion of Local against National Bills, Philippine House of Representatives, 1987-2004



Source: Coronel et al. (2003).

In the Philippines, the cost of getting elected to Congress easily runs into several millions of pesos. In the 2004 election, in urban areas, the campaign cost for a

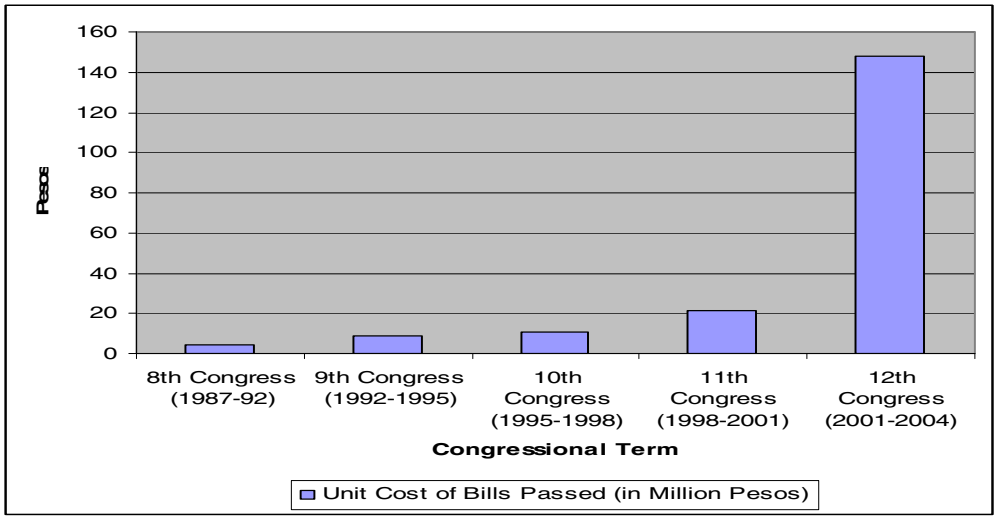
congressional seat was estimated at P30M (US$0.6M). In rural areas, it was around P3M to P10M depending on the intensity of competition. One begins to wonder, therefore, why candidates spend so much for a relatively low-paying job to serve the public interest. The obvious answer is the allure of the pork barrel, the perks of the office and protection of family interests.

Pork-barrel funds appear to be the favorite tool of the president to line up the support of legislators for the executive branch's legislative agenda. Each congressional district usually gets P200M ($US3.5M) a year in pork-barrel funds which, according to Coronel et al. (2003), are largely used to subsidize the patronage network that they need to court favor, win votes and entrench themselves and their families. Not surprisingly, the unit cost of bills that have been passed in the Philippine Congress over the years has skyrocketed (see Figure 7.7).

Pork barrel is not the only reason for spending so much to win a seat in Congress. Coronel et al (2003, 43) note that

> …. historically, political dynasties have been able use their positions to expand their land holdings or their business empire, using their preferential access to privileges from the state – loans, franchises, monopolies, tax exemptions, cheap foreign exchange, subsidies, etc. These privileges have made these families wealthy, allowing them to assemble formidable election machines that guarantee victory at the polls.

Figure 7.7 - Unit Cost of Bills Passed in the Philippine Congress



Source: Coronel et al. (2003).

The links between political power and economic wealth become clear when one considers the following facts: from 1964 to 1986, 87 families controlled the top 120 companies in the Philippines. About 20 percent of these families were involved in politics. They are still in Congress up to the present, their ability to sustain their economic base allowing them to continue in public office and their government posts in turn enabling their businesses to survive. In the current House of Representatives, 58 percent of its members have proprietary interests in agricultural land, 32 percent in agricultural enterprises, 19 percent in banking, 21 percent in financial services, 52 percent in property and development and 15 percent in mining, oil and energy (Coronel et al. 2003).

The establishment and maintenance of political dynasties is central to the effort of protecting and growing these business interests. This is evident when one considers that at least 60 percent of members of the Philippine House of Representatives have relatives in elective office (parents, children, spouses, siblings, in-laws and other close relatives):

21 percent have relatives who are local legislators, 44 percent as representatives and 38 percent as governors and mayors. About 54 percent of representatives are also second - generation and 26 percent are first-generation politicians. With these incentives faced by politicians, the conventional expectation is to find a positive, strong and statistically significant effect of political dynasty on the rates of free riding in irrigation. To maintain these political dynasties, the support of relatively organized groups such as IAs would also have to be maintained.

I tested the widely held argument that farmers embedded in a system of political patronage expect politicians to bail them out from financial liabilities in return for their continued support of political dynasties. I hypothesize, therefore, that IA's embedded in a system of political patronage - where political dynasties are fairly established - are more likely to have higher levels of free riding, *ceteris paribus*.

My findings surprisingly indicate that the presence of established political dynasties has no statistically significant impact on the levels of monetary free riding (Table 7.5). This means that political dynasties make no difference in explaining the variation in the levels of monetary free riding.

Table 7.5 - Effect of Political Dynasties on Free Riding

Predictor	Coef	SE Coef	T	P
Constant	52.947	4.976	10.64	0.000
PATRON	-0.228	1.285	-0.18	0.859

*** Significant at alpha 0.01
** Significant at alpha 0.05
* Significant at alpha 0.10

One possible explanation is that the creation and maintenance of durable political dynasties in the Philippines go beyond the traditional patronage networks as argued by

scholars of "iron triangles" (see Bickers 2001). Briscoe (2000) and Panella (1999) make the conjecture that irrigation in the Philippines is characterized by the presence of irrigation iron triangles that mutually bind the interests of farmers, irrigation agencies and politicians.

In explaining how political families perpetuate themselves in power in the Philippine context, Coronel et al. (2003) suggest that dynasty building in the Philippines is a function of seven "M's": money, machine, media or movies, marriage (amongst members of dynasties), murder and mayhem, myths and mergers (among dynasties). Political patronage is just one of the several factors that help build political dynasties and may not necessarily be the most decisive one as conventional expectation may suggest.

Another plausible explanation has to do with the evolution of NIA during the Marcos martial law years. One of the objectives of Martial Law was to dismantle the control of political dynasties and oligarchies in the rural areas and to build a "strong state". As discussed in Chapter Two, the evolution of NIA was largely driven by the personal patronage of Marcos instead of political dynasties.

For instance, during the Marcos martial law years and period of green revolution in the early 1970s to the mid-980s, Marcos played a major patron to NIA. During this period, Marcos amended NIA's charter several times, increased its capitalization by more than 33 times and its staff by 9 times. Marcos was the primary architect of reforms at NIA, and other politicians had little or secondary influence at NIA. This relative insulation, engendered during the long period of the Marcos regime (1965-1986), appears to explain why the existence of political dynasties has a weak and no statistically significant effect on the levels of monetary free riding.

Figure 7.8 – A picture of the family of a local political dynasty adorn the office of the IA. I found no statistically significant relationship between the presence of a local political dynasty and the levels of monetary free riding. I surmise that this has to do with the fact that NIA was insulated by Marcos from local dynasties during his regime when Marcos himself became the personal patron of NIA instead of local politicians. During Marcos' years, NIA's charter was amended several times, its budget increased 33 times and its staff grew by 9 times.

7.5 Additional Explanations to the Problem of Monetary Free Riding

In this section, I speculate about other plausible reasons – aside from those I have already examined – to explain the free rider's problem. A lot still needs to be explained to come up with a more satisfactory answer to the free rider's problem in irrigation in the Philippines. Below, I briefly describe these plausible factors which, by themselves, can be the subject of future research.

7.5.1 Principal-Agent Problem

In non-autonomous systems, NIA acts as the principal and IAs as agents, among others, in the collection of irrigation fees. A key motivation of the IAs in serving as NIA's agent is that the IA will be properly compensated by NIA according to contract. As is often the case, NIA does not pay the IAs on time. Delayed remittance of the IAs share of irrigation fees is a widespread and systemic problem that has gone on over the years. In my fieldwork, I often hear this complaint among farmer leaders. These delays consequently dampen the enthusiasm of contracted IAs to collect irrigation fees despite the elaborate collection fee sharing scheme devised by NIA.

In contrast, among autonomous IAs, this problem does not exist. A role reversal in fact is the case: the IA becomes the agent and the farmers become the principal. Since the farmers own the IA and the system, they have strong motivations to increase efforts to collect irrigation fees.

7.5.2 Coordination problems

NIA and farmers also face coordination problems in the collection of irrigation fees. One problem lies in the method of payment. Farmers can choose to pay either in cash after harvest or in kind, i.e., in sacks of unhusked rice. More often, however, NIA does not have the equipment and manpower to haul these bulky produce. Neither does it have adequate facilities for post-harvest handling, particularly for drying and warehousing (Bagadion 1994). This gives farmers the excuse not to pay NIA on time.

Another coordination problem is the delay by NIA in the issuance of irrigation water bills to farmers. When bills are issued past harvest season, when farmers have

already disposed of their crops and paid off their debts, little is left to pay for irrigation fees. This is another reason often cited by farmers to explain low levels of irrigation fee collection. However, if one considers the fact that the level of irrigation fee collection only averaged 57 percent over more than a 10-year period, the excuse of late issuance of irrigation bills does not hold much water.

7.5.3 Moral Hazard Problems

Another plausible explanation is the moral hazard problem that exists among parties in land transactions in irrigation systems. The pervasive practice of informal land exchange, characterized by weak or non-existent documentation and contractual guarantees, often aggravates the problem of post-contractual opportunism among parties.

Because of the absence of effective land registries or existing land registries that are not updated regularly, property rights over land and farmer obligations in the payment of irrigation fees become fuzzy. In other words, boundary rules become unclear. This often leads to disagreements and conflicts over who should be responsible for the payment of irrigation fees particularly when such payments are interrupted or stopped because the cultivator is unable to make such payments. The new owner may disclaim any outstanding dues, while the past owner may have already sold the land without NIA knowing it. Raby (1998) suggests that this is one possible explanation to the high incidence of free riding, particularly among non-autonomous IAs. I illustrate this problem of moral hazard between NIA and non-autonomous IAs in the next section using the case of the Angat Maasim River Irrigation System (AMRIS).

The Moral Hazard Problem among Non-Autonomous IAs and NIA

This case study focuses on how the moral hazard problem binds non-autonomous IAs and NIA which, combined with the problem of non-credible enforcement, has created incentives for farmers to evade payment of irrigation fees. I illustrate this with the case of the Angat-Maasim River Irrigation System (AMRIS).

AMRIS serves an area of 26,000 ha with close to 23,000 farmers. It is about two-hour drive north of Metro Manila in the province of Bulacan. AMRIS is owned and operated by NIA through contracted IAs. There are about 94 IAs in this system, most of whom were contracted by NIA to undertake canal clearing and collection of fees, but none are autonomous.

AMRIS has above-average levels of water scarcity compared to the national average. The reason is that water from the Angat reservoir that feeds the system is also diverted for domestic water supply for Metro Manila, the capital region with a population of more than 10 million. The infrastructure condition at AMRIS, however, is better than the national average. Most of the IAs at AMRIS were NIA organized and most are ten years or older. The size of user groups ranges from a low of 17 farmers per IA to as high as 1,200 farmers with an average of 212 farmers per IA. On average, only 6 percent of IA members are women, but in some cases as high as 32 percent. These IAs are typically multipurpose, i.e., also functioning as cooperatives that are engaged in commercial activities such as trading, milling and warehousing. In general, however, most IAs have poor per capita net worth,

averaging 385 pesos. Paddy farming does not appear to be as salient in AMRIS compared to the national average. Land holdings are small on average, about 1.48 ha, which is about the same as the national average. About half of the farmers have secure land tenure. Political patronage in the form of established political dynasties older than 30 years is not a phenomenon in the province. There are political dynasties, however, who have been in power for more than 10 years but less than 30.

One possible explanation why the rate of free riding, on average, is higher in AMRIS compared to the national average is the moral hazard problem. Farmers in AMRIS tend to wait for NIA to condone unpaid irrigation fees since NIA has done this in the past and more recently in 2003 when it launched its Compromise Agreement Program (CAP). Under CAP, farmers can pay only a fraction of what they owe NIA in return for clearing up their record.

This problem is compounded by a history of not so credible enforcement of rules by NIA over the non-payment of fees. Farmers note that in AMRIS, no one has been sent to jail or heavily penalized for not paying their irrigation fees. This is further reinforced recently in the case of a congressman, representing a farmer's group and who also owns a rice farm in AMRIS, who has been remiss in the payment of fees. Over the years, NIA has had difficulty collecting irrigation fees from him. The message that farmers get from these cases is clear: it is alright not to pay irrigation fees since NIA will have difficulties enforcing the rule and will condone them anyway. Not surprisingly, the incidence of free riding in AMRIS ranges from 52 to as much as 79 percent as against the 43 percent national average.

7.6 Summary and Conclusions

In this chapter, I examined how institutional and political factors such as land tenure, IA autonomy, communication and political patronage help explain variation in the levels of monetary free riding found among IAs that lead to persistently low collection of fees and drives the vicious cycle problem in irrigation.

