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P E R U

IRRIGATION WATER CHARGES IN PERU

by

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IRRIGATION WATER CHARGES
IN PERU

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This paper will be presented in the Joint AID/FAO EXPERT CONSULTATION ON IRRIGATION WATER CHARGES to be held from September 22 - 26 , 1986, in Rome, Italy.

The outline of the paper limits itself strictly to the instructions of the meeting. It does not intend to analyze beyond that, even though the irrigation Water Charges Problems in Perú merit more analysis and explanation.

Thanks are expressed to the Agriculture Policy Analysis Group of the Ministry of Agriculture for their help and information provided.

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I. INTRODUCTION

1.1 Agriculture Potential and Relevance of Irrigation Developments.

Peru has a territory of 128 million Ha. with a potential arable land of 7.6 mill. Ha. or 6% of the national territory. Actual use is 2.7 mill. Ha. That is, an existing potential increase of 4.88 mill Ha. (Table 1).

Two regions with the best potential for additional land are the coast, with a potential of 876,000 Ha., and the jungle, with 4.160 mill Ha., together representing 85% of new land to be incorporated.

Also, Peru only uses 1% of its potential water resource (see Table N°2) . 2% from the Pacific Vertient, 97% from Atlantic and 1% from the Titicaca Vertient.

For a better understanding of the use of these resources may be had by studying the chart below, which shows existing water resource distribution in the 3 regions of Peru :

	<u>Coast</u>	<u>HighLand</u>	<u>Jungle</u>
- NATIONAL TERRITORY	10%	30%	60%
- NATIONAL AREA CULTIVATED	25%	50%	25 %
- REGIONAL AREA IRRIGATED	100%	20%	6 %
- NATIONAL POPULATION	50%	40%	10 %
- NATIONAL VALUE OF AGRICULTURE PRODUCTION	50%	25%	25 %
- REGIONAL LAND CULTIVATED	5.6 %	3.9 %	0.6 %
- REGIONAL POTENTIAL INCREASE OF LAND	2.1 Times	0	10.5 Times
- RELATION Ha/INHABITANTS	0.003	0.21	0.23

TABLE N°1

POTENCIAL AND ACTUAL USE OF AGRICULTURE LAND IN PERU

<u>REGION</u>	<u>TOTAL</u> <u>AREA</u> (Ha)	<u>ACTUAL</u> <u>USE</u> (Ha)	<u>POTENCIAL</u> <u>USE</u> (Ha)	<u>INCREMENT</u> (Ha)
COAST %	13'637,000	760,000 5.6	1'636,500 12	+ 876,000
HIGH LANDS %	39'198,000	1'517,000 3.9	1'361,000 3.5	- 156,000
JUNGLE %	75'686,560	440,000 0.6	4'600,000 6.1	+ 4'160,000
T O T A L %	128'521,560	2'717,000 2.1	7'597,000 5.9	+ 4'880,000

SOURCE : NATIONAL OFFICE OF NATURAL RESOURCES 1982.

TABLE N°2

POTENCIAL AND ACTUAL USE OF WATER IN PERU

	<u>TYPE OF USE</u>	<u>VOLUMEN</u> <u>USED</u> (MILL m ³)	<u>%</u>	<u>TOTAL</u> <u>VOLUMEN</u>	<u>RELATION</u> <u>USE/VOLUMEN</u>
NO RETURN	AGRICULTURE	14,054.99	91.9	-	-
	POPULATION	896.97	5.9	-	-
	MINERAL	113.99	0.8	-	-
	INDUSTRIAL	156.34	1.0	-	-
	CATTLE	70.63	0.4	-	-
	SUB TOTAL	15,292.93	100.0	-	-
RETURNABLE	ENERGETIC	6,929.42	100.0	-	-
	SUB TOTAL	6,929.42	100.0	-	-
	T O T A L	22,222.35		2'043,532.48	1.09

SOURCE : ONERN

The numbers show that the coastal region is important in : population concentration; high value of agriculture production; high level of irrigated land; very low person per Hectare ratio, high productivity of land and the high potential to double its area cultivated. The highlands are also important because of a high concentrated level of population; high level of cultivated land, but land with a low level of productivity; low proportions of irrigated land and low potential for increasing cultivated areas (Terraces). The jungle region is the area that shows the most potential in the long run. It has a low population concentration and a great capacity to increase the cultivated areas (10.5 Times).

In focusing our attention on the actual and potential irrigated land we must consider three aspects to evaluate the best way to increase agriculture production in the short run :

a) Cost and Financial Possibilities

The cost of irrigation considers incorporations of new land, the improvement of the water sistematization , and an evaluation of the irrigation projects (Zamora 1985) including 1'075,000 Ha., concluded in the cost of US\$ 900 per Ha. to US\$ 6,000 with an average of US\$ 2,500 in the coast.

The same study mentions that in the highlands with 9,000 Ha of irrigations projects analyzed concludes in US\$ 800 to US\$ 3,500 with an average of US\$ 1,300 per Ha. In the jungle considering the small irrigation projects of Huallaga Central concluded in US\$ 1,000 per Ha.

