

PART V: COUNTRY REPORTS

HILL IRRIGATION IN VALAIS (SWISS ALPS): RECENT EVOLUTION OF COMMON PROPERTY CORPORATIONS

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INTRODUCTION

The Swiss Canton of Valais (**Figure 1**) is situated in the central part of the Alps. It is drained by the Rhone River, that flows from East to West and is boarded by two high mountain ranges: the Penninic Alps in the South and the Bernese Alps in the North. Because of rain shadow effects, the climate is relatively dry and annual rainfall is not more than 600 mm at 500 m AMSL and 800 mm at 1600 m AMSL (**Figure 1**). On the southern facing lateral valleys, the dry climatic conditions are accentuated by high insulation and evaporation.

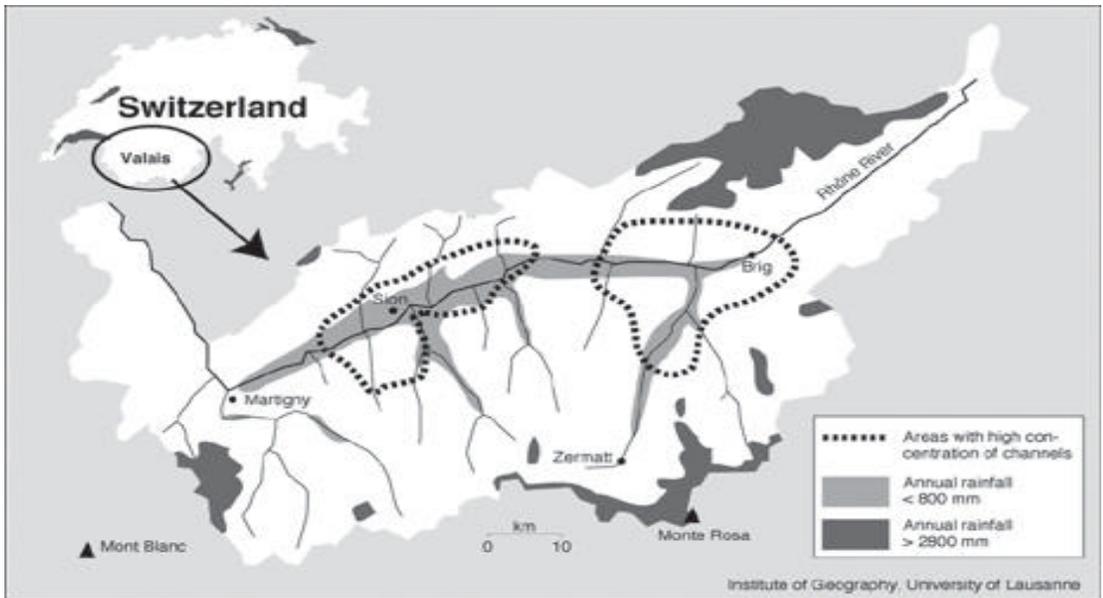


Figure 1: Situation of Valais and Principal Areas with High Concentration of Channels

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Because of these climatic conditions, irrigation has been carried out almost since the 13th century (Mariétan, 1948; Ammann, 1995; and Reynard D., 2002). A network of mountain channels that transport water from naval or glacial rivers to cultivated fields was gradually constructed. These channels are called *Bisses* or *Rayes* in the French-speaking part of the valley and *Suonen* in the German-speaking part (Casanova, 1995). In this paper, we use the term *bisse* in a generic form. The channels are normally 5 to 10 kilometers long and the longest one is 32 kilometers long. The smaller ones are not more than one kilometer long. The principal channels derive water to secondary and tertiary channels. Sometimes, the channels transport water to small artificial lakes that allow the water to be stocked during the night or on Sundays. The channels are normally cut directly into the valley side (**Figure 2**); in some sectors, because of the presence of high rock cliffs, wood channels (**Figure 2**) were constructed along the cliffs (Högl, 1995; and Bratt, 1995). These wood channels are emblematic of the Valais irrigation system, but they are no longer in use and are replaced by galleries. Until the 19th century, irrigation was limited mainly to the meadows. In the 19th century, it was extended to vineyards and orchards. Meadows are irrigated by aspersion or gravitational techniques; only aspersion is used to irrigate orchards and vineyards (Reynard, 1995). Micro-irrigation is quite limited. In the main valley (the Rhone alluvial plain), irrigation is carried out by pumping from the phreatic nappe. Since the first decades of the 20th century, in relation with the decrease of mountain agriculture, channel irrigation has been in regression. The *bisses* network is currently about 600 kilometers long (SAT, 1993). It was more than 1400 kilometers long at the end of the 19th century (Rauchenstein, 1908:11; Lehmann, 1913:43; and Papilloud, 1999:28). Recently, the channels were integrated into the tourist industry as paths for hiking.

In this paper, we study the recent evolution (the last 50 years) of irrigation in the Valais and the correlated transformations of infrastructures and management institutions. We also analyze the impacts of public policy change, especially agricultural policy, on such evolution. In the next section, the analysis framework is presented. The property rights system of irrigation is analyzed in the third part. In the following section, we analyze the recent transformations of social and economic conditions in Valais. The fifth part is dedicated to the analysis of major changes of public policies concerning *bisse* management. We then study the impacts of social and economic change and policy change on *bisse* management institutions. In the last section, a synthesis and some perspectives are elaborated.



Figure 2: Channel Cut into the Valley Side, the Bisse of Aye nt (Left), and Wood Channel, the Former Bisse of Savièse (Right)

ANALYTICAL FRAMEWORK: THE INSTITUTIONAL RESOURCE REGIMES

The comprehension of the management organization of an irrigation system is necessary in order to evaluate its degree of sustainability. Our framework analysis is based on Elinor Ostrom's works on common-pool resource management (Ostrom, 1990). In this section, we recall the problem of Tragedy of the Commons. We then present the concept of Institutional Resource Regime (IRR).

When Garrett Hardin published his famous paper on the tragedy of the Commons (1968), he argued that his model of unsustainable management could explain management of common-property natural resources such as oceans, air, forests, water, etc. The rapid degradation of this type of

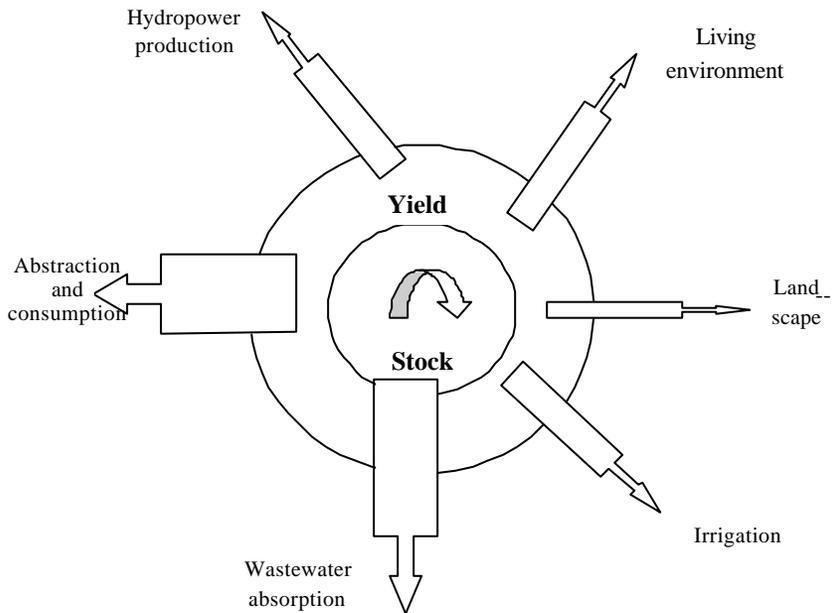
resource is due, according to Hardin, to their property characteristics that allow each user to access the resource and to use it freely. Hardin concluded that collective management of such natural resources was not possible and that only privatization or State control could preserve the resource from degradation. Several scholars, like Netting, 1981; Berkes et. al., 1989; Feeny et. al., 1990; Ostrom, 1990; Stevenson, 1991; and Becker & Ostrom, 1995, then criticized Hardin's model and showed, from multiple case studies, that renewable natural resources like forests, water, meadows, etc. are managed sustainably by endogenic collective self-organized management structures. Numerous irrigation systems in various parts of the world are studied and presented as cases of the robustness of management structures (e.g. Boelens & Dávila, 1998; Bruns & Meinzen-Dick, 2000; and Shivakoti & Ostrom, 2002). Swiss mountain irrigation is sometimes presented as an example of a success-story of local management (Netting, 1974), as well as alpine meadows management (Netting, 1981; and Stevenson, 1991).

