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IRRIGATION DEVELOPMENT IN BHUTAN

by

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FOREWORD

My effort in this report is to present the development of the irrigation sector in Bhutan. The present status of the sector, agency organization, investment trends, and donor agency involvement are highlighted within the context of a long tradition of farmer-managed irrigation systems and subsequent developments in government policy on irrigation development and management. Since 1961, the Government of Bhutan has made substantial investments in the agricultural and irrigation sectors through planned development exercises. As new developments have evolved, the government has changed its policy in the irrigation sector to respond to the changes.

This report is based on my visit to Bhutan during the third week of June 1988, when I had the opportunity to interview people directly involved in irrigation development and management in the country. The report draws on information obtained from key informants, publications of the Royal Government of Bhutan, and other documents and literature on Bhutan.

I would like to thank the Department of Agriculture, Royal Government of Bhutan for inviting me to observe some of the irrigation systems in the country. My sincere thanks go to Dasho Khundu Wangchuck, Director General, Department of Agriculture. My visit was made more fruitful because of the special care and help provided by Mr. Tsering Dorje, Superintendent Engineer; Mr. John Scott, European Economic Community (EEC) Advisor; and Mr. L.B. Rai, Deputy Executive Engineer of the Irrigation division of the Department of Agriculture.

Mr. Keylzang Tsering, Assistant Engineer, who accompanied me on my field trip to Punakha, Thimpu, and Wangdipodrang, deserves special thanks. His role as interpreter was vital to my communication with the Bhutanese farmers. Last but not least, I would like to thank the farmers of those systems that I visited during my field trip. They were very kind to take time off from their busy agricultural schedules to provide information on their systems.



PART I

BACKGROUND ON IRRIGATION IN BHUTAN

INTRODUCTION

Bhutan is a mountainous kingdom comprising 18,000 square miles (46,620 square kilometers). Ninety-five percent of the population is dependent on agriculture. Half of the gross domestic product and one-fourth of the country's total export earnings are derived from this sector. However, Bhutan's population density is 25 per square kilometer and the annual population growth rate is 2 percent. The small population and the resultant labor shortage constrain the development efforts of the country (Karan, 1987).

Maize is cultivated throughout the country. It is the major crop for many people in Bhutan. Rice occupies the second largest area and is grown in many regions. Other crops are buckwheat, millet, wheat, and barley. Only 6 percent of the total land is cultivated, with an estimated 27,000 hectares (ha) irrigated. Agricultural details by region are given in Table 1.

Table 1. Land under agriculture, in hectares.

Region	Wet land	Dry land	Shifting cultivation	Kitchen gardens	Orchards
Western	7,300	6,567	887	197	1,773
Central	1,662	5,173	1,751	94	1,722
South/ Central	3,691	10,344	293	115	3,900
Southern	12,063	27,229	5,295	515	11,401
Eastern	4,990	16,296	3,597	366	210
Total	29,706 (23.31%)	65,609 (51.49%)	11,823 (9.28%)	1,287 (1.01%)	19,006 (14.92%)

Source: Central Statistical Office, Planning Commission, Bhutan (1986).

According to the Statistical Handbook of 1986, 1.6 percent of the valleys are cultivated and 4.4 percent of the land is under terraced cultivation. Combined, these areas represent the total of the land under cultivation.

IRRIGATION DIVISION

The Irrigation Division is part of the Department of Agriculture in Bhutan. In the government's Fifth Five-Year Plan (1981/2-1986/7), the Irrigation Division was mandated to 1) construct new irrigation systems, 2) renovate existing irrigation systems, 3) protect river banks from slides and erosions, and 4) construct feeder roads in order to open rural farm areas for input supply. Under the current Sixth Five-Year Plan, the objectives of the Irrigation Division have been modified to emphasize new construction and renovation of existing irrigation systems.

The approach of the Irrigation Division in relation to assistance to farmer-managed irrigation systems has changed since the introduction of a decentralization policy beginning in 1981. This policy emphasizes strengthening local institutions, including farmer irrigation organizations. Until 1981, the Royal Government of Bhutan subsidized irrigation systems. Each system received Ngultrum (Nu)¹ 10,000-20,000 per year. Since 1981, as part of the policy to have the beneficiaries operate and maintain the irrigation systems themselves, the government has not allocated funds for an operation and maintenance (O&M) subsidy to farmer-managed irrigation systems.

Organization of the Irrigation Division

The Irrigation Division came into existence in 1967 under the Department of Agriculture. Planned development in agriculture and irrigation was initiated during the Second Five-year Plan. The outlay in this sector increased tenfold over that in the First Five-Year Plan. During this period, Bhutan was divided into eight irrigation zones for administrative purposes (Singh, 1985). In 1979, the Irrigation Department was separated from the Department of Agriculture, but was once again merged with it in 1981. In 1988, the Irrigation Division was renamed the Land Use and Irrigation Division. It encompasses three sections plus centrally administered projects such as the Takalai and Gaylegphug Lift Irrigation Systems.