The cost of land recuperation in the coast (PLAN REHATIC) varies between US\$ 750 to US\$ 2,500 with an average of US\$ 1,600 per Ha. In the highlands (terraces recuperation) the cost is between US\$ 750 to 1,000 per Ha. (Masson 1985).

In addition to these cost alternatives to the critical financial needs of Peru, where the external debt problems leave small margin for public investment, we can understand why the present government is giving more priority to small and medium size irrigation schemes in the highlands instead of large irrigation projects in the coast

b) PRODUCTIVITY MARGIN

Peruvian agriculture is characterized by a low productivity level (Table N°3). The actual margin for increases with low cost of extension service offers the possibility to double the production in the coast as in the highlands.

c) WATER MANAGEMENT AND TECHNOLOGY

The coast of Peru only uses 25% of the total water runoff.

Water management and technology are in a critical situation due to low budgets in the irrigation districts and the very low cost of water charges.

Water management and technology improvement in the coast and highlands provide real sources for production increase in the short run. We can conclude that, in these times of financial scarcities, the policy of irrigation development is concentrated on small and medium irrigation schemes in the highland and on improving crop technology and water management and technology on the coast.

1.2 Agriculture Investment

In the last 10 years, agriculture investment represented 15% of the total public investment. These investments were highly concentrated on irrigation Projects (80%), especially on 4 projects on the coast (Table N°4) :

<u>Name</u>	<u>% Of Total Irrigation Investment</u>		
	<u>1981</u>	<u>1982</u>	<u>1983</u>
MAJES - SIHUAS	41.9	10.0	13.8
CHIRA - PIURA	23.0	34.2	19.4
JEQUETEPEQUE - ZANA	9.4	9.1	16.1
TINAJONES	7.8	5.1	3.0
TOTAL	82.1	58.4	52.3

TABLE N°3

POTENTIAL AND ACTUAL YIELDS OF MAIN IRRIGATION

PRODUCTS IN PERU

<u>CROP</u>	<u>NATIONAL AVERAGE</u> 1971 - 1982		<u>DEMOSTRATION FIELDS</u> (FARMERS)		<u>EXPERIMENTAL LEVEL</u>
	Kg/Ha	% Demostrated Yield	Kg/Ha	% Experimental Yield	Kg/Ha
RICE	4,336	68.3	6,349	70.4	9,060
WHITE CORN	1,007	40.6	2,481	31.0	8,000
YELLOW CORN	2,767	67.8	4,076	62.7	6,500
SORGUN	3,266	85.2	3,834	61.8	6,200
WHEAT	986	-	-	-	3,500
POTATOES	6,794	37.3	18,179	38.7	47,000
BEAN	837	-	-	-	1,300
SOYA	1,827	-	-	-	2,700
COTTON	1,729	-	-	-	2,927
SUGAR	193,587	-	-	-	234,000

SOURCE : INIPA 1,983.

TABLE N°4

AGRICULTURE PUBLIC INVESTMENT
(1000 U.S.\$)

<u>TYPE</u>	<u>PROYECTS</u>	<u>1,981</u>	<u>1,982</u>	<u>1,983</u>
LARGE SIZE PROYECTS	MAJES - SIHUAS	87,516	20,354	17,128
	CHIRA - PIURA	48,068	69,295	24,109
	JEQUETEPEQUE - ZANA	19,647	18,483	20,012
	TINAJONES	16,298	10,286	3,716
	OLMOS	1,280	430	805
	CHAVIMOCHIC	4,126	706	1,451
SMALL & MEDIUM SIZE PROYECTS	PLAN MERIS I	2,488	2,435	1,815
	PLAN MERIS II	806	2,076	1,702
	LINEA GLOBAL N°2	2,370	9,919	9,426
	PLAN REHATIC	4,503	11,598	6,415
	AFATER	592	365	216
	OTHERS	15,175	21,067	13,939
	JUNGLE PROYECTS CORPORATIONS	5,903	7,418	5,042
		-	28,135	18,563
T O T A L	208,772	202,567	24,339	

SOURCE : MINISTRY OF ECONOMY AND FINANCE, GENERAL DIRECTION OF INVESTMENTS

* Exchange Rate. : 1981 422 SOLES / US\$
 1982 698
 1983 1,682.3

These irrigation investments were also concentrated on large coast projects of long maturity periods instead of on small and medium sized projects, with low cost and short maturity periods.

<u>Size</u>	<u>% Of Total Irrigation Investment</u>		
	<u>1981</u>	<u>1982</u>	<u>1983</u>
Large Coast Projects	84.7	59.0	54
Small & Medium	5.2	13.0	15.9

The actual tendency is not only toward small and medium size irrigation, (increased from 5% in 1981 to 16% in 1983) , but also toward non-irrigation investments, such as : research & development, soil conservation, rural settlements, trade, etc.

