Compensation of Irrigation Professionals:

A Comparative Study of the Philippines, Sri Lanka and Pakistan

Masao Kikuchi, Douglas J. Merrey, and Lalith Dassenaike

International Water Management Institute
P O Box 2075, Colombo, Sri Lanka

Authors: Masao Kikuchi is an IWMI Fellow; Douglas J. Merrey is Director General (Programs) and Lalith Dassenaike is Research Associate, both of IWMI.

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The International Irrigation Management Institute, one of sixteen centers supported by the Consultative Group on International Agricultural Research (CGIAR), was incorporated by an Act of Parliament in Sri Lanka. The Act is currently under amendment to read as International Water Management Institute (IWMI).

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ABSTRACT

This paper analyzes trends in the level of compensation of irrigation engineers in three irrigation agencies in three countries, Philippines, Sri Lanka, and Pakistan. The paper tries to relate these trends to the performance of the agencies, to understand promotion policies and their relationship to performance and compensation, and to compare the current level of irrigation engineers' compensation to that in other professions. In the Philippines and Sri Lanka, irrigation engineers' compensation has declined continuously, reaching a 1995 low that is one half of what they received in 1965 in real terms. Irrigation engineers' compensation in these countries was also considerably less than for engineers working in private firms and even in other government agencies. In contrast, irrigation engineers in one Pakistani agency have enjoyed a significant increase in their compensation, largely because of the high level of benefits. Trends in the performance of the three agencies studied showed a strong positive correlation with the trends in engineers' compensation, suggesting the plausibility of a relationship but not proving it. The study found that none of the agencies maintains adequate long-term records (two agencies were dropped from the study because the data were not adequate). The crudeness of the data and the analysis is such that no causal relationship is established, but there is a plausible case that compensation of irrigation professionals needs to be increased as part of a program to increase irrigation agency performance in developing countries.

INTRODUCTION

The irrigation sector in developing countries is changing rapidly, making new and more complex demands on the agencies responsible for management. Organizations originally established primarily with a construction mandate, in which O&M functions were rather routine, are now being asked to manage irrigation systems to meet new demands and expectations, to provide support services to local user-based water management organizations, to regulate water allocations among competing users, and to fulfill other new functions. Meeting these new expectations is even more difficult under conditions of rising water scarcity—in which demand for water often exceeds the available supply. These new functions require new skills, higher levels of professional expertise, and acceptance of greater responsibilities. In addition, irrigation professionals are often responsible for contracts and assets worth millions of dollars.

It is clear that in many developing countries recruitment procedures, personnel policies, and compensation in the public sector have not been adapted to meet these new demands.[1] In particular, the

[1]A previous study had shown, based on a three-country comparison, that irrigation performance is higher where the agency provides incentives for achieving higher performance (Merrey, Valera and Dassenaike 1994).

level of compensation of irrigation professionals is rarely commensurate with the level of responsibility and technical expertise required. However, we are unaware of any systematic studies that examine this issue beyond impressionistic observations or grumbling. The purpose of this paper is therefore to begin filling this gap by systematically observing changes in compensation of irrigation professionals and their impacts on the performance of both irrigation agencies and irrigation systems.

We chose for this study three irrigation agencies from three countries: the National Irrigation Administration of the Philippines, the Irrigation Department of Sri Lanka, and the Water and Power Development Authority of Pakistan.[2] Since civil, irrigation, and agricultural engineers are the dominant group in irrigation agencies, we focus on the compensation of engineers.[3] In the following sections, unless otherwise noted, the term 'engineer' is used to designate civil, irrigation and agricultural engineers.

Objectives of the Study

The study, intended to be exploratory in nature, had the following objectives:

1. Obtain good data on the levels and trends in salaries and benefits in real terms of irrigation professionals working in selected public irrigation agencies and how their compensation levels compare to other professionals in the same country.
2. Document what relationship, if any, exists between compensation, and promotions and performance assessment of personnel.
3. Refine the methodology for collecting these data, as a basis for a larger cross-sectional study on compensation of irrigation professionals.

Working Hypotheses

The study attempts to examine the following hypotheses.
The compensation of irrigation professionals by public organizations in developing countries:

1. Is low compared to the income of other (comparable) professionals;
2. Has declined over the past several decades in terms of purchasing power;

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[2]We intended to include in our analysis two other organizations, the Mahaweli Authority of Sri Lanka and the Department of Irrigation, Punjab, Pakistan, but after considerable effort it became clear that adequate data were not available.

[3]Irrigation agencies are, in most cases, government or semi-government agencies; therefore, the salary and benefits of other officers within the same organizations are more or less the same, except that the highest possible position of nonengineers is usually lower than that of engineers.

3. Is based primarily on initial qualifications at recruitment and seniority, and is not related to personnel performance, especially in agencies dependent on the government for their income; and
4. Is lower in public agencies dependent on the government for their income than in agencies whose income is largely generated through users' fees.
5. Higher levels of compensation of irrigation professionals, and linkage of compensation and promotions to personnel performance will lead to better organizational performance and, therefore, better performance of irrigation. On the other hand, declining compensation levels will lead to deteriorating organizational performance and, therefore, irrigation performance.

The last hypothesis is plausible, but difficult to establish, and this paper does not claim to do so. As the economic value of water increases in response to growing scarcity, and particularly if this value is 'communicated' through realistic water service charges to users, one would expect agencies to be restructured to be more performance- and customer-oriented. As water becomes scarcer, the application of more sophisticated management tools, such as computer modeling, becomes more attractive. However, using these tools requires technically competent managers and technicians. Agencies therefore need to recruit and motivate well-trained staff, in competition with other sectors of the economy where there is also a high demand for this expertise. Higher salaries and performance-based rewards for staff are, therefore, required, if water management agencies are going to satisfy their customers. This study was unable to test the hypothesized linkage between compensation and irrigation performance. However, the issue is very important, so we present and interpret the data we have.

Study Methodology and Data Collection

The three organizations in the three countries were selected to reflect a range of levels of economic development, types of organizations and types of irrigation. A common questionnaire was used to ensure comparability of data among the countries. In each country, a consultant was hired to collect the data, do the initial tabulation and write a short interpretive report to capture local nuances.The sources of these data in each case were official records, which proved surprisingly incomplete. This was designed as an exploratory study. The inadequacy of basic record keeping is in itself an important finding (we had to drop two agencies from the study because the data were so poor; see footnote 2).

In the next section, we present the results of the study by country, while the section on Cross-Country Comparison attempts to compare the three cases and link compensation trends to performance. The Conclusions section discusses the conclusions and lessons learned from the study.

COUNTRY-LEVEL RESULTS

Philippines

The Agency

Irrigation systems in the Philippines are grouped into two categories, national irrigation systems and communal irrigation systems. The National Irrigation Agency (NIA), which was established in 1964,[4] is the sole government agency overseeing all these irrigation systems. Of the two groups, communal systems are operated and maintained by the farmer-users; NIA supports their construction and rehabilitation and extends technical assistance for operation and maintenance (O&M) as well as for formation of irrigators' associations. For national irrigation systems (171 systems in 1997), NIA is responsible not only for construction and rehabilitation but also for O&M, though some O&M activities in many national irrigation systems have been handed over to irrigators' associations since the early 1980s (Wijayaratna and Vermillion 1994).

Organization and Personnel Strength of NIA

Although NIA's organization has been changed a few times since its establishment, the essential structure has been kept intact. Under the Headquarters in Quezon City come the regional offices (12 at present) to which the system offices in charge of managing individual national irrigation systems belong. Aside from this line, project offices are created under Headquarters when major construction projects are implemented. Engineers head all the offices, including Headquarters.

The changes in the number of employees at NIA over the last three decades are shown in table 1. Employees are grouped into two categories; monthly-paid and daily-paid. The former includes all permanent employees working at the Headquarters in Manila as well as in regional and field offices. The latter consists of casual laborers, most of whom work in the national irrigation systems at the field level as water masters and ditch tenders. All the engineers (civil, irrigation and agricultural) in NIA hold permanent positions. The total number of employees increased ten times from 1965 to 1975. Such a rapid increase is partly because 1965 was just one year after the establishment of NIA, when it was still strengthening its organization. Another reason is that between 1965 and 1975 the number of national irrigation systems and their service area increased rapidly due to the construction boom triggered by the food crises in the late 1960s and the early 1970s.

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[4]Before the establishment of NIA, irrigation systems had been administered by the Bureau of Public Works (now the Department of Public Works and Highways).

Table 1. Number of NIA employees, Philippines, 1965–1995.

		Number of employees				Per service area	
		Monthly	Daily	Total	index*	Persons/1,000ha	index*
1965		635	2,101	2,736	10	10	14
	%	23	77	100			
1975		7,629	19,358	26,987	100	68	100
	%	28	72	100			
1985		10,225	11,254	21,479	80	38	56
	%	48	52	100			
1995		7,175	7,021	14,196	53	22	33
		51	49	100			

*Index is based on 1975 as the base (100).

By 1985, however, NIA's total work force had begun to decrease, in spite of even more rapid increase in service area.[5] The shrinkage in staff strength has continued in the 1990s. During 1975–85, the decrease occurred for casual laborers, but it was to some extent compensated for by an increase in the number of permanent employees. During the 1985–95 period, the work force was reduced substantially for both categories. As a result, the number of employees in 1995 had declined by nearly 50 percent compared to 1985. The number of employees per unit of service area was reduced to a level just one-third of the level in 1975, though this was still more than double the number of staff per unit of service area in 1965.

Such a striking reduction in the number of employees in recent years has been a result of a change in NIA's financial status in the late 1970s and the subsequent financial crisis in the 1980s. It has been stipulated since 1974 that NIA should finance its current expenditures for the O&M of existing systems from its own revenue, consisting mainly of irrigation fees collected from farmers. In 1980, the government's subsidy was eliminated, and instead NIA was allowed to receive 5 percent of project funds for new construction and major rehabilitation to cover administrative overhead costs. However, as international food markets turned into a low-price regime in the 1980s, the aid flow tothe irrigation sector was reduced sharply, which in turn resulted in large declines in NIA's revenue (Rosegrant and Svendsen 1993). The decline in the rice price also reduced NIA's revenue from irrigation service fees, because the fee rate was fixed in kind (rice paddy). Altogether, NIA's budget was cut by half between 1976 and 1985.[6]

[5]See table 7 presented later in this section.

[6]See table 5 presented later in this section.