In the districts, public works, agriculture, education, basic health, and irrigation units administrate government funds. The *dzongdha*, appointed by the Ministry of Home Affairs, is the head of district administration. *Dzongs*, or forts, were constructed for defense purposes in ancient times. They contained monasteries and served as the administrative center for the region. In those days, persons who resided in the *dzongs* were considered the authorities. Instead of creating a new government unit in the districts, an effort was made to modernize these traditional institutions in Bhutan. In 1960, *dzongs* were converted into district administrative headquarters because people were accustomed to seeking and obtaining assistance there. Today, the district administration is known as *dzongkhag*.

¹A unit of Bhutanese paper currency is called the Ngultrum (Nu). The value of Indian currency and Bhutanese Nu is kept at par US\$1.00 = Nu 13.70. Indian currency is accepted in Bhutanese markets.

The *dzongkhag* is subdivided into *gewogs*, or blocks. Each block is headed by a *gup*, *mongup*, or *mandal* (village headman) who is elected by the people but is paid by the government. The term *gup* is used in northern Bhutan and *mandal* in the southern part. The *gup* or *mandal* functions as the link between government and community. He collects land revenues for the government and the government communicates with the community through him.

Each *dzongkhag* has an irrigation unit to supervise assistance to farmer-managed irrigation systems. Each *dzongkhag* irrigation unit has an assistant engineer, 1-5 section officers, a draftsman, and construction supervisors. The section officers are overseers appointed by the government, but assigned to the district. Administratively, these officials fall under the jurisdiction of the *dzongkhag*, but functionally they are under the technical direction and supervision of the Land Use and Irrigation Division.

Manpower in the Irrigation Sector

According to 1985 statistics, 330 persons were employed with the government in agriculture and irrigation, of whom 304 were male. In June 1988, it was estimated that there were 102 technical persons working in the Irrigation Division of the Department of Agriculture. Many volunteers from the United Nations and other organizations also work in the irrigation sector.

Attempts are being made to upgrade manpower skills through training programs. A new institute, the National Agriculture Training Institute (NATI), will come into existence in 1992. Meanwhile, the Institute of Resource Management will conduct training programs in agriculture and forestry. This institute started functioning at Paro in July 1988. Besides developing technical manpower, the Irrigation Division is making efforts to organize the beneficiaries so they will be capable of undertaking O&M responsibilities. New personnel are being trained in this field of organization and extension activities.

INVESTMENT IN AGRICULTURE AND IRRIGATION

The resource allocation to agriculture and irrigation from the First to the Fifth-Year Plan period is shown in Table 2.

Table 2. Resource allocation to agriculture and irrigation.

	Outlay (Nu in millions)	Percentage of national budget
First Plan (1961-66)	1.90	1.80
Second Plan (1966-71)	21.60	10.70
Third Plan (1971-16)	58.30	12.30
Fourth Plan (1976-81)	259.00	23.40
Fifth Plan (1981/82-1986/87)	419.42	5.93

A breakdown of expenditures for agriculture and irrigation is not available. However, investment in agriculture and irrigation has increased tremendously in recent years. In the Fifth Plan period, it is estimated that 12 percent of the investment in the agriculture sector was for irrigation development. The major sources of investment included the Indian Government, the United Nations Capital Development Fund (UNCDF), Indian projects, the International Fund for Agricultural Development (IFAD), and the Asian Development Bank (ADB).

Financing of Irrigation

Major irrigation projects are funded from external resources. Examples include the Gaylephug Lift Irrigation Project (Indian aid), the Takalai Irrigation Project (UNCDF), and the Chirang Hill Irrigation Development Project (ADB). The EEC is basically involved in institutional and manpower development. In the Fifth Five-Year Plan, 80 percent of the resources for development activities was mobilized from external sources.

The Irrigation Division provides assistance to the farmer-managed systems through the *dzongkhags*. In 1979/80, an effort was made to collect an irrigation water charge at the rate of Nu 5/acre/year (approximately Nu 12/ha/year). Later on, the water charge collection effort was dropped. A decentralization policy was introduced and an effort made to strengthen beneficiary organizations to be responsible for operation and maintenance (O&M). The Bhutan Development Financing Corporation has provisions for providing loans for irrigation development but thus far no such loans have been given.