<u>YEAR</u>	<u>IRRIGATION</u>	<u>NON IRRIGATION</u>
	%	%
1975	93.9	6.1
1976	88.5	11.5
1977	91.5	8.5
1978	85.6	14.4
1979	85.3	14.7
1980	77.5	22.5
1981	84.3	15.7
1982	68.9	31.1
1983*	65.0	35.0

SOURCE : " PERU : EL. Agro en Cifras " Universidad El Pacífico

* Estimated.

1.3 Crop Pattern under irrigation agriculture

The predominant crops under irrigated lands of the Coast are:

- Rice
- White Corn
- Yellow Corn
- Sugar Cane
- Fruit
- Vegetables
- Sorgoun
- Soya
- Beans

In the highlands we have:

- Potatoes
- Wheat
- White Corn
- Barley

1.4 Future Irrigation Plans

A National Irrigation Plan is under preparation, to be conducted by the National Institute to Increase The Agriculture Frontier (INAF) with the participation of the Agriculture Office of Planning (OSPA) and the Agricultural Policy Analysis Group (GAPA) .

The priorities are :

1. To concentrate the financial resources on small and medium size projects in the highlands where most of the rural people live, and where the projects have a high return with a short maturity time.
2. To finish the present stages in which large projects on the coast are involved, but not to continue the projects under the traditional standards.

- 3) To give increased importance to improving and maintaining the irrigation infrastructure and to improving water management and technology.

Under these bases , the expectations of the government for the future increase of land from the projects under way are :

<u>INSTITUTION</u>	<u>TOTAL INCREASE 1986 - 1990</u>	
	(Ha)	
	<u>IMPROVE LAND</u>	<u>NEW LAND</u>
<u>National Institute to Increase</u>		
<u>Agriculture Frontier</u>		
- Plan Meris I	680	130
- Plan Meris II	1,983	2,347
- Línea Global 2	14,360	12,315
- Plan Rehatic I	2,827	-----
- Plan Rehatic II	-----	-----
- AFATER	18,502	-----
<u>Agriculture Sectorial Program</u>	7,577	7,020
<u>National Institute of Development</u>		
- Majes	-----	20,000
- Tinajones	12,000	-----
- Jequetepeque - Zaña	30,000	13,400
- Chira - Piura	-----	-----
- Chavimochic	-----	-----
- Chinecas	-----	-----
- Olmos	-----	1,200
- Sierra - Centro - Sur	18,429	-----
- Puyango - Tumbes	2,500	6,500
TOTAL	114,858	62,912

II. ACTUAL POLICIES REGARDING THE RECOVERY OF IRRIGATION INVESTMENTS IN PUBLIC IRRIGATION SCHEMES

2.1 Definition of Public Investment in Irrigation :

An irrigation scheme is considered a public investment when it is conducted by :

- 1) The National Institute to Increase Agriculture Frontier , which specializes in small and medium size irrigation projects. They also conduct the preliminary studies of large projects.
- 2) The National Institute of Development, wich specializes in the construction of Large Projects.
- 3) The Agriculture Sectorial Special Project, which specializes in small projects.
- 4) The Corporation of Development, dedicated to small projects and emergency investments.

2.2 Actual Policy Applied in the Recovery of Investment

In Peru there is no National Policy for Public Investment Recuperation as a whole, but specifically for irrigation investments the actual policy is based on the General Law of Water D.L. 17752 July 24, 1969, in which all water users have to pay per volume unit in order to finance the operations and maintenance of the irrigation district. Also, all beneficiaries of public works have to pay back to the government in conditions established for each specific case. The regulation of Tariffs D.S. 683-72-AG , August 2, 1972 mentions three components : Use, Service and Amortization. The last component is the one applied for recuperating public investment and was totally calculated by the government. These regulation was very specific in the methodology to calculate the amortizations:

- 1) Net cost excluded of financial expenses and interest.
- 2) Time of payment determined in each case depending on the return and useful life of the infraestructure
- 3) Annual Payments actualize by a " Factor "

If the government does not calculate the amortization by the time it was specified by the law the value will be 10% of the first component. Also in this tariff regulation there was no farmers' participation and the total income went to the government treasure.

On July 10, 1981 a New Tariff Regulation changed the components:

- 1) Users Group Income
- 2) Canon
- 3) Amortization.

But, in this instance there is no specification for amortization. It is only mentioned that the value is 10% of "Users Group Income" Component if there are no government calculations.

In conclusion, we see that the actual policy for public investment recuperation is the "symbolic" payment of 10% of the "Users Income" component which is also symbolic due to the reduced level with no relation with the actual needs in the irrigation district.

2.3 Effectiveness of the Method Applied

In spite of the years gone by, Peruvian farmers are not prepared for real values of amortization. Post Agrarian Reform years, draughts, flood periods, and negative terms of trade, made the farming business difficult even with the negative margins and losses. From 1975 to 1983 agriculture suffered under these circumstances and then it was difficult to apply a sound policy of public investment recuperation. In addition to this there was the government crisis: reduced budgets, low personnel salaries and the exodus of technical talent the consequence were: no up-dated amortization calculations and ineffective measures to recuperate public investment.

