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THE IMPACT OF TWO COMMUNAL IRRIGATION PROJECTS IN THE PHILIPPINES

by

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ABSTRACT

The economic impact of two communal irrigation projects in the Philippines is assessed. One of the projects is a small-scale communal gravity system while the other is a communal pump system. It is shown that the benefits of both projects appear to substantially outweigh the projets' cost. In addition, both projects mobilize low opportunity cost resources (primarily labor) so that small rice farmers are able to grow two crops of rice per year instead of one. Although both of the projects appear to be profitable from a societal benefit-cost viewpoint, some of the project farmers do not necessarily gain that much. Institutional factors such as land tenure and credit affect the returns to individual farmers in both systems.

THE IMPACT OF TWO COMMUNAL IRRIGATION PROJECTS IN THE PHILIPPINES

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Irrigation development has become a major component of the agricultural modernization program in the Philippines. The National Irrigation Administration (NIA)-- the lead agency for irrigation development--plans to irrigate an additional 1,574,550 hectares and improve irrigation on 291,000 hectares during the next ten years (National Irrigation Administration, 1978, pp. 7-8). In 1977 only 1,227,114 hectares of land were irrigated (Ongkingco and Galvez, 1979, p. 8). The prospective expansion in irrigated land should contribute significantly to agricultural development and economic growth (International Labour Office, 1974 and Asian Development Bank, 1978).

The Government of the Philippines invests in both large-scale (national) systems and small-scale (communal) systems. The National Irrigation Administration estimates that their 114 national systems irrigate 466,092 hectares while 5,180 communal systems irrigate an additional 610,680 hectares (Ongkingco and Galvez, 1979, p. 8).

During the past decade the national systems received

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the primary attention of decision-makers and irrigation planners. During this period, the international lending institutions tended to support large-scale systems also. Now, the smaller systems are receiving quite a bit of attention as well. The Government of the Philippines plans to spend ₱700 million during NIA's current five year plan period (1979-1983) to create and improve community gravity systems (Bagadion and Korten, 1979, p.8). In addition, the Philippine Government with support from the United States Agency for International Development has started a substantial program to develop communal pump systems. The pump system development program is being handled by the Farm Systems Development Corporation (FSDC)---a sister agency to the National Irrigation Administration.

There are an increasing number of studies on the economics of irrigation as well (Kikuchi, Dozina, and Hayami 1978; Hayami and Kikuchi, 1978). Case studies on the impact of specific projects though are still relatively scarce. Thus, there is a need to examine specific projects to see whether they are contributing to the well-being of the nation as well as to the welfare of farmers and communities. This paper will specifically examine two communal irrigation systems which are located in the Province of Bulacan.

After a brief statement on the data collection process, the benefit-cost approach that will be used to estimate the projects' impact on national economic development will be outlined. Then, both projects will be reviewed and analyzed in terms of their contribution to national economic development. In a following section some of the distributional or equity aspects of the two projects will be discussed. Some suggestions and issues for improving project returns and increasing the benefits to poor farmers will be made in a concluding section.

Data

Construction cost data was provided by the National Irrigation Administration's Region 3 office in Bulacan and by the Farm Systems Development Corporation's central office in Manila. Data on operation and maintenance costs were obtained from the irrigation associations of the two projects. Production data (quantity produced and cost) were collected through interviews with project farmers between December 1978 and May 1979---the dry season production period. The National Irrigation Administration's Region 3 office and the Farm Systems Development Corporation assisted in the collection of the production data.

Benefit-Cost Ratios

In this paper benefit-cost ratios were calculated for the projects by estimating the net incremental value of agricultural production generated by a project. Project costs included the total capital expenditure on the project plus annual operation and maintenance expenses.

The Sibul Project

The Sibul Communal Irrigation Project was constructed after the dry season harvest in late March and April of 1977. The project consists of a small concrete diversion dam which captures water from a natural sulfur spring and then diverts it to laterals and ditches on project land. It was expected that the project would irrigate at least twenty hectares. However, some of the project land was bought for commercial development after the project was buil so that the actual irrigated hectarage is slightly less thar twenty hectares.