In this type of study on common-pool resources management, it is presupposed that property regime is the main explicative factor of sustainable or unsustainable management. Only the "local scene" is analyzed, independently of the general political framework (State political structures, federalist or centralized state, for example), macro-economic tendencies (e.g. globalization, global markets, etc.) or social changes (modernization, tertiarization of society, etc.). Moreover, only one type of resource use (e.g. irrigation) is analyzed, independently of the other complementary or competitive uses of the same resource. For these different reasons, we propose here a larger framework analysis, that we have called IRR (Kissling-Näf & Varone, 2000; Knoepfel et. al., 2001; and Varone et. al., 2002).

The IRR concept considers that a renewable natural resource is generally exploited by more than one type of use. Forests are for example used for various wood exploitation (e.g. fire, construction), other material exploitation (e.g. mushrooms, litter, leaves), protection (e.g. against rockslides and avalanches), leisure (e.g. walking) and biodiversity conservation. Water is used for consumption, irrigation, industrial production, energy production, pollutant absorption, support for navigation, fishing or gravel extraction, recreation (e.g. water landscapes such as lakes, glaciers, waterfalls or sport activities), medical uses (mineral and thermal waters), religious uses, reserve against fire and biodiversity conservation (Reynard et. al., 2001). Natural resources are therefore defined as the components of the natural system that are used by societies

to satisfy their needs (Siebert, 1983:2) and it can be considered that they create goods and services for the society. Renewable natural resources are formed by two components: the stock, that is auto-reproduced (e.g. in the case of water, the reproduction is made by the water cycle), and the fruits that are produced by the stock (Ostrom, 1990:30f). Goods and services are produced by the stock as well as by the yield (Kissling-Näf & Varone, 2000 and **Figure 3**). Management of such high heterogeneous resource use systems needs efficient institutional regulations and we postulate that sustainability of resource management highly depends on institutional framework. The IRR concept allows the analysis of all the components of such institutional conditions.

Figure 3: Examples of Goods and Services Produced by the Water Resource



An institutional resource regime is defined as the combination of the property regime and public policies that regulate the natural resource management (Knoepfel et. al., 2001:35f; and Varone et. al., 2002). The property regime is analyzed through three types of property rights (formal property titles, disposition rights and use rights) and two categories of public policies are considered: exploitation and protection policies. Evaluation of public policies is made through the analysis of various

components (objectives, causality model, target groups, instruments and actors) of the policy design of such policies (Bussmann et. al., 1998). Two complementary dimensions are also considered: the extent and the coherence. The extent describes the numbers of goods and services explicitly regulated by the IRR. The coherence concerns the degree of coordination of the actors' network. The IRR are then classified into four regime types: no regime, simple regime, complex regime and integrated regime (Knoepfel et. al., 2001:38f). In this paper, the IRR analysis framework is partially used in order to analyze the transformation of the irrigation management institutions in the Valais.

PROPERTY REGIME

In Switzerland, water rights are currently regulated by the Swiss Civil Code (SCC) in use since 1912. Property rights on water are based on two principles: the principle of accession (art. 667 SCC), which considers that underground property is linked to soil property (springs and underground water property are therefore linked to soil property) and the principle of state sovereignty, which restricts private property for predominant public interest. The Swiss Civil Code considers therefore that surface water (rivers, lakes, glaciers) are public water (art. 664 SCC) and underground water bodies and springs are private water (art. 704 SCC). In fact, large phreatic water bodies are now considered public water as well. It has to be noted that the civil code did not cancel all the former historical rights and there still exist several cases of private property of rivers or glaciers, especially in the Alps.

The public property of surface water means that the State can dispose of the water and give concessions (e.g. for energy production), authorizations (e.g. for sport activities), licenses (e.g. for fishing) to users or user groups. Some uses, like bathing, are free. Because of the federalist structure of the Swiss political system, public property is organized on three levels: the Confederation (central State), the Cantons (26 regional, relatively autonomous states) and the Communes (local municipalities). In the Canton of Valais, the principal river, the Rhone, is property of the Canton, whereas the other rivers are property of the communes. During the Middle Ages, the period when most of the current *bisses* were constructed, surface waters were property of land Lords, principally the Duke of Savoy and the Bishop of Sion (Reynard D., 2002). Irrigation systems benefit from *access or use rights* ("concessions") to river water accorded by the Lords (Middle Ages and Ancient Regime) or by the communes (in more recent times). Very few channels use spring water. The duration of these use rights is

generally unlimited (the so-called *droits perpétuels* in French) and most of these rights were preserved and reallocated when the rivers of Valais began to be used for the production of electricity (end of the 19th century - beginning of the 20th century). Because of the high costs of construction and maintenance, there are nearly no private *bisses*. The channels were therefore constructed by the entire local community or by corporations of farmers called *consortages*. In a village, various specialized corporations could be created for managing a specific resource (e.g. alpine meadows, forests, dairies, fountains, etc.). Even now, new *consortages* are emerging, for example for irrigating lawns in villa allotments. The relationships between the entire community (the so-called *comunitas*) and the economic corporations during the Middle Age is not well documented. It seems that corporations were created and managed by the richest people of the community (Reynard D., 2002). Irrigation systems could also have been constructed by the local community and more recently by the local administration (municipality). Transfers from common systems to public systems are also documented.

The *consortage* is an example of common-property regime. The members of the association are common owners of the infrastructure and they benefit from rights on the use of the resource (e.g. water rights) or on the products of the association (e.g. wood, cheese). In the case of irrigation, the water division and allocation is normally organized into the form of a cycle (the so-called *tour d'eau*). Netting (1974) showed that the allocation was not always equitable. In Valais, 52.5 % of the channels now in use are managed by farmer associations and 42.5 % by local municipalities (state property), and the last 5 % are private *bisses* (Reynard, 1995:58). In the case of public management, the municipality is responsible for the capture, the transport and the distribution of water, and for the maintenance of the infrastructures. The farmers are responsible for the maintenance of the networks on their fields and pay a tax for the water allocation, generally based on the surfaces they irrigate. Their decision power is indirect by electing the municipal council and by participating in the local legislative assemblies. In the case of common management by a *consortage*, all the rights and obligations are in the hands of the association's members. The maintenance is carried out by the members themselves in the form of workdays (the so-called *corvées*). Rights and obligations are generally calculated according to the surfaces to irrigate. Sometimes water rights are independent of surface (personal rights). The members, called *consorts*, elect their own committee and people for various specialized functions like the allocation of water, the control, the responsibility of maintaining works, etc.

Ostrom (1990) showed numerous cases of natural resources sustainably managed by this type of common-property system. The reason Hardin's "tragedy of the Commons" is avoided is the presence of precise use rights that allow the exclusion of non-members, strict and precise internal regulations that organize access to the resource and high mutual control that limits practices of free-riding (Ostrom, 1990:45; and Feeny et. al., 1990:11). Numerous case studies of irrigation *consortages* in the Valais show evidence of these features and the long history of these associations. The robustness of the self-organized associations and the sustainability of irrigation water management by farmer corporations and common-property systems are therefore well documented in Valais.

SOCIAL AND ECONOMIC TENDENCIES

As outlined above, more than half of the total length of irrigation channels has been abandoned during the 20th century, especially during the period 1920-1970. Moreover, most of the remaining channels were transformed and modernized (replacement of wood channels by galleries, replacement of traditional open channels by concrete tubes, etc.). The reasons for such an evolution are multiple (Reynard & Baud, 2002). First of all new engineering techniques (e.g. use of explosives) allowed tunnels to be built to replace dangerous sectors along cliffs. The rapid modernization of agriculture after the 1950s (increasing productivity needing more water, aspersion needing "pure" water, not charged with sediments, use of chemical fertilizers replacing the natural fertilization by sediments transported by water) induced use of concrete in order to reduce infiltration and sediment transport. The concurrence of lowland agriculture and the general tendency of farmers to leave agriculture for secondary (chemical and metallurgic industries since the end of the 19th century) and tertiary (tourism and administration since the 1950s) activities provoked a rapid decrease of mountain agriculture and rearing. Intensive building of hydropower dams during the 1940s-1970s also reduced farming activities in the high valleys by reducing labor for agriculture. Entire sectors, formerly farmed as meadows, are therefore now being replaced by forests. Numerous agricultural surfaces are also replaced by the extension of urbanized areas, especially in the valleys where mass winter tourism is developed. Water needs for irrigation are therefore highly reduced in respect to the last decades of the 19th century. A lot of former water rights of *consortages* members are no longer in use because the owners of these rights do not practice agriculture any more or because the former farmed surfaces are now forested or urbanized.