Recently, as a result of government policy oriented towards improving the terms of trade and the farming business, has been possible to initiate a new policy with real values for the amortization componen

2.4 Direct Subsidies Applied to Different Kinds of Irrigation Works and Government Financial Contribution in the Development of tertiary Canals and on Farm Works

Both Large Coastal Irrigation Projects and for Small Projects in the Sierra, direct Government subsidy was the only way for construction and rural development. The San Lorenzo Irrigation, Chira - Piura, Tinajones, Majes - Siguas, or Chili Irrigations together with all small projects of Plan Meris I and Linea Global II are all clear examples of the government as the direct investor, to date farmers are reluctant to repay. Table 5 shows the real subsidies on Chancay - Lambayeque Valley due to the difference between the nominal tariff ($0.00030 \$ m^3$) versus the real tariff ($0.0032 \$ m^3$) (Sarria & Zavaleta 1985).

Farmers accept participating in the development of tertiary canals and on farm works where a traditional quota exists to face these kinds of investments. Sierra communities are used for these projects works which have their own systems for working it out.

Government financial contribution occurs in emergency cases where the Regional Development Corporation receives special funds to finance these special situations. In 1983, the northern coastal region suffered from a destructive flood. Government financial participation was significant in this instance.

2.5 Deficiencies of the Actual System and Plans for Changes

The main deficiencies of the actual system are (Sarria 1984) :

- 1) Lack of government decision to enforce the Water Law, in any or all of its aspects.
- 2) Lack of government investment recuperation policy to be applied in the amortization calculations, as stipulated by the Water Law.
- 3) The reduced budget in the Tariff Office of the General Board of Water, Soil and Irrigation where there is no technical capability to follow the amortization policy.

TABLE Nº 5

GOVERNMENT SUBSIDIES ESTIMATES IN THE WATER COST
FOR THE CHANCAY - LAMBAYEQUE - VALLEY
(1984 - 1985 CAMPAIGN)*

PRODUCT	PRODUCTION COST (US\$/Ha)	NºHas. VALLEY (Ha)	WATER NEEDS (m ³)	WATER COST PER Ha ¹⁾ (US \$)	% OF TOTAL COST	TOTAL REAL COST WATER (US\$)	ACTUAL COST ²⁾ (US\$)	TOTAL OF SUBSIDIES (US\$)
RICE	395.2	38,479	16,000	51.2	12.9	1'970,124	184,699	1'785,424
COTTON	276.4	386	8,500	27.2	9.8	10,499	984	9,514
ALFALFA	444.9	2,340	12,000	38.4	8.6	89,856	8,420	81,432
SUGAR CANE	215.0	28,827	20,000	64.0	29.7	1'844,928	172,962	1'671,966
SWEET POTATO	195.1	111	4,500	14.4	7.3	1,598	149.8	1,448
WHITE BEANS	147.5	254	6,000	19.2	13.2	1,876	457	1,418
MQUEGUA BEANS	132.9	256	6,000	19.2	11.0	4,915	460	4,454
FRUITS	348.3	193	10,600	33.9	9.7	6,542	613	5,928
VEGETABLES	312.0	1,045	7,600	24.3	7.7	25,393	2,382	23,010
WHITE CORN	138.3	748	7,200	23.0	16.6	17,204	1,615	15,588
YELLOW CORN	170.2	2,599	8,100	25.9	15.2	67,314	6,315	60,998
FORAGE SORGUN	415.6	58	12,000	38.4	9.2	2,227	208	2,018
GRAIN SORGUN	226.6	159	7,200	23.0	10.1	3,627	343	3,283
SOYA	139.1	24	6,000	19.2	13.8	460	43	416
YUCA	196.4	305	11,500	36.8	18.7	11,224	1,052	10,171
						T o t a l		3'677,068

* Exchange Rate 6,583 Soles per US\$

1) Water Tarif 0.0032 US\$ per m³

2) Water Tarif 0.00030 US\$ per m³

- 4) Lack of government decisions to punish farmers who do not follow the payment conditions.
- 5) Lack of farmers awareness and acceptance of the need for public investment recuperation.
- 6) Bad experiences of the Users Group in the management of the Tarif Funds and farmer training

At this time, the government is trying to design a new tariff legislation where a clear methodology is fixed for indicating :

- Who the direct beneficiary is
- What the net recuperated investment is
- When to initiate payments
- How long farmer must pay

III. ACTUAL POLICIES REGARDING THE FINANCING OF IRRIGATION INVESTMENT IN PRIVATE SCHEMES

3.1 Definition of Private Irrigation

Water for agriculture is owned by the State . All users must be registered in each Irrigation District and must present their crop plans each year.

The Water Law (1969) stipulates that any private initiative to work on desertic land requires a Licence for developing a private irrigation scheme.

Private initiatives could be on any kind of irrigation works : canal, constructions, pumping system developments, etc.