PROCESS OF IRRIGATION DEVELOPMENT AND IMPROVEMENT IN BHUTAN

The vast majority of Bhutan's irrigation systems were built, and continue to be managed, by farmers. After the introduction of planned development in Bhutan, farmer-managed systems started receiving support from the government. From 1967, the Irrigation Division of the Department of Agriculture provided specialized attention to the improvement of irrigation systems. No reliable figure is available regarding the number of farmer-managed irrigation systems in Bhutan. However, an IFAD study identified about 129 systems in a sample of 19 blocks in the Punakha, Wangdipodrang, and Thimpu districts.

Charles G. Reed (n.d.), in analyzing water management of the four existing schemes in Mongor and Tashigang districts, has reported the existence of beneficiary organizations with officials, rules, and regulations for irrigation management. The *chu nagerpa* (water officer) or *rilarm gothkang* is the irrigation official elected by the villagers. Rules approved by the villagers regarding irrigation water management are enforced by this water officer.

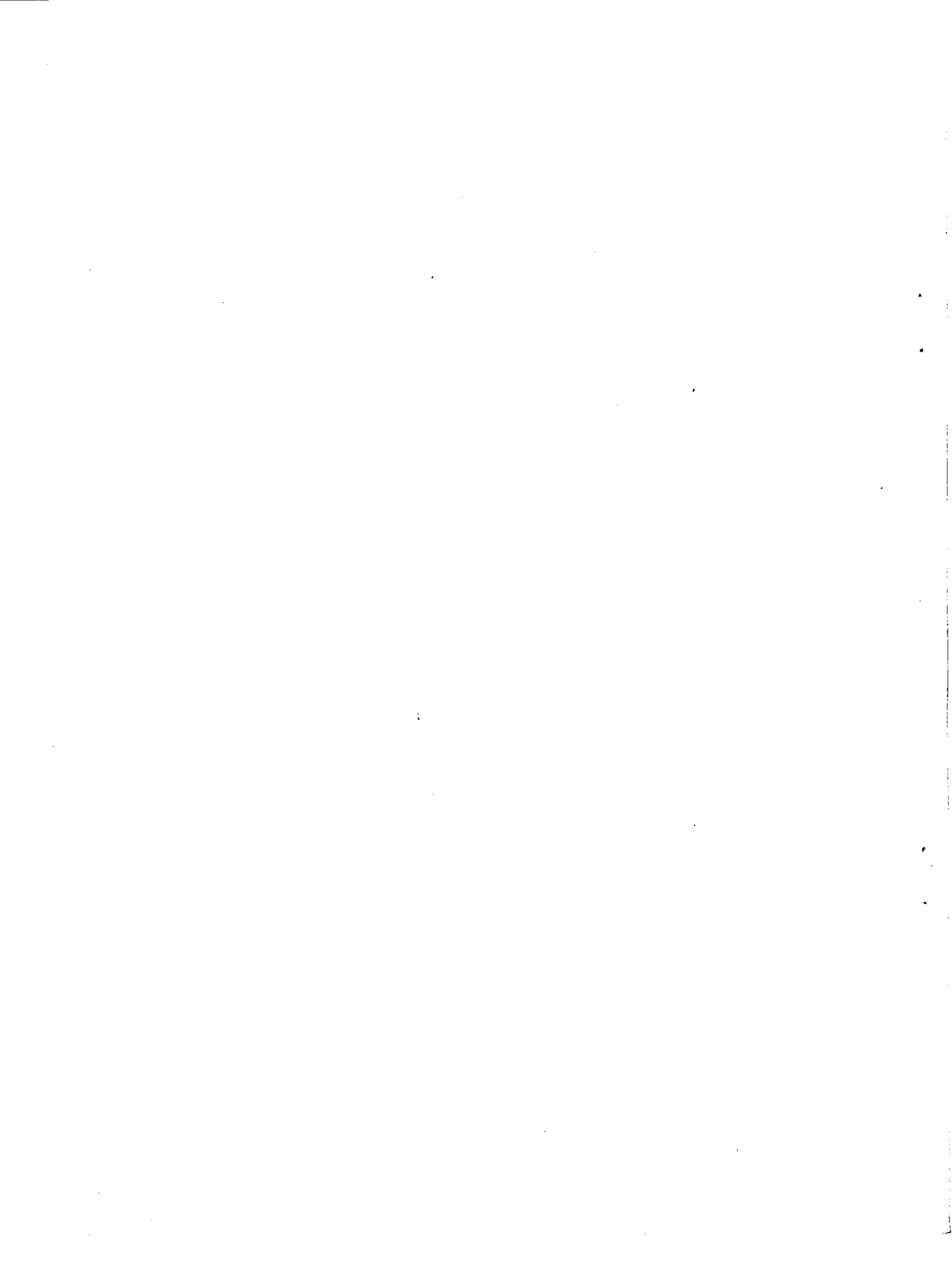
While appraising the Chirang Hill Irrigation System, the ADB report says "the construction, operation and the maintenance of traditional irrigation schemes is invariably a cooperative venture involving some form of

organization, generally at the hamlet or village level; the irrigators elect one of their peers to supervise operation of their particular system, to achieve equitable distribution of water and to organize routine maintenance work." (ADB 1985).