Fourteen farmers are members of the project. Seven of these farmers are leaseholders while five of them own the land which they cultivate. One of the farmers in the project is a share tenant and one farmer is an amortizing owner. (Under the agrarian reform program in the Philippines a farmer can become the owner of the land he cultivate

by paying an annual amortization fee).

Almost all of the irrigated land in the project is used to grow rice. The project enables farmers to get two crops per year instead of one. A few farmers who are near the source of water are able to get three crops per year. Without the project, some of the farmers were able to get a second crop by constructing temporary brush dams which would divert water to their land. The brush dams wash away every year and were not always reconstructed so that a dry season crop was not something that a farmer could always count on. (If data were available one could compare the economic returns from the temporary brush dams with the returns from the more permanent concrete structure.)

The average farm size in the project is 1.3 hectares. All of the farms within the project are small--less than three hectares.

The project farmers form an irrigation association, called the Sibul Irrigation Service Association. The association is responsible for operating and maintaining the project. Each farmer contributes labor to maintain the project. In addition, each farmer pays an irrigation service fee which is based upon the amount of land he farms. The fee is used to cover operation and maintenace expenses and an amortization charge on the construction cost. The

farmers are expected to repay the outlay for construction within twenty five years. In effect, the farmers are subsidized on the capital outlay since ten percent of the construction cost (estimated as the National Irrigation Administration's contribution to the project) is deducted from the repayment obligation and no interest charge is levied on seventy percent of the capital outlay. A six percent interest charge is levied on the remaining twenty percent.

Construction Cost

The project cost ₱16,691.52 to build in 1977. A breakdown of the construction expenses is given in Table 1 below. The economic cost for constructing the Sibul Project was probably quite a bit less than the financial cost since over six thousand pesos was expended on local unskill labor. (NIA paid local unskilled laborers ₱13.07 per day to help build the diversion works.) These laborers were primarily project farmers who did not have anything else to do when the project was built. Thus, the opportunity cost of this labor was quite low---perhaps zero. If the economic cost of the local labor contribution is put at zero the the economic cost of the project was ₱10,143.42 as shown in Table 1.

Operation and Maintenance Costs

The project is operated and maintained by the project farmers, as noted above. Each farmer has to contribute labor to clean the irrigation canal. This is done after the wet and dry seasons when the farmers have little else to do. It takes about 8 man-days to clean the canal after each harvest (or 16 man-days per year). If the labor expended for this was valued at the market wage for hired labor in the area (about ₱13 per day), the imputed labor cost for cleaning the canal would be ₱208 per year. Since the canal is cleaned after the dry and wet season harvests the economic cost of cleaning the canal would be closer to zero since the farmers are generally idle during this period.

In addition, the farmers have to pay for other maintenance expenses for the project. In 1979, the farmers had to repair part of the system which was damaged by a severe typhoon in 1978. The cost of the repairs was ₱859.83 (1977 prices). However, a substantial share of the repair cost was for farm labor which was mobilized after the dry season harvest. This labor was paid ₱15.34 per day. Since the farm labor was mobilized to make the repairs at an agriculturally idle time, the opportunity cost of this labor was again--perhaps zero. If the labor cost is valued at zero, the economic cost of the repairs would be ₱395.99 (1977

Table 1
Construction Costs - Sibul Project
(1977 Prices)

Materials	Case A	Case B
Cement	₱3,000.00	₱3,000.00
Steel bars	1,536.60	1,536,43
Gravel	939.60	939.60
Sand	918.67	918.67
Lumber	1,881.00	1,881.00
Hardware	246.10	246.10
Other	152.00	152.00
Sub-total	8,673.80	8,673.80
Labor		
local unskilled labor	6,548.10	0
NIA skilled labor	1,469.62	1,469.62
Sub-total	8,017.72	1,469.62
T O T A L	16,691.52	10,143.42

prices). The project farmers also contributed local materials (primarily boulders) to make the repairs. The opportunity cost of the local materials was not significant and was not included in the economic cost of the repairs. However, an official of the National Irrigation Administration noted that the repair cost would have been ₱600 to ₱700 more if the local materials had not been contributed.