In 1982 the government created the " Private Integral Development Project " (PRIDI) to organize and finance through the Agrarian Bank all private initiative for developments agricultural projects on desertic lands, Supreme Decree N°019-84-AG has regulated private irrigation schemes since April 10, 1984 , for development projects a minimum of 100 Ha to a maximum of 50,000 Ha. In July 26, 1984 by Supreme Decree N°068-84 AG, the government lays out the economic and financial conditions to develop these projects.

3.2 Actual Financial Policies to Incentivate Irrigation Investments

Due to national financial problems in the last two years, the Agrarian Bank has not been able to create the funds specially applied to " PRIDI " projects. However, any private initiative could also apply to Agrarian Bank funds for capitalization under terms and conditions that vary with the crop and with the flows of income and expenses. The private initiative could include :

- a) pumps, canals, machinery, rural constructions, etc.
- b) cropping costs.

There are " Integral Project Credit Basis " and are conditioned to land owners who plan to work their land (not sell or rent). The actual carrying out depends on water availability.

1. Capitalization Credit Policy : (Long Term)

- Beneficiaries : Individual farmer
Farmer Association
Cooperatives
Water users' Group
- Time of Payment : From 7 to 10 years .
Program BID 125/IC-PE considers 15 years
- Grace Period : From 2 to 4 years
- Interest Rate : Coast 48% of effective rate
Sierra or Jungle 28% of effective rate
Emergency areas 13% of effective rate
- Equity relation : From 5% to 20% Borrowers
From 95 % to 80% Bank

2. Cropping Cost Credit Policy : (Short Term)

- Time of payment : Depends on type of crop
From 6 to 18 month
- Grace period : None
- Interest Rate : Coast Food 22.9 % effective rate
Nonfood 40 % effective rate

TABLE N°6

" PRIDI " PROJECTS UNDER EXECUTION

AGRARIA REGION	RESERVED	NUMBER OF PROJECTS	AREA ADJUDICATED (Hás.)			CROPS TO BE IMPLEMENTED	ACTUAL INVESTMENT US\$	TOTAL PROJECT COST (MILLION US\$)	EXPECTED LIFE OF THE PROJECTS (YEARS)
			TOTAL	TO BE INCORPORATED	IN PRODUCTION				
II. PIURA	OASIS - PIURA	01	175.00	175.00	-	COTTON-LEMON BEANS	3,134.2	2,057	25
	LA CABAÑA	13	2,032.34	2,032.34	PECUARIA	POULTRY PROCESSING	2,405	95.6	12
III. LAMBAYEQUE	LA CABAÑA	03	817.80	817.80	PECUARIA	POULTRY PROCESSING	14,997	2,059	10
IV. LA LIBERTAD	LA CABAÑA	05	1,300.26	1,300.26	PECUARIA	POULTRY PROCESSING	1,105	61.2	10
VII. ICA	PAMPA CALIFORNIA	01	2,442.00	440.00	-	FRUITS , COTTON , POTATOES AND ESPARRAGUS	7,180	39.2	20
	PAMPAS DE VILLACURI	21	7,600.09	5,604.41	300.00		52,238	158.3	18
	SANTA FE DE LANCHAS	01	225.5	225.5	-		3,317	2.5	18
	CHACARILLA EL SAPO	01	994.36	944.36	20.00		4,603	2.05	06
VIII. AREQUIPA	SECOCHA - URASQUI	01	1,500.00	1,500.00		RICE - BEANS	9,244	41.9	25
TOTAL		47	17,037.35	13,039.65	320.00		97,630	2,545.00	

* JULY 1, 1986.

The annual budget for O & M is prepared by the Users Group together with the Technical Administrator who is the government official in charge of water management of the Irrigation District.

The main components of the O & M calculations are :

1. Management and Water distribution cost
2. Water charge administrative cost
3. Users Group administrative cost
4. Hydraulic Studies cost for superficial or underground water
5. Conservation of irrigation and drainage infrastructure
6. Reserve Funds for emergencies.

The Tarif Regulation mentions that 90% of the O & M budget is involved in these cost items. The remaining 10% is used to study the basin of a river. The Users Group General Assembly have to approve the budget and send it to the Regional Director for Final Tarif Calculation. The water legislation is clear in pointing out that this component of water cost must not be higher than 5% of production cost of the least profitable crop.

Dams O & M cost are supposed to be included on " Management and Water Distribution Cost " and " Conservation of Irrigation and Drainage Infrastructure " However since large irrigation schemes are under " Autonomous Authorities " they are in charge of the maintenance of the irrigation infrastructure which is partially financed by the Water Tarif and by a Special Quota .

4.2 Government Contribution to O & M Expenditures

As mentioned previously, in recent years farmers' conditions have created the need for constant government contributions for the maintenance of their irrigation infrastructure, either by National Agriculture Sector Budget directed to Irrigation Districts, or by the emergency funds as was the case of the Reconstruction Bonds applied to the Northern Floods in 1983.

Government contributions have been increasing from 1981 - 1983, due to the decreasing collection charges from tariff this has also been the tendency through 1984 and 1985.