Facing this serious financial crisis, NIA was compelled to reduce the number of employees.[7] Table 2 suggests the priorities that NIA gave to the various categories of its work force. Reduced most were the number of field-level workers. By 1996, only 40–50 percent of the positions for Water Resource Facility (WRF) tenders, operators, and technicians (ditch tenders, gatekeepers, and water masters), who dealt with day-to-day O&M activities in the irrigation systems, were filled. Other types of field workers, such as survey aids and engineering assistants, were also low priorities for retention. On the other hand, the filled ratio for engineers was high, resulting in a higher percentage in the actual work force than intended in the original positions. More workers engaged in clerical jobs, such as cashiers and accountants, were retained than the field-level workers. It seems that officers working to develop and strengthen irrigation associations were of relatively high priority, though the work force for institution buildingis a very small proportion of the overall work force.

Drastic declines in construction projects in the mid-1980s and thereafter, resulting from the shrinkage in aid flows, would have made many construction-related positions redundant. Also, the handing-over of some O&M responsibilities to irrigators' associations since the early 1980s would have reduced the workload at system level to some extent. However, the more than 50 percent reduction in field-level workers within a decade or so must have entailed a serious strain on NIA in maintaining the quality of irrigation services. This concern is not groundless since the downsizing of the work force has been done more to cope with the financial crisis, and less, if at all, to rationalize, or restructure the agency (Kikuchi et al. 1998).

Changes in Salary Level of Engineers in NIA

Salary and benefits: As of 1996, there were as many as 250 types of permanent positions from the top to the bottom of NIA. NIA classifies its employees into three broad levels from the first to the third. Within the first and the second levels, a further distinction is made between supervisory and nonsupervisory positions. The highest is the third level including Department Directors (called Managers) at the Headquarters in Quezon City, up to the top, the Administrator. On the other hand, NIA's salary scale has 30 grades,[8] and each level corresponds to certain salary grades; the first level from grade 1 to 18, the second level from grade 19 to 24, and the third level from grade 25 to 30. A fresh engineer, with a B.Sc. degree after passing the Board Examination for civil engineer, starts his/her career in NIA from a nonsupervisory position in the second level, with the salary grade of 14 (Engineer A).

[7]The financial crisis was not limited to NIA. The political upheaval during and after the downfall of the Marcos regime in the 1980s put serious strains on the government treasury. The government promulgated the Attrition Law that prohibited the filling of vacated positions in government offices unless approved by the Civil Service Commission. The Law was annulled in 1997.

[8]Before 1976, the salary scale for government agencies had 75 grades (ranges). In 1976, a new salary scale was given to NIA with 19 grades, and further revised in 1989 (effective in 1990) to the present one. Salaries in each grade are revised nearly every year.

Table 2. Number of permanent positions and filled-up ratio of NIA staffing, Philippines, 1996.

	Number of Positions		Number filled-up		Filled-up ratio
	(1)		(2)		(2)/(1)
		%		%	%
Engineer:					
Senior Engineer [a)]	371	3	299	5	81
Engineer	830	7	604	9	73
Total	1,201	10	903	14	75
Field level worker:					
WRF Technician	1,063	9	550	9	52
WRF Operator	524	5	273	4	52
WRF Tender	3,212	28	1,324	21	41
Total	4,799	42	2,147	33	45
Officers for IA Development [b)]	96	1	71	1	74
Draftsmen [b)]	58	1	46	1	79
Cashier-Accountant-Clerk [b)]	1,369	12	916	14	67
Storekeeper	174	2	116	2	67
Engineering Assistant	204	2	110	2	54
Survey Aid	108	1	48	1	44
Auto Mechanic	212	2	117	2	55
Sec Guard	619	5	277	4	45
Utility Worker	381	3	240	4	63
Others	2,234	20	1,429	22	64
Total	11,455	100	6,420	100	56

Note: a) Principal Engineer and above; civil and irrigation engineers.
b) Include different ranks.

The compensation that an engineer, as well as those in other categories, receives consists of a basic salary plus benefits. Until the late 1980s, fringe benefits of employees in the developmental corporations such as NIA were on average 12 percent of basic salaries. Since then, fringe benefits have been improved significantly.

As of November 1997, NIA employees were entitled to the following benefits: bonus (1 month basic salary plus ₱1,000 flat rate for all grades), medical allowance (₱450/year of government contribution), pension (9.5%, consisting of 3% for life insurance and 6.5% for retirement, of basic salary contributed by the government), *Pag-Ibig* (multipurpose loan program of 2% of basic salary, but not more than ₱100 per month, contributed by the government), clothing allowance (a flat rate of ₱2,000/year for all), and additional compensation called "PERA"(a flat rate payment of ₱12,000/year for salary grades 1–21, and ₱6,500/year for salary grade 22 and above). In addition, officers of salary grade 22 and higher are given a special allowance and vehicle allowance, both of which increase as the salary grade becomes higher.

Furthermore, all employees are entitled to various types of leave, but these details are not included in this paper.

Changes in salary level over time: To understand how the remuneration for NIA engineers has changed over time, table 3 shows the salary and benefits received by junior and senior engineers for the years 1965, 1976, 1990, 1995, and 1997.[9] Junior engineers are represented by field engineers (category: Engineer A)

Table 3. Annual salary and benefits of irrigation engineers in NIA, Philippines.

	Current prices			1995 prices (deflated by CPI)				Total compensation relative to per capita GNP [c]	
	Basic salary [a]	Benefits [b]	Total	Basic salary	Benefits	Total			
		₱1,000/ year …			₱1,000 / year …		Index	Ratio	Index
Directors at NIA Headquarters									
1965	13.2	1.6	14.8	414	50	464	100	28	100
				89	11	100			
1976	33.0	4.0	37.0	327	39	366	79	13	46
				89	11	100			
1990	149.1	54.2	203.3	244	89	333	72	11	40
				73	27	100			
1995	169.5	75.2	244.7	169	75	245	53	8	29
				69	31	100			
1997	214.9	100.0	314.9	192	89	281	60	9	31
				68	32	100			
Field Engineers									
1965	5.9	0.7	6.6	185	22	207	100	13	100
				89	11	100			
1976	12.8	1.5	14.3	126	15	142	68	5	40
				89	11	100			
1990	50.2	12.4	62.7	82	20	103	50	4	28
				80	20	100			
1995	60.3	26.9	87.2	60	27	87	42	3	23
				69	31	100			
1997	105.2	35.4	140.6	94	32	125	61	4	31
				75	25	100			

Note: [a]Median between the minimum and maximum salaries of each category.
[b]Include allowances for representation, medical, and clothing, bonus, pension, vehicle, additional compensation, and PERA.
[c]Total compensation in 1995 prices divided by GNP per capita in 1995 prices.

[9]Salary data for 1976, instead of 1975, are presented because of major revisions made in the salary scale in that year. Also, 1990 data are shown, instead of 1985 data, since the salary levels in government corporations as well as agencies were severely disturbed in the mid-1980s by the political turmoil after the downfall of the Marcos regime.

with salary grade 14, who work as the lowest level unit managers in the Systems Offices of national irrigation systems under NIA. As senior engineers, Department Directors at the Headquarters (category: Department Managers A and B) with salary grades 25–26 are taken. The consumer price index (CPI) is used to convert salary and benefits in current prices into 1995 prices.

Assuming that the CPI roughly represents changes in purchasing power, the real income (salary plus benefits) of engineers at NIA continuously decreased between 1965 and 1995. One might have expected such a trend, but what is surprising is the degree of decrease. In particular, an average field engineer's income in 1995 was far less than one half of that received in 1965. The rate of decrease was especially high between 1965 and 1976 and between 1990 and 1995. The changes in directors' income followed a similar pattern.

NIA (or the government) apparently tried to improve employees' income by increasing the benefits. From 1976 to 1995, the share of benefits in the total income increased significantly, and indeed increased in real value from 1976 to 1990. However, it was not sufficient to compensate for the rapid erosion in the basic salary.

The declining trend in their income, however, appears to have been reversed since 1995. Indeed, the rate of income increase between 1995 and 1997 was very large, 15 percent for director-level engineers and as much as 44 percent for field-level engineers. It may be worth noting that the economy of the Philippines had experienced relatively rapid growth during this period. However, a mini rice crisis, which occurred in 1995 due to a poor rice crop, led the government to recognize that the deterioration of irrigation systems was to a large extent responsible for the stagnation in rice production. Even with such substantial increases in salary level, possibly in response to this rice crisis, the engineers' income in 1997 was still 40 percent lower than the level in 1965.

Even more striking are the changes that have occurred in the relative position of engineers' compensation in the Philippines' society. As shown in table 3, in 1965, the total compensation was nearly 30 times as high as the GNP per capita for senior engineers and 13 times for junior engineers. Between 1965 and 1997, the GNP per capita in the Philippines increased in real terms at an annual growth rate of 2.1 percent, while NIA engineers' compensation decreased in real terms. As a result, the relative position of NIA engineers' compensation vis-à-vis the GNP per capita declined to 30 percent of the level enjoyed in 1965 for both senior and junior engineers. This clearly indicates that the society gives far less prestige and incentive to the engineers working in NIA than they did three decades ago.

Comparison with salary levels of other engineers and occupations: How does the income of NIA engineers compare to that of other institutions and professions? Table 4 presents the annual 1995 income of engineers working in private firms, other public corporations, and universities for entry level and with 10 years of experience, together with medical doctors' income, which are compared with the income of field engineers and of directors at NIA, respectively. It should be noted that it usually takes much more than 10 years for a fresh engineer at NIA to be promoted to the director level.

Compared to the salary level of private consultant firms engaging in irrigation-related projects, NIA engineers' salary in 1995 was at the same level for both the entry level and those with 10 years of experience. The salary of young engineering lecturers in public universities and of medical doctors with 10 years' experience in government hospitals was also comparable to that of NIA engineers. If compared to engineers in private universities and to medical doctors in private institutions, the salary that NIA engineers received was less than one half. Some public corporations also pay high salaries to engineers, particularly for entry level. It may thus be concluded that among government employees, NIA engineers' income level is neither favorable nor unfavorable, but that there are job opportunities that offer them salaries two to three times higher than they receive in NIA.

Table 4. Comparison of annual salary and benefits of NIA engineers with others, Philippines, 1995.

	Entry level			With 10-year experience		
	₱1,000	Index	Ratio to per capita GNP	₱1,000	Index	Ratio to per capita GNP
NIA Engineer	85 [a]	100	3	229 [b]	100	8
Engineer:						
Consultant firms [c]	85	100	3	224	98	8
NPC [d] (govt. agency)	268	315	9	472	206	16
MWSS[e] (govt. agency)	207	244	7	251	109	8
Senior Lecturer:						
Private universities	184	217	6			
National universities	84	99	3			
Medical Doctor:						
Private institutions				1,200	523	40
Government institutions				227	99	8

Note: [a]The minimum level of salary and benefits for field engineer.

