

situation is fast changing; the irrigation traditions of the Tessaout are being transformed, but important elements-- both physical and organizational -- will contribute to the working of the new expanded irrigation system.

- David Groenfeldt (based on a recent visit hosted by Rachid Abdellaoui and Abdellah Herzenni)

*Bhutan Irrigation

Bhutan is a small landlocked Kingdom in the eastern Himalayas covering some 46,000 Km² nearly all of which is mountainous. The topography becomes increasingly rugged northward from the lower foothills and includes large, south flowing rivers. Communication is difficult and even though a road system is being developed the 4 1/2 to 5 months of monsoon weather in the summer and snow and ice on high passes during winter make travelling extremely difficult. Although the country is located in the subtropical zone, the climate is diverse and varies from subtropical to tundra.

Physiographically there are many similarities with Nepal and Northern Indian Hill regions. In other ways however Bhutan is quite different. With a population of only 1.2 million, it is the least densely populated country in Southern Asia, but since the cultivable area is extremely limited there is considerable pressure on useful farm land. The average farm size is only 0.5 ha. Bhutan is considered to be one of the least developed countries and although it enjoys a long history, until recent times has been kept largely isolated from the rest of the world. The initial step toward modernization took place in 1950 and the first five year development plan began from 1961.

Agriculture, which mainly involves subsistence type farming, employs 95 percent of the population, and half the GDP and over a quarter of total export earnings. Bhutan is just beginning its 6th Five Year Plan. In this plan of "selective development" agriculture will play a major role. The long term goal of the agriculture sector is "to maximize the contribution of agricultural development to national self reliance and overall economic growth within a context of sound conservation".

Of Bhutan's total land area, only 3% is cultivated and with an annual population growth rate estimated at about 2% the pressure on arable land is increasing. Irrigation is an essential input in the drive to intensify agricultural production and an area of relatively major investment for the Royal Government of Bhutan (RGOB).

The potential for comparatively large scale development has been very limited and confined almost entirely to a few locations in the southern foothills. These schemes tend to be agency/centrally planned and have often included the clearing of forest areas and the settlement of people from both the immediate vicinity and/or from mid-hill areas of the country. Such developments have been severely handicapped by the combination of unfavorable geological conditions and extremely high, intensive rainfall common to this part of the country.

The current Five Year Plan questions the rationale of further extension of irrigation facilities in such areas and points towards available resources being diverted to research and development of other agricultural systems better suited to the agro-ecological conditions. Nevertheless it is clear that given adequate resources, a much higher level of success could have been

achieved by more thorough investigation, and appropriate overall design relating both to technical details and organizational aspects.

Apart from this relatively large scale type of development, schemes with command areas in the order of 50 ha are to be found throughout the country up to altitudes of 2500 m. and even higher. Again RGOB has given considerable assistance to this element of irrigation development both with regard to construction of new schemes and rehabilitation of those already existing. Although the terrain is generally steeper and more rugged it would seem that the technical problems are on average less severe than in the southern belt. Early indications are again however, that expected benefits from such schemes are not materializing, with little prospect of improvement.

Manpower is a very limited resource in Bhutan and beneficiaries are expected to provide all unskilled labor for the construction of new schemes and are fully responsible for routine operation and maintenance whether the scheme is new or rehabilitated. Despite local authorities imposing substantial fines on villagers for non-attendance, unskilled labor realized has been about 50% of that called for. The immediate outcome of some externally funded programs where evaluations have been carried out is that scheme budgets have been underspent by an average of 30%. This is evidenced in many cases by the omission of essential structures such as those to provide cross drainage facilities, side spillways, and offtakes.

Until the present time very little, if any, consideration has been given to the water management aspects or irrigation development. Assistance has been given only with physical infrastructure and in the vast majority of cases this has not extended beyond the main supply channel level. On completion of the physical works the

schemes are simply handed over to the beneficiaries.

The Irrigation Cell (IC) within the Department of Agriculture (DOA) is directly responsible for all irrigation development. The IC is seriously undermanned and many staff lack the appropriate training. Added to this is the fact that the extension service provided by DOA is very limited, particularly regarding irrigated agriculture.

The DOA is aware of the unsatisfactory situation with respect to irrigation development in Bhutan. During the 6th Five Year Plan, which began 1st April 1987 emphasis is to be given to the drawing up of sound policies for irrigation development (to be translated into by-laws) especially relating to routine operation and maintenance, the training of IC staff, and hopefully research into such areas as locally established water management techniques and possible improvements.

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