NOMINAL VALUES (Million US\$)	TARIF CHARGES	GOVERNMENT CONTRIBUTION	TOTAL	
	(1)	(2)	(3)	(2/3)
1,981	2.22	3.085	5.37	57%
1,982	1.50	2.93	4.43	66%
1,983 *	0.50	1.38	1.88	73%

SOURCE : Programa Sectorial Agropecuario

* Estimates by DGASI

4.3 Comparison of Actual O & M Expenditures with those actually Required Tinajones Case

One of the most important characteristics of present irrigation systems is the considerable difference between actual O & M expenditures and the real required costs.

The inflation rate and the small increases in the budget were ingredients for this situation. The consequence of this deficiency is poor conditions in most of the irrigation infrastructure.

I will mention the Tinajones Case where the maintenance situation is not as bad as the rest of the systems.

EMTECO, a private technical conservation enterprise, is in charge of these works.

In 1985 , the Irrigation District of Chancay-Lambayeque had a tarif of 0.0002 US\$ / m³ but the SARRIA - ALIAGA - ZAVALETA-VILLAR Study concluded that the real components of the tarif were :

USERS GROUP INCOME (O & M)....	517,000 US\$
CANON	51,700 US\$
AMORTIZATION	1'752,000 US\$
	<hr/>
T O T A L	2'320,700 US\$
	=====

Considering 1,079 million m³/year gives us a tarif of 0.002 US\$ which explains the difference of actual budget for O & M with real expenses, where only 10% of real need is collected.

- 4.4 Method of Collection of O & M charges Are the O & M charges collected separately from cost recovery ? If the charges are collected by the National Administration, how are they reallocated to irrigation schemes ? How are they reallocated to support staff at central provincial and Project levels ?

The water Tarif Regulation mentions that water charges payments have to be made in the Technical Administration Office at the Irrigation District where special personnel is in charge of the collection, bank deposits and general accounting. (Art. 15).

Each Irrigation District chooses the frequency of payment. There are two alternatives : Cash Payments , in which farmers have to pay in advance to get their irrigation order, and Monthly Payments , in which farmers have to pay the last month's water received in order to be able to receive water the following month. (Art.18)

In actual practice , farmers pay on a yearly basis and upon issue of the invoice by the technical Administration Office.

There is a delay in the payments, but there are no penalties for this. The Tarif Regulation mentions that if the farmer uses water without making a tarif payment , he is obliged to pay a fine which runs from 0.37 US\$ to 10US\$. (Art. 38)

Delay in payments is the reason for liquidity problems and lack of O & M expenses. Since the tarif is the result of O & M expenses and capital recovery cost, both are collected together at the same time.

But when charges are collected, the funds are deposit in different bank accounts : the funds collected for O & M from the " Users' Group Income " component of tarif go to the Agrarian Bank to an account named " Users' Group of the Irrigation District of"

The funds collected from capital recovery or " amortization " and " canon " go to the Bank of the Nation to an account named " Users' Service " (Art.19)

The funds collected in these ways are used as follows :

- a) The bank account " Users' Group of the Irrigation District of" has to be administrated by the water users' group for specific purposes, as was mentioned before; 90 % of O & M and 10 % for river basin studies.

Thus it is clear how the funds collected by a National Administration Office go back to the irrigation district where the funds were collected.

- b) The bank account "Users' Service " is used by the Public Treasury Office in new investments.

Central level staff receive no support from tarif collection funds. They are paid by the State Agrarian Sector Budget and follow the National Budget rules and limitations. Provincial level staff are in the same situation. At the project level the Special Autonomous Authority have their own budget which has nothing to do with tarif collection funds.

Only the personnel in charge of tarif collection, bank deposits and accounting are paid by tarif funds from the " Users' Group Income " account and they work for the Technical Administrator Office.

4.5 Compare the O & M Cost for Irrigation Schemes with High Investments per Hectare with Those of Low Cost. Compare also O & M Cost of Gravity Schemes With Those Needing Pumping

Let us analyze the data comparing one example for each type of irrigation:

HIGH INVESTMENT : CHILI IRRIGATION DISTRICT *

a) O & M BUDGET FOR AREQUIPA USERS GROUP **

YEAR	AMOUNT	HA.	US\$/HA
1983	92,629 US\$	10,644	8.7
1984***	63,882 US\$	10,644	6.0
1985***	29,824 US\$	10,644	2.8

* Study made by the Agricultural Sectorial Program DGSI 1,983

** Average Exchange Rate: 1983 1,683 soles/US\$

1984 3,730 soles/US\$

1985 11,364 soles/US\$

*** Projected

b) O & M BUDGET FOR LA JOYA USERS GROUP

YEAR	AMOUNT	Ha.	US\$ / HA.
1983	349,975 US\$	12,370	28.2
1984	222,468 US\$	12,370	17.9
1985	106,818 US\$	12,370	8.6

c) O & M BUDGET FOR SIHUAS USERS GROUP

YEAR	AMOUNT	Ha.	US\$ / HA
1983	79,551 US\$	838	94.9
1984	50,288 US\$	838	60.0
1985	36,348 US\$	838	43.3

II. LOW INVESTMENT : PLAN MERIS I (1983)

a) LA HUAYCHA PROJECT : 540 Ha (Medium)