[b]The minimum level of salary and benefits for director at NIA HQ; to be a director, far more than 10 years' experience is necessary.

[c]Average of two private firms for irrigation-related projects.

[d]NPC=National Power Corporation.

[e]MWSS=Metropolitan Waterworks and Sewerage System.

Promotion: Aside from the grouping mentioned thus far (category, level and grade), the NIA employees are classified by a more fundamental criterion geared to their rank and promotion, i.e., career (professional and sub-professional) and noncareer. Engineers belong to the career (professional) category and, therefore, they start their career from the second level. Since NIA is an engineer-dominated agency, any fresh engineer who joins the agency has a chance to be promoted to the top, at least theoretically, and the speed of promotion toward higher-ranking positions is faster than for other nonengineering career officers.

However, the competition among engineers for higher positions is stiff, as the number of engineers recruited is disproportionately high compared to other professionals, such as agriculturists and economists. Moreover, there are often cases, as NIA's basic policy for promotion stipulates, in which a high-rank position, when vacated, is filled by a candidate from outside NIA, such as from other government agencies and universities. Promotion depends on eligibility, qualification and vacancy. When a career service position becomes vacant, a selection board is formed to select a successor eligible and qualified for the position. Eligibility generally includes a certain number of years of experience in a position of next in rank. An important qualification is the results of previous performance evaluations. A higher priority is given to an engineer who is next in rank working in the organizational unit containing the vacant position. However, some engineers in other units in NIA, or outside as stated earlier, can be considered as candidates.[10]

In terms of number of years of experience, a fresh engineer can be promoted to Irrigation Superintendent (the top engineer of national irrigation systems; salary grade 20–23) within 10 to 15 years, if qualified at each step in-between. However, if higher positions remain occupied for a long time, the speed of promotion is slower. It is not rare to observe cases in systems offices where a Senior Engineer (one or two ranks above Engineer A, salary grade 15–16) stays in a position for more than 15 years.

Performance of the Agency

How has the agency itself performed during this 30-year period of decline in the salary and benefits of its engineers? It is hazardous to measure the performance of any government organization. It is even more hazardous to infer a causal relationship between the agency's performance and the level of engineers' compensation. It is likely that the work morale, ethics and working spirit of the engineering cadre of an irrigation agency affect the performance of the agency, the performance of irrigation systems in particular, and that, *ceteris paribus*, the higher the compensation the higher the work spirit. However, the level of compensation for engineers is also not a sole determinant of the work spirit of the cadre (Grindle 1997). Further, there are numerous factors that determine the performance of irrigation systems, and measuring system performance is itself problematic (Rao 1993).

With these difficulties in mind, let us consider some indicators that may be related, directly or indirectly, to agency performance. One indicator could be the strength of the work force. As mentioned earlier, the total work force of NIA decreased by 50 percent from 1975 to 1995. The reduction of employees was especially large for the field workers engaged in O&M activities. Although part of their functions was replaced by farmer-beneficiaries through irrigators' associations, it would be fair to hypothesize that the quality of O&M at the system level has been affected adversely.

A second indicator considered is NIA's budget (table 5). The total budget including capital investments, a large part of which was financed by foreign funds, decreased by over 50 percent in real terms between

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[10]The World Bank's World Development Report 1997 on "The State in a Changing World" pinpoints the Philippines as a country where the appointment and promotion of bureaucrats in civil service are highly politicized. It is said that extensive political appointments rather than meritocracy, combined with poor pay, have resulted in lower bureaucratic capability. These statements are by and large applicable to NIA.

1976 and 1995.[11] Largely responsible for this decrease in the total budget was the decrease in capital investments from 1976 to 1985. The total O&M expenditures, a small fraction of NIA's total budget, were fairly constant over time. With the rapid increase in service area during the period, however, O&M expenditure per hectare of service area decreased sharply; the level of O&M expenditure per hectare in 1995 was only 44 percent of the 1975 level. There are indications that the performance of NIA irrigation systems has deteriorated as the quality of O&M has declined.[12] Thus, the trends in both total budget and unit O&M expenditure suggest performance deterioration. While the decline in O&M expenditures affects system performance directly, the decline in the total agency budget might have had negative impacts on the work spirit of engineers and other employees, as they perceive their agency is shrinking (Oorthuizen 1999).

Table 5. NIA's total budget, and capital and O&M expenditures, Philippines.

	In current prices			In 1995 prices[a]					
	Total	Of which		Total		Of which			
		Capital investments	O&M			Capital investments	O&M	O&M per ha [b]	
		... ₱ million ...		₱ million		... ₱ million ...		₱/ha	
1965	na	3.7	na	na		116	na	na	
1976	1,013	925	20	10,309	100	9,413	204	723	100
	(100)	(91)	(2)						
1985	1,957	1,670	76	4,873	47	4,159	190	479	66
	(100)	(85)	(4)						
1995	4,773	3,900	201	4,773	46	3,900	201	316	44
	(100)	(82)	(4)						

Note: [a]Deflator = GDP implicit deflator for construction.
[b]Per service area.
Na = Data not available.

Table 6 shows the revenue side of NIA's budget. As explained before, NIA has been at least nominally financially autonomous since 1974, and the government subsidy for O&M ceased in 1982. As a result, NIA must raise its own revenue for paying employees' salaries and O&M costs. The main sources of revenue were irrigation fees to be collected from farmer-beneficiaries and the management fee given to NIA when implementing construction and rehabilitation projects. As construction projects shrank (table 5), revenue from the management fee declined (table 6). From 1985 to 1995, NIA's revenue from 'other sources' declined by nearly 50 percent. Facing such a situation, NIA initiated a strong drive to increase revenue from irrigation fee collection, which has resulted in a steady increase in the fee collection rate.

[11]For deflating expenditures made by the agencies, the GDP implicit deflator for construction is used throughout this paper.

[12]Masicat, Vera, and Pingali (1990); Lauraya and Sala (1995); and Kikuchi et al. (1998) report deteriorating physical infrastructure; on the other hand Svendsen (1992) using 20 years of aggregated data shows stable area and yields even though water availability declined by 13 percent.

Unfortunately, however, the irrigation fee is charged in terms of paddy, and the price of paddy has declined during this period relative to other prices. Therefore, the real value of the fees collected has declined slightly in spite of the increase in the fee collection rate.

Altogether, the total revenue declined by more than 30 percent from 1985 to 1995. With the reduced work force, the revenue per employee remained constant. However, NIA's total wage bill in 1995, as indicated in its staffing plan, was nearly twice as large as its revenue. As a result of serious revenue shortages, delayed salary payments of up to several months have not been rare in many regional and systems offices since the mid-1980s. There is no doubt that this situation has had a negative impact on NIA staff morale. Even worse was the fact that the revenue shortage meant little funding was available for O&M.

Table 6. NIA's revenue and irrigation fee collection, Philippines, 1975–1995.

	In current prices			In 1995 prices [a]						
	Irrigation fee	Others [b]	Total	Irrigation fee	Others [b]	Total	Per NIA employee	Per service area	Irrigation fee per ha [c]	Fee collection rate [d]
		...₱ million ...			... ₱ million ...		₱/person	₱/ha	₱/ha	%
1975	17	1	17	184	8	192	7,128	485	465	24
				96	4	100				
1985	143	332	475	357	827	1,184	55,102	2,085	629	45
				30	70	100				
1995	346	447	792	346	447	792	55,823	1,216	531	53
				44	56	100				

Note: [a]*Deflated by GDP implicit deflator for construction.*
[b]Includes, in the order of magnitude in 1995, equipment rental, management fee, community amortization, interest earnings, Pump amortization and others.
[c]Per service area. Fees collected per service area in 1975 and 1985 loom large relative to that in 1995, of the differences in he rates of change between GDP deflator and paddy rice price. Irrigation fee is charged in terms of paddy.
Estimated from current price values.

The third group of indicators for performance is irrigated area and cropping intensity in the NIA irrigation systems (table 7). NIA's service area increased rapidly until 1990. Irrigated area, or area planted to rice, in the wet and dry seasons has increased accordingly. However, the growth rate of irrigated area has declined over time, resulting in an apparent stagnation or slight decline in cropping intensity since 1975.

Table 7. NIA service area, irrigated areas, and irrigation ratio, Philippines, 1965-1995.

	Service area	Area planted to rice			Cropping intensity
		Wet	Dry	Total	
	... 1,000 ha ...				
1965	283	237	98	336	1.19
1975	396	357	187	543	1.37
1985	568	428	335	763	1.34
1990	637	477	369	847	1.33
1995	652	467	409	876	1.34
Growth rate (%/year):					
1965-75	3.4	4.2	6.6	4.9	1.5
1975-85	3.7	1.8	6.0	3.5	-0.2
1985-90	2.3	2.2	1.9	2.1	-0.2
1990-95	0.5	-0.4	2.1	0.7	0.2

Note: Three-year averages for irrigated area centering the years shown, except 1965 and 1995. For 1965, 1965–67 average, and for 1995, the single-year figure.

All the performance-related indices examined above suggest the same picture: the performance of the agency and its systems has been deteriorating since the mid-1970s. We do not claim that these data confirm a causal relationship between engineers' compensation and systems performance. What we can say is that the evidence is consistent with the hypothesis that the level of engineers' compensation is one of the determinants of systems performance.

Sri Lanka

The Agency

Irrigation systems in Sri Lanka are grouped into two categories, major and minor schemes, with the size of command area of 80 hectares as the official demarcation line. The major irrigation schemes are further classified into two groups, those operated and managed by the Irrigation Department (ID), and those under the Mahaweli Authority of Sri Lanka, most of which have been developed since the early 1970s. We focus on the ID in this paper.[13] The ID has a long history dating back to the beginning of the twentieth century. It has been considered one of the most important government departments because of the critical importance of rice in the Sri Lankan economy. With numerous tank schemes scattered in the dry zone of the country, the number of schemes under the ID's management was about 290 in 1997.

Organization and Personnel Strength of the ID

The ID's organizational structure has been subject to changes occasionally, but its essential structure related to the management of the existing systems has been unchanged for a long time; the Range Offices (14 in 1996) under the Headquarters in Colombo are in charge of O&M of irrigation schemes in the

[13]The minor schemes, which are managed by farmers and largely taken care of by the Department of Agrarian Services, are not included here.