Thus, the operation and maintenance cost for the project in 1979 was ₱1,067.83 (in 1977 prices) if an imputed labor cost for cleaning the canal and the financial cost of hiring farm labor to make repairs is included. If the farm labor contribution was valued at zero the operation and maintenance cost would be ₱395.99 (in 1977 prices) for 1979.

Net Benefits

According to the National Irrigation Administration's planners, the Sibul Project enables farmers to get higher yields during the wet season and a second crop during the dry seasons. Thus, the net benefit of the project would be equal to the increment in production that farmers received during the wet season plus the net value of the second crop. This year a few farmers are also trying to get a third crop which would not be possible without the project.

Although farmers may eventually get slightly high yields during the wet season with the project, it is not clear that this incremental benefit will be very substant ial. This past year, in fact, the farmers received very low yields during the wet season (about thirty cavans per hectare) because of the damaging effects of a severe typ- hoon. Thus, the net value of the dry season crop may bet ter reflect the economic value of the project. As was not above, a few farmers are trying to get a third crop (a se cond dry season crop) this year. This should not amount to much and will be excluded in the analysis since the third crop planting only covers about 1.5 hectares.

Two farmers use the project to maintain fishponds A value for these fishponds will be imputed since the fis ponds enable the farmers to save on their food bill (all the fish are used for home consumption). Thus, the econo mic value of the project will be estimated as the net val of the second crop plus the value of the fishponds.

In Table 2 below the annual net economic value (i 1977 prices) of the Sibul Project is given for three diff ent scenarios. All of the scenarios are based upon an av rage production during the dry season of 49 cavans per he tare. In the first scenario palay is valued at ₱1.10 per kilogram---the regulated market price for palay during th

past few years. In addition, a market wage rate of ₱13 per day is imputed for the labor expended by project farmers. And it is assumed that project farmers allocate thirty days of family labor per hectare to grow one crop of rice. This last assumption is based upon labor use in rice production in Laguna and Central Luzon (Herdt, p. 75).

A zero opportunity cost is imputed for the project farmers' labor contribution in the second scenario. Since many of the farmers in the project would not have alternative employment opportunities during the dry season, it is not unrealistic to assume that the opportunity cost of their labor is low. In the third scenario palay is valued at a new regulated price in the Philippines (₱1.30 per kilogram).

In all three scenarios the cost of current inputs includes the cost of seeds, chemicals, and hired labor. The average cost of hired labor in the Sibul Project was ₱742 per hectare (current prices) while the average cost of other inputs was ₱802 per hectare (current prices). The hired labor expenses generally included an imputed value for a one sixth share in the crop for harvesting and threshing.

Thus, based upon these assumptions the annual net economic value of the project would be between ₱19,513 and ₱31,403 as shown in Table 2. This includes an imputed value of ₱1,000 per year for the two fishponds which is

based upon the assumption that both families that have fishponds save about ₱10 per week on their food bill. In addition, ₱1,500 is included for the net return that farmer gets from vegetable production during the dry season.

Benefits/Costs

In Table 3 below estimates of the benefit-cost ratio for the Sibul Project are derived from present valu calculations of the project's benefits and costs. It was assumed that the project had a fifteen year life after it was constructed and that a 15% discount rate reflected th opportunity cost of capital.

Based upon these assumptions the benefit-cost rat for the Sibul Project would be in the range of 5:1 to 14. depending upon what assumptions are followed. Thus, it appears that the government's investment in the Sibul Pro ject was a highly profitable one even under the most pess mistic assumptions concerning project benefits and costs.

The Talaksan Project

The Talaksan Project was constructed during the s mer of 1977. It consist of a diesel driven pump and a sy tem of laterals and ditches. The project irrigates sligh over forty hectares of land.

Without the project only one crop of rice could b

grown on the project land. With the project the farmers are able to grow a second crop of rice during the dry season.