From the 129 irrigation schemes identified by IFAD in parts of Punakha, Wangdipodrang, and Thimpu districts, 30 were selected for assistance. Previously, some of the systems were managed by monasteries. With the cautious introduction of a land redistribution program in the 1970s, much of the redistributed land has been transferred from the monastic establishments to farmers in some of the districts (IFAD, 1988). The new landowners have taken responsibility for managing irrigation systems.

Prospective systems for improvement are identified by the *dzongkhag* development committee. This committee, which is responsible for the development of the whole district, consists of district level administrators, national representatives, and village leaders. An irrigation organization seeking to be considered for assistance by the *dzongkhag* development committee forwards its request through the village leader. Once the irrigation system is selected for renovation and improvement, the Irrigation Division provides assistance in the technical survey and design, since the *dzongkhag* irrigation units do not have sufficient technical skill and manpower. Once the design is approved, it is the responsibility of the district irrigation unit to supervise the construction work. Construction proceeds on a "force account" basis. Contracts are not given out for the work. The government provides the materials and technical supervision. The beneficiaries are required to provide the labor for the construction work, thereby ensuring their participation. Although labor mobilization is often a problem due to the low population density, this condition is uniformly enforced. Once the systems have been renovated and improved, they are managed by the beneficiary farmers (with the exception of some centrally administered projects).

O&M responsibility is accorded to the farmers. No grant or subsidy is given by the government for annual O&M activity. However, there are provisions to provide assistance in the event of damage from natural disasters. A request for such assistance would originate in the *dzongkhag* development committee.



PART II

OBSERVATIONS ON THE MANAGEMENT OF IRRIGATION SYSTEMS IN BHUTAN

INTRODUCTION

Farmers in Bhutan have developed management systems suitable to their terrain, climatic conditions, and social needs. Travelers and members of trade and other missions that visited the country in the 19th and 20th centuries remarked on the agricultural practices. Narendra Singh (1985:177) describes irrigated agriculture thus: "British travelers to Bhutan in the 19th century as well as visitors and experts who now visit the Himalayan Kingdom have not failed to observe the presence of Bhutanese skill in manipulating irrigation channels despite the natural obstacles." Both Pemberto and Rennie, the renowned British observers of the Bhutanese scene during the 19th century noted: "The fields of both sides of the rivers were neatly fenced and water was conducted by an indigenous system of small channels." Sir Claude White, the British Political Officer in Bhutan in the first decade of the present century wrote in his memoirs: "I have particularly noticed during my travels in the country, how remarkably skilful the Bhutanese are in laying out canal and irrigation channels, and the clever way in which they overcome what to ordinary people would seem insurmountable difficulties in leading water over steep, difficult places on bridges or masonry aqueducts, often built up at a great height." This is further corroborated by Nari Rustomji, a discerning and learned observer who visited Bhutan in the 1960s said, "It was a delight to see such well terraced and skillfully irrigated fields in so many areas I visited. I do not think the Bhutanese have much to learn in the matter of agricultural irrigation." (Singh, 1985:177).

FIELD OBSERVATIONS

In June 1988, I visited five irrigations systems to gain an insight into the dynamics of their management. Although more extensive documentation on Bhutan's irrigation systems is needed, the present observations may be useful in showing broad trends in the development and management of irrigation systems in the country. The following systems were observed: 1) Simtokha, (Thimpu District); 2) Chavana, (Punakha District); 3) Bajo, (Wangdipodrang District); 4) Lapchaka, (Punakha District); and 5) Yuwawon (Lobesa), (Thimpu District). Table 3 gives the specific characteristics of each system.

Type of Management

Irrigation systems can be classified into three basic management types: agency-managed, jointly managed, and farmer-managed. Examples of the first two categories are relatively rare in Bhutan. Some large irrigation systems such as the Takalai and Gaylegphug Lift Irrigation System are agency-managed systems. The Bajo Irrigation System (described below) in Wangdipodrang District is jointly managed by the farmers and the irrigation agency. The vast majority of irrigation systems in Bhutan are farmer-managed.

Table 3. Characteristics of the irrigation systems observed during my visit.

Name of system	Length of canal (km)	Area irrigated (ha)	Number of beneficiaries	Management style
Simtokha	10.0	23	24	farmer-managed
Chavana	6.7	6	8	farmer-managed
Bajo	13.2	140	20 ^a	jointly managed
Lapchaka	22.0	627	a few households ^b	agency-managed
Yuwawon	8.0	600	123 ^c	farmer-managed

^aThe beneficiaries include the Center for Agriculture Research and Development (CARD), the town of Wangdipodrang, and the army barracks receiving drinking water from the canal.