Range (except for the 1970s during which the O&M of ID irrigation schemes were transferred to the Territorial Civil Engineering Organization [TCEO]). Engineers head the Range Offices as well as the Headquarters Units.

The ID's total work force was reduced by 25 percent from 1985 to 1995 (table 8).[14] The number of employees decreased for almost all categories. Among them, the staff categories that experienced the largest reductions absolutely as well as relatively were technical assistants and work supervisors, while the relative share of engineers has remained constant at 6 percent of the total staff. Technical assistants are

Table 8. Number of employees by category, the Irrigation Department, Sri Lanka, 1985 and 1995.

	1985		1995				Rate
	Number in place (1)	Share in total	Number of positions (2)	Number in place (3)	Share in total	Filled-up ratio (3)/(2)	of change [(3)-(1)]/(1))
		%			%	%	%
Civil Engineer	312	6	277	252	6	91	-19
Technical Assistant	998	18	649	445	11	69	-55
Work Supervisor	736	14	478	286	7	60	-61
Maintenance Laborer	[a]		1,077	799	20	74	[b]
Draftsman	341	6	301	246	6	82	-28
Hydrological staff	73	1	61	37	1	61	-49
Drilling Assistant	48	1	31	21	1	68	-56
Soil Surveyor	26	0	36	34	1	94	31
Soil Tester	24	0	24	16	0	67	-33
Accountant	26	0	24	22	1	92	-15
Clerical Services	640	12	558	466	11	84	-27
Typist Service	68	1	169	135	3	80	99
Store Keepers Service	122	2	98	89	2	91	-27
Others	2,033	37	1,586	1,248	30	79	1
Total	5,447	100	5,369	4,096	100	76	-25

Note: [a]Data are not available; included in others.
[b]Computed adding the number of maintenance laborers to the number of others in1995.
Source: Irrigation Department, Administration Report, 1985 and 1995.

[14]Data on the size of staff in the 1960s and 1970s are not available. Since there were 73 engineers and inspectors in 1946 (Arumugam 1978), the total number of ID employees increased significantly between the time of Independence and the 1980s, corresponding to the increase in the command areas of ID schemes.

nondegree engineers who, along with work supervisors, engage in day-to-day management at the scheme level. The fact that the percentage of vacancies as of 1995 was also higher for these categories suggests the high priority for reduction given to these field-level O&M engineers and workers.[15]

Changes in Salary Level of Engineers of the ID

Salary and benefits: In terms of the broad salary scale, the engineers of the Sri Lanka Engineering Services (SLES) in the ID are classified into three grades: Grade II–II (consisting of 15 detailed salary steps) for the entry level, Grade II–I (7 steps) for the middle level, and Grade I (11 steps) for senior engineers. The senior engineers in Grade I include the Directors at the Headquarters.[16] Basic salaries are determined according to these salary grades and steps, with the scale subject to occasional revisions.

Benefits given to the ID engineers are housing and pensions. Engineers assigned to a Range Office live in government housing with a rent payment of 10 percent (12 % in the 1960s and 1970s) of their salary. This rent level is usually below the market rate for the same quality of houses for engineers assigned to cities. The difference is considered as a subsidy (benefit) given to the engineers. It is difficult to estimate this subsidy, since the difference varies across regions in the country and across grades of housing. Here we make a rule-of-thumb assumption, based on a typical case for lower-grade engineers staying in a middle-sized local town in the dry zone, that this housing benefit is equivalent to 15 percent of their basic salary. As such, the estimated housing subsidy may be underestimated for higher-ranking engineers.

Government employees in Sri Lanka are entitled to receive a pension after their retirement, which is a certain percentage of their last salary (at present 85% for higher grades and 95% for lower grades; until 1990, 67% for all grades), shouldered 100 percent by the government. Since the retirement age is 55 and the male life expectancy at the age of 55 has been about 75 with little change over time, an average employee receives his/her pension for 20 years. The annual benefit for this pension is estimated by dividing the capitalized present value of this pension flow for 20 years at the time of average entry age to each Grade by the average years of service for the entire career. The following parameters are assumed in the estimation: the discount rate for capitalization (5%), the entry age (25, 35, and 45 for Grade II–I, II–II, and I, respectively), and the average years of service (30 years). This approach probably underestimates the value of this benefit as it ignores special subsidies to encourage earlier retirement at full pension.

[15]Large reductions of the number of technical assistants and work supervisors from 1985 to 1995 were due partly to a labor dispute between the government and the trade union as to the recruitment procedure for these positions. Because of this problem, the recruitment of new persons for these positions has been delayed since the early 1990s.

[16]The Head of the ID is the Director General (DG) of Irrigation. Before 1996, the designation was the Director of Irrigation, followed by Additional Directors (ADs) and Senior Deputy Directors (SDDs) in that order. In the 1996 reorganization, ADs and SDDs were made Directors with the same rank, reporting to the DG.

The use of a department vehicle for private purposes is considered as a benefit for engineers in government agencies. However, it is limited to the engineers of the director level in the ID and is, therefore, not included in the estimation of the benefits.[17]

Changes in salary level over time: The ID engineers' salaries and benefits are summarized in table 9 for the three Grades. Values in current prices are converted to 1995 constant prices using the Colombo Consumer Price Index (CCPI).[18] Figures for each Grade are the medians for the salary ranges in each Grade.

For all grades, the real income of engineers has been declining continuously from 1965 to 1995, except of those in Grade I, from 1985 to 1995. The rate of decline was substantial. For junior engineers (Grades II–II), the real income in 1995 was about 50 percent of that in 1965, and for the middle-level engineers (Grade II–I) it was a mere 44 percent. The real income of Grade I engineers increased during the last decade, but its level in 1995 was still 50 percent of the 1965 level. Even if some errors are involved in our estimation of benefits, the sharply declining trend over the last three decades of the compensation received by the ID engineers is unambiguous. The degree of decline and its trend in Sri Lanka are surprisingly similar to those in the Philippines.

The decline in the position of engineers' total compensation relative to the GNP per capita has been even more serious than in the Philippines. The GNP per capita in Sri Lanka has increased in real term at a rate of 2.8 percent per annum over the last three decades, while engineers' compensation has decreased in real term at a rate of 2–3 percent per year during the same period. As a result, the relative position of engineers' compensation in 1995, with respect to the GNP per capita, has declined to around 20 percent of the level enjoyed in 1965 for all grades of ID engineers. Undoubtedly, such a significant decline must reflect a sharp decline in the social prestige of engineers in Sri Lanka's society.

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[17]This may cause an underestimation of engineers' benefits, since it seems that actually some high-ranking engineers below the director level do enjoy this benefit.

[18]Since many ID engineers are working in Range Offices outside Colombo, the use of CCPI as the deflator may not be optimal. However, it is the only CPI series in Sri Lanka that is available for a long time series.

Table 9. Engineers' salary and benefits, Irrigation Department, Sri Lanka, 1965-1995.

	Current prices			1995 prices (deflated by CPI)				Total compensation relative to per capita GNP	
	Basic salary [b]	Benefits [a]	Total	Basic salary	Benefits	Total			
		... Rs 1,000 / year ...			... Rs 1,000 / year ...		Index	Ratio	Index
Grade I [c]									
1965	18.3	6.1	24.4	268	89	357	100	21	100
				75	25	100			
1975	21.8	7.3	29.1	181	60	242	68	12	56
				75	25	100			
1985	39.9	13.3	53.2	117	39	156	44	5	25
				75	25	100			
1995	131.4	50.5	181.9	131	50	182	51	5	22
				72	28	100			
Grade II–1 [d]									
1965	14.7	3.9	18.6	215	56	271	100	16	100
				79	21	100			
1975	18.5	4.9	23.4	154	40	194	72	10	59
				79	21	100			
1985	33.5	8.8	42.2	98	26	124	46	4	26
				79	21	100			
1995	90.9	28.2	119.1	91	28	119	44	3	19
				76	24	100			
Grade II–II [e]									
1965	8.6	1.9	10.5	126	28	154	100	9	100
				82	18	100			
1975	12.7	2.8	15.5	105	23	129	84	6	69
				82	18	100			
1985	24.9	5.46	30.4	73	16	89	58	3	33
				82	18	100			
1995	65.6	16.31	81.9	66	16	82	53	2	23
				80	20	100			

Note: [a]Benefit includes housing subsidy and pension. For the estimation, see note to the text.
[b]Median between the minimum and maximum salaries of each category.
[c]Senior rank engineers including the Directors in the HQ.
[d]With 10-year service or more.
[e]With 0 to 10 year service.

Comparison with salary levels of other engineers and occupations: The level of salary and benefits received by ID engineers at entry level in 1995 was lower than that of engineers working in private firms, but the income gap is not pronounced (table 10). However, the income gap between ID engineers and those in private firms or in universities grows wider as they continue their career to 10 years of experience. It should be noted that the private sector gives engineers with 10 years of experience high remuneration, as high in terms of the ratio to the GNP per capita as the level enjoyed by ID engineers two decades ago.

Table 10.Comparison of salary and benefits of ID engineers with others, Sri Lanka, 1995.

	Entry level				With 10-year experience			
	Rs 1,000	%	Index	Ratio to per capita GNP	Rs 1,000	%	Index	Ratio to per capita GNP
ID Engineer [a]								
Basic salary	66	80			91	76		
Benefits	16	20			28	24		
Total	82	100	100	2	119	100	100	3
Engineer								
Other government agency [b]:								
Total	104		127	3	159		133	4
Private engineering firms [c]:								
Basic salary	79	91			189	57		
Benefits [d]	8	9			142	43		
Total	87	100	106	2	331	100	278	9
Unversity lecturer [e]:								
Basic salary					157	65		
Benefits [f]					86	35		
Total					243	100	204	6
Medical Doctor								
Government:								
Basic salary					155	45		
Benefits [g]					189	55		
Total					344	100	288	9
Private:								
Total					472		397	12

Note: [a]Entry level = Grade II–II, With 10-year experience = Grade II–I. From Table 9.
[b]Sri Lanka Land Reclamation Board.
[c]Average of three firms.
[d]Include transportation allowance or vehicle made available.
[e]National universities; Level 2.
[f]Include academic and backlog-clearing allowances.
[g]Include earnings from private practices.

Compared to medical doctors working in government hospitals, the income of middle-level engineers in ID is barely one-third. Medical doctors in private hospitals receive even higher salaries and benefits. Judging from the ratio of their compensation to the GNP per capita, medical doctors, as professionals, are still valued highly in the society, as used to be the case for ID engineers in the 1960s and 1970s.