Consistent with expectations, I find that IA autonomy and face to face communication have a strong negative effect on levels of monetary free riding. Autonomous IAs and frequent face-to-face communication are associated with lower levels of monetary free riding. I surmise that autonomous IAs have lower levels of free riding compared with non-autonomous IAs because of their differences in boundary rule, payoff rule, aggregation rule, scope rule, authority rule, perception of fairness and legitimacy, and strategic interdependence and common understanding.

I also showed that while farmers may be successful in addressing one form of a collective action problem such as equitable water distribution, farmers may also have great difficulties surmounting the problem of providing for a lumpy investment in a public good such as the rehabilitation of the irrigation system. I showed how the homogeneous characteristics of the population, the problem of poverty and the shape of the production function that farmers face can contribute to this difficulty.

Surprisingly, I find that land tenure security is positively associated with free riding contrary to expectations. Irrigation systems with higher levels of land tenure security are associated with higher levels of free riding. I explained how this came about as a result of the dynamics of land reform efforts in the early 1970s.

I also find that, contrary to expectations, political patronage - as indicated by the presence of a political dynasty in the province where the IA operates - has no statistically significant effect on monetary free riding. I surmise that this has to do with the fact that NIA was insulated by Marcos from local dynasties during his regime when Marcos himself became the personal patron of NIA instead of local politicians. As I showed in Chapter Two, during Marcos' years, NIA's charter was amended several times, its budget increased 33 times and its staff grew by 9 times.

Since my linear regression model can explain only 26 percent of the variation in monetary free riding, I considered alternative explanations such as the principal agent, moral hazard and coordination problems in the relationship between NIA and the IAs as other plausible alternative explanations that may warrant consideration in future research.

CHAPTER EIGHT

SUMMARY, CONCLUSIONS AND IMPLICATIONS

8.0 Overview

In this chapter, I present the summary, conclusions and policy implications of my dissertation. In Section 8.1, I summarize the puzzle of poor irrigation performance in the Philippines and outline the importance of the study in Section 8.2. I then discuss my analytical framework in Section 8.3 followed by my research hypotheses in Section 8.4 and research methodology in Section 8.5. The summary of my key findings and conclusions about my hypotheses are presented in Section 8.6. Policy implications follow in Section 8.7 with concluding remarks in Section 8.8.

8.1 The Puzzle

Decentralization – the transfer of authority and responsibility for public functions from the central government to intermediate and local governments, quasi-independent government organizations, and/or the private sector – is a popular instrument of policy reform in most developing countries. Since the early 1980s, 63 out of 75 national governments in developing and transitional countries – many in Asia – have embarked on some form of decentralization (Agrawal and Ribot 1999).

In this dissertation, I examined the experience of the Philippines in the decentralization of the operation and maintenance of large-scale, government-owned

irrigation systems. Since the 1970s, at least 25 developing countries have embarked on policy reforms to decentralize irrigation management (Vermillion 1997), and the experience of the Philippines raises an interesting puzzle. In the mid-1970s, the National Irrigation Administration (NIA) launched a pioneering program to decentralize the construction and O&M of small-and-large scale public irrigation systems gradually on a national scale. Independent studies have shown that NIA's model – known as the Participatory Irrigation Management Program – led initially to consistently positive results. Canals and structures were viewed by farmers as more functional and the systems more productive, with greater increases in rice yields and irrigated areas in the dry season. Participatory approaches also led to a more equitable water distribution and better financial management (see Section 1.0 in chapter one).

The success of the model soon gained widespread international recognition and documentation. The World Bank cited NIA as "the finest irrigation agency in Asia and any developing country in the world" (NIA, 1990: p.57). The NIA model also attracted widespread documentation from experts and scholars, arguably one of the widest of its kind in the irrigation literature to date (see Sabio and Mendoza 2002; Briscoe 2001; Vermillion 2002; Mejia 1999; Panella 2002, 1999; Fujita et al. 1999; Raby 1997; Merrey 1996, 1994; Oorthuizen and Kloezen 1995; Wijayaratna and Vermillion 1994; Bagadion 1994a, 1995; Meinzen-Dick, Reidinger and Manzardo 1995; Korten and Siy 1989; NIA Consult 1994a and 1994b).

The NIA model also caught the attention of irrigation authorities from India, Indonesia, Thailand, Sri Lanka and Nepal who imported and adapted the NIA model to their countries. By the late 1980s, NIA became the undisputed international leader in

irrigation decentralization, such that the World Bank acknowledged NIA's efforts as a "venerable tradition of reform" (Briscoe 2000).

Some twenty years later and $2.12B in investments, however, the story looks different. As shown in chapter four, irrigation in the Philippines is now characterized by a high incidence of free riding in the payment of fees, chronic underinvestment in maintenance, unabated deterioration of facilities, persistently poor water service and eventually poor farm productivity and incomes.

For example, I find that at least 80 percent of all the 196 large-scale irrigation systems are in poor condition and require major rehabilitation. Cropping intensity, a measure of the quality of irrigation service, is only 68 percent on a ten-year average (1990-2000). During the same period, the incidence of free riding among farmers in the payment of irrigation fees is reported at 56 percent. Also, less than 25 percent of irrigation associations (IAs) take responsibility for the maintenance of their systems (see chapter four).

What explains this puzzle? How could poor performance occur in a system known and lauded worldwide for its major decentralization success? What are the conditions that might lead to poor performance of large-scale, government-managed irrigation systems even after earlier efforts at decentralization? How are the incentives faced by the key players – irrigation bureaucrats, donors, farmers and politicians – linked to the problem of poor performance? What factors might have influenced these incentives? These are the questions I addressed in this dissertation.

8.2 Importance of Study

This study hopes to make the following contributions to the theoretical, policy and methodological literature on political economy, public choice and institutional economics particularly on the subject of decentralization, collective action, common-pool resources and irrigation. First, as a study on political economy, this dissertation builds on the theory of collective action, a subject that lies at the heart of the political economy approach to policy analysis (Bickers and Williams 2002; Ostrom 1998). I extend this approach of political economy to a developing country context in the tradition of Popkin (1979), Wade (1994), and Ostrom (1990).

Second, as a study of public policy, it builds on the literature on decentralization, a frequently recommended, all-purpose solution to a large number of problems in many developing and former socialist countries. However, much of the literature on decentralization suffers from the lack of specificity and grounding in empirical and theoretical analysis (Ostrom, Schroeder and Wynne 1993). Many scholars of decentralization – particularly in the tradition of development administration – describe its variants along numerous dimensions of what Conyers (1984) regards as characteristic of all decentralization efforts:

- the functional activities over which authority is transferred;
- the type of authority or powers that are transferred with respect to each functional activity;
- the level or areas to which such authority is transferred;
- the individual or organization to which authority is transferred at each level; and
- the legal or administrative means by which authority is transferred.

This approach, however, while reasonable, is not related to a broader theory that identifies the factors affecting the incentives that individuals in centralized or decentralized institutional arrangements face and hence can be considered as just one of many efforts to specify the multiple dimensions of decentralization. In addition, the scholarship on public policy – at least in the political science tradition – has been dominated by the stages heuristic approach to policy analysis, an approach criticized by Sabatier (1999) as being largely atheoretical and unable to generate testable hypotheses.

This dissertation attempted to address these limitations in the public policy literature by grounding the study of decentralization in both theoretical and empirical analysis. It empirically examined the incentives faced by participants in ongoing situations and how various contexts – the physical, social, institutional and historical context – shape their incentives and the resulting outcomes. As a study of a multidisciplinary subject, this dissertation drew on both the disciplines of political science – including its subfields of theory and methodology, political economy and public administration – as well as the field of economics, particularly the subfield of development economics, resource economics and institutional economics.

Third, this dissertation examined the pathologies of public bureaucracies in developing countries in the tradition of Bates (1989, 2005), Gibson (1999) and Olowu and Wunsch (2004). In addition, I also showed how and why incentives embedded in foreign aid, such as moral hazard, influence bureaucratic incentives that lead to perverse outcomes. Indeed, while foreign aid plays a dominant role in policy making in foreign countries, little is known about how it influences the incentive structure faced by irrigation bureaucracies and the outcomes when bureaucratic and aid incentives interact.

This dissertation builds on the scholarship along the tradition of foreign aid analytics by Colliers (1997, 1999) and more recently by the empirical work of Gibson et al. (2005).

Fourth, this study is about irrigation infrastructure and institutions. The expected policy payoff of research on irrigation institutions is substantial, since there are at least 25 developing countries – mostly in Asia – in the process of undertaking irrigation reforms in efforts to achieve poverty alleviation, economic growth and food security (Briscoe 2000).

Fifth, as a study of common-pool resources, this dissertation took into account some of the key methodological lessons learned over the last fifteen years of research in this field. The literature on common pool resources in its early days was largely small-n case studies and ignored the mediated and indirect effects of contextual variables (but see Lam 1994). Earlier work focused on operational-level analysis and seldom considered collective choice analysis. This dissertation addressed these limitations by taking into account lessons learned from fifteen years of scholarship in this field and addressed these issues both at the operational and collective-choice levels.

Finally, as a theoretical and empirical study of how institutions shape the incentives faced by bureaucrats, donors, politicians and farmers, this dissertation builds on the increasing literature in institutional economics that examines the causes and consequences of both micro – and macro – level institutions.

8.3 Analytical Framework

I organized my research around an adaptation of the institutional analysis and development framework. The framework suggests that outcomes in irrigation (in this case

the condition of irrigation facilities, payment of irrigation fees and labor contribution among farmers, service and productivity and incomes) are independently and configurally affected by the physical characteristics of irrigation systems and the attributes of resource users. It also suggests that outcomes are affected by the incentives and the resulting patterns of interaction among the key irrigation players – irrigation bureaucrats, donors, farmers and politicians. The incentives of these actors, in turn, are shaped by the political and institutional context that in turn is shaped by the physical characteristics of irrigation systems and the attributes of resource users.

8.4 Research Hypotheses

To answer the puzzles posited above, I advanced three hypotheses in the theoretical section of the dissertation (Chapter Three) that examine the incentives faced by key irrigation actors engaged in strategic interaction. The first two hypotheses focused on collective-choice processes at the national level that are embedded in international processes, i.e., how incentives of a public bureaucracy such as NIA are shaped by incentives embedded in foreign aid. The third set of hypotheses and sub-hypotheses focused on local processes that are also embedded in larger national and international processes i.e., the factors that shape the incentives faced by farmers in different physical, social and institutional contexts given that they are also embedded in the incentive structure of NIA and foreign aid.

Hypothesis 1

The problem of persistently poor performance in large-scale public irrigation systems is linked to the incentive structure faced by public irrigation agencies. Irrigation agencies characterized by perverse incentives are more likely to be associated with persistently poor irrigation performance. This hypothesis was discussed in Chapters Four and Five.

Hypothesis 2

Irrigation aid is characterized by the problems of moral hazard. Irrigation agencies highly dependent upon irrigation aid are more likely to face perverse incentives that contribute to poor irrigation performance.

Hypothesis 3

The problem of poor performance in large-scale public irrigation systems is also linked to the problem of collective action among farmers – particularly the problem of free riding. I hypothesize that the incentive to free ride among farmers is influenced independently as well as configurally by the characteristics of the irrigation systems, the attributes of the farmers as well as the micro-institutional context.

In chapter six, I examined a series of variants of Hypothesis 3 by looking at the impact of: (1) the physical characteristics of the irrigation system (in terms of water scarcity, size of the system, proximity to markets and the condition of irrigation facilities); (2) the attributes of farmers (in terms of group size, gender distribution, age and origin of the IA, extent of poverty, salience of irrigated farming); and (3) the micro institutional context (in terms of political patronage, extent of autonomy enjoyed by the IA, extent of face-to-face communication among IA members and security of tenure).

8.5 Research Methodology

8.5.1 Study Site

I chose the Philippines as a study site for a number of reasons. First, irrigation development in the Philippines shares a similar history with that of many other developing countries in Asia (Vermillion 2002), and therefore irrigation issues are also most likely to be generic to these countries (Briscoe 2000). Second, NIA's experience with irrigation decentralization is a crucial and interesting case study. Third, the Philippines is also an ideal study site since there exists a considerable database on irrigation that is publicly accessible. Finally, I chose the Philippines because of my familiarity with its irrigation institutions and its political, economic and social context.

8.5.2 Data and Data Collection

To examine how bureaucratic and aid incentives – Hypotheses 1 and 2 – affect irrigation performance, I used an aggregate panel data (1990 to 2000), available from NIA archives, that describes the characteristics and performance of NIA as an organization and those of the 196 national irrigation systems. These include data on the financial, technical and organizational aspects of NIA, the performance of irrigation systems, the physical condition of irrigation facilities as well as the overall profile of IAs in national irrigation systems. Archival research was primarily undertaken at the library of NIA in the summers of 2003 and 2004 and was facilitated by the professional assistance of NIA's librarian. The archival research, which covered the periods from 1964 to 2003, focused mainly on two types of documents: 1) project documents and 2) administrative and legal documents pertaining to the creation of NIA since 1964.