^bFifty ex-army personnel have been given land in Lapchaka. Most of them have not yet resettled there.

^cThey hold land in Yuwawon as well as in Thimpu Valley. Yuwawon has many absentee landlords.

Source: Field study, June 1988.

Farmer-managed systems. The Simtokha, Yuwawon, and Chavana systems (see Table 3) are farmer-managed, although they received assistance from the government for renovation and improvement. After they were identified for renovation, the irrigation agency (*dzongkhag* irrigation unit) negotiated with the beneficiaries regarding their labor contribution.

Jointly managed systems. Bajo System is an example of joint management, where agency and beneficiaries work together. Not all of the beneficiaries in this system are farmers; the water is used for various non-agricultural purposes. Previously, irrigation water was used only for agricultural purposes. With the establishment of a Center for Agriculture Research and Development (CARD) in 1982, water is also provided to its agricultural farm. Over time, the township of Wangdipodrang was developed and an army barracks was established, creating more demand for water. A drinking water project was constructed about 20 years ago, using the same canal water. Because of the numerous beneficiaries and multiple uses of the water, the government has provided assistance to strengthen the canal at its weak points. The townspeople and farmers work together to maintain the canal and have received support from the army as well. The district administration has also given attention to the maintenance of the system. Hence, the system is jointly managed.

Agency-managed systems. The Lapchaka System is dependent on the district administration and the national irrigation agency for operation and maintenance. One section officer is assigned to this system and is in charge of repair, maintenance, and operation. The government has allocated Nu 100,000 for maintenance. The person in charge of irrigation management, elected by the beneficiaries, is known as the *yopen*. The responsibility of the *yopen* is rotated among the beneficiaries and is usually an unpaid office. The canal is divided into 13 sections and a *yopen* is placed in charge of each

section. All 13 *yopens* in Lapchaka meet twice a month. Any problems that the *yopens* cannot resolve are referred to the section officer, who passes the matter to the district administration for resolution. Conflicts are sometimes referred to the courts.

Fines are collected from those persons who fail to report during maintenance work. The fine is fixed at Nu 25 per day during the rice planting season, and Nu 35 per day off-season. In the past, there have been abuses of the rules and regulations governing water distribution and now fines are imposed against transgressors.

In June 1988, the section officer stationed in Lapchaka reported that a separate account was opened with the district administration. The beneficiaries have deposited Nu 97,000. The interest from this account will be used for the maintenance of the system, subject to the approval of the *dzongkhag*.

The district administration is considering accumulating sufficient funds in the Lapchaka account to enable the beneficiaries of the irrigation system to use the interest from the account for the O&M of the system, instead of depending on a subsidy from the government.

The section officer and the support of the *dzongkhag* to this system give the impression that this is an agency-managed system. However, Mr. Tsering Dorje, Superintendent Engineer in the Irrigation Division, suggested that this is not an agency-managed system in a true sense. He asserted that the beneficiaries are active in operation and maintenance. The section officer assigned to Lapchaka assists the beneficiaries with the ultimate goal of having the system managed by the farmers.

Annual Maintenance

In all the systems observed, annual desilting and maintenance of the canals are done by the farmers. In the large systems, either the *mandal*, *gup*, or *yopen* organizes the annual maintenance of the system. The *mandal* or *gup* is the head of the village elected by the people for a period of three years. He is assisted by the *febe*. The *febe* is responsible for transmitting messages from the *mandal* or *gup* to the villagers. The *yopen* is in charge of the maintenance of the system. In small systems, the farmers decide when and how to undertake the annual maintenance of the canal.

Maintenance in farmer-managed systems. In the Simitokha System, the *mandal* fixes the date and mobilizes the beneficiaries for the desilting and repair of the canal. This system serves five villages plus the government agriculture farm. The five villages are Simitokha, Olakha, Jalu, Luthe, and Zigithana. Labor mobilization is based on the number of households in each village. The command area and the number of households in each village are different. All the beneficiaries from all villages contribute labor at the time of desilting and repair, starting at the intake, and working toward the tail. Each village contributes labor to work on the area from the intake up to the village. The Simitokha people help to desilt the canal only from the intake to Simitokha. Zigithana village, at the tail end, contributes labor to

clean the entire length of the canal. Should breaches in the canal occur, repair is done by the village in the area of the breach.