Promotion: A fresh engineer who joins the ID with a B.Sc. Engineering degree has a chance to become its Director General. Unlike NIA in the Philippines, the Director General is exclusively selected from the engineering cadre. It takes about 10 years for a fresh engineer of Grade II–II to be promoted to Grade II–I, and another 10 years to Grade I, i.e., 20–22 years from entry. To proceed to Grade II–I, a junior engineer has to obtain within the first 5 years of recruitment a full membership of the professional engineers' institution as a Chartered Engineer by passing an examination. With the Charter, he/she becomes a Professionally Qualified Engineer in the ID.

From Grade II–I to Grade I, there is no such hurdle, but all candidates for promotion are interviewed by the Unified Engineering Service (UES) of the Ministry of Public Administration. Candidates to be promoted from Grade II–II to II–I also have to face a similar interview, but it is said the interview for Grade I candidates is much tougher. In this interview, the results of past annual performance evaluations are carefully examined. For qualified engineers, promotion is mainly based on vacancy, seniority and experience. Aside from the interview by the UES panel, internal selection committees are formed to interview candidates for high-ranking positions, i.e., the Heads of the Range Office (Deputy Directors).

For a Technical Assistant (TA), a necessary qualification for entry is either an Advanced Level Certificate or a National Diplomat in Technology. If no qualification is added to this, the highest possible position is Non-Professionally Qualified (NPQ) Engineer, after about 25 years' service. With additional education and training and passing an examination held by the Institute of Engineers Sri Lanka, a TA becomes eligible to be promoted as an engineer. Once promoted to that level, his/her future is the same as for other junior ID engineers. In fact, there have been several TA-promoted engineers who have risen to the director level or even to the Director General position. While some informal discrimination against TAs for promotion exists, promotion based on merit is formally open to them.

Performance of the Agency

For the ID in Sri Lanka, data on the total budget, O&M expenditure per command area, and cropping intensity are available as our 'performance' measures.

The total budget of the ID in real terms decreased by as much as 80 percent from 1965 to 1985, due to the large decrease in capital investments (table 11). It recovered slightly in 1995, but the level in 1995 was still 40 percent of that in 1965. This large decline in capital investments between 1965 and 1985 is a reflection of the fact that the construction of irrigation systems based on the renovation of abandoned ancient tank schemes in the dry zone had been nearly completed by the late 1970s, and that large-scale new irrigation construction around the same time was implemented by the newly created Mahaweli Authority (Aluwihare and Kikuchi 1991). The resurgence of the ID's capital investments in 1995 was not due to a revival of new construction but to an increase in rehabilitation projects (Kikuchi et al. 1999).

Table 11. Total budget, and capital and O&M expenditures, Irrigation Department, Sri Lanka.

	In current prices			In 1995 prices[a]					
	Total	Of which		Total		Of which		O&M per ha[c]	
		Capital investments	O&M[b]			Capital investments	O&M		
	... Rs million ...				Index	... Rs million ...		Rs/ha	Index
1965	60.5	47.2	5.2	2,184	100	1,704	187	1,158	100
	100	78	9						
1975	83.3	51.9	17.4	1,603	73	999	336	1,455	126
	100	62	21						
1985	164.1	84.7	55.1	437	20	226	147	559	48
	100	52	34						
1995	881.6	710.4	125.5	882	40	710	126	466	40
	100	81	14						

Note: [a]Deflator = GDP implicit deflator for construction.
[b]For 1975, O&M expenditures were of TCEO, which then, as an independent government organization outside of the ID, was responsible for schemes' O&M.
[c]Per command area.

Since the creation of the Mahaweli systems, the ID has become an irrigation management agency whose major functions are O&M and rehabilitation or modernization of existing schemes.

The share of O&M expenditures in the total ID budget is relatively high compared to that in the Philippines. However, in real terms, it decreased from 1975 to 1995. As a result, O&M expenditure per hectare of command area decreased rapidly. The unit O&M expenditures did apparently increase by nearly 50 percent from 1965 to 1975, but 1975 was a year when a combined engineering organization was in charge of irrigation O&M. Many ID engineers remember this as a period of disorder and chaos. Therefore, the high figure of unit O&M for this year should be discounted. Compared to the 1965 level, the O&M expenditures per unit of command area in 1985 and 1995 were significantly lower.[19] Coupled with the large reduction in field-level workers, it is very likely that the performance of the ID irrigation systems has been deteriorating.

Since the mid-1980s, farmers' participation in system O&M through farmer organizations has been an important policy in Sri Lanka. As noted above, the number of field O&M staff and the O&M budget have been reduced since 1985. Farmers' participation might have eased the burden of the ID workload to some extent, but it is difficult to believe that the promotion of farmer organizations had been so successful that the Department's burden has been reduced by around 50 percent. Samad and Vermillion (1999a) found that government O&M expenditures declined by about 50 percent in both transferred and nontransferred systems. Some case studies show that most farmer organizations, through participatory management, now

[19]Kikuchi et al. (1999) show that the actual O&M expenditures per command area of major irrigation schemes in 1995 is 40 percent of the desired O&M level.

have the capability of handling maintenance work but lack financial resources for implementing O&M at a desired level (IIMI and HKARTI 1997). The O&M expenditure per hectare of ID command area has continued to decline in the last two decades; and there is evidence of under-investment in maintenance (see Samad and Vermillion 1999b). Altogether, a net result of the large reduction in the number of engineers and workers at the field level as well as the O&M budget could have had a negative impact on the quality of system O&M.

Reflecting the transition of the ID from a phase dominated by construction projects to a phase oriented to managing existing schemes, the total command area of ID schemes increased rapidly during the 1965–1975 decade but since then it has stagnated (table 12). Because of serious droughts in 1975 and 1976, the cropping intensity in the mid-1970s was extremely low, even after taking a 5-year average. This period also coincides with the period when a combined engineering agency was in charge of O&M of the ID schemes. Between 1965 and 1995 the cropping intensity in ID schemes declined considerably. Therefore, performance measured by the level of cropping intensity has clearly not improved. A study of using a sample of transferred and nontransferred schemes confirms this finding for all types of schemes (Samad and Vermillion 1999a).

Table 12. Command areas of major irrigation schemes under Irrigation Department and the area Planted to rice within the schemes, Sri Lanka.

	Command area [a] (1)	Area planted to rice [b] maha	yala	Total (2)	Cropping intensity (2)/(1)
	... 1,000 ha ...				
1965	158	121	88	209	1.32
1975	253	157	94	251	0.99
1985	263	197	140	336	1.28
1995	269	179	134	312	1.16
Growth rate (%/year):					
1965-75	4.8	2.6	0.7	1.9	-2.8
1975-85	0.4	2.3	4.0	3.0	2.6
1985-95	0.2	-1.0	-0.4	-0.7	-1.0

Note: [a]In 1990, substantial parts of the irrigation schemes under the ID were transferred from the ID to the Provincial Councils, and again many of them were returned to the ID toward the mid-1990s. Here, we Disregard these transfers and returns, and treat them as the ID schemes.

[b]Within the command area of the ID schemes; data are of Department of Census and Statistics for major irrigation Schemes. For the years after the Mahaweli schemes started operation, the planted area for the ID is estimated by Subtracting the planted area within the Mahaweli command area from the DCS data. To eliminate year-to-year Fluctuations, 5-year averages, centering the years shown, are presented.

In summary, as in the case of NIA in the Philippines, all the available performance measures suggest a declining trend in the performance of the irrigation schemes under the ID. The data from both countries thus provide evidence for a positive association between the level of engineers' compensation and the level of system performance.

Pakistan

The Agency

Situated in the semiarid area of South Asia, Pakistan has the world's largest contiguous irrigation system. Through a huge integrated network of canals, water from two large reservoirs, Tarbela and Mangla, irrigates agricultural land all over the country including Punjab, Sindh, the Northwest Frontier Province (NWFP), and Baluchistan. Each province has a Provincial Irrigation Department (PID) in charge of water distribution and maintenance of canals in their jurisdictions.[20] The Water and Power Development Authority (WAPDA), which is the agency studied in this paper, is a federal, i.e., national institution, established in 1958. Its Water Wing is responsible for planning, constructing and maintaining the reservoirs and dams, and for releasing water to the canal network. WAPDA's role ends when it delivers water to the canal network, and the O&M of canal systems in each province fall under the PID's responsibility. The performance of the entire surface system depends, therefore, not only on WAPDA but also, perhaps largely, on PIDs. The O&M role played by WAPDA's Water Wing in the entire system is relatively easy and clear-cut as compared to the role played by PIDs.[21]

Organization and Personnel Strength of WAPDA

The Water Wing of WAPDA, headed by the Managing Director, has 11 Divisions, each headed by a General Manager. It is a highly engineer-dominated organization. All the General Managers as well as the Managing Director are engineers, with many Chief Engineers heading the Subdivisions, though the ratio of engineers in the total work force was 6 percent in 1994 (the same percentage as in Sri Lanka's ID).

Unlike the NIA in the Philippines or the ID in Sri Lanka, the total number of employees in WAPDA has increased continuously (table 13). This is surprising, as, like the Philippines case, construction projects have declined in the past 10 years. After a rapid expansion from 1975 to 1985, however, during the period up to 1994, the annual growth rate of the staff declined to a mere 0.4 percent, while the number of some

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[20]We do not consider here more recent reforms, whose implementation has barely begun, to convert the PIDs into autonomous authorities.

[21]It is obviously preferable to include a PID in our study, but as mentioned earlier we failed to do so because adequate data were not available. WAPDA's Power Wing is responsible for the generation and distribution of electricity to the irrigation tube wells. We did not explore this connection, but suggest the Power Wing's performance has a very significant impact on overall irrigated agriculture.

groups of workers, such as unskilled laborers, began to decrease.[22] With the share of officers including engineers increasing, the structure of the organization has become more top-heavy.

Table 13. Number of employees of WAPDA Water Wing, Pakistan, 1975–1994.