To test my various hypotheses on how physical, social and institutional factors affect free riding, I gathered and analyzed secondary data on 2,056 IAs in all of the 196 large-scale public irrigation systems throughout the Philippines. The data I used came from the following sources: (1) archival records at the NIA headquarter and its field offices; (2) National Statistics Office (NSO) and Bureau of Agricultural Statistics (BAS), both of which are government agencies; (3) field observations, key informant interviews and as participant in three major farmer and NIA conferences; and (4) local government units particularly from their Municipal Agriculture Office. The data sets describe the physical characteristics of the irrigation systems, the characteristics of irrigation associations and farmers as well as key institutional and political variables.

8.5.3 Measurement Reliability

To determine the reliability of the quantitative data sets obtained from NIA, two rounds of ground-truthing were undertaken. The first round – undertaken during the summers of 2003 and 2004 – involved field visits to thirteen irrigation systems drawn from purposive sampling. The focus of the ground-truthing was to establish the quality and independence of the data sets within a reasonable degree of confidence. This was done by determining, based on the sampled irrigation systems, if NIA had a compelling incentive to systematically bias reporting of performance indicators and whether there is strong evidence to support this belief. For instance, a determination was made regarding the primary source of the data sets and whether the rewards of the NIA staff responsible for coding them were tied to a particular measure of performance. A determination was also made whether there were any political pressures to report particular performance

measures. Overall, based on the results of the first ground-truthing, I find ─ with a reasonable degree of confidence ─ that the data sets obtained from NIA are not systematically biased because of a robust system of checks and balances, and that measurement errors are presumed to be random.

To validate my findings and double check the veracity of the coded data sets, I did a second round of ground-truthing in the summer of 2005. I revisited two irrigation systems and discussed the results of my statistical tests with key informants from NIA and IAs. I also re-examined the coded data sets, as far as practicable, to determine if there were coding errors, particularly for observations with outliers.

8.5.4 Analytical Approach and Statistical Tests

For analytical purposes, I examined my research hypotheses at two levels of analysis – collective-choice analysis and operational-choice analysis. Current studies on decentralization seldom address these two levels of analysis simultaneously. For my first and second hypotheses, I employed collective choice analysis by focusing on the incentives of irrigation bureaucrats and donors and how these are linked generally to the problem of persistently poor irrigation performance. To qualitatively test my hypothesis, I examined descriptive statistics and panel data from 196 irrigation systems nationwide covering the period 1990 to 2002 for which data was available. I also examined archival records from NIA – primarily data about irrigation projects and loans, legal documents as well as financial, personnel and organizational records – to historically understand bureaucratic incentives and behavior and how these are linked to poor irrigation outcomes. My unit of analysis was the NIA and the aggregate performance of the 196

public irrigation systems in the Philippines. I then examined how the history of irrigation development and the incentives embedded in irrigation aid played a role in reinforcing the perverse incentives faced by NIA and how these are linked to the problem of persistently poor irrigation performance.

For my third hypothesis – i.e., how the puzzle of irrigation decentralization and the problem of poor performance are also linked to collective-action problems faced by farmers – I shifted my focus to operational-choice analysis. Here, I focused on the problem of free riding among farmers, particularly in the payment of irrigation service fees and the provision of labor counterpart for irrigation O&M. I used cross-sectional data from the entire population of 2,056 IAs in all of the 196 public irrigation systems in the Philippines. My purpose was to understand how variations in the physical characteristics of irrigation systems, the attributes of the farmers and the micro-institutional context could explain variations in the free rider's problem in irrigation. I employed both descriptive and inferential statistics including correlation analysis, linear regression and a binary logistic regression model.

I employed a linear model to test the statistical significance of my predictor variables on one of my dependent variables (i.e., the extent of monetary free riding among farmers, a continuous variable). I employed this model mainly to establish how my results compare with findings from other related empirical studies. I then used illustrative mini-case studies and in-depth discussion to provide a more nuanced understanding of the results of the regression.

On the other hand, I employed a binary logistic regression model to examine how the probability of a binary outcome – i.e. labor contribution among farmers – changes

as the set of predictor variables also changes. My purpose in doing this test was to compare the levels of free riding among farmers between paying irrigation service fees and making labor contributions. I also wanted to see which factors influence levels of labor contribution and whether they are different when it comes to monetary payments.

8.5.5 Inferential Validity

I sought to address issues of inferential validity by paying attention to (1) the logic of scientific inference (King, Keohane and Verba 1994); (2) the need to combine approaches from the rational choice, cultural approach and structuralist traditions in political science (Cook and Levi 1990); and (3) the limitations of a quasi-experimental study (Shadish, Cook and Campbell 2002), i.e., employing case studies to illuminate results of regression analysis using theory-based evaluations in the analysis of incentives by farmers, bureaucrats, donors and politicians and using robust statistical methods.

8.6 Findings and Conclusions

The three main findings and conclusions from the study can be summarized as follows and are discussed in the sections that follow.

First, I find adequate evidence that the performance of irrigation in the Philippines indeed can be described as a vicious cycle characterized by 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 particularly at tail-end sections of the system.

Second, I also find adequate evidence to support my hypothesis that the problem of chronic underinvestment in maintenance, which drives the vicious cycle problem in irrigation, is driven by perverse incentives faced by NIA and aggravated by incentives embedded in irrigation aid.

Finally, I also find that the problem of persistently poor payment of irrigation fees by farmers, which also contributes to the vicious cycle problem of irrigation in the Philippines, can be explained by variation in the incentives faced by farmers as influenced by, among others, the physical characteristics of the irrigation system, the attributes of farmers and the institutional context.

8.6.1 The Performance of Public Irrigation in the Philippines

I examined the performance of public irrigation in the Philippines in terms of the physical condition of irrigation facilities, water service, payment of irrigation fees by farmers, investment in maintenance, and farm productivity and incomes. I find that the performance of irrigation in the Philippines can be described as a vicious cycle characterized by 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 particularly at tail-end sections of the system (see Chapter Four for detailed discussion).

I find that about 80 percent of the 196 national irrigation systems are in need of rehabilitation and/or improvement as of 2002. More than 50 percent of control structures for both lateral and main canals and more than 60 percent of main and lateral canals are in need of rehabilitation such as desilting, reshaping, and heightening of embankments.

The magnitude of the problem would clearly suggest a pattern of chronic underinvestment in irrigation maintenance.

The unmitigated deterioration of physical facilities has led to a persistently sub-optimal water delivery, particularly at the tail end of systems where farm holdings are at their farthest point from the head gate where water is delivered. Over the last ten years, on average, the actual irrigated area is only 71 percent of the total irrigation service area.

The persistently poor delivery of water eventually leads to farmer dissatisfaction, particularly at the tail ends, and hence reduced willingness to pay for irrigation fees. Fee collection over a 10-year period from 1991 to 2000 averaged only 44 percent with a maximum of 51 percent in 1991 and a minimum of 34 percent in 1998. Besides a weak incentive to pay for current accounts, farmers are also not paying their back accounts which have averaged 80 percent over 10 years.

I also find that IAs generally do not bother to repair and maintain tertiary canals for which they are responsible. Only about 8 to 25 percent of the 2,056 IAs nationwide fully implemented their repair and maintenance plans. The problem of chronic underinvestment in O&M is also apparent among primary and secondary canals managed by NIA. As shown in Chapter Four, underinvestment in irrigation maintenance is particularly a problem in water operations, canal cleaning, gate maintenance, communication and equipment. Persistent underinvestment in routine maintenance has the effect of exponentially increasing maintenance costs as routine work that is neglected leads to increasing costs over time.

Poor water service eventually impacts productivity and farmers' income. Productivity – measured in terms of cropping intensity over a ten-year period (1990-

2001) nationwide – ranged from 1.24 to 1.43 with an average of 1.36 or 68 percent of the ideal. Besides cropping intensity, another measure of farm productivity is output per unit area. This is an appropriate impact indicator given that in the Philippines, land is a constraint relative to water. Only 10 percent of all irrigation associations in the nation's 196 national irrigation systems have productivity above 5 tons/ha while 50 percent have productivity levels between 3.5 to 4.5 tons per ha. Overall productivity in the Philippines lags behind a number of comparable countries such as Indonesia, Vietnam and Myanmar. Not surprisingly, because of poor productivity, at least 60 percent of all IAs in the Philippines have relatively low paddy-farm incomes.

8.6.2 Bureaucratic and Foreign Aid Incentives

In Chapter Five, I hypothesized that the problem of chronic underinvestment in maintenance that drives the vicious cycle problem of irrigation in the Philippines is driven by the problem of perverse bureaucratic incentives faced by NIA and aggravated by incentives embedded in irrigation aid.

I find that NIA has a strong incentive to underinvest in the maintenance of irrigation systems because this justifies new loans from donors for capital-intensive investments in rehabilitation. In Chapter Four, I have shown clear evidence in Figure 4.1 and Table 4.1 of the extent of deterioration of irrigation facilities due to underinvestment in maintenance. In Chapter Five, I also showed in Table 5.1 clear evidence of NIA's incentive to pursue irrigation rehabilitation projects. These indications, when viewed together, indeed show a pattern of bureaucratic behavior by NIA consistent with what

Vermillion (2002) described as the tendency of irrigation bureaucracies in Asia to "build, neglect and rebuild irrigation systems."

I have also argued and shown in Chapter Five that the tendency to "build, neglect and rebuild" irrigation systems is a rational, and in fact a dominant, incentive for NIA since loans for irrigation rehabilitation provide direct and indirect subsidies that have enabled NIA to survive a precarious financial condition. I explained that this precarious financial condition is linked to the problem of an oversized and aging bureaucracy and entrenched interests developed during the construction phase of irrigation development in the Philippines in the 1970s. As discussed in Section 6 of Chapter Two, the expansion and improvement phases of irrigation development in the Philippines saw NIA's capitalization grow by 33 times and its staff size by 9 times.

I have also shown in Chapter Five why NIA has an incentive to allow farmer participation with patronage because of bureaucratic self-interest and its preoccupation for agency survival. As discussed in Chapter Two, pressures from donors and planning agencies prompted NIA to attempt to create IAs in national irrigation systems with management authorities mainly limited to tertiary canals. These efforts to encourage farmer participation are often limited to special project sites or they die out after a few years because of the government retaining its role in governance of public irrigation systems and farmers retaining their role as supplicants to the government. This is a condition referred to by Shah (2002) as participation with patronage, the same conditions argued by Vermillion (2002) as also prevalent in other developing countries in Asia.

I have also argued and shown in Chapter Five that donors are just as motivated to provide capital-intensive "brick and mortar" rehabilitation loans to NIA because this is

good for the donor's loan portfolio. These projects are attractive because they are straightforward in design and are quick-disbursing. These projects also take the incentive structure and modus operandi of NIA as given and do not adequately examine alternative governance modes of providing irrigation to farmers.

Finally, I have also shown in Chapter Five that NIA and its donors are bound in a moral hazard problem. Donors need NIA as a client as much as NIA needs donors. This creates an incentive for donors to be lax in the enforcement of loan provisions on O&M and for NIA to routinely promise adequate funding for O&M. I find that while all irrigation loans contain provisions requiring NIA to ensure adequate funds for irrigation O&M after project completion, NIA routinely makes this promise, yet the reality is one of chronic underinvestment in maintenance. This is because, regardless of NIA's compliance record, it can correctly expect donors to continue financing rehabilitation projects because it is in the donor's interest to increase their loan portfolio. Absent enforcement and the negligible costs of non-compliance, NIA's dominant incentive is to default on its responsibilities towards O&M.

The evidence in support of the moral hazard argument becomes clear when one considers analytically and empirically how these rehabilitation projects have helped to keep NIA afloat. For instance, I find that NIA's central office is largely dependent on the management fees it collects from foreign-funded projects to pay for its operations. Foreign projects also provide equipment assets to NIA that in turn generate equipment rental fees that finance NIA's regional offices. Rehabilitation projects also bring in additional income from irrigation service fees to support the operations of NIA's Irrigation System Offices (NISOs). Altogether, NIA's budget is supported by explicit and

implicit subsidies provided by foreign aid amounting to roughly 40 percent of its total budget. If these subsidies were to be directly absorbed by IAs or if the private sector were to undertake rehabilitation, NIA would not exist in its present form (Briscoe 2000). NIA, therefore, has strong incentives to maintain the current subsidy scheme provided by donors because this keeps NIA afloat amidst a precarious financial condition. I have also argued that donors have little incentive to alter this incentive structure because this contributes to the growth of their irrigation portfolio.

In conclusion, I find adequate evidence to support my hypothesis that the puzzle of decentralization and poor irrigation performance in the Philippines can be partly explained by inherent bureaucratic incentive problems at NIA, the history of irrigation development in the Philippines and how the incentives embedded in irrigation aid aggravated these bureaucratic incentive problems.

8.6.3 The Incentives of Farmers: Linear Model

While the hypothesis about bureaucratic and aid incentives provided a plausible explanation to the puzzle of irrigation decentralization and poor performance, it cannot adequately explain another puzzle: the variation in the levels of free riding found among IAs in particular. Why do some IAs have higher levels of free riding – in terms of the payment of irrigation fees and labor contribution – compared to other IAs, even though they are all subjected to the same set of collective-choice incentives?