Characteristics

Main canal	7 Km
Lateral canal	6 Km
Art Works	47 Km
Drainage	7 Km

TOTAL O & M EXPENSES	1,183	US\$
TOTAL O & M EXPENSES PER HA	2.19	US\$

b) GRANJA PORCON PROJECT : 190 Ha. (Small)

Characteristics

Main Canal	9 Km
Lateral Canals	4 Km
Art Works	34 Km

TOTAL O & M EXPENSES 487 US\$
 TOTAL O & M EXPENSES PER HA..... 2.5 US\$

c) CARAHUANGA PROJECT : 970 Ha (large)

Characteristics

Main Canal 12 Km
 Lateral 17 Km
 Art Works 50

TOTAL O & M EXPENSES 5,830 US\$
 TOTAL O & M EXPENSES PER HA.....: 6.0US\$

III. PUMPING SYSTEM COST

There is not an specific study on O & M Expenditures for Pumping Irrigations. However, the data for Moche Irrigation from the AFATER Project (Increase of Agricultural Frontier Through Irrigation Techniques) could be used to determine some coefficients to make comparisons possible.

WELL N°	OPERATION COST*		MAINTENANCE COST		TOTAL O & M		
	Total \$	\$/m ³	Total \$	\$/m ³	Total \$	\$/m ³	\$/Ha**
p-3	8,200	0.028	938	0.0028	9,138	0.030	300
p-4	8,100	0.028	969	0.0028	9,069	0.030	300
p-5	23,500	0.023	1,677	0.0021	25,177	0.022	220
p-6	13,300	0.020	1,036	0.0014	14,336	0.024	240
p-7	28,000	0.023	1,677	0.0014	44,013	0.024	240
p-8	7,900	0.022	988	0.0028	8,888	0.024	240
p-9	8,200	0.020	941	0.0021	9,141	0.024	240
p-10	8,600	0.028	938	0.0028	9,538	0.030	300
p-11	13,200	0.018	1,052	0.0021	23,790	0.028	280
p-12	8,200	0.016	957	0.0014	9,157	0.017	170
p-13	6,900	0.043	723	0.0043	7,623	0.047	470

* Exchange Rate 13,977 Dic 1985

** Assume 10,000 m³/ Ha average for Coast ...

We can draw some conclusions from the numbers shown:

1. High Investment irrigation has an O & M expenditure of around 20 to 17 US\$ per Hectare / year.
2. Low investment irrigation is around 5 US\$ per Hectare/year
3. Pumping irrigation systems have an expensive O & M cost of around 240 US\$ per Hectare / year
4. The difference between O & M of High Cost with Low Cost is understandable because of the sophisticated system of canals reservoirs and drainage.
5. Gravity schemes are considerably cheaper than pumping because of equipment and fuel cost savings as well as the fact that they last considerably longer than mechanical systems which periodically break down and require repairs.

4.6 FARMERS PARTICIPATION

Through the years, Peruvian water legislation has progressively changed from being state oriented to becoming more farmer-participation oriented.

The water Law of 1969 and tarif regulation of 1972 had no farmers' participation at all on O & M decision . In 1979, the Water Users' Group was created and the New 1981 Tarif Regulation gave farmers the administration of the " Users' Group Income " funds from tarif collection thereby giving them responsibility for O & M budgeting and expenditures, as well as for technical administration.

Today all Water Legislation for evaluating farmers' performance of these responsibilities is undergoing revision.

V. CONCLUSION AND RECOMMENDATIONS

1. There is a potential for increased Agriculture production that can come from installing new cultivated land or by -- improving already existing crop and water technologies
2. The Government of Peru is in critical financial condition due to external debt problems and balance of trade difficulties.
3. There is no national policy for public investment recuperation. In the specific case of public irrigation investment, the tariff regulation stipulates an amortization tariff component to recover public investment. However there are no policy guidelines for making calculations.
Past experience shows that the use of this " amortization " tariff component did not obtain the desired objectives.
4. The PRIDI Project is a public organization dedicated to the development of private irrigation schemes. The Agrarian Bank does not have the necessary funds to develop the PRIDI projects, nonetheless it offers capitalization funds for irrigation projects under conditions that are not so convenient to farmers.
5. Water management in Peru is in a state of crisis. O & M expenditures are far below those actually required. Tariff collection is slow and late. The tariff rates are out of date.
6. O & M cost per hectare of low cost irrigation schemes are much lower than high cost investment irrigation and pumping systems. Gravity irrigation O & M expenses are lower than the irrigation system which need pumping. A reduction in fuel prices can change this situation.

RECOMENDATIONS

1. The Government must dedicate public agriculture investments to small and medium sized irrigation schemes in the highlands. They should also improve crop and water technologies.
2. The Government must establish a short run public investment recuperation policy .
3. The tariff regulation has to be updated to include clear policies for irrigation public investment recuperation and to allow for calculating amortization tariff components.