	Number			Share (%)			Growth rate (%/year)	
	1975	1985	1994	1975	1985	1994	1975–1985	1985–1994
Officers:								
Civil and Agricultural Engineers	420	922	1,052	4	5	6	8.2	1.3
Specialist	228	658	659	2	4	4	11.2	0.0
Nonengineers	63	318	390	1	2	2	17.6	2.1
Total	711	1,898	2,101	7	11	12	10.3	1.0
Establishment:								
Technical	1,136	2,015	1,948	12	12	11	5.9	-0.3
Ministerial & accounts	1,174	2,020	2,214	12	12	12	5.6	0.9
Miscellaneous	476	1,178	1,057	5	7	6	9.5	-1.1
Total	2,786	5,213	5,219	29	31	29	6.5	0.0
Skilled & unskilled								
Skilled	2,059	3,500	3,513	21	20	20	5.4	0.0
Unskilled	368	1,115	1,075	4	7	6	11.7	-0.4
Total	2,427	4,615	4,588	25	27	26	6.6	-0.1
General aid staff	3,766	5,354	5,824	39	31	33	3.6	0.8
Total	9,690	17,080	17,732	100	100	100	5.8	0.4
	100	176	183					

Changes in Salary Level of Engineers in WAPDA

Salary and benefits: As in the ID in Sri Lanka, the salary and the rank of WAPDA employees are according to Grade. There are 21 grades. In the case of a graduate engineer, the entry level is Grade 17.

The list of benefits to which WAPDA engineers are entitled is long. As of 1995, the following benefits exist: personal allowance, pension contribution, housing acquisition allowance, vehicle, free residential telephone, free electricity, entertainment allowance, senior post allowance, and orderly allowance. In the above list, benefits from the personal allowance to free electricity are given to all the engineers, while the last three allowances are limited to engineers of Grade 20.

Changes in salary level over time: The compensation in real terms for WAPDA engineers declined drastically from 1965 to 1975, a 50-percent decline for both senior and junior engineers (table 14).

[22] In fact, the restructuring of WAPDA, including downsizing of its staff, is envisaged for the near future.

Table 14. Annual salary and benefits of irrigation engineers in WAPDA, Pakistan.

	Current prices			1995 prices (deflated by CPI)				Total compensation relative to per capita GNP	
	Basic salary [b]	Benefits [a]	Total	Basic salary	Benefits	Total			
	... Rs 1,000/year ...			... Rs 1,000/year ...			Index	Ratio	Index
Grade 20 [c]									
1965	21.6	12.7	34.3	183	108	290	100	40	100
				63	37	100			
1975	29.4	16.3	45.7	94	52	146	50	18	45
				64	36	100			
1985	54.2	86.2	140.4	126	200	325	112	26	67
				39	61	100			
1995	136.7	246.6	383.3	137	247	383	132	27	68
				36	64	100			
Grade 17 [d]									
1965	8.4	2.6	11.0	71	22	93	100	13	100
				77	23	100			
1975	10.5	4.1	14.6	33	13	46	50	6	45
				72	28	100			
1985	27.8	36.6	64.4	64	85	149	161	12	96
				43	57	100			
1995	67.4	83.5	150.9	67	83	151	163	11	84
				45	55	100			

Note: [a]Include housing and other various allowances, pension, telephone, electricity, and vehicle.
[b]Median between the minimum and maximum salaries of each category.
[c]With 15-year experience or more.
[d]With 1 to 4-year experience.

However, it showed a remarkable recovery by 1985. The compensation for senior engineers more than doubled and that for junior engineers more than tripled. The increase in compensation continued from 1985 to 1995, though with moderate growth rates. As a result, compared to the 1965 level, the compensation in 1995 was 30 percent and 60 percent higher for senior and junior engineers,[23] respectively.

A characteristic of WAPDA's compensation is the large increase in benefits after 1975. The basic salary in real terms has increased quite rapidly since 1975, but its level in 1995 was still lower thanthat in 1965. The benefits increased far more rapidly than the basic salary, so that the weight of benefits in the total compensation became more than the basic salary in 1985 and thereafter. This is particularly so for senior

[23]The term 'junior engineer' is sometimes used in WAPDA to designate a Subdivisional Officer (civil engineer with diploma). However, we use it here to refer to engineers with a recent B.Sc. in Engineering.

engineers. Their high compensation in 1985 and 1995 was made possible by large benefits, which accounted for nearly two-thirds of the total compensation[24].

In spite of increases in the total compensation, the income position of WAPDA engineers declined relative to the GNP per capita, which increased at an annual growth rate of 2.2 percent between 1965 and 1995. Compared to the low point in the mid-1970s, the relative position had improved significantly in 1985 and 1995, but the 1995 level is still lower than that enjoyed in 1965. Compared to the relative income position of engineers in the Philippines and Sri Lanka, however, it is substantially higher in Pakistan, indicating that the deterioration of engineers' social status in the last two to three decades has been much less than in the other two countries. Indeed, the most senior engineers' compensation in 1995 is nearly 30 times higher than the GNP per capita; this ratio is almost at the same level or much higher than the level their Philippine and Sri Lankan counterparts enjoyed three decades ago.

Comparison with salary levels of engineers in private firms: Compared to the compensation that comparable-level engineers in private firms receive, the 1995 compensation of WAPDA engineers is lower by about 40 percent both for the entry level and for the level with 10 years' experience (table 15). This gap in compensation is brought about mainly by the differences in the benefits they receive. Although WAPDA's benefits are generous, private firms are apparently even more generous with benefits.

Table 15. Comparison of annual salary and benefits of WAPDA engineers with those in private Companies, Pakistan, 1995.

	Entry level				With 10-year experience			
	Rs 1,000	%	Index	Ratio to per capita GNP	Rs 1,000	%	Index	Ratio to per capita GNP
WAPDA Engineers [a]:								
Basic salary	67	45			116	45		
Benefits	83	55			144	55		
Total (1)	151	100	100	11	260	100	100	18
Private Firms [b]:								
Basic salary	68	33			128	36		
Benefits	139	67			228	64		
Total (2)	207	100	137	15	356	100	137	25

Note: [a]For WAPDA, entry level = Grade 17, with 10-year experience = Grade 19. To be promoted to Grade 19, at least 13 years' experience is required.
[b]Averages of two private engineering firms.

[24]WAPDA employees' salaries are taxable, but benefits are not—this may explain why improving benefits is the preferred means to reward employees.

Promotion: The promotion of WAPDA engineers of Grade 17 and above depends on vacancies in the next cadre, seniority in the same cadres and annual performance evaluation. In addition, clearance of a professional examination and of various management courses provided by the WAPDA Academy and Staff College are required for promotion. Promotion Committees (for Grade 17 to 18) and Promotion Boards (for Grade 18 to 19 and 19 to 20) are formed to select candidates for promotion. A specified number of years of service are also required for promotion. The minimum period of service to be promoted from Junior Engineer (Grade 17) to Senior Engineer (Grade 18) is 5 years; a total of 12 years from Senior Engineer / Executive Engineer (Grade 18) to Superintendent Engineer (Grade 19); and a total of 15 years further to Chief Engineer (Grade 20). Altogether, a junior engineer who joins WAPDA needs at least 15 years to reach Grade 20. For engineers, it is possible to climb further to the position of Managing Director of the Water Wing and, maybe, to the Chairman of the entire organization.

The same promotion policy is applied to the officers of other categories, such as agronomist and economist, except that the professional examination is not required for some categories, and the highest possible grade for them is Grade 20. Nondegree engineers with a diploma are promoted to Grade 17 after a minimum 10 years of service, but without additional qualification their highest possiblepromotion is to Grade 18.

Performance of the Agency

Among possible 'performance' measures, data on budgets and cropping intensity are available for Pakistan.

The total expenditure of the Water Wing of WAPDA in 1995 constant prices declined slightly from 1965 to 1975 (table 16). But it has increased rapidly since then, bringing it up in 1995 to a level three times as high as in 1965. This trend in total expenditure has been created by the investments in physical expenditure.

Table 16. Expenditures of WAPDA, Pakistan.

	Current prices			1995 prices				Total expenditure per canal command area	
	Total	Of which		Total		Of which			
		Physical expenditures	Admini-stration		Index	Physical expenditures	Admini-stration		Index
	... Rs million ...			... Rs million ...		... Rs million ...		Rs/ha	
1965	352	269	34	2,875	100	2,200	278	205	100
	100	77	10						
1975	754	560	140	2,321	81	1,724	432	166	81
	100	74	19						
1985	1,728	1,530	43	3,820	133	3,383	95	273	133
	100	89	2						
1995	8,633	7,523	498	8,633	300	7,523	498	564	275
	100	87	6						

Unfortunately, the data to break down the physical expenditure into construction and O&M are not available. Since there have been many construction projects, both new construction and rehabilitation, an overwhelming part of the physical expenditure would have been for these projects. However, as the sole agency specializing in the construction and O&M of the upstream storage headworks, a substantial amount of funds must have been allocated to O&M activities, and at the margin it would be difficult to demarcate rehabilitation activities from maintenance activities made to the physical structures. On the other hand, the performance of the irrigation systems served by the water released by WAPDA depends not only on the water management performance of WAPDA but more heavily on the performance of the PIDs.

The total expenditure per canal command area (CCA) is shown in table 16. Since there was no change in CCA between 1962 and 1985 after the construction of Ghotki Canal had been completed in 1961,[25] it increased at the same pace as the total expenditures did. The CCA increased somewhat toward 1995 (table 17), but the total expenditures continued to increase at a much higher rate, so that the unit expenditure increased in 1995 to a level nearly three times as high as the level in 1965.[26] In this respect, too, the Pakistan case is in sharp contrast to the Philippine and Sri Lankan cases.

Table 17. Canal command and irrigated cropped area in Pakistan.

	Canal command area (1)	Irrigated cropped area (2)	Cropping intensity (2)/(1)
	... million ha ...		
1965	14.00	11.37	0.81
1975	14.00	12.49	0.89
1985	14.00	16.11	1.15
1995	15.31	16.28	1.06
Growth rate (%/year):			
1965-75	0.0	0.9	0.9
1975-85	0.0	2.6	2.6
1985-95	0.9	0.1	-0.8

Source: For 1965–1985, D. J. Bandaragoda 1993.
For 1995, from IIMI Pakistan and Agricultural Statistics of Pakistan.

[25]Data are from Bandaragoda (1993). In 1986, Chashma Right Bank Canal Stage I Project was completed, resulting in an increase in CCA by about 60,000 hectares. Even if this area is included, the discussion that follows is not affected.

[26]This assumes a constant level of administrative efficiency.

The other performance measure available is cropping intensity (table 17). As mentioned above, changes in cropping intensity depend heavily on the performance of both the PIDs in the canal and field levels and WAPDA's Water and Power Wings. With this caution, let us observe its trend. The total irrigated crop area in the entire canal system increased rapidly between 1965 and 1985, so that the cropping intensity improved gradually toward 1985. Within these two decades, the improvement was more distinct in the second decade. This may largely be due to the rapid increase in private tube wells (Meinzen-Dick 1996). However, there are indications that the cropping intensity has begun to stagnate, or even to decline slightly in recent years.