From collective-choice analysis of bureaucratic and aid incentives, I shifted to operational-choice analysis to examine the incentives faced by farmers. I hypothesized that the puzzle of irrigation decentralization and poor performance is also linked to

collective action problems faced by farmers. I focused, in particular, on the problem of free riding among farmers in the payment of irrigation service fees and contribution of labor. Based on the theoretical and empirical literature, I examined – using a linear regression model – the following three sets of predictor variables identified in the literature as being relevant.

- the characteristics of the irrigation system in terms of water scarcity, size of service area and infrastructure condition;
- the characteristics of farmers in terms of their size, age and origin of the IA, gender distribution, poverty levels, proximity to markets and salience irrigated farming; and
- the political and institutional context, particularly land tenure (as a determinant of boundary rules), autonomy of the IA and communication among farmers.

I find adequate evidence to confirm my conjecture that the puzzle of irrigation decentralization and persistently poor performance of public irrigation in the Philippines is also linked to collective-action problems among farmers. This is particularly the case in the payment of irrigation fees but not in the case of labor contribution among farmers.

For instance, I find that variation in levels of monetary free riding among IAs can be explained by the following statistically significant predictors: water scarcity, cropping intensity, age of the IA, user size, entrepreneurship, poverty levels, IA autonomy, land tenure security and frequent face-to-face communication. Among these predictors, the variables with the strongest and statistically significant effects were water scarcity, poverty, IA autonomy and communication.

The direction of the impact of these variables on the rates of monetary free riding is generally consistent with expectations, except for the effect of land tenure security. Since my linear regression model can explain only 26 percent of the variation in monetary free riding, I considered the principal agent and moral hazard problems in the relationship between NIA and the IAs as plausible alternative explanations that can be considered in subsequent research.

I also find that farmers do behave differently when the required input is labor contribution. For instance, I find that 84 percent of all IAs have at least 75 percent of their members contributing labor to group work. However, when the contribution is monetary, the average rate of contribution nationwide over a ten-year period (1990-2000) is only 57 percent.

The relatively high level of monetary free riding found in public irrigation systems throughout the Philippines, at a ten-year average of 43 percent, is a crucial factor that drives the pernicious problem of persistently poor irrigation performance. Coupled with the perverse bureaucratic incentives faced by NIA, the persistently low collection of irrigation fees leads to the problem of chronic underinvestment in maintenance that in turn leads to the unabated deterioration of facilities and consequently to the problem of poor water service and eventually poor farm productivity and incomes. Poor returns to farming, driven by, among others, poor water service, small farm holdings, lack of credit, post-harvest facilities and poor marketing infrastructure leading to low prices and high production costs, all contribute to the problem of poor incomes of farmers that in turn help explain the persistently low levels of payment in irrigation fees.

8.7 Policy Implications

Before discussing the implications from the study, I briefly examine in the following sections the various recommendations on irrigation policy reform in the Philippines as suggested by policy analysts, reform advocates, consultants and donors. These recommendations range from the conventional approaches that take NIA's current role as given to the more progressive ones that call for fundamental reforms.

8.7.1. Conventional Recommendations

Conventional recommendations take the current role of NIA as given and seek to improve irrigation performance by tinkering on the margins. A central feature of these recommendations is the strengthening of organization and management at NIA. In particular, these prescriptions seek to: 1) improve NIA's financial viability by cutting costs through personnel reduction and increasing revenues by increasing management fees, irrigation fees, and the disposal of assets; and 2) streamline operations by delegating more responsibilities to regional and field offices, improving management information systems, staff training and related organization and management improvements.

These prescriptions, however, are less likely to overcome the incentive problems underlying the persistently poor performance of irrigation in the Philippines. By tinkering on the margins and taking NIA as an end in itself, these prescriptions will only prolong and aggravate, rather than cure, the incentive problems faced by NIA. So long as the current perverse incentive structure at NIA is ignored, the problem of poor irrigation performance is more likely to persist. More radical measures are needed to overhaul the incentive structure at NIA.

8.7.2 Recommendations for Reform

Irrigation reform advocates have proposed a variety of institutional reforms to develop a more healthy incentive structure in the irrigation sector in lieu of the current perverse incentives. I suggest that this reform agenda can be organized into three levels (Figure 8.1), building on the framework developed by Williamson (2000) on institutional economics. The discussions that follow are my efforts to elaborate on this reform agenda.

Figure 8.1- Getting it Right: Institutions, Governance and Prices in Irrigation

Purpose	**Reform Agenda**
Get the institutional environment right: Formal Rules of the Game	• Irrigation property rights reform o Exclusion rights o Monitoring and enforcement authority o Fiscal authority (authority to raise and allocate revenues) o Veto rights over government assistance o Updating of farmer registries / masterlist
Get the governance structure right: Play of the Game	• Aligning governance structures with transactions o Redefining the role of NIA o Unbundling and contracting out of services ▪ By type of service ▪ By time ▪ By level o Development of quasi market for irrigation service • Contract enforcement
Get the prices right	• Continuous alignment of incentives o More imaginative deployment of subsidies ▪ Incremental demand-driven rehabilitation ▪ Rehabilitation aid tournaments ▪ Matching and block grants ▪ Rehabilitation trust funds o Marginal pricing of irrigation fees ▪ Volumetric pricing

The first reform agenda seeks to get the institutional environment or the formal rules of the irrigation game right by reforming irrigation property rights. The second agenda seeks to get the governance structure or the "play of the game" right. These

recommendations include the alignment of governance structures and enforcement of contracts. Finally, the third agenda seeks to get the prices right by continuously aligning incentives, particularly the deployment of subsidies and pricing of irrigation fees. Each of these levels are mutually reinforcing as indicated by the arrows in Figure 9.1. The potentials, limitations and collateral consequences of these recommendations are briefly reviewed in thenext section.

Getting the Institutional Environment Right

Getting the institutional environment or "the rules of the irrigation game" right is a crucial step in resolving the perverse incentives problems in irrigation. Central to this reform are efforts to accelerate the restructuring of property rights in Philippine irrigation. The transfer of water rights and full governance authorities to IAs in national irrigation systems in the Philippines should be expanded beyond pilot projects and should be given top priority. To be meaningful, such transfer to IAs should include, among others, the authority to exclude other non-paying farmers, to raise and allocate revenues, to make and enforce rules and the right to veto government assistance. Giving IAs adequate scope of authority would enable them to address the challenges that come with diverse physical and social settings in which they find themselves.

The importance of transferring water rights to IAs is generally recognized in the irrigation sector in the Philippines, NIA being an early proponent of transferring water rights to farmers in communal irrigation systems. In fact, NIA's charter (Republic Act 3601 in 1963 and Presidential Decree 552 in 1974) legally allows it to transfer ownership of irrigation assets through the collection and recovery of the cost of construction. These

mandates were reiterated by succeeding legislation (Local Government Code 1991 and Agriculture and Fisheries Modernization Act or AFMA 1998) requiring NIA to transfer property rights to local governments in the case of communal systems and to irrigation associations up to secondary canals in national systems. Both laws reinforce the principle of subsidiarity, i.e., that the national government should not do what farmers can do and are already doing. Implicit in these laws is a vision for NIA to be transformed from its current orientation as a construction and O&M agency into a regulatory agency and a technical service provider.

However, to date, these laws have not produced anything substantial. Reform efforts have been limited to a few pilot projects and in small schemes. As this dissertation has shown, irrigation in the Philippines remains mired in chronic underinvestment in maintenance, unabated deterioration of physical facilities, persistently poor water delivery and consistently low levels of irrigation revenue collection.

The key to moving forward in irrigation property rights reforms, however, requires the rehabilitation of dilapidated systems to give farmers the incentive to accept the accountability for them and to finance the much-needed retirement of NIA's staff to be displaced by farmers.

Getting Irrigation Governance Structure Right

One lesson that can be drawn from the experience of the Philippines in the decentralization of irrigation management is that the transfer of property rights per se is not adequate at resolving the problem of poor performance. Equally important is how to get the "play of the irrigation game" right. Doing so requires 1) redefining the role of

NIA *vis-à-vis* the IA, 2) the unbundling and contracting out of irrigation service, and 3) the development and regulation of the market for irrigation service providers. The purpose of redefining the role of NIA is to address the perverse bureaucratic incentive problems that it faces.

Redefining the role of NIA means several things. First, it means shifting its current role as retailer and manager of irrigation service to one of wholesale distributor of water, regulator and technical service provider. Second, it may require the unbundling of technical and social services currently undertaken by NIA and giving IAs the voice and exit options to choose service providers that will meet their irrigation objectives. In contrast to the current approach, NIA by default is responsible for all irrigation services down to the farmers' field level. The purpose of unbundling is to simulate markets by introducing dynamic efficiencies – including responsiveness and greater accountability – usually lacking in a natural monopoly. As Vermillion (2002) suggests, unbundling can be done in at least three ways:

- Unbundling by type of service whereby IAs may use different service providers for water delivery than for maintenance and rehabilitation.
- Unbundling by level where there may be different service providers at different hydraulic levels such as the reservoir, main system and at the secondary and tertiary levels.
- Unbundling by time means that service providers have time-bound contracts and may compete in a periodic selection process.

In particular, Briscoe (2000) suggests exploring the possibility of getting the private sector to manage some of the NIS through management or lease contracts. Direct

contracting is presumed to be a general solution to principal-agent problems in a public bureaucracy. It has the potential for improving O&M for contracted irrigation systems as well as introduce performance and cost benchmarking against which to judge NIA's performance. Groenfeldt (2004) specifically suggests that farmers need not necessarily work as managers in addition to farming. The key is for farmers to have control of irrigation management like the cases within Turkey and Mexico, where farmers created management boards and hired professional irrigation managers who were directly accountable to the board. This arrangement is more accountable, and hence more responsive, than is the case when a government bureaucracy manages irrigation.

Many advocates of unbundling and contracting, however, do not attempt to examine their limitations and collateral consequences and simply assume that they will work. This may not always be the case. When the market for irrigation service providers is thin – which is currently the case for irrigation services in the Philippines – one could expect opportunistic behaviors among suppliers (Weimer and Vining 1999). Regulations are therefore needed to address these collateral consequences of direct contracting. Regulations may take the form of price, quantity and quality regulation of irrigation goods and services. In addition, to develop the thin market of irrigation service providers, a system of supplier certification may be needed as well as a way to provide information linking buyers and sellers of irrigation services. These are some of the new roles that NIA could fulfill in conjunction with efforts at property-rights reform.

Getting Prices Right

I would further suggest that getting the formal rules and the play of the game right are not adequate to address the problems of persistently poor irrigation performance. Getting prices right in the context of irrigation in the Philippines means two things. First, it means re-examining irrigation fees, and second, it means a more imaginative deployment of irrigation subsidies.

Getting prices right means re-examining irrigation fees that were decreed in 1975. The current fee takes the form of a universal tax and is remitted to NIA's general fund. The general fund is spent on NIA's administrative costs including overhead costs and also used for cross subsidies to poor performing systems. When marginal costs do not match up with marginal benefits, i.e., when irrigation fees are not related to the level of service, not surprisingly, farmers are reluctant to pay.

Lately, NIA has been keen on the potentials of volumetric pricing – charging and collecting water fees from farmers on a wholesale basis.[8] Currently, NIA, by itself or through its contracted irrigation association, is collecting fees from individual farmers. Volumetric pricing is based on two efficiency arguments. First, by pricing on the basis of actual consumption, farmers would be more motivated to use water efficiently. Irrigation water would be regarded as an economic good and could be priced at a level closer to its economic value. In practice, NIA's approach to volumetric pricing, however, is anything but marginal pricing. In its pilot test, NIA simply multiplied its current rates (1975 irrigation service fees) to the actual volume consumed. These have little to do with the marginal value of water or the marginal value of irrigation service. To be meaningful,

[8] NIA embarked on a pilot test of volumetric pricing, the results of which appeared to be promising. On the basis of this pilot test, NIA is considering the adoption of volumetric pricing as a policy instrument.

volumetric pricing needs to consider at least three principles: 1) marginal pricing that also capitalizes the cost of maintenance of the facility and the watersheds that supply water; this is, however, not advisable on grounds of equity since most farmers are small and impoverished and any further increases in current fees is only counterproductive; 2) metric reliability – that the measurement device can be trusted and relied upon by both parties and can be easily operated and maintained; and 3) farmers have fiscal authority, or the right to determine and adjust price to capture and allocate the efficiency gains from volumetric pricing. NIA needs to go beyond its current concern for metric reliability.

The second argument for volumetric pricing has to do with a more efficient way of collecting irrigation fees from farmers. Under this system, NIA would now deal only with one entity, the IA, which would then have the burden of collecting from individual farmers. Again, this would require transferring property rights and authority and helping build the capacity of irrigation associations to enable them to effectively govern the system. A simple transfer of rights and volumetric pricing would not be adequate without also substantially investing in building the capacities of IAs. Follow-up support to IAs after property-rights reform would also be essential. As experience has shown, building the capacity of IAs takes years of steady investment.