Maintenance in jointly managed systems. Maintenance of the Bajo System is complicated because various groups use the water for different purposes. The *dzongkhag* requires the townspeople to contribute to the maintenance of system up to the water tank, while the Army provides manpower. The Center for Agriculture Research and Development (CARD), also uses water from the Bajo Irrigation System and contributes machinery and cash for maintenance. Farmers provide labor for maintenance work from the intake to their farms, which are situated beyond the water tank. Because so many people use the water from the canal, the farmers have petitioned that the army, CARD, and the townspeople be responsible for O&M of the canal from the intake to the water tank. The farmers would then take responsibility for O&M from the water tank to their farms. To this date, no decision has been made regarding their petition.

Maintenance in agency-managed system. Annual maintenance of the Lapchaka System's long canal is the responsibility of the beneficiaries, who are usually supervised by the section officer assigned to the system. The *yopens* of each section make sure that their sections are desilted.

Each system has developed a management method to accomplish annual maintenance. *Yopens* perform important roles in mobilizing people, maintaining the system, supervising water distribution, and resolving conflicts regarding irrigation management. Labor mobilization is compulsory in many places, except in Lapchaka where cash fines are collected from persons who are absent from the annual maintenance work.

Water Distribution

Water allocation and distribution are two important elements in farmer-managed systems which shape the nature and strength of the irrigation system. Water distribution methods varied among the systems that were observed, each having distinctive characteristics.

Water distribution in Simtokha. In the Simtokha System, water is allocated among five villages. Each village has to contribute labor for the maintenance of the system, and this labor contribution ensures the village's water rights. After desilting the canal, the total volume of water in the canal is used by the first village until planting is complete. When that village has completed planting, the total volume of water is diverted to the second village. Each village receives the entire amount of available water for planting by turn. Once the whole command area has been planted, the principle of water distribution changes so that water flows continuously in the canal and all the villages receive a share.

Each village has its own method of internal water distribution. During the time of planting, each village decides on the rotation system for water distribution. One informant said that the basis of rotation within the village during and after planting depends on the number of households. The *mandal* supervises the rotation. Field-to-field irrigation is the norm; there

are not many field channels and control devices in the command area of the Simtokha Irrigation System.

Water distribution in Chavana. Chavana, with only eight beneficiaries and a small command area, has some interesting features regarding water allocation and distribution. Water is distributed using different methods depending on its availability.

This system received government assistance for canal improvement. Since water is scarce during the early part of the season, the farmers decided to install wooden proportioning weirs, called *gahs* in the local language, across the canal at two points. The water share appears to be based on the number of beneficiaries, and not on the size of landholdings. Water is allocated equally to the original beneficiaries (seven) in this system, so there are seven notches of equal size in the first weir to allow for an equal flow of water to each household. The water flowing through one of the notches is again divided below the weir to supply the eighth beneficiary without disturbing the share of the other six original beneficiaries.

A second wooden proportioning weir is installed at a point in the canal where only five beneficiaries receive water; hence there are five notches of equal size cut in the second weir. However, the amount of water flowing through any one notch is not always sufficient for agricultural purposes. Therefore, the five farmers have established a rotation system whereby all the water is diverted through three notches for a specified time, then the other two notches receive all the water for a specified time. The Chavana System adopted the use of the wooden proportioning weir after learning about its functions from one of the beneficiaries who had seen a proportioning weir in the village Dhawakha where he was formerly a resident. According to the farmer, a High Court Judge initiated this to resolve water-related conflicts in the Dhawakha System.

An interesting concept related to ownership of water shares was observed in this system. Water shares are not attached to the land but are considered the property of the individual farmer. One farmer in the Chavana System brought his share of water from the neighboring Dhawakha System to his fields in Chavana by digging a channel from the Dhawakha canal to the Chavana canal. He runs the water from Dhawakha to his fields in Chavana whenever the Chavana System is not running water in its canal. Hence, this beneficiary can use his share of water in whichever system he wishes as long as he can get his share of the water from the other canal to his fields.

Water distribution in the Bajo System. Various groups use the water from the Bajo System, and formal agreements regarding water allocation are enforced. Water from the Bajo canal is used by the townspeople, the army, CARD, and the farmers. However, the farmers are the primary users of the system. A proportioning weir divides the water flow between the irrigation canal and the drinking water tank. The *dzongkhag* and the farmers have an agreement regarding this allocation. However, as the town of Wangdipodrang has developed, its need for water has increased. The farmers also have a written agreement, registered in the *dzongkhag*, with the agriculture farm and CARD that specifies that the agriculture farm receive water from a 3x3 inch

outlet day and night, irrespective of season. Despite being a government farm, it is not entitled to receive more than this amount. The Bajo System also serves two villages, Bajo Wangukha and Thango. The two villages rotate the flow of water. One village would receive water for 12 hours during the night and in the next rotation, it would receive water for 12 hours during the day. Within the village, water is distributed according to the size of the landholding, but no control devices to measure the water are used. The *yopen* and the villagers observe the fields and determine the amount of water to be applied.