If water needs for irrigation rapidly decreased during the 20th century, general water exploitation of the watersheds highly increased (Reynard et. al., 2001). Domestic water uses increased until the beginning of the 1970s before stabilizing. Since the end of the 19th century, nearly all the major watersheds, and especially the ones highly covered in glaciers, were progressively exploited by the electrical industry. Several private companies obtained concessions from the communes (generally for a duration of 80 years) for the exploitation of hydropower. Natural discharge of the rivers was therefore highly reduced (frequently in the order of more than 80 %). More recently, since the 1980s, water is also used for artificial snowmaking. At the same time, the tourist industry, formerly oriented mainly to winter activities (skiing), is now trying to diversify the offer, principally by proposing estate tourism based on walking and “green” natural activities. Demand for preserved natural landscapes, for example “hydrologic” landscapes like natural lakes, rivers with high discharge, waterfalls, etc., is increasing. There is therefore now a high competition between different water uses that can provoke conflicts, especially in tourist areas (e.g. Reynard, 2000, 2001) and in watersheds with a high range of goods and services produced by the water resource (Reynard et. al., 2001).

A third tendency has been observed since the beginning of the 1980s: the tourist use of the irrigation channels (Reynard 1998; and Reynard & Baud, 2002). Numerous paths boarding the *bisses* for their maintenance are now used for hiking and integrated in the official walking paths network managed by the communes and the Canton. Various sectors with former wood channels are also renovated (e.g. Bisse d’Ayent; and Reynard, 2002a). Some channels no longer in use are reconstructed and refilled with water, sometimes only for tourist purposes. In several places, pedagogic boards are installed along the channels and numerous guides and booklets are edited by tourist offices or other organizations. In the inventory of the Cantonal Territorial Survey Office (SAT, 1993), 50 % of the 190 listed channels have only an agricultural function, 37 % have an agricultural and tourist function, 8 % have only a tourist function and 5 % have no function any more (Reynard, 1995:58). The local population also seems to be rediscovering the patrimonial value of the network and local conferences on the theme of *bisses* always attract a large public. The *bisses* may therefore not only be considered as pure agricultural infrastructures but as multi-functional objects at the interface of agriculture, culture and tourism (Reynard, 1997). It is to be noted that this tendency towards the multi-

functionality of the channels does not exist in other channel-irrigated regions of the Alps, like the Aosta Valley (Italy) or the French Alps.

PUBLIC POLICIES

The current multi-functionality of the *bisses* induces that the management of the channels is now concerned with three groups of public policies: water policy, agricultural policy, and tourist, nature conservation and territorial management policies. In this section, we rapidly analyze the recent transformations of these three groups of policies and their impacts on the channel management.

There is not one water act in Switzerland but numerous legislative texts, which are the result of a complex legislative history that began at the end of the 19th century and that can be summarized in four stages (Reynard et. al., 2001:118f): (1) the last decades of the 19th century developed a policy of protection against floods provoked by large deforestation in the mountainous watersheds of the country; (2) since 1908, the central State has been regulating the hydropower production (Law on the Use of Water Power, 1916); (3) since the 1950s, a sophisticated policy has been developed to fight against water pollution; (4) in 1991 a new Water Protection Act was adopted, that aims to protect the quantitative, qualitative and dynamic natural features of water resources. The main innovation of this law is the adoption of the principle of residual minimal flows in rivers exploited by hydropower industry or irrigation. In 1991 as well, a new River Act was adopted, that introduced the principle of revitalization of rivers in order to reconstruct the natural hydrological processes.

The agricultural policy changed its objectives at the beginning of the 1990s, as well. From World War II, agricultural policy has followed three main objectives (Sciarini & Von Holzen, 1995): (1) insuring the food security for the country (strategic function), (2) producing in the interest of the national economy (economic function) and (3) insuring a decentralized occupation of the country by maintaining the rural population in the campaigns (social function) (Agricultural Act, 1951). The 7th Report on the Agriculture (1992) is a turning point in the agricultural policy development in Switzerland and introduces a new objective for Swiss agriculture: the protection of nature and landscape. The objectives of the agricultural policy are now the insurance of food security (strategic function), the production in relation to the market demands (economic function), the conservation and sustainable use of natural resources (ecological function),

the management of rural landscapes (tourist and landscape function) and the decentralized occupation of the Swiss territory (social function) (Agricultural Act, 1999). The main instruments of the new policy are the ecological direct payments, that aim to pay the indirect services offered by the farmers to the whole society (landscape and nature management) and therefore to complete the direct revenues coming from food production. These direct payments are provided by the Confederation and by the Cantons and they are normally calculated on the basis of the surfaces that are farmed with respect of natural processes (e.g. few entrants). No subsidies however are provided to linear infrastructures like traditional *bisses* or stone walls (terrace cultures) that still play an important function in rural landscapes and nature conservation. The Canton of Valais policies are now trying to develop direct ecological payments for this type of infrastructure as well. A traditional instrument that was introduced by the agricultural policy in 1951 is the subsidies for the so-called *améliorations foncières*, that means all the technical innovations aiming to improve agricultural productivity, especially allotment reshuffling. In the Valais, where irrigated agriculture had a strategic importance, this type of subsidy was introduced in 1924 already, to improve the *bisses* productivity by replacing wood channels by galleries or concrete channels. Until the 1980s the policies of the agricultural cantonal administration was to improve the productivity of the *bisses* without any consideration for tourist or patrimonial aspects. Since then, technical improvements that respect historical and natural features of the infrastructures are used.

The *bisses* are also concerned by the tourist policy because of their use as hiking paths. The *bisses* can also obtain subsidies in relation with the cantonal Nature and Landscape Conservation Act (1998) for their patrimonial and historical interest. In the same order, they are considered in the cantonal Territorial Management Act (1987) as object to being preserved.

The recent transformations of the social and economic framework, shown in chapter 4, and the new ecological objectives of various public policies, presented in this section, have great impacts on the functioning of the irrigation corporations and on the structure of the actors' networks interested with the *bisses* management and conservation. These impacts are analyzed in the next section.

OLD AND NEW ACTORS OF *BISSES* MANAGEMENT

Irrigation *consortages* are highly concerned by social, economic and policy change. As these changes are spatially differentiated, *consortage* transformations are differentiated as well. The aim of this section is to analyze how the *consortages* react to outside impacts and how their internal characteristics transform. The analysis is based on the results of various case studies (Crettol, 1998; Reynard, 2000; Reynard & Baud, 2002; and Reynard, 2002).

Two tendencies can be seen. Some corporations conserve a high dynamism. Their internal structure (committee, specialized functions) is conserved and they finance their activities (maintaining, technical investments, tourist valorization) without any problems. Part of the financial income sometimes comes from the hydropower industry that buys water no longer used for irrigation because of the decreasing agricultural needs and that is preserved as former water rights in the hydropower concession acts. In the case of tourist investments, these corporations promote the valorization themselves, like the *consortage d'Ayent* (Reynard, 2002). Other corporations, often situated in tourist or suburban areas, have a lot of functioning difficulties. Because of agriculture reduction and urbanization, the consorts do not participate in the *consortages'* activities any more. Very often, the committee is composed of old farmers that have difficulties being replaced by younger ones. The assemblies are sometimes patronized by less than ten members. There is also a reduction of the "official" functions in the *consortage* and sometimes the committee is composed of only one or two persons. Because of the effective water rights reduction, these corporations often have financial difficulties. Because of low dynamism of the committee, these *consortages* often do not ask for subsidies for patrimonial conservation. Some *consortages* are not associated with tourist or patrimonial projects. The maintenance of the infrastructures is also being reduced, which means that potential risks induced by channel breaking increase. This problem is even more acute where the channels cross urbanized areas. The consequence is a difficulty in taking out insurance (Crettol, 1998) and the problem of the responsibility of the committee, and especially of the president, in case of flooding induced by channel degradation. Most of these *consortages* are now trying to be dissolved and to transfer their infrastructures to public administrations. This is clearly a tendency to a transfer from common-property management to public management.