Redesigning irrigation subsidies is another way to get prices right. In irrigation, subsidies have a role to play in terms of increasing the supply of a local public infrastructure such as irrigation facilities, increasing equity (particularly for small farmers) and minimizing the impact of catastrophic losses, i.e., frequent destruction of facilities because of flooding from typhoons, which are a regular occurrence in the Philippines. However, getting irrigation prices right means a more imaginative

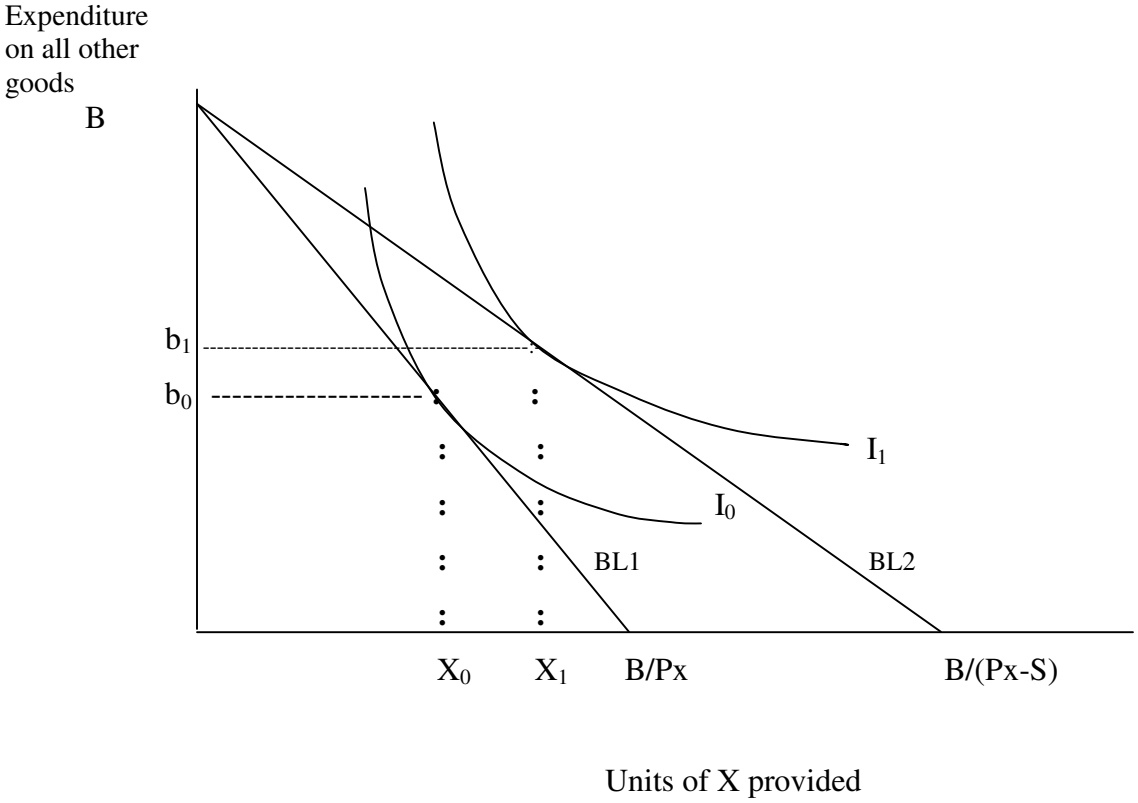
deployment of irrigation subsidies that are all currently channeled through, and inefficiently absorbed by, NIA.

Vermillion (2002) suggests that supply-driven and externally financed rehabilitation should be replaced with incremental, demand-driven infrastructure repair and improvement funds based on competitive review of proposals, technical approval and matching investments. Gardner and Waller (2001) referred to this as *aid tournaments*, which they suggest can forestall the worst effects of the principal-agent problem.

While matching grants in irrigation have an intuitive appeal and are widely popular, I suggest that a more nuanced understanding is needed of their effects on the behavior of irrigation grantees. Consider, for example, the problem of spillover effects or decategorized budget expenditures arising from irrigation subsidies as discussed in Figure 5.9 of Chapter Five. I analytically argued and empirically showed how a subsidy to NIA for irrigation O&M can lead to the problem of spillover effects, i.e., a budget allocation for O&M spills over to other spending categories, such as paying for salaries of personnel and the operation of offices not directly related to irrigation O&M (see section 5.3.4 in chapter 5).

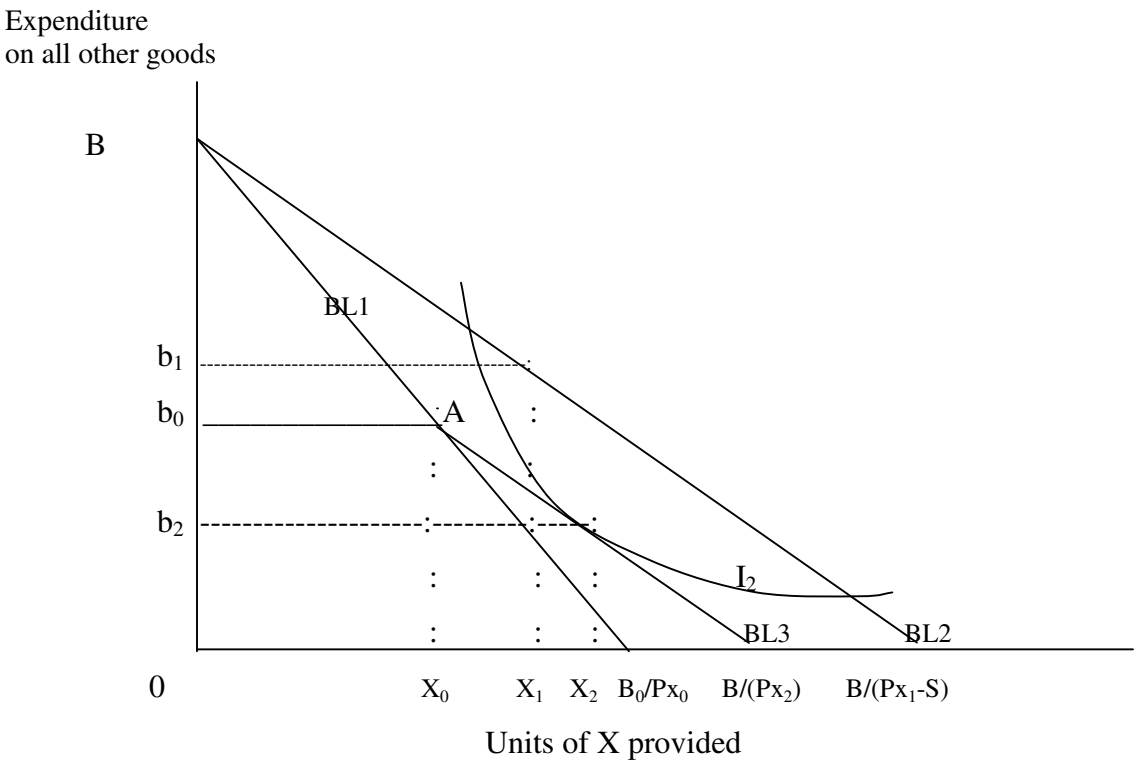
I earlier showed in Figure 5.9 (reproduced in Figure 8.2) how a subsidy to irrigation O&M could spill over to spending categories other than O&M. This spillover effect is represented by the difference between point b1 and b0 that results when NIA's budget line shifts from BL1 to BL2 because of the subsidy. Because of this additional budget, NIA is now able to produce more X (i.e., shift from X_0 to X_1) and its indifference curve shifts from I_0 to I_1 and its expenditure for goods other than O&M also increases from b_0 to b_1 (the spillover effect).

Figure 8.2- The Effect of a Matching Grant on Irrigation Maintenance



One way to deal with the problem of a spillover effect arising from the subsidy to irrigation O&M is to design the matching grant with a maintenance-of-effort (MOE) requirement, as illustrated in Figure 8.3. With MOE requirement, only units beyond X_0 would be subsidized. The budget line with this new requirement follows the original budget line up to X_0 (point A), then rotates to the right so that is becomes parallel to the budget line BL2 for the subsidy without maintenance of effort requirement. The irrigation agency is now faced with a new budget line BL3 when maintenance of effort is required.

Figure 8.3 - Matching Grant with Maintenance of Effort Requirement



At any point of the new budget line BL3 with maintenance of effort requirement, NIA now responds by providing more of canal maintenance X_2 with a new indifference curve I_2 and spending less on other goods and services than it would without the subsidy (X_0) and a subsidy without the maintenance of effort requirement (X_1).

The key lesson here is that MOE provisions may be useful in targeting subsidies either for NIA and IAs so that expenditure levels have the highest desired impact and that subsidies are spent where they are actually needed (i.e., for irrigation O&M) instead of being spent on the general operation of the NIA bureaucracy with little or no direct impact on O&M. However, to ensure that the MOE requirement is complied with, both at the level of NIA or IA, a variety of periodic irrigation audits – technical, financial and performance – would be needed to verify compliance. The grantees will receive O&M

grants only upon verified compliance with this MOE requirement. The national government should require NIA to submit an MOE compliance report as a requirement before it is allowed to enter into irrigation loan agreements with donors. This is one strategic policy instrument that can be deployed to reshape NIA's current perverse incentives.

8.8 Concluding Remarks: Learning from the Past

The task of simultaneously getting institutions, governance and prices right would not be easy but reformers within and outside of NIA could benefit from the lessons learned from its initial transformation in the early 1980s. These lessons, summarized by Korten and Siy (1987), are as follows: First, it is possible to convert a conventional, technically oriented, bureaucratized public development agency into a more responsive agency. Second, the process of transforming such a bureaucracy, however, is not quickly and easily achieved and requires a style of leadership focused on the task of developing and weaving together complex strategies, organizational structures, systems and procedures, skills and shared values. The task is to achieve a strategic fit among three key elements: the policy framework, a method for organizational change and a supportive management. Finally, a successful reform would need a constituency of skilled policy reformers inside and outside NIA, strongly articulated demand and high levels of performance from IAs, technical assistance and enlightened lending from donors and a lot of political will from the national government to overhaul NIA's incentive structure.

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ANNEXES

ANNEX 2.1

The Process of Organizing Irrigator's Associations in National Irrigation Systems
Source: NIA-IDD

Organizing Phase/Activities	Time Frame	Person (s) to be Involved	Expected Output
I. Preparatory Phase Listed below are requirements before formal organizing work starts. 1. Record of previous 2 years performance of the irrigation system, the IA and/or the proposed IA area. 2. System (color coded) indicating canal network and facilities; IA area and/or proposed IA area. 3. Individual IA and/or proposed IA map. 4. List of farmer-beneficiaries by RA (include tenurial status) compiled by individual RA and/or proposed IA. 5. Systems improvement plan with Sub-area (according to IA area) details. 6. Preliminary list of minor repair works needed inside & outside the IA area. 7. Preliminary organizational structure of the IA & model By-Laws. 8. Parcellary map 9. IA & System profile	0-8 weeks	IS/O&M Personnel concerned & Reg. IDD	1. Record of performance of the irrigation system in terms of • ISF collection efficiency • Viability index c) O&M cost per hectare d) cropping intensity e) yield 2. Irrigation System colored map. Map of existing IA &/or proposed IA 3. Listing of farmer by RA compiled by individual IA and/or proposed IA. 4. System Improvement Plan 5. List of repair work needed inside & outside the IA with indicative amount 6. Organizational structure & mode By-Laws 7. Parcellary map 8. IA and system profile

Organizing Phase/Activities	Time Frame	Person (s) to be Involved	Expected Output
II. Pre-Organizational Phase 1. Courtesy call to Barangay official and/or military & choosing of boarding house. 2. Interface with systems personnel 3. Attendance to social gathering 4. House & farm visits and farmer and/or farmer group interviews 5. Ocular survey and familiarization of IA area features 6. Collation, analysis & interpretation of data gathered	8 weeks	IDO assisted by IS/ WRFT	Established initial rapport with system personnel and farmer Contacted all farmers in proposed IA area and established contracts conducted ocular survey and listed irrigation structures and facilities, problems in the IA area Prepared the details of data, its interpretation and summary of investigations conducted one quarter action plan formulated

Organizing Phase/Activities	Time Frame	Person (s) to be Involved	Expected Output
III. Organizational Phase a. Formation of organizing committee 1. Formation of organizing committee 2. Turnout service area members firmed-up	4 weeks	IDO/WRFT & farmer leaders	• core group of farmer-leaders formed in every TSA • Specific activities as to validations, firming-up of membership, information, mobilization & facilitating IA organization at the TSA level defined
b. Turn -out Service Area (TSA) Group Formation 1. Formation of Ad Hoc committee 2. Functionalization of the committee 3. Pre-membership training	12 weeks	IDO/WRFT	• All Ad Hoc committee formed • Committee works by consulting members in planning and implementing activities & initiate the practice of collective leadership & participative decision-making in tasks performance • Pre-membership training conducted ▪ By-Laws & Article of Incorporation understood and approved by members at each TSA ▪ 95% of the members have applied and membership fee paid TSA membership consolidated • TSA membership consolidated

Organizing Phase/Activities	Time Frame	Person (s) to be Involved	Expected Output
c. TSA consolidation and ACPL Formation Consolidation of the turn out Service Area Group (TSAGs) Formation of Ad Hoc council of Potential leaders (ACPL) and election of chairman & committee members Mobilization of the committees of ACPL Approval of the By-Laws	8 weeks	IDO/WRFT all TSA-Chairmen	• All TSAG leaders are consolidated in ACPL • Different committees as in the TSA have been formed and are already functioning well • ACPL activities represents members' interest • By-Laws of the association approved at the ACPL level
d. Election of the Board of Directors and IA officers 1. Planning for the election & requirements 2. Election of the board of directors at every TSA 3. Election of the officer of the association 4. IA functionalization	4 weeks	IDO/RIO/IDD/BOD	• The BOD have selected their officers and first meeting held • All membership application are already approved by\ BOD and signed by the President • 90% of the total membership paid their dues.