Lapchaka System. The Lapchaka System is evolving a method for water allocation and distribution through trial and error. The management of a 22-kilometer canal along a mountainside is a big challenge to the farmers and administrators. The *yopens* meet twice a month to determine the water distribution and repair schedules. Observation of the canal reveals many places where damage has occurred because attempts have been made to divert all the water through one outlet. Other damage to the canal indicates that farmers have attempted to open unauthorized outlets.

Yuwawon System. Yuwawon is a large system serving seven villages. Water scarcity is a characteristic of this system. Water is distributed on a village basis usually in 24-hour rotations. When it rains, there is plenty of water. But when water is scarce, people guard their water against water stealing attempts day and night. The rotation schedule is fixed and each village receives water during its turn. Within a village, water is distributed according to landholding size. No devices are used to control the flow of water at the farm level.

Water allocation and distribution are implemented in different ways in the systems that were observed. However, in each system the farmers have worked out methods to assure that water is available for the rice crop when it is required.

Resource Mobilization for the Operation and Maintenance of the System

Two categories of resources may be mobilized by an irrigation system: internal and external. Internal resource mobilization means that the beneficiaries utilize resources from within the system. These could be labor or monetary resources. External resources refer to resources obtained from outside the system. External resources such as construction materials and technical expertise are sometimes provided by the government. Construction is directly under the supervision of a technical expert. This assistance is given to improve the physical condition of the system.

Internal resource mobilization. In the five systems that were observed, labor is the primary resource that exists within a system. Labor contributions may be assessed in one of two ways: according to size of landholding, or according to the number of households. To be more equitable, the farmers have agreed that labor contribution should be based on size of landholdings.

The Simtokha, Chavana, Bajo, Lapchaka, and Yuwawon systems mobilize labor for operation and maintenance of their irrigation canals. Because of the short supply of manpower, many systems do not accept money in lieu of labor. If one household cannot supply the required manpower it is held responsible for finding a laborer from somewhere to do the work. If a beneficiary fails to appear for work on a specified day, he is required to present himself on another day. Peer pressure is important in obtaining compliance with the labor requirement. In Simtokha, Yuwawon, and Bajo the absent beneficiary is denied water for the season.

In Lapchaka, farmers who are absent during maintenance and repair work are fined. The fine is collected by the section officer and deposited in the *dzongkhag*. This is the only system with a bank account.

In the Bajo System, materials, tractors, and cash are mobilized from CARD for maintenance of the system. The townspeople and the army also contribute manpower for the maintenance effort.

External resource mobilization. All of the five systems observed had assistance from the government for the renovation of physical structures. Any system can qualify to receive assistance for such improvement. Farmers, through the *gup*, file a petition with the irrigation unit of the *dzongkhag*. The district administrator puts the proposal before the *dzongkhag* development committee. Once approved by the *dzongkhag* development committee, the petition is sent for approval to the Irrigation Division, which checks the technical feasibility of the system. Approval is sent to the irrigation unit of the *dzongkhag*. Once approved, the *dzongkhag* unit is in charge of the renovation work. In all improvement projects, the farmers provide the labor for the construction work.

Conflict Resolution

Although very few conflicts were reported, mechanisms do exist for the resolution of conflicts, should they arise. When a conflict arises within the village regarding irrigation water, it is settled by either the *yopen*, the *gup*, or the *dum*, who is the caretaker of royal lands. When the case is of a larger dimension, it would be referred to the *dzongkhag*, as occurs in Lapchaka. Sometimes the case is referred to the judiciary court in order to establish the water rights.

Irrigation-related Functionaries

Some form of irrigation organization exists in farmer-managed irrigation systems. *Yopens* are elected by the beneficiaries to carry out certain functions. In some cases, they are paid in cash or in-kind, but this is unusual. Each of the beneficiaries takes a turn at holding the office of *yopen*. The *gup* or *mandal* is the village head. He is paid by the government but elected by the villagers. The *gup* especially plays an important role during the time of renovation and selection of the system for renovation. He keeps a record of landholdings and organizes the farmers for desilting and maintaining the canal.

The *dun* is the caretaker of the royal lands. Since he is close to the royal families, he is influential in resolving irrigation-related conflicts within a village.

AGRICULTURAL PRACTICES

Irrigation activities are primarily geared toward rice cultivation. Red rice is grown at higher altitudes, and white rice at lower altitudes. Around the valleys, chili, mustard, and wheat are grown as second crops. Wheat is not yet a very important crop. Wheat straw is used as animal fodder.