Disposition rights on Swiss Alps rivers were highly transformed when the Hydropower Act (1916) precisely organized the concession of water to hydropower companies. Preservation of former water rights for irrigation was clearly mentioned. That means that in the concession acts, irrigation water rights are preserved, and generally quantitatively calculated. As irrigation needs are now lower than the discharge conserved for irrigation, some corporations sell the water surplus to the electrical companies (e.g. Bisse d'Ayent and Reynard, 2002) and therefore receive interesting financial incomes. Other *consortages* concede water free to the hydropower companies.

Because of a general decrease in mountain agriculture, the conflicts between *consortages* occupying the same watershed, that were very common in the past centuries (SHVR, 1995), are now very scarce. Several scholars (e.g. Lehmann, 1913; Mariétan, 1948; and Netting, 1974, etc.) described very precisely the sophisticated internal regulations that organized water rights distribution between the members and the water allocation (irrigation cycles). These regulations are now often no longer in use. Water access is very often free. Exclusion of non-members is also beginning to disappear, and non-members can often use the channel water freely, as was shown in the Ayent area (Reynard, 2002a). Selling water rights to non-members is possible, as well. In the past, such a practice was forbidden. In some valleys, irrigation water use is completely free (e.g. Bagnes Valley) and infrastructure maintenance is paid by the whole population (Reynard, 2002b). The argument is that irrigation participates in the maintenance of meadows and indirectly to rural landscape conservation: it is therefore logical that this service is paid to the farmers by all of the inhabitants of the valley.

Patrimonial and tourist valorization of the *bisses* induce an enlargement of the actors network (Reynard, 1998). Until the 1970s, three groups of actors were concerned by the *bisses* management: the *consortages*, the local administration and the cantonal agriculture administration (for technical support and subsidies). The new interest for patrimonial conservation and tourist valorization of the channels has enlarged the circles of actors interested by *bisse* management. At the local level, new actors are emerging from the tourist industry (e.g. tourist offices) or simply from society (e.g. associations for patrimonial conservation, association for the conservation of one particular *bisse*, etc.). Very often, these new circles are animated by one or two strong individualities that promote the conservation and valorization of the channels. Sometimes, their actions are not coordinated with the *consortages* that manage the channels.

CONCLUSIONS AND PERSPECTIVES

This presentation of the recent evolution of the *bisses consortages* of Valais show a very high diversity of situations. Some corporations are dynamic and their financial situation is good. They promote the irrigation improvements themselves and the tourist valorization. Other associations are losing speed. Their internal structures are weak and they have an unhealthy financial situation. They often do not promote the tourist valorization of their infrastructures and other specialized associations are emerging. The public policies concerning the *bisses* management have diversified. The general evolution of the social and economic framework is towards a decrease in mountain agriculture and to a tertiarization of the society. The tourism sector is diversifying its offer, by promoting estate activities. The analysis showed however that *consortages* situated in tourist sectors and suburban areas have more difficulties than corporations acting in more rural regions, because of progressive disinterest of their members for agricultural activities and progressive reduction of effective water rights. The principal transformations are presented in the table in **Table 1**.

Table 1: Principal Transformations of Irrigation and Channels Management in Valais (1950-2000)

Characteristics	Situation in 1950	Situation in 2000
Social and economic framework	Regression of mountain agriculture. Lowland agriculture (Rhône valley). Tendency towards a tertiarization of society (emerging winter tourism). Construction of large hydropower dams.	High tertiarization of society. Full-time agriculture occupied only by 3.5 % of the active population. Tourism is diversifying the estate offer. Political willingness to promote sustainable development of the Canton of Valais.
Irrigation infrastructures	Tendency to abandon or technical transformations (concrete tubes, galleries). New irrigation sectors in vineyards.	Conservation of traditional channels. New channels are very rare.
Irrigation	Transfer from gravitational techniques to aspersion, especially in vineyards and orchards.	Transfer from gravitational techniques to aspersion, in the meadows as well. Reduction of vineyard irrigation.
Institutions	<i>Consortages</i> and local administrations.	<i>Consortages</i> and local administrations. Tendency: transfers from <i>consortages</i> to local administrations.
Property regime	Corporations' water rights to rivers preserved in the concession acts for hydropower production. Strict internal regulation of the <i>consortages</i> is evolving. Regulated access to water (irrigation cycles).	Corporations' water rights still in use but not always effectively recognized. Internal regulation often weak or non-existent. Tendency to free access to water.

Public policies	<i>Bisse</i> management concerned by water and agricultural policies. Hydropower policy recognized the former water rights of the irrigation corporations. Agricultural policy: subsidies for technical improvements to irrigation systems.	Greater ecological focus in water and agricultural policies. Enlargement of public policies concerned by channel management. New subsidies for the preservation of patrimonial aspects of the channels and for their tourist valorization. No subsidies for their landscape conservation function in the sense of agricultural policy.
Actors network	<i>Consortages</i> , local municipalities, cantonal agricultural office	Enlargement of the actors network: tourist industry, local society, other cantonal and federal administrations (tourism, environment).
<i>Consortages</i>	Corporations generally well organized. Some <i>consortages</i> no longer exist because of channel abandon.	Differentiated evolution of the <i>consortages</i> . Some conserve their dynamism; others are losing speed.

The question is now to know if the robustness of the irrigation corporations of Valais, that are sometimes five to six centuries years old, is intrinsic to their common-property characteristic or if other reasons to their long-term activity have to be found. The answer is varied. Several *consortages* are very old and it is certainly a sign of a certain robustness or almost a capacity to adapt to changes. The *consortages* are also models of participation management (cf. Ostrom, 1992). But, this paper shows that internal pressure (competition between irrigators, mutual control), that is one reason for the efficient functioning of such corporations (Ostrom, 1992), is hardly decreasing. On the other hand, external pressure (increasing water demand for new uses like drinking water, hydropower production, artificial snowmaking) is increasing. The consequence is that several *consortages* are weakening and some have almost disappeared. One could therefore ask if *consortage* robustness is not intrinsic to the property regime, but a consequence of favorable external conditions like a non-globalized economic context, based on agricultural production, and the absence of interventionism of the central state. Current decrease of common-property management of irrigation in Valais would then be explained by new economic conditions, characterized by a high tertiarization, globalization of the food markets, transformation of agriculture objectives, transformations of the channel functions (new tourist uses) and apparition of new actor groups. Only the *consortages* that are situated in areas with high agricultural activity or the *consortages* that can adapt to the new economic conditions (new types of subventions for ecological agriculture, financing of tourist services, etc.) will survive.

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IRRIGATION MANAGEMENT TRANSFER EXPERIENCE OF LAO PEOPLE'S DEMOCRATIC REPUBLIC

PHALASACK PHEDDARA¹

BACKGROUND

Lao People's Democratic Republic (PDR) is near the top in the list of the world poorest countries. Lao PDR, located in South- East Asia, is one of the Indochina countries, bordered in the North by China, in the East by Vietnam, in the South by Cambodia, in the West by Thailand and Myanmar.

Since 1996 irrigation infrastructures were being rapidly developed in Lao PDR. **Table 1** and **Figure 1** show the status of irrigation achievements of Lao PDR.

Table 1: Yearly Irrigation Development

Year	1975-1995	1996	1997	1998	1999	2000	2001
Dry Season (Thousand ha)	26	28	45	75	124	197	214
Wet Season (Thousand ha)	150	156	164	217	258	296	300
Flood Protection (Thousand ha)	25	27	29	35	40	45	50
Investment (Million US\$)	5.5	2	9	19	37	27	24

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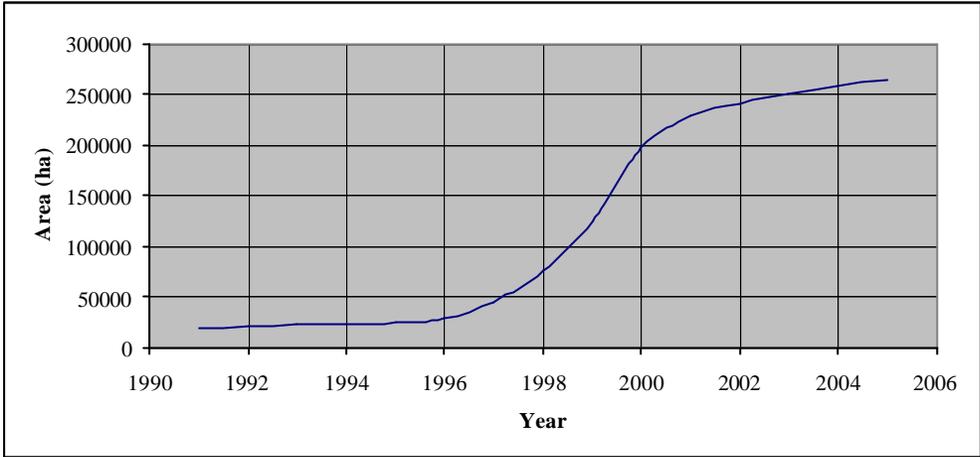


Figure 1: Dry Season Irrigated Area Development

The evaluation by the government in 2000, four years after the start of implementation of the rapid irrigation development program, has found that some changes have occurred. Some of them are positive and others as negative. They are shown below;

The Positive

- Both farmers and government are happy; and
- Rice production rapidly increased.