Organizing Phase/Activities	Time Frame	Person (s) to be Involved	Expected Output
IV. Registration Phase 1. Preparation of registration documents 2. Signing of documents and sub-mission to SEC	4 weeks	IDO/BOD	• SEC registration papers all signed by 51% of the members • SEC Registration forwarded to SEC • Approved SEC registration papers
V. NIA IA contract Negotiation 1. Orientation on contract signing 2. Preparation of terms and conditions 3. Negotiation of terms and conditions 4. Drafting of NIA-IA contract 5. NIA-IA Review contract 6. Preparation of Final contract 7. Signing of Contract	8 weeks	IDO/IS/RID/IDD Staff/ BOD	• BOD/farmers oriented on types of contract • Terms and condition discussed with BOD and farmers • NIA-IA draft contract • NIA-IA reviewed and agreed on the terms of condition • Prepared final contract • NIA-IA contract sign

Organizing Phase/Activities	Time Frame	Person (s) to be Involved	Expected Output
VI. Capability Build-up Phase a. Training Implementation and Monitoring 1. BLDC 2. SMT 3. FMS	12 weeks	IS/IDO Staff RIDD Staff	• BOD and concerned officers trained on three major types of training • Plan on SMT prepared for implementation • Knowledge, skills & attitude at BOD concerned improve for effective management of the officers of the IA
b. Post Training Guidance 1. Membership development 2. Planning & budgeting 3. Monitoring and Improving Operation 4. Record Keeping 5. Policies & procedures 6. Auditing			• List and names of members trained • IA activities plans and budget • Schedule and activities on IA Supervision and Guidance • Appropriate book of accounts maintained • Audited records and account • Written policies and procedures in implementing IA activities

Organizing Phase/Activities	Time Frame	Person (s) to be Involved	Expected Output
VII. IA Sustenance	Onward	WRFT	• WRFT utilized IA in improving O&M in IA area and WM division; Improve area performance in terms of a) ISF collection efficiency b) Viability Index c) O&M cost per hectare d) Cropping Intensity e) Yield • WRFT sustaining the IA

Organizing Phase/Activities	Time Frame	Person (s) to be Involved	Expected Output
I. Preparatory Phase	0-2 months	IS/O&M Personnel concerned IDO assisted by IS/WRFT	Record performance of Irrigation System & IA Profile
II. Pre-organizational Phase	2 months	IDO/WRFT/TSA off/IDD/BOD	Social & Physical Profile
III. Organizational Phase	6 months	IDO/BOD	Organizing Committee Formed TSA Formed; TSAG Consolidated & ACPL Formed
Registration Phase	2 months	IDO/WRFT/RIDD/IS IA/IDD/O&M Staff	Approved IA Registration Papers Signed NIA-IA Contract
NIA-IA Contract Negotiation Phase	2 months		BOD Trained on Major IA Trainings
Capability Build-up Phase	12 months	IS/IDO/WRFT	WRFT Sustaining the IA
IA Sustenance			
TOTAL	24 months		

IS	-	Irrigation Superintendent	SMT	-	Systems Management Training
BOD	-	Board of Directors	FMS	-	Financial Management Seminar
O&M	-	Operation & Maintenance	ACPL	-	Ad Hoc Council of Potential Leaders
IDO	-	Irrigators Development Officer	TSAG	-	Turn-out Service Area Group
POW	-	Program of Work	BLDC	-	Basic Leadership Development Code
WRFT	-	Water Resource Facilities Technician			

ANNEX 2.2

Description of Contracts between NIA and IAs

Type I Contracts (Operation and Maintenance Contracts)

Type I contracts cover the maintenance of canals and water distribution. IAs are contracted by NIA to maintain canals and distribute water under the supervision of a NIA staff. The IAs participate in O&M planning and implement water distribution plans under NIA supervision. Canal maintenance includes cutting grass, removing debris and silt, filling gaps in embankments, lubrication of gates and generally keeping the canals in proper size, shape and slope. The IAs are paid Pesos 1,400 ($26) for every 3.5 kms of canal maintained. More specifically, the duties and responsibilities of the IA and NIA are as follows:

<u>IA Obligations</u>

- Undertake grass cutting and clearing on the inside and outside slopes of the supply canals.
- Fill up potholes along canal embankments and drain accumulated water from depressed portions of canal embankment.
- Remove debris from canals and conveyance structures.
- Undertake minor repairs of facilities that will not require equipment or construction materials.
- Undertake greasing of steel gates /turnout gates at least once a month.
- Undertake, with NIA, the painting of regulatory and control structures.
- Protect and safeguard all irrigation structures.

- Prevent people from constructing illegal turnouts.
- Maintain all farm-level facilities within the IA area, including desilting, removal of debris, and grasscutting.
- Prepare monthly maintenance reports to be submitted to NIA.
- Participate in regular meetings, trainings, and seminars.
- Coordinate with other institutions (barangays or village, and so on) and promote programs for the welfare of the association.
- Participate in the identification of structures needing repair or restoration and undertake such activities with NIA.
- Allocate and deliver in a timely fashion adequate amounts of water from the lateral head-gate to individual farms programmed for irrigation during a cropping season.

NIA Obligations

- Undertake rehabilitation of facilities jointly with the IA.
- Provide the IA with supplies for maintenance activities.
- Provide the IA with water delivery and planting schedules one month before cultivation begins and notify the IA of any unavoidable delays
- Deliver in a timely manner adequate water to the head-gate of the lateral canal of the IA.
- Develop and implement training programs to develop the IA capacity to undertake its activities.
- Regularly inspect and monitor the IA activities regarding fulfillment of its contract.

- Assist the IA in conflict resolution beyond its capacity to resolve.

Type II Contracts (Contract for the Collection of Fees)

Type 2 contracts cover the collection of irrigation fees and water distribution. IAs are contracted by NIA to collect irrigation fees and distribute water within its assigned area under NIA's supervision. The IAs, in turn, are given a progressive percentage share of the fees collected – i.e., 2% for collections between 50-60%; 5% for collections between 60-70%; 10% for collections between 70-90% and 15% for above 90%. The duties and responsibilities of both the IA and NIA are as follows:

<u>IA Obligations</u>

- Monitor irrigated/planted areas and report this weekly to NIA.
- Distribute water within the IA area.
- Gather water discharge data and submit to NIA.
- Deliver irrigation fee bills to farmers.
- Collect payments and remit them to NIA every Friday or when amount collected reaches P5,000.
- Assist NIA in verifying farm lots to be exempted from the irrigation service fee.
- Gather yield data from randomly selected farmer beneficiaries.
- Monitor changes in land ownership and tenure.

NIA Obligations

- Inform the IA of water delivery and planting schedules.
- Train the IA to gather and report water discharge data.
- Prepare and deliver irrigation bills to the IAs.
- Issue official receipts on remitted fee payments.
- Assess farm lots requesting exemption of payments.
- Train IA members in gathering yield data.
- Ensure timely payment of the IA share from fee collection.

Joint System Management Contracts (combines types 1 and 2 contracts)

Type III Contracts (System Turnover Contracts)

Type III contracts provide for the partial or full turnover by NIA of the irrigation system to the IAs that will then amortize it without interest charges within a period of 50 years. The IA owns the irrigation system and is responsible and accountable for all the governance and management rights and responsibilities. Under full turnover, the irrigation system is turned over to the IA under the following agreement.

- The irrigation system is amortized by the IA.
- Operation and maintenance tasks over the entire irrigation system are the responsibility of the IA including the promulgation of rules and their enforcement.
- NIA continues to be responsible for major repair and rehabilitation of the irrigation system.

- NIA provides technical and managerial training for the IA.
- NIA assists the IA in developing a system operation plan.

Under partial turnover, NIA retains a share of the O&M tasks. The IA performs the following:

- Maintaining the entire length of the main canal
- Undertaking all technical repair works considered to be minor
- Implementing a jointly agreed water delivery plan for the system
- Collecting irrigation service fees from farmers based on contract

Under partial turnover, NIA is responsible for the following:

- Undertaking rehabilitation/major repairs of the irrigation system
- Providing the IA with managerial and technical training to enhance its capacity for self-management
- Providing the IA with necessary tools and equipment
- Giving preference to the IA in carrying out rehabilitation works
- Operating the main canal and, where relevant, the reservoir.

ANNEX 3.1

List of Key Informants
May 15 to August 2004

From NIA

1. Engr. Avelino Mejia – Manager, IDD, NIA Central Office
2. Engr. Rodolfo Domingo – WRDP Manager
3. Engr. Renato Gamboa – Deputy Manager, IDD-NIA Central Office
4. Caloy Lintag – IDO - WRDP
5. Engr. Enrique Sabio – Manager, IA Training Division, IDD
6. Federico Nina – WRFT Kipaliku RIS
7 Emmanuel Jusay – WRFT Lasang RIS
8. Luis Gulfan – WRFT Lasang RIS
9. Alfredo Sajulga – WRFT Libuganon RIS
10. Rene Cosmod – Agriculturist LALIK RIS
11. Manny Vender – WRFT THIRIS
12. Manny Sunga – IS Sta. Maria. RIS
13. Engr. Amado Serrano – Provincial Irrigation Officer (Davao Sur)
14. Engr. Chavez – Assistant Irrigation Superintendent, LALIK RIS
15. Lorna Bitangcol – IDD Staff AMRIS
16 Heartie Mendoza – Supervising IDS, NIA
17. Bosy Salceda – NIA Librarian
18. Susie Taniegra – EDP-NIA
19. Jeanette Ingaran – IDD-NIA
22. Emma Cruz – AMRIS- IDD
23. Aniano Sayon – Regional IDD Manager, Region XII
24. Nicanor Victoria – WRFT –IDD AMRIS

Farmer Leaders

1. Dicko Ramos – President LALIK RIS FIA
2. Romy Engco – BOT Lasang RIS
3. Eglecerio Pancho – BOT Lasang RIS
4. Eduardo Bernadas – President DITCIA / Treasurer LALIK RIS FIA
5. Lisa Sacdalan – President – AMRIS IA
6. Rodante Pascual – President – Porac Gumain IA
7. Pacifico Dimla – President, Federation of IAs in Region III
8. Romeo Fudia – President, Plaridel IA, AMRIS
9. Damaso Taruc – President, AMRIS IA
10. Jolly Gaspar – President, AMRIS IA
13. Apolinario Ortega – President, BUSFA IA
14. Rodante Pascual – President, Porac Gumain IA

15. Fransisco de la Cruz.
16. Rafael Lagunsing -

Others

1. Ines Bagadion – NIA PIM consultant in NIS 1980- 1995; World Bank Consultant
2. Luis Eleazar – Consultant, ADB- Southern Philippines Irrigation Project
3. Dr. Romana de los Reyes – Sociologist / irrigation consultant
4. Hideki Furijata – JICA Expert, Engineering and Institutional Development
5. Karen Jacob- former staff member, NIA Institutional Development Department; World Bank / ADB Consultant;

Follow Up Field Work
July 7 to 24, 2005

From NIA
1. Engr. Alejandro Alberca- Irrigation Superintendent, LALIK River Irrigation System
2. Engr. Romeo R. Annonuevo – Provincial Irrigation Officer, Laguna Province
3. Engr. Virgilio M. Yorro – Assistant Provincial Irrigation Officer, Laguna Province
4. Isagani Violanta – Water Master, Balanac River Irrigation System
5. Marietta de la Cruz – Institution Development Officer, Balanac River System
6. Hermi Joya – Water Master, Mabacan River Irrigation System
7. Renato Cosmod – Institution Development Officer, LALIK RIS
8. Generoso Tan – Water Master, LALIK RIS, Division 7, Davao Norte Province
9. Aquilino Baguilod –Water Master, LALIK RIS, Division 8, Davao Norte Province

From IAs

Balanac River Irrigation System Irrigator's Association (BRISIA), Laguna Province

1. Pastor Fernandez – Member, BRISIA Board of Directors
2. Noel Aspa – Member, BRISIA Board of Directors
3. Jacinto Manggay – Member, BRISIA Board of Directors
4. Pefecto Bucal - Member, BRISIA Board of Directors
5. Remo Negal - Member, BRISIA Board of Directors
6. Ernesto Negal - Member, BRISIA Board of Directors
7. Federico Salva - Member, BRISIA Board of Directors
8. Buenaventura Javier - Member, BRISIA Board of Directors
9. Romeo Cabrega - Member, BRISIA Board of Directors
10. Petronio Macalalag- Member, BRISIA Board of Directors
11. Leonardo Gamit - Member, BRISIA Board of Directors
12. Adelio Inabez- Member, BRISIA Board of Directors