Thirty-six farmers are in the project. Twelve of the farmers are owner-operators while the remaining twenty-four farmers are share-tenants. The average farm size in the project is 1.4 hectares. The range is from 0.5 hectare to 2.6 hectares.

The project farmers are organized into an irrigation association (called Talaksan Irrigators Service Association). The association is responsible for operating and maintaining the project. One week before each cropping each project farmer is required to spend one to two days cleaning the project's distribution system (laterals and ditches). The association hires an operator to run the pump. The operator is paid a fixed fee for each cropping.

The Talaksan farmers also have to meet their operation and maintenance expenses as well as an annual amortization fee for the construction cost. The capital cost of the project is subsidized to the extent that the project farmers do not have to pay for the Farm Systems Development Corporations contribution to the project (survey work, project design, feasibility study) and to the extent that a low interest charge (6%) is levied on the capital repayment obligation.

Construction Cost

The Talaksan Project cost ₱39,235 (1977 prices). The breakdown of project costs is given in Table 4 below. As shown in this table, the cost of the pump accounted for most of the cost of the project. The project farmers contributed ₱5,811 worth of labor (imputed at ₱13 per day for 447 days worth of work). A value of ₱3,567 was imputed for the Farm Systems Development Corporation's contribution to the project. FSDC estimates that they generally contribute 10% of the project costs in such projects. Therefore, 10% of the cost of the materials and the imputed cost for local labor is used as an imputed cost for FSDC's skilled labor contribution. Therefore, the financial cost of the Talaksan Project would be equal to the cost of materials plus the imputed cost for local unskilled labor as well as FSDC skilled labor.

The economic cost of the project would be slightly less than the financial cost since the opportunity cost of the local unskilled labor's contribution was quite low. The local contribution consisted primarily of work done by project farmers who had several days of free time to contribute. Thus, if a zero opportunity cost is imputed for the local contribution, the economic cost of the Talaksan Project would be ₱33,424 as shown in Table 4.

Table 2

Annual Net Economic Benefits - Sibul Project

(1977 Prices)

Gross Value of Palay Production	Cost of Current Inputs	Opportunity Cost of Farmers' labor	Net Value of Project[1]
1. ₱38,005	₱14,752	₱6,240	₱19,513
2. 38,005	14,752	0	25,753
3. 44,915	16,012	0	31,403

[1] Includes ₱1,000 for the net value of two fishponds and ₱1,500 for the net value of vegetable production on 0.5 hectare.

Table 3

Benefits/Costs - Sibul Project

Scenario	Present Value of Construct-ion Costs	Present Value of O & M	Present Value of Costs (1)+(2)	Present Value of Net Benefits
1.	₱14,523	₱5,423	₱19,946	₱99,126
2.	8,825	2,012	10,837	130,825
3.				159,527

Benefit-Cost Ratio: In the range of 5.0:1 to 14.7:1.

Operation and Maintenance Costs

During the 1978-79 dry season the project cost ₱5,550 to operate and maintain. This included ₱200 for repairs and maintenance, ₱4,600 for fuel, and ₱750 for the pump operator's salary. In addition, each farmer in the project contributed one to two days of labor to clean laterals and ditches. If each farmer contributed two days of labor and an imputed value of ₱13 per day was placed on this labor, the farm laborers' contribution would equal ₱832. The total operation and maintenance cost for the project then would be equal to ₱6,382 (or ₱5,360 in 1977 prices). Since the project farmers contribute labor to the project during an idle period, the opportunity cost of their labor contribution is closer to zero. Thus, the economic cost of operating and maintaining the project is probably closer to ₱5,550 (or ₱4,662 in 1977 prices) during the dry season.