As part of a program to increase rice production, experiments are being carried out for the cultivation of short-term rice. Depending on the availability of water in an area, the Department of Agriculture will designate areas where two rice crops may be grown. All irrigation systems will not be allowed to have two rice crops because this may cause water conflicts.

CARD is introducing row plantation with the objective of introducing rotor weeders as part of an extension program that includes farmers in the Bajo System. Inputs are subsidized, and insecticides are free in the Thimpu, Wangdipodrang, and Punakha districts. In order to increase the area under rice, the government has encouraged people to convert hill slopes into terraces and is providing Nu 300/acre (Nu 741/ha) for such terrace making.

SUMMARY

1. Each irrigation system has some form of irrigation organization, to perform the tasks of water acquisition, water allocation and distribution, and resource mobilization.
2. Annual maintenance is the responsibility of the beneficiaries of the system. Either the *yopen* or *gup* decides when desilting and repair of the canal is necessary. Irrigation management officials reside in the villages.
3. The Royal Government of Bhutan provides material and technical support to the irrigation systems designated for assistance. Usually the government provides construction materials and technical manpower and the beneficiaries contribute the labor for the construction activities. Labor mobilization has become a difficult task in many of the farmer-managed systems because canals are long and manpower is scarce. Construction work is supervised by irrigation personnel. Contracts for construction are not allowed when the government assists a farmer-managed irrigation system.
4. The irrigation organizations that were visited do not keep written records of their activities.

5. With the exception of one system, monetary transactions within the irrigation organization do not exist. Labor has a higher value than money since Bhutan is a country with a manpower shortage, and foreigners are not allowed to work as agricultural laborers.

6. Irrigation organizations do not presently have a legal status.

IMPLICATIONS AND ISSUES FOR FUTURE DEVELOPMENT AND GOVERNMENT INTERVENTION

1. Because of labor shortages, the government needs to consider the canal length and number of beneficiaries in a system when determining which systems should receive government subsidies.

2. The irrigation systems observed in Thimpu, Wangdipodrang, and Punakha have adopted flexible systems adapted to the local topography and terrain. Hence, government regulations pertaining to the beneficiary organizations should be flexible. Rigid rules applied to all systems might render the irrigation organizations ineffective.

3. Issues of tenancy rights underlie management problems in some systems. In one of the villages of the Bajo System, tenancy changes each year, requiring water allocation and labor mobilization quotas to be readjusted according to the number of tenants/beneficiaries using water that year. In the Lobesa System, absentee landlords are predominant. The tenants on these lands have no assurance from one year to the next whether they will remain on the same land. Where there is no sense of security, the tenants have little incentive to maintain or improve the irrigation system beyond their immediate necessity.

4. Irrigation organizations are a strategic resource enabling better management of irrigation systems. The irrigation organizations which are presently in operation in Bhutan need to be properly understood before new forms of water users' associations are introduced across the country.

5. In many systems, the roles of the *yopen*, *gup*, and *dzongdha* are spelled out clearly. These leaders presently play important roles in making the irrigation systems functional. The government plans to create water users' associations to manage the O&M of the irrigation systems. Any irrigation organization which is created needs to capitalize upon existing local expertise and integrate the already existing leaders and management practices into the new organization.

6. Over time, the demand for water for other purposes such as new settlements, towns, industrial use, and for government agriculture farms will increase. Hence, the Royal Government of Bhutan needs to set up regulations regarding the use of water for irrigation.

7. Government projects are taking water from existing irrigation systems and new agriculture farms have plans to take water from existing systems. Norms need to be developed to define the rights and limitations of new projects using water from existing systems.

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AREAS OF WET AND DRY CULTIVATION

Areas	Wet cultivation (ha)	Dry cultivation (ha)
Paro Valley	3,237	1,214
Thimpu Valley	2,428	809
Wangdipodrang Valley	3,237	2,023
Punakha Valley	4,856	2,023
Ha Valley	1,618	404
Sambe Valley	809	404
Gasa Valley	1,214	404
Lungshi Valley	809	404
Samchi Zone	1,618	2,428
Phuntsholing	809	1,618
Chacha	1,618	404
Chirang Valley	2,428	3,237
Dagana Valley	1,214	809
Khen Valley	1,214	1,618
Sarbhong Zone	2,023	2,832
Bumthang Valley	2,428	809
Tongsa Valley	1,214	809
Lunatshi Valley	1,618	1,214
Songar Valley (Mongar)	2,428	1,618
Tashi-Yangtshi Valley	1,214	1,618
Tashigang Valley (including base area)	5,665	3,237
TOTAL	43,707	29,947

Source: Singh (1985:181).

The figures given in the table indicate the availability of cultivable land under different conditions. Wet land does not necessarily mean irrigated land. The total irrigated land in Bhutan is still very small.

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