Our examination of WAPDA, using rough performance-related measures intended to represent in some way the performance of the agency and of the overall system it manages, reveals a similar association between the compensation of engineers and performance as found in Sri Lanka and the Philippines. By and large, they move down and up together, but we do not believe there is a causal relationship because of the confounding impact of the expansion of private tube wells.

CROSS-COUNTRY COMPARISON

In this section, we put the results for each country together to obtain a comparative perspective.

Level of Compensation

First, we compare engineers' compensation among the three countries, using junior engineers' levels of compensation for each country. In order to make a comparison across countries possible, two conversion rates are tried; one is ordinary exchange rates with US dollars in 1995, and the other is the 1995 consumer price of rice in each country. Both rates have various shortcomings to make an international comparison of the real purchasing power of their compensation. The degree of crudeness in our data, however, would negate any effort to devise more sophisticated conversion rates.

Engineers' annual compensation in the three countries in terms of US dollars and the quantity of rice that can be purchased is shown in table 18. As we noted earlier, the pattern of changes over time in compensation is quite similar for the Philippines and Sri Lanka. However, there are differences in the absolute levels of their compensation. The differences are particularly pronounced when compared in terms of US dollars (figure 1). In 1965, the compensation in the Philippines was more than twice higher than in Sri Lanka. The real value of compensation in the Philippines has declined faster than in Sri Lanka in the last three decades, narrowing the gap between the two countries a little, but the Philippines' level is still more than twice as high as in Sri Lanka in 1995.

Table 18. Comparison of junior irrigation engineers' annual salary and benefits, in 1995 constant prices.

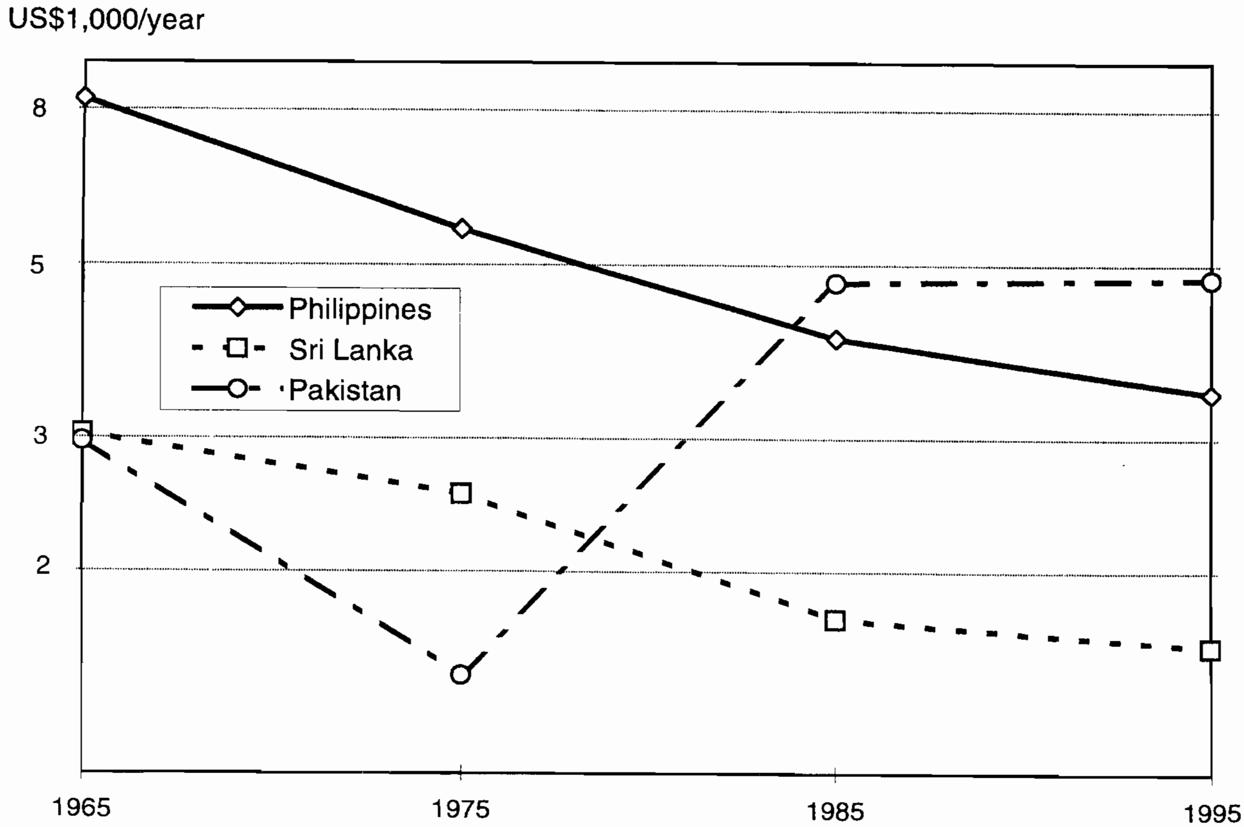
	In US dollars			Total	Total
	Basic salary	Benefits	Total	in rice equivalent	relative to per capita GNP
	... US$/year ... [b]			mt/year [c]	ratio
Philippines [a]					
1965	7,182	862	8,043	13.0	13
1975	4,918	590	5,508	8.9	5
1985	3,202	793	3,995	6.5	4
1995	2,346	1,046	3,393	5.5	3
Sri Lanka					
1965	2,464	540	3,005	8.2	9
1975	2,058	451	2,510	6.8	6
1985	1,424	312	1,736	4.7	3
1995	1,280	318	1,598	4.3	2
Pakistan					
1965	2,245	690	2,935	9.2	13
1975	1,057	411	1,468	4.6	6
1985	2,037	2,675	4,711	14.8	12
1995	2,131	2,638	4,769	15.0	11

Note: [a]For 1985, salary and benefits in 1990 are shown.
[b]Converted using exchange rate in 1995.
[c]Converted into rice equivalent using rice price in 1995.

In contrast, engineers in Sri Lanka and Pakistan in South Asia received nearly the same amount in 1965. Continuous decreases since then in the former and substantial increases since 1975 in the latter have resulted in a large income gap by 1995: at present, Sri Lankan engineers receive just one-third of what their Pakistani counterparts receive.

If compared in terms of rice equivalent, however, the picture becomes a bit different. The ordering of the countries from favorably to unfavorably remunerated is not altered over the years, except for Sri Lanka and Pakistan in 1965. But the compensation differentials between countries change. In particular, the gap between the Philippines and Sri Lanka becomes much less conspicuous, reflecting differences in the price of rice between the two countries. It should be noted that rice is the staple food in these two countries. It would be reasonable to assume that the actual differential between the two countries lies between these two series of estimates. The rice price is even lower in Pakistan than in Sri Lanka, such that the gap in compensation between Pakistan and the other two countries becomes larger. Wheat, not rice, is the major staple cereal in Pakistan, making rice equivalency a less-salient comparator for this country.

Figure 1. Junior engineers' annual salary and benefits, Philippines, Sri Lanka and Pakistan, 1965–1995, US$, 1995 constant prices, semi-log scale.



A salient feature of engineers' income in Pakistan is the large weight of benefits in the total compensation in recent years. If only basic salary is compared, the gaps in compensation become much less pronounced. In fact, the basic salary in 1995 was about the same level or slightly higher in the Philippines than in Pakistan. The facts that large benefits are given to engineers in particular and that their higher total compensation may suggest that some difference exists in the prestige the society gives to engineers between a semiarid country and countries in monsoonal Asia.

In this respect, it is interesting to compare the ratio of engineers' total compensation to the per capita GNP. To the extent that this ratio represents the prestige the society gives to irrigation engineers, its change over time would reveal the change in their social position. Three decades ago, engineers in the three countries enjoyed an almost equally high social status (figure 2); it was a respectable profession receiving a high remuneration. It is ironic to see that the social position of irrigation engineers in the Philippines and Sri Lanka, where rice is the staple food and self-sufficiency has been attained or nearly attained primarily because of the development of irrigation infrastructure, has dwindled dramatically in the last three decades. In semiarid Pakistan, engineers' social position declined sharply from 1965 to 1975, but it has improved since then.

Association with System Performance

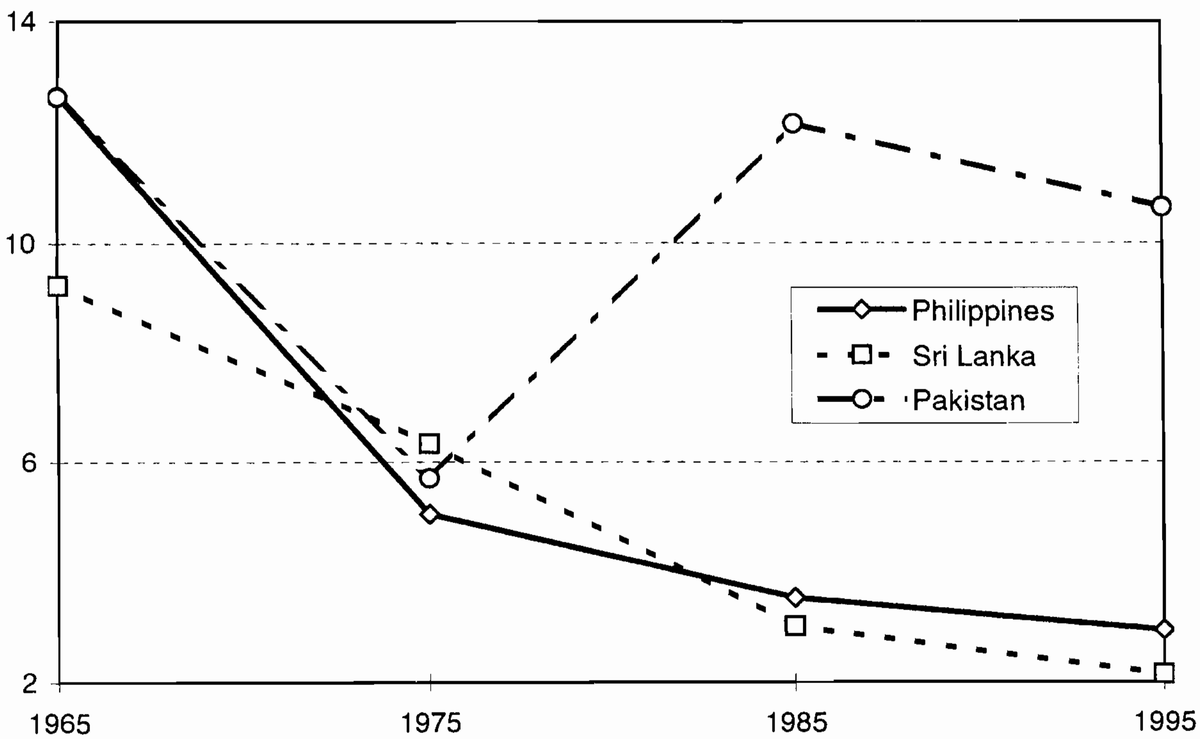
What is the relationship between the level of engineers' compensation and the performance of the agency, when the experiences in the three countries are put together? The 'performance' measures available commonly for the three countries are summarized in table 19, together with junior engineers' annual compensation in US dollars in 1995 prices.