The Negative

- High investment;
- Not ready for O&M;
- Poor extension service system;
- No market;
- No quality control;
- Limited government staff;
- Lack of experience; and
- Limited budget.

However, the government of Lao PDR has attached high importance to this program. This importance is shown not only by the government

approving about 30% of the total Public Investment Plan for irrigation development in 1996-2000, but also many laws, regulations, guidelines were adopted as follows:

- Prime Minister's Order No. 26/PM, dated December 18, 1998, approved the policy of irrigation management transfer from the government to the farmers' community;
- Announcement by the Central Party Office No. 616/CPO, dated December 17, 1999, stated the result of the Politburo Members decision on irrigation management transfer development concept and modality;
- Ministerial Regulation states the full irrigation management transfer to the water user association (No. 149/MAF 2000, dated 27 June 2000); and
- Announcement of the Ministry of Finance No. 94/MF regarding the Tax of Irrigation Management Transfer (IMT), dated 12 January 2000.

The government has also requested many external financing agencies to assist in the improvement and strengthening of irrigated agriculture organizations and institutions. Some of them are listed below;

- Sustainable Irrigated Agriculture Project (SIRAP) funded by the Netherlands Government through the Mekong River Committee (MRC);
- Strengthening and Restructuring Irrigation Development Project (SRIDP) funded by ADB;
- Farmer Irrigated Agriculture Training (FIAT) Project funded by UNDP;
- Eco-development and Irrigation (EDI) Project funded by UNCDF;
- Master Plan Study on Small Scale Irrigation Development along the Mekong River funded by JICA;
- Small Scale Community Managed Irrigation (CMI) Project Loan from ADB;
- Decentralization Irrigation Development and Management (DIDM) Project Loan from ADB;
- Irrigated Agriculture Infrastructure Development Project Loan from World Bank; and
- Also mobilized many grants, assistances and supports from different NGOs, bi-lateral and international organizations such as; Luxembourg, Vietnam, France, Germany, Japan, Korea, FAO, IHF, American Friend Service (QUARKER), CAA, Concern, etc.

At present, Lao PDR has a total of irrigated agriculture land of 300,055 ha in 19,279 schemes. The types and sizes are given in **Table 2, 3** and **4**:

Table 2: Number and Area of Irrigation Schemes by Type (2001)

Type	Number	Wet Season (ha)	Drv Season (ha)
Weirs	716	53188	26218
Reservoirs	172	22698	13281
Pumps	3435	159589	136260
Gate & Dike	65	6948	2020
Traditional	14787	54497	35609
Gabion	104	3135	972
Total	19279	300055	214360

Table 3: Number and Area of Irrigation Schemes by Sizes (2001)

Type	Small	Medium	Large	Total
Weirs	538/13450	174/35086	4/4652	716
Reservoirs	127/6373	43/11825	2/4500	172
Pumps	3125/62775	29865228	12/31586	3435
Gate & Dike	47/1243	185705	-	65
Traditional	14787/54497	-	-	14787
Gabion	104/3135	-	-	104
Total	18728/141473	533/117844	18/40738	19279

Table 4: Irrigation Schemes Sizes Definition

Small	Medium	Large
Less than 100 ha	100 - 1000 ha	More than 1000 ha

Irrigation Management Transfer

The objectives of Irrigation Management Transfer (IMT) in Lao PDR are;

- To promote community ownership in irrigated agriculture management;
- To promote sustainable irrigation agriculture development;
- To promote effective and appropriate government support;
- To promote and contribute the government decentralization program; and
- To promote the operation of the Village Development Funds.

The IMT Strategy

Long Term: The long term strategy is full transfer of all constructed irrigation schemes (Irrigated Agriculture Management) to the farmers' community.

Short Term: The short term strategy proposes to;

- Improve and rehabilitate and failed irrigation schemes;
- Strengthening of Water User Organization (WUO);
- Transfer automatically newly constructed (Small and Medium) irrigation schemes;
- Transfer step by step the big irrigation schemes; and
- To promote development based on community incentives.

The community incentives mean that the farmers take lead and show the ownership to develop the irrigation facility by themselves. The government through DOI networks will only provide technical support on the request. With the assistance of DOI, the local government will decide case by case the amount of government contribution for project development. This is one of the difficult tasks of the Department of Irrigation. The reasons is that the government has limited budge, but there is demand for irrigation development. The priority is given to those communities which really need and are willing to develop irrigation by themselves. Therefore, the approval process is to be considered case by case. However, no standard is developed. The burden to DOI is increasing. For last five years many thousand irrigation schemes were developed with farmer participation. They have contributed between 15-85% is shown in **Table 5**.

Table 5: IMT Situation

S.N.	Province	Total Need		Up to 2001			In 2002			Total (%)
		No.	Area	No.	Area	%	No.	Area	%	
1.	Municipality	107	24371	53	12469	49.5	25	3630	23.4	72.9
2.	Phongsaly	14	1600	3	520	21.4	1	40	7.1	28.6
3.	Luang Namtha	29	2010	6	509	20.7	7	558	24.1	44.8
4.	Oudomxay	16	3536	36	1433	31.0	8	250	6.9	37.9
5.	Bokeo	50	5491	17	1391	34.0	1	100	2.0	36.0
6.	Luang Prabang	138	4126	2	97	1.4	13	528	9.4	10.9
7.	Saiyabury	17	9324	35	1150	29.9	16	820	13.7	43.6
8.	Houaphan	59	7250	6	750	10.2	10	1200	16.9	27.1
9.	Xiengkhouang	91	6960	24	2348	26.4	10	250	11.0	37.4

10.	Vientiane	167	45500	69	5911	41.3	50	6100	29.9	71.3
11.	Bolikhamsai	95	11000	75	5750	78.9	7	695	7.4	86.3
12.	Khammouane	138	20000	75	8110	54.3	35	1600	25.4	79.7
13.	Savannakhet	265	25000	96	8114	36.2	62	8917	23.4	59.6
14.	Saravane	123	12000	77	9400	62.6	10	600	8.1	70.7
15.	Champasak	208	14773	87	6177	41.8	52	3744	25.0	66.8
16.	Sekong	22	914	2	121	9.1	3	180	13.6	22.7
17.	Attapu	10	1280	2	165	20.2	2	180	20.0	40.0
18.	Special Region	57	1600	3	80	5.3	6	150	10.5	15.8
Total		1806	196735	668	64495	37.0	318	29542	17.6	54.6

At present, about 1800 irrigation schemes which cover about 200,000 ha of irrigated land need to be transferred. There are about 17,600 small irrigation schemes covering about 100,000 ha of irrigated land. They do not need to transfer, because they are too small. Most of them were built traditionally by farmers themselves.

Water User Organization

- Water User Association (WUA), registered with the Provincial Finance Service Office.
- Water User Group (WUG), registered at the District Governor Office.

WUO is usually established during the pre-construction stage in order to mobilize farmers contribution for the development of the irrigation scheme. The mobilization work takes place with assistance of the provincial and district extension workers. A standard structure is proposed;

Before Operation: The WUO consists of;

- Chairman
- One or two Deputy Chairman
- Three Committees for 1) Labor, 2) Quality/Quantity and 3) Finance/Procurement

When system is in operation, following officials will be elected;

- Chairman
- One or two Deputy Chairman
- Three Committees 1) Labor, 2) Water Management and 3) Administration

Basic regulating instruments for establishment of WUO are as follows:

- Ministerial Decree No. 156/MAF, dated 17 March 1997 on Irrigation Water User Association;
- Departmental Guideline on implementation of the Ministerial Decree on Irrigation Water User Association;
- Ministerial Regulation No. 1150/MAF. 2000, dated 27 June 2000, regarding the establishment and role of Water User Association.
- Ministerial Order No. 0202/MAF. 2000, dated 4 March 2002, regarding Agricultural Production Institution in Irrigated area.