13. Florencio Javilinar - Member, BRISIA Board of Directors
14. Benito Macatangay - Member, BRISIA Board of Directors
15. Dioscoro de Leon - Member, BRISIA Board of Directors
16. Mario Manggay - Member, BRISIA Board of Directors
17. Josefino Punzalan - Member, BRISIA Board of Directors
18. Juanito Torralba - Member, BRISIA Board of Directors
19. Jimmy Palacol - Member, BRISIA Board of Directors
20. Jovelyn de los Santos - Member, BRISIA Board of Directors

BEDUCAS IA, Libuganon River Irrigation System, Davao del Norte Province

21. Saturnina Macaraeg - Member, BEDUCASIA Board of Directors
22. Narsiso Gonzaga - Member, BEDUCASIA Board of Directors
23. Arman Logarita – Chairman, BEDUCASIA Board of Directors
24. Flora Camacho – Member, BEDUCASIA Board of Directors
25. Epefhany Quinto – Treasurer, BEDUCASIA Board of Directors
26. Winie Bordez - Member, BEDUCASIA Board of Directors
27. Ma. Grace Aileen Guillego – Secretary, BEDUCASIA Board of Directors

DITCIA, Division 7 IA, Libuganon RIS, Davao del Norte Province

28. E. Berdanas – IA member

NIA NO.1	Republic of the Philippines NATIONAL IRRIGATION ADMINISTRATION Quezon City	M.O.R.E. PERFORMANCE COMMITMENT	RATING PERIOD JANUARY - JUNE 2003

EMPLOYEE	POSITION	OFFICE/DIVISION
MANUEL V. VENDER	WRF Technician	NIA-PMIRMS

P	RESPONSIBILITY AREA	OBJECTIVE/RESULT	SUCCESS INDICATOR	TARGETTED IMPROVEMENT
I	INSTITUTIONAL ACTIVITIES	a. Conduct BOD meetings, 45 BO Jan-June 2003. b. Facilitated TWA meetings, 50 BO Jan-June2003 c. Facilitated NIA-IA meetings 26 BO Jan-June 2003 d. Assisted/facilitated/resolved farmers conflict, 5 BO Jan-June 2003. e. Assisted/facilitated federation meeting, 70 BO Jan-June 2003	Minutes/attendance -do- -do- -do- -do-	
II	SUPERVISION ACTIVITIES	a. Delivery of irrigation water 2,818 has. b. Assisted WRF Tenders & collectors, 2,828 has. c. Supervised WRF Tenders/operators/collectors, BO Jan-June 2003.	WRFA -do-	
III	EVALUATION ACTIVITIES	a. Collection per week/collector BO Jan-June 2003. b. Physical facilities of irrigation BO Jan-June 2003	reports -do-	
IV	REPORT PREPARATION	a. Prepared & submitted various reports, (IDD)	file	
V	OTHERS	a. Collected 2110,647.47 PA; 12,720.0 PA.	OR Remittances	

RATED BY	DATE	CERTIFIED BY	DATE	APPROVED BY
MANUEL V. VENDER		EMILIANO C. PANGANIBAN		ELIAS V. PERLAS
POSITION: WRF Technician		POSITION: Engineer A		POSITION: Irrigation Superintendent I

ANNEX 3.2 How NIA Field Technicians are Evaluated

ANNEX 6.1

Correlation Matrix

	FREERIDE	GRPWRK	SCARCT	CROPINT
GRPWRK	-0.027			
	0.299			
SCARCT	-0.074	-0.071		
	0.003	0.004		
CROPINT	-0.379	0.040	-0.010	
	0.000	0.120	0.688	
AREA	0.117	-0.048	-0.070	-0.066
	0.000	0.052	0.003	0.006
DISTANCE	0.004	0.022	0.134	-0.002
	0.878	0.361	0.000	0.934
INFRACON	-0.026	-0.002	-0.430	0.111
	0.288	0.936	0.000	0.000
AGE	-0.049	0.003	-0.096	0.020
	0.046	0.897	0.000	0.414
USERSIZE	0.076	-0.015	-0.105	-0.038
	0.003	0.555	0.000	0.124
GENDER	-0.023	0.020	-0.025	0.062
	0.354	0.413	0.289	0.009
ENTREP	-0.063	0.017	-0.035	0.016
	0.011	0.477	0.134	0.500
SALIENCE	-0.087	-0.081	0.164	0.094
	0.001	0.003	0.000	0.000
PVRTY	0.134	0.005	0.008	-0.182
	0.000	0.835	0.740	0.000
ORIGIN	-0.059	0.069	0.100	0.091
	0.017	0.004	0.000	0.000
PATRON	0.059	0.087	-0.022	-0.216
	0.018	0.000	0.348	0.000
ELECT	-0.068	0.087	-0.105	0.095
	0.006	0.000	0.000	0.000
AUTO	-0.205	0.076	-0.114	0.200
	0.000	0.003	0.000	0.000
TENURE	0.201	0.036	-0.199	-0.099

	0.000	0.147	0.000	0.000
COMM	-0.077	0.098	-0.214	0.059
	0.002	0.000	0.000	0.014

	AREA	DISTANCE	INFRACON	AGE
DISTANCE	-0.125			
	0.000			
INFRACON	-0.068	-0.064		
	0.003	0.004		
AGE	0.102	-0.009	-0.021	
	0.000	0.699	0.356	
USERSIZE	0.735	-0.089	-0.072	0.069
	0.000	0.000	0.002	0.004
GENDER	0.079	0.079	-0.109	0.007
	0.001	0.001	0.000	0.769
ENTREP	0.009	0.001	0.004	0.022
	0.699	0.970	0.847	0.340
SALIENCE	0.033	0.009	-0.405	-0.053
	0.197	0.726	0.000	0.038
PVRTY	0.198	-0.024	-0.009	0.070
	0.000	0.289	0.696	0.002
ORIGIN	0.053	-0.105	0.159	-0.024
	0.021	0.000	0.000	0.299
PATRON	-0.086	0.265	-0.018	0.150
	0.000	0.000	0.435	0.000
ELECT	0.066	0.051	-0.035	0.071
	0.004	0.024	0.127	0.002
AUTO	-0.035	0.118	0.120	0.040
	0.150	0.000	0.000	0.100
TENURE	-0.085	0.097	-0.013	0.037
	0.000	0.000	0.564	0.109
COMM	0.120	-0.010	0.078	0.057
	0.000	0.663	0.001	0.011

	USERSIZE	GENDER	ENTREP	SALIENCE
GENDER	0.038			
	0.114			
ENTREP	0.001	0.054		
	0.970	0.019		

SALIENCE	0.106	0.066	-0.043	
	0.000	0.010	0.096	
PVRTY	-0.199	0.036	0.027	-0.267
	0.000	0.115	0.241	0.000
ORIGIN	0.009	-0.120	-0.008	0.073
	0.699	0.000	0.720	0.005
PATRON	0.004	0.072	-0.024	-0.089
	0.860	0.002	0.294	0.001
ELECT	0.066	0.148	0.042	0.002
	0.005	0.000	0.067	0.937
AUTO	0.021	-0.005	0.076	-0.040
	0.408	0.830	0.002	0.128
TENURE	-0.060	0.073	0.008	-0.070
	0.012	0.002	0.730	0.006
COMM	0.119	0.040	0.048	0.013
	0.000	0.081	0.034	0.621

	PVRTY	ORIGIN	PATRON	ELECT
ORIGIN	-0.109			
	0.000			
PATRON	-0.007	0.092		
	0.752	0.000		
ELECT	-0.039	0.045	0.007	
	0.087	0.045	0.751	
AUTO	-0.106	0.215	0.236	0.118
	0.000	0.000	0.000	0.000
TENURE	0.138	-0.225	0.057	-0.049
	0.000	0.000	0.014	0.033
COMM	-0.052	0.080	-0.022	0.672
	0.024	0.000	0.328	0.000

	AUTO	TENURE
TENURE	-0.142	
	0.000	
COMM	0.137	-0.038
	0.000	0.103

Cell Contents: Pearson correlation
P-Value

ANNEX 6.2 OLS Full Model (Dependent variable is monetary free riding)

Predictor	Coef	SE Coef	T	P	
Constant	52.947	4.976	10.64	0.000	
SCARCT	-4.208	1.344	-3.13	0.002	***
CROPINT	-0.13100	0.01063	-12.33	0.000	***
AREA	-0.010993	0.007845	-1.40	0.161	
DISTANCE	-1.337	1.464	-0.91	0.361	
INFRACON	0.01183	0.03024	0.39	0.696	
AGE	-2.730	1.468	-1.86	0.063	*
USERSIZE	0.02769	0.01144	2.42	0.016	**
GENDER	-0.03916	0.06418	-0.61	0.542	
ENTREP	-0.0008084	0.0003694	-2.19	0.029	**
SALIENCE	-0.03229	0.03108	-1.04	0.299	
PVRTY	5.298	1.600	3.31	0.001	***
ORIGIN	6.638	5.003	1.33	0.185	
PATRON	-0.228	1.285	-0.18	0.859	
ELECT	-0.866	2.196	-0.39	0.693	
AUTO	-5.238	1.474	-3.55	0.000	***
TENURE	0.12239	0.02193	5.58	0.000	***
COMM	-3.176	1.587	-2.00	0.046	**

S = 15.9893 R-Sq = 25.9% R-Sq(adj) = 24.7%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	17	97292.1	5723.1	22.39	0.000
Residual Error	1091	278921.0	255.7		
Total	1108	376213.2			

1109 cases used, 849 cases contain missing values

*** Significant at alpha 0.01
** Significant at alpha 0.05
* Significant at alpha 0.10

Annex 6.3 - OLS Trimmed Model (Dependent variable: monetary free riding)

```
Predictor        Coef    SE Coef       T      P
Constant       51.474      3.033   16.97  0.000 ***
SCARCT         -4.313      1.038   -4.15  0.000 ***
CROPINT     -0.121339   0.009306  -13.04  0.000 ***
AGE            -2.373      1.342   -1.77  0.077 *
USERSIZE     0.016254   0.004415    3.68  0.000 ***
ENTREP     -0.0008900  0.0003724   -2.39  0.017 **
PVRTY          2.9969     0.8112    3.69  0.000 ***
AUTO           -6.448      1.320   -4.89  0.000 ***
TENURE        0.12943    0.01937    6.68  0.000 ***
COMM           -3.321      1.275   -2.61  0.009 ***


S = 16.2603   R-Sq = 24.7%   R-Sq(adj) = 24.2%


Analysis of Variance

Source            DF      SS     MS      F      P
Regression         9  113246  12583  47.59  0.000
Residual Error  1306  345304    264
Total           1315  458550

   1316 cases used, 642 cases contain missing values


   ***  Significant at alpha 0.01
    **  Significant at alpha 0.05
     *  Significant at alpha 0.10
```

ANNEX 6.4

TESTS FOR ROBUSTNESS OF THE LINEAR REGRESSION MODEL

To test the robustness of my statistical inferences from the CLRM, I tested the following assumptions of the linear regression model: (1) linearity between dependent and independent variables; 2) that disturbance terms have uniform variance and are uncorrelated; 3) absence of multi-collinearity among independent variables; and 4) the absence of simultaneity or endogeneity between the dependent and independent variables. These tests are summarized in Table 1 and their results reported below.

Table 1 - Tests for Robustness of the CLRM

Assumptions Tested	Mathematical Expression
1. The dependent variable is a linear function of a specific set of independent variables plus a disturbance.	$Y = X\beta + \varepsilon$
2. The expected value of the disturbance term is zero	$E\varepsilon = 0$
3. Disturbances have uniform variance and are uncorrelated	$E\varepsilon\varepsilon' = \sigma^2 I$
4. No exact linear relationships between independent variables and more observations than independent variables	Rank of $X = K \leq T$

Linearity Assumption

Some scholars suggest that user size is a linear function of collective action while others suggest that this is not the case. On one end of the debate, scholars suggest that smaller groups are more likely to engage in successful collective action implying size as a linear function of collective action (Olson 1965; Baland and Plateau, 1999; Wade 1988). Marwell and Oliver (1993), on the other hand, suggest that a significant number of

empirical research found that group size is positively related to its level of collective action. Agrawal and Goyal (2001) hypothesize a curvilinear relationship while Ostrom (1997) suggests that the impact of group size on collective action is usually mediated by many other variables.

If group size indeed behaves in a curvilinear manner, then it would require transformation before being employed in OLS estimation. Following Kennedy (2001), I tested the curvillinearity assumption of user size in relation to the incidence of free riding by transforming it into both parabolic and logarithmic models and comparing its standard error and coefficient of determination (R^2) with the OLS model. The assumption of linearity is upheld when the standard error and R^2 for both logarithmic and parabolic models are the same as the OLS Model.

The purpose of the test is to see if, in the case of the definition of user size in my data set, there is empirical ground to consider user size as a non-linear variable in relation to the incidence of free riding. The results below do not provide statistical support for this claim since the standard error and R^2 for non-linear models are almost the same as that of the OLS model (Table 2). These results do not necessarily and conclusively refute the arguments by other scholars on the nonlinearity of user size since the test is only limited to ascertaining the linearity assumption involving user size and free riding, holding other factors constant. It is possible that the non-linearity assumption might hold when the interaction effect of user size with other variables – such as boundary and input rules – is examined.