Table 19. Junior engineers' annual compensation and some performance-related indices, Philippines, Sri Lanka and Pakistan.

	Junior engineers' annual compensation	Total budget	O&M Expenditure per ha [a]	Cropping intensity	Summary performance index
	US$1,000/year	(1)	(2)	(3)	(1)*(2)*(3)
Philippines					
1975	5.51	1.00	1.00	1.00	1.00
1985	4.00	0.47	0.66	0.98	0.31
1995	3.39	0.46	0.44	0.98	0.20
Sri Lanka					
1965	3.06	1.00	1.00	1.00	1.00
1975	2.55	0.73	1.53	0.84	0.94
1985	1.68	0.20	0.65	0.99	0.13
1995	1.53	0.40	0.55	0.90	0.20
Pakistan					
1965	2.93	1.00	1.00	1.00	1.00
1975	1.47	0.81	0.81	1.10	0.72
1985	4.71	1.33	1.33	1.42	2.50
1995	4.77	3.00	2.75	1.31	10.79

Note: [a]For Pakistan, budget per ha of irrigated crop area.

Figure 2. Ratio of junior engineers' salary and benefits to per capita GNP.



We reiterate the crudity of our measures of the performance of irrigation agencies, and we recognize it is even more hazardous to make inferences as to the causal relationship between agency performance and the level of engineers' compensation. The work morale, ethics and spirit of the engineering cadre of an irrigation agency certainly affect the performance of the agency and, *ceteris paribus*, higher compensation should lead to a stronger work ethic. Perhaps more important than the absolute level of compensation, the trend over time—whether positive or negative—is likely to have an important impact on motivation of staff. However, there are numerous factors that determine the performance of irrigation systems. Moreover, the level of engineers' compensation is not a sole determinant of the work spirit of the cadre. The performance indicators listed in the table, even if they represent some aspects ofagency performance, are mixed in nature. While cropping intensity is an 'outcome' or 'expost' measure of the agency performance, O&M intensity is a 'cause-related' or 'ex-ante' measure. The total budget of an agency may be related to the work spirit of the cadre, and therefore could be a factor that affects the performance, rather than its measure.

Recognizing all these limitations, let us examine the available performance indicators. For each country, data are available for four time points, except the Philippines for which data are presented only for the last three time points. With some irregularities, the trends of the three indicators are fairly concordant with one another, and show close association with the compensation trend in all three countries. In the Philippines and Sri Lanka, the declining level of compensation is associated with the declining level of performance, and the other way around for the period from 1975 to 1995 in Pakistan. It is worth observing that the phase characterized by large irrigation construction projects has already ceased for the NIA in the Philippines and for the ID in Sri Lanka, whereas the construction phase in Pakistan continued at least until recent years.

The degree of association between the level of compensation and performance is shown in figure 3 with the summary performance index constructed by multiplying three indicators. At a glance, a positive correlation between the level of compensation and performance is observed. Further scrutiny reveals that the data points of Sri Lanka and Pakistan are bunched together forming a group, while those of the Philippines, located outside the group, lie nearly on a straight line. It is interesting to see that the two South Asian countries, despite large differences in conditions that constrain the irrigation sector, lie in another straight line.[27] Figure 3 thus summarizes the experiences of the three countries as favoring the hypothesis that the level of engineers' compensation could be one of the determinants of systems performance.

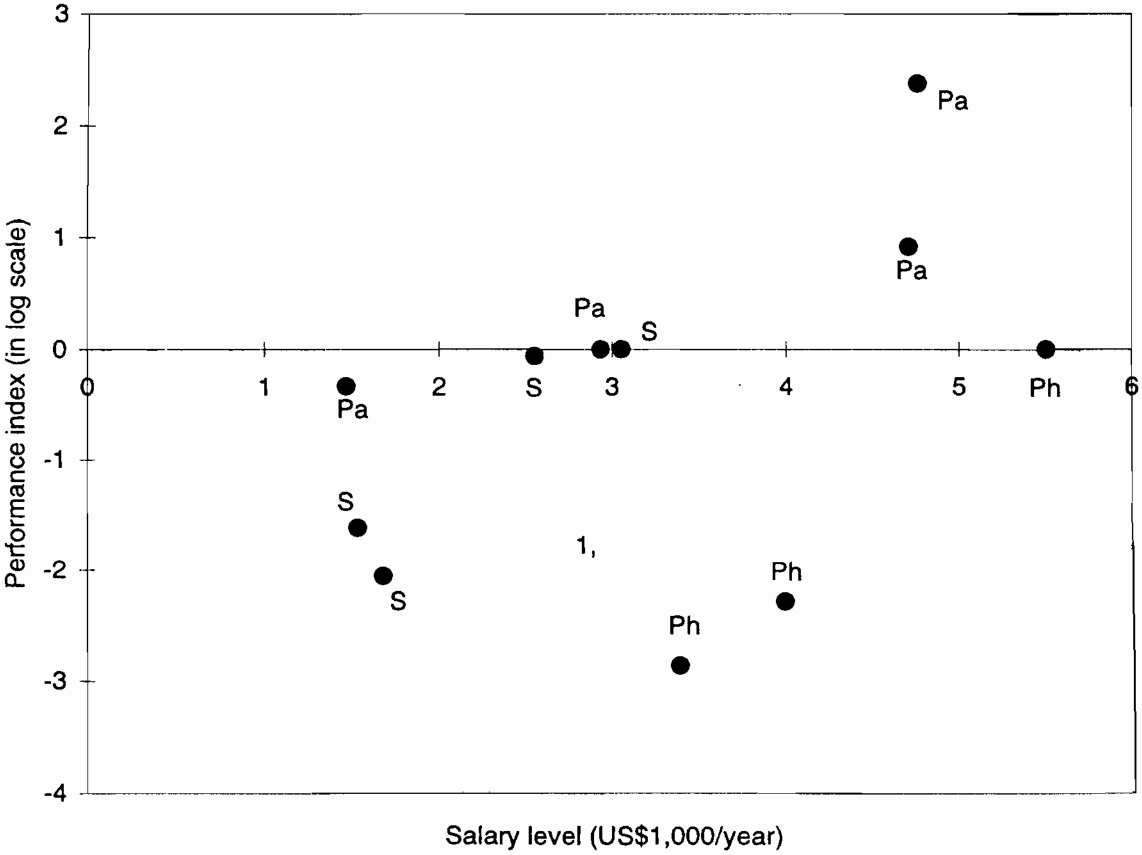
[27]The positive relationship between engineers' compensation and system performance can be confirmed statistically by fitting separate regression lines of semi-log form to each country using dummy variables for the Philippines and Sri Lanka:

$$\text{Ln } Y = -2.39 + 0.901\,X - 3.20\,D_{\text{Philippine}} - 0.53\,D_{\text{Sri Lanka}}$$
$$(-3.16)\quad(4.61)\quad(-6.03)\qquad(-1.01)\qquad R^2 = 0.871$$

where,

Y = summary performance index, X = annual compensation (US$1,000), D = dummy variables, R^2 = coefficient of determination, and the figures in parenthesis are t-ratios. The coefficients of annual compensation and the Philippines dummy are highly significant. A similar result is obtained if cropping intensity, the most 'objective' performance measure adopted in this study, is used as the dependent variable.

Figure 3. Correlation between junior engineers' salary level, and summary performance index, the Philippines, Sri Lanka and Pakistan.



CONCLUSIONS

We have examined changes over the last three decades in the compensation received by irrigation engineers in three irrigation agencies in three countries, i.e., the National Irrigation Administration of the Philippines, the Irrigation Department of Sri Lanka, and the Water and Power Development Authority of Pakistan. Special attention was given to the relationship between the level of engineers' compensation and the performance of the agencies. To the extent possible, we try to identify how irrigation engineers' compensation compares to the compensation of their counterparts in private firms and to the compensation other professionals receive, and how engineers are promoted to higher ranks in their agencies. We also try to assess changes in the social status of irrigation engineers over time.

In the Philippines and Sri Lanka, engineers' compensation has declined continuously, reaching in 1995 a level as low as one half of what they received in 1965. In contrast, Pakistani engineers have enjoyed a significant increase in their compensation since the mid-1970s.The social position of irrigation engineers in these countries has dwindled drastically, much more than the decline in compensation, in the last three decades. In the Philippines and Sri Lanka, the compensation of irrigation engineers is considerably less than that of engineers in private firms and other government agencies and universities.

Such a negative trend in engineers' compensation could have worked to discourage their work ethic and work incentive. This paper confirms that this oft-voiced fear is not groundless. There seems to be a strong positive correlation between the level of compensation and agency performance in all three countries. However, there are many intervening variables involved, making it difficult to establish a direct causal relationship. Such a relationship is certainly plausible.

An important observation from carrying out this study is that none of the agencies studied maintains adequate long-term records. This has severely hampered the implementation of this study. Future studies should use a wider variety of data sources, including interviews with older and even retired staff; and should put greater emphasis on analyzing the organizational culture, i.e., the values and performance orientation of staff.

In sum, we found support for all but one of our working hypotheses: the compensation of irrigation professionals is indeed low compared to that of other professionals, has declined over the past few decades, is based largely on initial qualifications and not on performance, and there is an apparent positive relationship between compensation trends, organizational performance, and irrigation performance. The hypothesis that compensation is lower in agencies dependent on government for their income than in agencies dependent on users for fees was not supported: NIA is partially dependent on users fees, but its compensation is also low.

Admittedly, our data are crude and our analysis falls far short of establishing a causal relationship between compensation and the performance. Our anecdotal evidence may not by itself be sufficient to support the strong statement that the compensation of irrigation professionals must be raised if the performance of both irrigation agencies and irrigation systems in developing countries is to be improved. We believe, however, that the findings in this paper make this view more plausible, taking us out of the realm of personal opinions. The findings are sufficiently strong to suggest that while more research would be useful, policy makers should strongly consider reforming the recruitment, promotion and compensation policies of public water-management agencies as one means to enhancing their performance.

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