Irrigation Service Fee (ISF)

An ISF is proposed which would support the full cost of routine operation and maintenance. The amount payable for ISF will vary from site to site depending on site specific needs. The WUO would set the rate of ISF on an annual basis, with the assistance of the Irrigation District Technicians. ISF requirements are expected to range from US\$25 to US\$100 per ha per year or equivalent to 250-1000 kg/ha/year.

Village Development Fund (VDF)

VDF should be established at village level on voluntary basis, WUO have not established VDF. With the new IMT process the WUO must establish a VDF. The VDF can be owned by the WUO or shared between WUO and Village authority.

The recommended payments to VDF are in kilograms of rice per hectare per year. The following amount is proposed;

- For a gravity irrigation system, 200 kg/ha/year
- For an electric powered pumping irrigation system, 150 kg/ha/year, and
- For a diesel powered pumping irrigation system, 100 kg/ha/year.

85% of VDF collection remain for the use of WUO and the remaining 15% will be contributed to the District Technicians for the sources provided. No portion of these funds would go up to a higher level.

The main objective of VDF is to mobilize all potential local resources for multi-purpose use for village development activities. With WUO, the main

objective of VDF is to make funds available for operation and maintenance of the irrigation system.

Basic regulating instruments for establishment of VDF are as follows:

- Prime Minister Order No. 01/PM, dated 11 March 2000, on decentralization program.
- Ministry of Finance Regulation No. 1823/MF, dated 24 November 2000, on Village Development Fund.

O&M activities for which the WUO is responsible are:

- Running cost (electricity, diesel, etc.)
- Administration
- Services (water distribution, cleaning)
- Maintenance (spare parts, fixing, repairing)
- Rehabilitation

The Ministry of Agriculture and Forestry through its provincial and district representatives was assigned to help and guide the WUOs on the use of VDF. The Chief of District Agriculture and Forestry Service Office becomes the adviser of the WUOs. All decisions are made by the WUOs themselves. The Ministry of Finance should be responsible for the auditing of VDF.

Lesson Learned (goodness/weakness)

Good Lessons

- Party and Government strongly support and give importance to VDF as a high priority;
- Solving the problems of food security, food sufficiency, increased work availability, reduction of poverty, reduction of shifting cultivation.
- Reduction of government allocation for O&M;
- Increase community ownership, support the government decentralization program;
- Participatory development and management;
- Getting support from NGOs, bilateral and international organization.

Bad Lessons

- Ideological conflict between the old and new development concepts;
- Limited qualified and experienced
- Limited extension fund and facilities;
- Not ready for implementation;
- No preparatory study for the Rapid Irrigation Development Program.

SOME EXPERIENCES AND LESSONS ON THE ROLE OF COMMUNITY IN PARTICIPATORY IRRIGATION MANAGEMENT IN TUYEN QUANG PROVINCE VIETNAM

NGUYEN XUAN TIEP¹

CONTEXT

Tuyen Quang is a poor mountainous northern province of Vietnam with its natural land area of 580,090 ha. in which 65,017 ha. is cultivated agricultural land, making up 11%. 447,761 ha. is the forestland, making up nearly 80%. The population of Tuyen Quang is 700,000 belonging to 22 different ethnic groups. As a monsoon and tropical climate area, high percentage of slopes are downgraded by rivers and streams. Annually, Tuyen Quang suffers from fiercer floods and inundation during rainy season, especially the flash flood and accumulated flood. Sunshine and hot weather contribute drought in summer. Biting cold, dry and low humidity in winter affect agricultural production and economic life. Many hydraulic works, mainly small-scale structures, have been constructed with the support of the government in Tuyen Quang.

Before 1996, there were 1,342 structures in the whole province. Out of them, 152 were managed by the State under Irrigation Management Company (IMC). Local people manage the remaining structures.

The irrigation fee collected annually from the state-managed structures was 450-500 tons of paddy rice which is only enough for salary of management staff. Due to lack of funds for annual maintenance, rehabilitation and upgrading of most hydraulic works in Tuyen Quang were seriously degraded. Some of them even stopped functioning.

Issue for Consideration

Annually, a large amount of fund is required to invest for repairing and rehabilitating the existing structures in Tuyen Quang. The requirement for maintaining system is estimated to be about 10 billion Vietnamese Dollar

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(VND)²/year (= 700 000 US\$). While the irrigation fee collected was 500-600 million VND (=35-40 000 US\$), the State invests in an average of 300 million VND/per year (= 20 000 US\$). If the investment is only at the level mentioned above (nearly 1 billion VND/year (= 70 000 US\$), accounting approximately 10% of requirement), then the question remains when will the hydraulic works system in Tuyen Quang be completely optimizing its design capacity?

Officials and farmers in Tuyen Quang recognized that individual households could not carry out hydraulic works construction. Even if efforts were made, it was ineffective, therefore the community participation was needed. As benefits come along with responsibilities, the management transfer of local hydraulic works to farmers would achieve the most effective result. With the above consideration in order to overcome the existing lack of fund, the People's Committee of Tuyen Quang province *decided to assign the farmers the management responsibility of hydraulic works through the Cooperative established by them.*

Achievements after Transferring the Structure Management to Farmers

In the past, many people were afraid of the transferring of structure management to farmers' thinking that it would make the structures more quickly degraded.

But the Results are Positive

Nearly 100% of hydraulic works of various types in Tuyen Quang have been assigned to the farmers for management with three different categories:

- Inter-district structural management board (managing the structures which serve irrigation for 2 districts)
- Inter-commune structural management board (managing the structures which serve irrigation for at least 2 communes)
- Cooperative (managing the structures which are located totally in a commune with many hamlets)

Important results of management transfer are;

² 1 US\$ = 15273 VND (Dong).

- The structures formerly had no owner. After transfer, the farmers have been the real owners. The farmers have been trained so they gained knowledge to use water economically. No tension on water related conflicts occurred. Cutting channel banks for getting water and destroying structures have been reduced. The responsibilities of farmers have been clearly defined.
- Farmers have contributed financial resources to build structures (equivalent to 30- 37% of the cost)
- Number of structures increased from 1,342 to 1,443.
- The farmers have participated in discussion through their cooperatives on financial income and expenditure, protection duty, structure maintenance and irrigation fee collection.
- Farmers contributed their financial resources to set up irrigation structures: In 1997, the total invested capital was VND 7.454 billion, in which share of farmers was VND 2.71 billion (nearly 37%). In 2000, total invested capital increased to VND 86.3 billion, in which share of farmers was VND 24.8 billion (nearly 30%)
- Due to the saving of irrigation water, the irrigated area has been increased. Paddy cultivated area was 41,600 ha in 1996 whereas in 2000 it was 44,500 ha. Similarly, rice yield has also increased from 7.6 tons/ha/year in 1997 to 9 tons/ha/year in 2000. In some areas, it was reported to be 12 tons/ha/year

Irrigated areas of others crops, such as maize, peanut, vegetables, tea, sugarcane are not included in the paper.

There was also their use of water.

- Fresh water was provided to 100,100 people in 1997. In the year 2000, receiving fresh water was 192,000.

The irrigation fee is increased to 749 kg/ha/year from 200/kg/ha. The fund is enough for operation and maintenance of the structure. Following figures show the increasing trend of fee collection.

- In 1996, 748 tons of paddy rice was collected
- In 1997, 2.470 tons of paddy rice was collected
- In 1998, 3.200 tons of paddy rice was collected.
- The increment is 4 times higher in comparison to the fee of 1996.

Cooperatives collected 100% irrigation fee is kept by the Cooperative. Out of that, 20% is used for managerial expenses and 80% for structure repair and maintenance.