Net Benefits

The Farm Systems Development Corporation estimated that without the Talaksan Project farmers could harvest only about 30 cavans of palay during the wet season. With the project farmers get a higher yield during the wet season and a second crop of palay during the dry season. During the 1978 wet season Talaksan Project farmers got an

Table 4
Construction Costs - Talaksan Project
(1977 Prices)

Materials	Case A	Case B
Pump, motor and accessories	25,383	25,383
Civil works	4,474	4,474
Sub-total	29,857	29,857
Labor		
Local unskilled labor	5,811	0
FSDC skilled labor	3,567	3,567
Sub-total	9,378	3,567
T O T A L	39,235	33,424

average yield of 76 cavans per hectare. Their average yield during the 1978-1979 dry season was 96 cavans per hectare. Although the project undoubtedly helps the wet season crop, dry season production will be used to estimate the net benefit of the project so that the benefit of the project so that the benefit estimate is kept on the conservative side.

The derivation of the annual net economic benefit of the Talaksan Project is presented in Table 5 below. The same assumptions were made with regards to the value of palay and the opportunity cost of the farmers' labor as were made in the Sibul Project net benefit analysis (see above). However, the average per hectare expense on inputs was higher than in the Sibul Project. Talaksan farmers spent ₱1,407 per hectare (current prices) for hired labor and ₱940 per hectare for other inputs. Based upon these assumptions the annual net economic benefit of the project is between ₱124, 137 and ₱175,193.

Benefits/Costs

In Table 6 below present value estimates of the Talaksan Project's costs and benefits are given. The project is given a fifteen year lifespan after it is constructed. Benefits and costs are discounted at 15%. Based upon these calculations, a benefit-cost ratio between 10.3:1 and

Table 5

Annual Net Economic Benefits - Talaksan Project

(1977 Prices)

Scenario	Gross Value of Production	Cost of Current Inputs	Opportunity Cost of Farmers' labor	Net Value of Producti
1.	₱221,760	₱81,243	₱16,380	₱124,137
2.	221,760	81,243	0	140,517
3.	262,080	86,887	0	175,193

16.9:1 is derived for the project. Thus, it appears that this project makes a substantial contribution to national economic development given the resources that are allocated to it.

Distributional Impact

In Table 7 the distribution of the shares of the benefits of the project is given for the tenant farmers in the Talaksan Project and the leaseholders and owner-operators in the Sibul Project. From this table, it appears that all interests surveyed gained. For the tenant farmer in the Talaksan Project 24% of his production went to hired labor, 23% to current inputs, and 29% to his landlord which left the tenant with 24% of the output. The leaseholder in the Sibul Project paid a higher share to hired labor and current inputs than the tenant in the Talaksan Project. The shares were 34% and 36%, respectively. The relatively higher shares that the leaseholder in the Sibul Project allocated to hired labor and current inputs is in part explained by the lower yields in the Sibul Project compared to the Talaksan Project (on the average 49 cavans/hectare compared with 96 cavans/hectare). The leaseholder in the Sibul Project gets a smaller share than the tenant in Talaksan (10% compared with 24%) while the landlord in

Table 6

Benefits/Costs - Talaksan Project

Scenario	Present Value of Construct-ion Costs	Present Value of O & M	Present Value of Costs (1)+(2)	Present Value of Net Benefits
1.	₱34,134	₱27,229	₱61,363	₱630,61
2.	29,079	23,683	52,762	713,82
3.				889,98

Benefit-Cost Ratio : In the range of 10.3:1 to 16.9:1.

the Sibul Project also received a smaller share than the Talaksan landlord (26% compared with 29%).

The owner-operator in the Sibul Project allocated about the same share to hired labor and current inputs as did the tenant in Talaksan. The higher yields that the owner-operator received compared to the leaseholders' average yield in Sibul (67 cavans/hectare compared to 39 cavans/hectare) may be the reason that the owner-operator can allocate a relatively smaller share to hired labor and current inputs than can the leaseholder in the project. As expected, the Sibul owner-operators' share (60%) is much higher than the share that other tenure classes receive.

The share distribution does not give the total picture of the projects' impact on the social well-being of the Talaksan and Sibul farmers. Many other factors are involved. One key factor is credit. Six of seven leaseholders in the Sibul Project had to depend upon private manoeylenders who charge usurious interest rates. These farmers repay loans at the rate of 3 cavans (equivalent to ₱165) for every ₱100 borrowed. The loan is for less than six months so that the rate of interest on it is well in excess of 100%. Several of the Talaksan tenants noted that they were able to rely more upon institutional credit where the interest rate on loans is better---about 12%.