Table 2 - Testing User Size for Linearity Assumption

	OLS Model	Parabolic Model (User Size ^{2})	Logarithmic Model (Log User Size)
Standard Error	17.7291	17.7262	17.7305
R^2	22.6	22.7	22.6

Poverty is also hypothesized as having a non-linear relationship with collective action. Ternstrom (2003) hypothesized that poverty, which she defined in terms of calorific intake, behaves in a concave manner in relation to collective action. I tested my poverty variable – defined in terms of farm size – by transforming it into both logarithmic and parabolic models to see if there is basis to consider it as a non-linear variable. Again, the results below show that this variable behaves in a linear manner since the standard error and R^2 for the non-linear models are almost the same as that of the OLS model (Table 3).

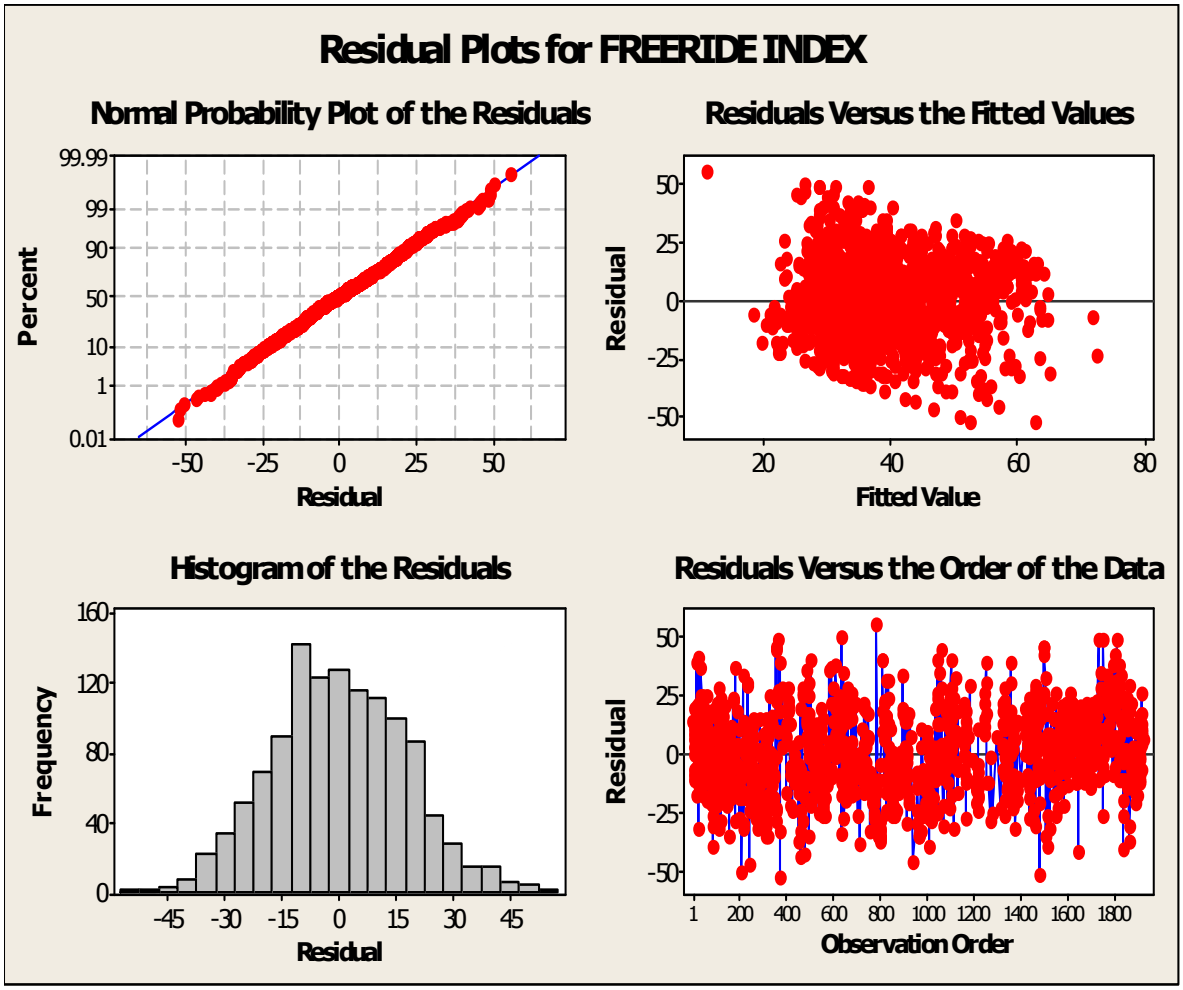
Table 3 -Testing Poverty for Linearity Assumption

	OLS Model	Parabolic Model (User Size ^{2})	Logarithmic Model (Log User Size)
Standard Error	17.7291	17.7308	17.7116
R^2	22.6	22.6	22.8

Heteroskedasticity

Heteroskedasticity, or non-constant error variance, was tested using visual inspection of residuals (Kennedy 2001). Heteroskedsticity is present if the residuals, when plotted against fitted values, look like a "fan." My findings show that the residuals are normally distributed (Figure 3.1) and thus meet the OLS assumption of constant error variance.

Figure 1 - Visual Check For Heteroskedasticity



Perfect multicollinearity

Another OLS assumption is the absence of perfect multi-collinearity among independent variables. To test this assumption, each independent variable is regressed against all other independent variables (Kennedy, 2001). The size of the irrigation area had the highest R^2, indicating that this variable exhibits high but not perfect collinearity with the rest of the independent variables (Table 4). Not surprisingly, the size of the irrigation area is closely correlated with user size.

Table 4-Test for Multicollinearity

Variables	R^2
SCAR	18.4
PROXI	21.1
INFRACON	34.4
AREA	78.8
AGE	8.7
GENDER	11.6
ENTREP	1.6
USERSIZE	78
SALIENCE	37.2
PVRTY	55.4
ORIGIN	26.6
PATRONAGE	26.3
ELECTION	30
AUTO	19.4
TENURE	12.5
COMM	32.7

Simultaneity / endogeneity

The potential problem of endogeneity occurs when there is a substantive ground to believe that the left-hand side variable is also a determinant of right-hand side variables (i.e., the level of free riding is also a determinant of the physical variables, user group characteristics and institutional variables). In a system of simultaneous equations, all endogenous variables are random variables and thus a change in any disturbance term changes all the endogenous variables since they are all determined simultaneously (Kennedy 2001). When employed in OLS, results are biased upwards.

Simultaneity was verified substantively by determining if the dependent variable (in this case the level of free riding) and independent variables (the physical and user group characteristics and institutional factors) are plausibly linked in a system of simultaneous equation. I examined how my dependent variable could possibly become a determinant of my independent variables (i.e., dependent variable ↔ independent

variables). For instance, based on substantive grounds and from what is known in the literature, I examined how the rates of free riding could possibly determine each of the variables pertaining to the characteristics of the resource, user groups and institutional variables. This method was preferred over the use of instrumental variables given the difficulty of establishing instruments and the complexity of interpreting two-stage least squares (2SLS) tests for simultaneity.

I find no logical and plausible reason to believe that the incidence of free riding could possibly determine the values of physical variables I examined (distance of irrigation system from economic centers, water scarcity, size of area). These physical variables are appropriately considered as exogenous. I also find no logical and plausible reasons how and why the incidence of free riding could possibly determine the characteristics of user groups in the manner that I have defined them in this study. For instance, I find no sensible or plausible reason how free riding determines the age of the IA, its gender composition, the number of farmer appropriators, the origin of the IA, the size of farm holdings and the salience of irrigated farming. Again, the user group characteristics I have examined here are also appropriately considered as exogenous variables and therefore do not contribute to the problem of simultaneity.

In the case of institutional variables, one could make the plausible argument that free riding is endogenously related to the type of governance arrangements – i.e., the rate of free riding determines the type of governance arrangements that also determines the rates of free riding. This seems to be a reasonable argument. If indeed this is the case, one would expect to find a high degree of correlation between free riding and the type of governance arrangements. However, when the evidence is closely examined, there is little

correlation between a particular governance arrangement (e.g., the autonomy of IAs) and particular outcomes (e.g., the incidence of free riding). One would find that only 15 percent of IAs are autonomous, yet the ten - year average rate of free riding is about 57 percent.

Selection bias

Selection bias is a potential threat when systematic differences over conditions in respondent characteristics could also cause the observed effect. In my case, selection bias occurs when the NIA data sets do not include irrigation systems that have performed poorly and are no longer functional. As Lam (1998) suggests in the case of irrigation systems in Nepal, if the process that selects out poor performers systematically censors out a particular group of systems, the systems included in the sample suffer from selection bias.

I find that selection bias is not a potential problem in my case since the entire population of 2,056 IAs was included in the analysis. No one particular IA or irrigation system was left out because of poor performance. In fact, a closer examination of the data sets reveals that a number of irrigation systems that were no longer functioning – mainly those that were buried by a volcanic eruption in 1991 – were still included in the data sets but were instead coded as missing information.

ANNEX 6.5

TESTS FOR THE ROBUSTNESS OF THE BINARY LOGIT REGRESSION MODEL

To test the robustness of the Binary Logit Regression Model (BLRM), I performed a goodness-of-fit test and test for measures of association.

Goodness-of-Fit Test

When fitting a logistic model, the objective is to choose a model that results in a good fit to the data. One can use goodness-of-fit statistics to compare the fits of different models. A low p-value indicates that the predicted probabilities deviate from the observed probabilities in a way that the binomial distribution does not predict. Two approaches to test the goodness-of-fit of the logistic model are the Pearson and Deviance tests. They are useful measures for evaluating how well the selected model fits the data. The higher the p-value, the better the model fits the data. For the group work data, both the Pearson and Deviance tests have p-values that are greater than alpha 0.10 indicating that there is insufficient evidence for the model not fitting the data adequately when the a-level is less than or equal to 0.10. Another goodness-of-fit test is the Hosmer-Lemeshow test, which assesses the model fit by comparing the observed and expected frequencies. The test groups the data by their estimated probabilities from lowest to highest and then performs a Chi-square test to determine if the observed and expected frequencies are significantly different. For the group work data, the relatively large p-

value (0.274) for the test indicates that there is a general consistency between the observed and expected frequencies. These results are reported in Table 2.

Table 2-Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	1175.78	1175	0.488
Deviance	950.01	1175	1.000
Hosmer-Lemeshow	9.87	8	0.274

Test for Measures of Association

Table 3 reports various tests for measures of association.

Table 3 - Measures of Association

Pairs	Number	Percent	Summary Measures	
Concordant	121439	66.9	Somers' D	0.35
Discordant	58544	32.3	Goodman-Kruskal Gamma	0.35
Ties	1457	0.8	Kendall's Tau-a	0.09
Total	181440	100.0		

The interpretation of Table 3 above is as follows:

First, the pairs column contains the number and percent of pairs of observations with different response values that are concordant pairs, discordant pairs, and tied pairs. To create the pairs used in these statistics, each observed "success" is paired with every "failure." It is then noted whether the probability of success predicted from the model is higher for the actual "success." If the predicted probability of success is higher for the observation corresponding to a "success," the pair is considered concordant. If the predicted probability of success is higher for the observation corresponding to a "failure," the pair is considered discordant. If the predicted probability of success is the same for both the observed "success" and the observed "failure," the pair is considered tied.

Second, Somers' D shows how many more concordant than discordant pairs exist divided by the total number of pairs. Goodman-Kruskal Gamma, on the other hand, shows how many more concordant than discordant pairs exist divided by the total number of pairs excluding ties. Finally, Kendall's Tau-a shows how many more concordant than discordant pairs exist divided by the total number of pairs of observations including pairs with the same response value. Larger values for Somers' D, Goodman-Kruskal Gamma, and Kendall's Tau-alpha indicate that the model has better predictive ability. For the group work data, 66.9 percent of the pairs were concordant, while 32.3 percent of the pairs were discordant. Thus, there is slightly more than a 50 percent better chance for a predicted probability of success to be higher for the observation corresponding to a "success."

Vitae

Ed's thematic research interest focuses on the causes and consequences of institutions that support the development of Southeast Asia, particularly i) property rights, ii) decentralization, iii) public bureaucracies, iv) foreign aid, and v) common pool resources. He has lectured at universities in the Philippines and at Indiana University and published in the *Policy Sciences* and the World Bank Working Papers. He is a staff consultant at the World Bank's rural and social development departments working as a development economist, institution / governance and evaluation specialist. He was also a field staff/project manager for seven years for an ADB funded rural development in the Philippines. Ed is a recipient of the Fulbright-Hays Award, Ronald Coase Institute Fellowship, International Water Management Institute Dissertation Award and scholarship from the Workshop in Political Theory and Policy Analysis-Indiana University. He obtained his PhD in Public Policy at Indiana University in 2006, a Master's Degree in Public Policy at the National University of Singapore and a Bachelor's Degree at the University of the Philippines.