- During 1999 – 2000, farmers contributed construction materials and labor to construct 710 km canals of all types. The cost is equivalent to 48.5 billion VND (nearly 3.5 million US\$)
- Irrigated area, productivity, and yields have increased. Many places have registered the rice yield of 12 ton/ha/year increase from 6 ton/ha/year.
- The farmers are very pleased with the benefit of their participation so they have paid attention to the protection of their structures in their local area.
- It is said that the rate of irrigation fee in Tuyen Quang is too high, especially for the people living in the poor mountainous area. During interview on the irrigation fee, the farmers said: “We do not care much about whether the irrigation fee is high or low but we really care of whether the water is supplied enough and timely by the cooperative”. In some cases, due to repairing of head works, water could not be supplied adequately and timely. This resulted in lack of water. Hence the irrigation fee was given back to the farmers.
- In the State managed structures, the farmers had to pay irrigation fee in cash or paddy rice. The collection would be used to pay salary for persons in charge of managing, repairing and maintaining the structure. However, the farmers were short of both cash and paddy rice while their labor force was abundantly available. Since the structure management has been transferred to the farmers, they can pay irrigation fee by their labor force for repairing channels and structures, exploiting construction materials (rock, brick, sand and gravel and so on). During 1999-2000, as mentioned above, farmers contributed construction materials and their labor force to construct 710 km canals which is equivalent to 48.5 billion VND (nearly 3.5 million US\$). This is a huge irrigation fee source that has been achieved by mobilizing local people. By this way, many communes even have contributed irrigation fee for some coming years. For example: the Yen Nguyen commune has contributed irrigation fee up to the year of 2005 (5 years in advance), the Binh Xa commune has paid irrigation fee up to 2007 (7 years in advance) with these

contributions, many head works have been upgraded, repaired and reinforced.

LESSONS LEARNT FROM THE PRACTICE OF TUYEN QUANG PROVINCE

Consciousness of Officials and People

The key officials at all levels have to well understand the trends for making proper decisions, proposing appropriate policy mechanisms, giving guidelines to farmers in implementing effective hydraulics works operation and management. If training is provided, farmers would act effectively.

It is noted that the provincial officials have to understand the process. Then provincial officials guide to the district officials. The district officials provide guidelines to commune officials to transmit to the farmers.

The experiences have shown that the key provincial officials play decisive roles in such success.

Policy Mechanism

Policy mechanism has to be unified from up to down. This is an important aspect for local actions. In order to implement such program, there should be appropriate policy mechanism corresponding to practice of localities and establishing a legal corridor for operation (as the decision on establishing cooperatives, irrigation fee levels, land and investment policies...). These policies have to be adjusted in accordance with the practical demands of farmers. If farmers pay irrigation fee in advance (at least one year), 15 % irrigation fee will be reduced. A special concern was raised regarding transfer of the State managed structures to people. The transfer also includes the human resource transference. Thus, it is necessary to have strict and reasonable policy mechanisms for transferring labor force in order to assure stable jobs for the employees. Being different from other provinces, Tuyen Quang has not been fully dependent on State. On the basis of policy frame issued by Center, it has forcefully issued suitable, creative policy mechanism in response to local condition.

The Role of Community

Paying attention to the role of community is very important. Based on community participation, mobilization of internal forces is of further significance. Tuyen Quang has mobilized the community force through the following conditions:

- *Communes and villages are linked by blood-relationship* so they are willing to foster the cooperation, financial support (lending money/fund), labor support to contribute in hydraulic works management and operation, equal land allocation and water delivery which create a real union. When conflicts occur, they themselves can solve their problem satisfactorily and sustainably.
- *Job relationship is expressed by cooperatives.* These organizations are established by themselves to protect their benefits, creating sustainable communities, and supportive assistance for rural development.

In Tuyen Quang, not only the direct beneficiaries but also all people in community contribute money and labor force. This is the powerful force to assure the successes.

Some channel parts in Tuyen Quang have consolidated by the contributions of factories, association organizations that located in province (as the channel routes of War Veteran Association and Cement Production factory...)

- *Gender Relationship*

Gender plays an important role in promoting the participatory irrigation management and operation.

Women should be taken into account. Women in Tuyen Quang play important roles. They participate and take the key position in State authorities as Deputy Secretary of the provincial committee, Vice-Chairman of the provincial people's committee, Chairman of district people's committee and Directors, Deputy Directors of Departments. More than 35 female officials are in charge of key positions at provincial level excluding many female officials who are taking leading role at district levels and communes. They have brought into play their patience, careful, strict, and openhearted characters to work perfectly.

Ms. Nguyen Thi Dinh (Deputy Director of Department of Agriculture and Rural Development) is a female official, who participated some training course organized by DSE organization, participates directly in giving directions for hydraulic works management and operation. She is the person who proposed positive solutions to implement the transference of hydraulic works to farmer. Obviously, this issue has been approved by leaders of province including support comments of Ms. Ha Thi Khiet (Provincial Committee Secretary). Apart from Ms. Dinh, many female officials who are leaders of districts (Chairwoman, Vice-chairwoman of the People's Committee) and concerned sectors (directors, deputy directors of Departments, Farmer Association, Woman Union Association, Youth Union) in province have taken united actions. Their actions express persuasively the role of women and make the management transference of hydraulic works in Tuyen Quang to farmers more effectively.

Collaborated Organization

It must belong to farmers. It must be established under their voluntary spirit and the organization should be self-reliant and financially sound. Its operation should be consistent with the State rules and regulations.

The Role of Sector

Implementation of the Resolution No 06 dated 10 November 1998 of the Vietnam Communist Party Politburo on "some issues for agriculture and rural development" provides guidelines in this sector. It includes issuing policies to encourage people to participate in hydraulic works investment and operation". The agricultural sector of Tuyen Quang has well carried out the function of proposing policy mechanism for targeted implementation on the base of united will and action of sectoral leaderships, staffs and other concerned sectors in the province.

Role of Officials

At the beginning, the implementation of the management transfer program of the hydraulic works to farmers faced the biggest obstacle that the officials did not conceive adequately and fully understand the program. They were not ready for action. They were afraid of resistance of people, "loss of power, benefits, finance, property" that they were managing and also "having additional work with undefined results". However, as through the seminars, workshops and consultation meetings, officials at all levels

from different sectors were provided enough awareness of soundness and necessity of this program. They gave guidance to the farmers in carrying out the program successfully.

Setting up Pilot Models

Due to different features of irrigation systems in numerous areas, it is necessary to set up pilot models. It is possible to draw lesson through these models in order to develop and expand as well as ensure their sustainability.

Training and Improving Knowledge

The farmers were exposed to the program and policy mechanisms (law, decree, decision, regulation, and statutes) through mass media. By doing so, the awareness of farmers is raised. Their roles are brought into play. Their benefits and responsibilities in hydraulic works management and operation are defined more clearly. Therefore, the farmers are ready to participate in discussions. Once they agree, they will implement effectively.

Tuyen Quang paid more attention on training. The provincial program is to strengthening capacity of officials at all levels (province, district, commune, cooperative) by short training courses, workshops, study tours or establishing on-site training courses or sending officials for training in central university and colleges. At present, the cadre of Tuyen Quang has been trained basically. They are in charge of important work including hydraulic management and operation. Some staff of Tuyen Quang had been trained through DSE programs which were organized at Tuyen Quang and some places in Vietnam as well as Lao PDR.

Infrastructure

Hydraulic works have to be assessed and plans are proposed for upgrading the structure by different funds (State budget, people's contribution).

Government Role

In spite of the successful results achieved in Tuyen Quang in Irrigation Management Transfer (IMT), Participatory Irrigation Management (PIM) have not been extended to other provinces and even nation wide. One of reasons for this delay is that the government has not issued a united

program. There is no timely and appropriate policy and framework or positive measures for supervising, speeding up the roles of local authorities. There is need to have working mechanism, policy framework, proper solutions to carry out PIM and IMT in order to bring into play the highest efficiency of hydraulic works located in local areas as well as to assure the balance on direction from “up” to “down” and vice versa.

Role of VNPIM

VNPIM network has recently set up in September 1998. Despite of financial difficulties and limited numbers of members, the network is functioning effectively. There should be formulation of proposals for development and orientation of PIM, writing PIM relevant documents, carrying out training programs, compiling guidance documents, exchanging experiences of external and internal bodies in implementing PIM and IMT.