Table 7

Distribution of Shares

Tenure	Project	Hired labor	Distribution		
			Current inputs	Tenant/ Lease-holder	Landlor Owner Operato
Tenant	Talaksan	24%	23%	24%	29%
Leaseholder	Sibul	34%	30%	10%	26%
Owner-operator	Sibul		40%[1/]		60%

[1/] For hired labor and current inputs combined.

Another key factor concerning distribution is whether the farmer has supplemental sources of income. In the case of the Sibul Project, four out of the five owner-operators in the project used the project to supplement their income. That is, their primary source of income came from economic activities elsewhere. Only one of the owner-operators at Sibul depended upon the project as his only source of income. Six out of nine of the other farmers in the project depended upon it as their primary or only source of income. Thus, the owner-operators in the Sibul Project received higher yields on the average than the other farmers in the project and they did not have to depend on the project as much as their means of livelihood.

To sum up, although both projects appeared to be good economic investments from a national benefit-cost perspective, all of the farmers within the projects did not necessarily gain that much. The distribution of project benefits seemed to be particularly affected by the farmers' tenure status, his credit arrangements, and his ability to find work elsewhere.

Discussion

The Talaksan and Sibul Projects appear to be good investments from a national economic growth perspective. Their benefits to the nation substantially exceed their

costs. In addition, both projects mobilize labor in an economy which is characterized by a surplus of labor. Farmers and hired laborers have more employment since two crops of rice are grown per year instead of one. Farm labor is also mobilized in the construction and operation and maintenance of the systems.

On the cost side, the Talaksan Project is relatively more expensive than the Sibul Project. The capital investment per hectare was ₱711 for Talaksan as compared with ₱493 for Sibul. Although the labor cost for constructing Sibul was more substantial than for Talaksan (₱456 per hectare compared with ₱223), the economic or opportunity cost of this labor was not that great. In addition, the Talaksan Project is more costly to operate and maintain since fuel must be purchased to run their pump. Thus, if it happened that the benefits of a communal gravity project such as Sibul were commensurate with the benefits of a communal pump project such as Talaksan, the gravity project may be a better economic investment since the gravity project utilizes more low opportunity cost resources (primarily labor) than pump projects.

With respect to benefits, although both projects appear to be good for the nation, it does not necessarily follow that the well-being of some of the project farmers

was improved significantly. Three problems can be discerned here.

First, tenants and leaseholders have to allocate a share of their crop to a landlord. Thus, a share of the benefits that would otherwise accrue to small farmers goes to a generally more well-to-do landowning class.

Second, leaseholders (in the Sibul Project) tended to rely upon private moneylenders who charged usurious interest rates for credit. Thus, a share of the benefits that the small leaseholder would reap goes to a wealthier moneylending class.

Third, in our interviews many of the leaseholders in the Sibul Project noted that they could not afford to buy the inputs (primarily fertilizer) that they needed to get a good crop. They noted that their level of input use was substantially below what had been recommended to them by extension agents. This was due to their lack of access to institutional credit and perhaps explains the low yields of the Sibul Project compared with the Talaksan Project. Related to this problem in the Talaksan Project is that the tenant farmers there did not want to participate in the land reform program in the Philippines. These farmers perceived that they would lose

their sources of credit (often their landlord) if they participated in land reform.

The problems associated with the system of land tenure and the system of credit in the Philippines have been documented in other studies (Herrera, 1975; Herrera, 1978; de los Reyes, 1972). And the rewards of reforming traditional land tenure systems and developing institutional credit systems which reach the small farmer are given to us in the post-war experience in Japan (see Ogura, 1966). To generalized from these two case studies, it seems as though irrigation development is mobilizing resources for economic growth in the Philippines while at the same time there is room for improvement upon the returns from irrigation and their distribution.

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