4. The Government must give priority to private irrigation investment by supplying funds to the Agrarian Bank and thereby permitting the development of PRIDI Projects.
5. Technical studies to support and promote private , commercially viable, irrigated agriculture in the coastal region should be undertaken by PRIDI. Commercial Farming by the private sector should be supported by government.
6. The Government must initiate a dynamic policy toward the optimization of water use in agriculture
 - Water charges collection must be up-dated
 - Tarif must be up-dated
 - On - farm water management training should receive greater emphasis by INIPA (National Institute for Agriculture Research and Extension)
7. Last, but not least, the government must reorganize its institutions and update its water laws to be able to face the challenges of the future.

APPENDIX N° 1

ACTUAL WATER CHARGES APPLIED
TO SOME REGIONS OF THE COUNTRY
1980 - 1985
(US\$ PER 1000 m³)

IRRIGACION DISTRICT	1980	1981	1982	1983	1984	1985
SAN LORENZO	0.83	0.56	1.72	1.96	0.88	0.67
ALTO PIURA	0.50	0.36	0.94	0.39	0.29	0.096
MOTUPE	0.50	0.35	0.28	0.23	0.26	—
LA LECHE	0.50	0.35	0.28	0.11	0.13	—
CHANCAY - IAMBAYEQUE	0.83	0.56	0.35	0.59	0.53	0.21
ZANA	0.50	0.35	0.71	0.29	0.13	—
JEQUETEPEQUE	0.50	0.35	0.35	0.17	0.26	0.10
CHICAMA	0.50	0.35	0.21	0.14	0.10	—
MOCHE	0.50	0.67	0.57	3.57	0.41	—
SANTA	0.83	0.56	1.00	0.41	0.26	0.10
CASMA	0.50	0.36	0.45	0.19	0.10	—
HUAPMEY	0.50	0.36	0.40	0.16	0.40	0.07
BARRANCA	0.83	0.56	0.50	0.20	0.32	0.39
HUAURA	0.83	0.56	0.50	0.20	0.35	0.10
CHANCAY - HUARAL	0.83	0.56	0.64	0.26	0.46	—
CHILLON	0.83	0.67	1.10	0.45	0.46	0.14
RIMAC	0.83	0.67	0.64	0.26	0.44	0.14
LURIN	0.50	0.49	1.10	0.45	0.51	0.16
MALA	0.50	0.42	0.74	0.30	0.89	0.28
CANETE	0.83	0.67	0.50	0.41	0.18	0.21
CHINCHA	0.50	3.50	0.71	2.05	2.06	—
OCONA	0.33	0.90	0.57	0.98	0.44	0.34
CHILI	0.83	0.56	0.68	0.24	0.10	0.13
CAJAMARCA	0.33	0.45	0.28	0.25	0.10	0.37
ABANCAY	0.33	0.22	0.64	0.46	0.31	0.39

*Average exchange rates: 1980...300 1981...442 1982...698 1983...1,682 1984...3,730 1985...11,364
S/. per US\$

APPENDIX N° 2

PRODUCTION COST AND REVENUES
OF THE MAIN CROPS IN PIURA VALLEY
 (US\$/Ha)¹

COST ITEMS	COTTON	RICE	YELLOW CORN	GRAIN SORGUN
LABOR	241.8	296.7	107.8	55.0
MACHINERY	114.0	183.3	118.0	118.6
ANIMAL TRACTION	5.9	—	—	—
SEED	15.1	26.4	25.9	52.1
TRANSPORTATION	15.5	31.2	28.9	4.2
WATER	2.2	5.16	1.7	17.7
FERTILIZER	64.8	97.2	57.0	52.9
CHEMICALS	163.2	14.2	58.1	66.1
PACKING	18.8	5.5	—	—
SUB-TOTAL	641.3	659.6	397.4	366.6
ADMINISTRATIVE COST	90.5	68.0	37.5	32.9
FINANCIAL COST	199.7	183.6	76.0	53.3
SOCIAL BENEFITS	113.1	149.6	52.1	26.6
OTHERS	37.7	40.4	19.8	18.3
TOTAL FARM COST	1,082.3	1,101.2	582.8	497.7
PRODUCTION KG/Ha	11.0	5,500.0	3,500.0	4,500.0
FARM PRICE US\$/Kg	146.4	0.23	0.21	0.19
VALUE OF PRODUCTION	1,610.0	1,265.0	735.0	855.0
NET INCOME	532.7	163.8	152.2	357.3

Source : NATIONAL INSTITUTE FOR RESEARCH AND EXTENTION

- 1) EXCHANGE RATE 13.5 SOLES PER US\$
- 2) COST ARE FOR MARCH 1986.- COTTON, CORN, RICE AND SORGUN ARE IMPORTANT CROPS IN COASTAL IRRIGATED LANDS
- 3) COTTON PRODUCTION ARE IN "CARGA" PER Ha

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