COUNTRY REPORT ON FMIS IN CAMBODIA

SONA CHY, MAO SANNAY, TE OUVKIM, SIN VUTHY AND PANG PENG¹

INTRODUCTION

General

Cambodia is surrounded by Laos and Thailand to the North, by Thailand to the West, by the Gulf of Thailand to the South and Vietnam to the East. The total area of the country is 181,035 km², consisting of 24 provinces, including 2 municipalities. The forest area is 67%, equal to 12.1 million ha. The cultivated area is approximately 21%, equal to 3.78 million ha. In 1999, the rice was cultivated in 2.08 millions ha, occupying 91.2% of the total cultivated area.

The population is estimated to be about 12 million. The annual average growth rate is 2.8% with the population density of 51 persons per km². It is notable that there is sex imbalance, 52.2% are female and 47% are male. The agriculture sector in Cambodia has been the top earner of the national economy, contributing 75% employment. 45% of the GDP comes from agriculture in 1994. Cambodia is a typical rice-producing and exporting country with favorable natural condition for paddy cultivation.

Rainfall

The rainfall distribution varies among regions, with an average of 3000 mm per annum in Western coastal regions, between 1800 - 3000 mm per annum in the East areas of the Mekong River and around 1200 mm in the Central area.

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Temperature

The temperature across the country ranges from a mean minimum of 19°C in January to a mean daily maximum of 35°C in April. There is very little variation across the region with differences of the order of about 32°C. The mean annual temperature varies from 26.9°C to 27.8°C.

Available Water Resources Development in Cambodia

The water sector contributes to many development activities in Cambodia. They are;

- Irrigation contributes to agriculture, and therefore to the achievement of food security, poverty reduction and socio-economic development.
- Water supply and sanitation meet the needs of the urban and rural populations, as well as their health requirements, and contribute to the achievement of better living standards.
- Drainage and sewerage, also, contribute to better health and living standard.
- Hydropower development aims at socio-economic development. They include;
 - Inland navigation serves to move goods and passengers from one place to another, and to facilitate tourism in general.
 - Water contributes to the livelihood and food supply of the population by providing fish, animal protein and aquatic plants.

BACKGROUND OF IRRIGATION SYSTEM IN CAMBODIA

Irrigation and Land Use Development

Modern irrigation systems were developed at the time of French colonial period during 1930 to 1953. These included the Bavel project in Battambang (30,000 ha supplementary irrigation), a number of storage reservoirs, including Kompong Sne in Prey Veng (100 million m³), Bat Rokar and Lom Chang in Takeo (30 million and 6 million m³ respectively), and several colmatage (flood recession) canals.

Following independence, between 1953 and 1960, eleven major schemes were constructed with the assistance of the United State, including partial rehabilitation of Bavel Irrigation project.

A number of new projects were constructed. With completion of these projects, the area under formal irrigation amounted to 74,000 ha (MOWRAM).

The events during the years of 1975 - 1979 period created a major impact on agricultural systems throughout Cambodia. Recognizing the importance of irrigation, the Cambodia Government undertook the construction of diversion works, reservoirs and other structures, supplying a rectangular grid of canals across a large part of the rain areas. In many cases, however, the works were designed and built with little regard to basic hydrological and engineering principles. In many instances, traditional water distribution and drainage patterns were disrupted so the performance was below expectations and structures were damaged or destroyed by floods.

An inventory of irrigation systems carried out in 1993 - 1994 by the Mekong River Commission (MRC) listed some 920 schemes totaling 310,000 ha in the country. In rainy lowland systems, the distinction between irrigated and rainy area is not clear. However, water is not supplied through a formal distribution irrigation system in the rainy low lands.

Donor Assistance in the Irrigation System

In Cambodia, the donor assistance to the development of the irrigation sector has been substantial. Many bilateral and multilateral institutions are involved in irrigation development. The Mekong River Commission Secretariat (MRCS) prepared an inventory of potential hydropower, irrigation project and the emergency rehabilitation of key irrigation structures damaged by flood in 1991. They have also initiated a longer-term countywide irrigation rehabilitation study. The Asian Development Bank (ADB) provided funds for a Special Rehabilitation Assistance Projects that included irrigation. ADB is planning to finance the Sung Chinit Water Resources Development Projects, one of the large-scale of irrigation projects in Kampong Thum. To generate employment, ILO has instituted a labor-intensive infrastructure rehabilitation program. In the irrigation sector, rehabilitation of canals and minor structures are being undertaken on the Bavel (Battambang) and Barai (Siem Reap) schemes.

Funds are being provided by UNHCR, UNDP/CARE, WFP and the Netherlands.

The JICA is providing US\$ 10 million for the development of flood plain areas and colmatage rehabilitation. The World Bank is extending a technical assistance grant of US\$ 2 million to increase the capacity building of MOWRAM staffs. The Food and Agriculture Organization (FAO) funded a pilot project on water control technologies. The European Union, as part of the program de Rehabilitation au Secteur Agricole du Cambodge (PRASAC), is developing local capacity building of farmers association in the provinces close to the Phnom Penh. The GTZ has been providing support for investigation and study of small and medium scale irrigation schemes in Kampot and Kampong Thom provinces.

The World Bank assisted Agricultural Productivity Improvement Project (APIP). The hydrological component focuses on capacity building within MOWRAM and at the provincial level of Kampong Thom and Kratie provinces. APIP will provide training, technical assistance, vehicles equipment and staff allowances.

NGOs have been providing assistance to the agricultural sector since the early 1980s. Currently, 20 NGOs are involved in irrigation, providing materials, equipment and technical assistance channel directly to central and provincial authorities. The work has focused on the rehabilitation of existing irrigation systems including repair of reservoir bunds and outlets works, pumps and rehabilitation of canal networks. The selection of schemes has not been in conformity with the national plan. NGOs have been involved in organizing and promoting farmers' organizations in particular for water user groups since 1991. Water user groups are to encourage the farmer's participation and involvement in the planning of operation and maintenance of irrigation systems.

FIELD EXPERIENCES OF IRRIGATION MANAGEMENT

Policies and Strategies in Irrigation Management

The irrigation system contributes the water for many purposes. The Government has recognized the socio-economic developments in April 2000. The formulation of the farmer water user community for the participatory irrigation management is very important. The Farmer Water User Community (FWUC) is a mechanism established by farmers. It has duties to manage water in irrigation systems by obtaining due recognition

from the Royal Government of Cambodia. The FWUC under the board of FWUC performs as the facilitator.

The irrigation development program shall be implemented only on the basis of the feasibility and demand of the majority of the farmers. During the planning and implementation of irrigation projects, participant-farmer's roles have been recognition at all levels from the beginning. Upon the completion of the project, the responsibility of operation and maintenance of emergency repair shall rest with FUWC, according to the government policy: The schedule is as shown in **Box 1**.

Box 1: Government Policy on Operation and Maintenance					
•	In year one	:	the government shares	80%	and the farmers members 20%
•	In year two	:	the government shares	60%	and the farmers members 40%
•	In year three	:	the government shares	40%	and the farmers members 60%
•	In year four	:	the government shares	20%	and the farmers members 80%
•	In year five	:	the government shares	0%	and the farmers members 100%

In the first year, 20% of responsibility for operation and maintenance shall remain in the bank account of FWUC as fund to cover the emergency repair and maintenance expenditure in the modernization of irrigation system.

The government's objectives of the participatory irrigation management is as follows:

- To receive efficient, sustainable, reliable and environmentally friendly irrigation systems.
- To promote irrigated agriculture ensuring food security and growth of the national economy.
- To increase gradually the role and responsibility of organized farmer users in every stage of program implementation including repair, operation and maintenance.
- To enhance the capacity of the farmers and FWUC in the irrigation management system.
- To promote the awareness of the management, responsibilities on irrigation schemes and expedite the transfer process to FWUCs.
- To encourage the international financing agencies for increased funding in the irrigation management and development.

On-going Irrigation Management Programs

The Ministry of Water Resources and Meteorology (MOWRAM) are involved in many types of irrigation systems in Cambodia. There are two other Ministries concerning the irrigation activities such as Ministry Rural Development and Ministry of Agriculture, Forestry and Fisheries.

There is a beginning of national program as the demonstration pilot areas on participatory irrigation management with FWUC. The initial operation and maintenance cost provide to the FWUC in the first phase of this program is for 5 years. The national program will cover in 11 places. The executing agency of this program is the Ministry of Water Resources and Meteorology under the financing of ADB Loan No. 1445. The major objectives of this program are such as:

- To formulate the FWUCs in the existing irrigation systems in provinces around the Great Lake and along the Mekong and Bassac Rivers.
- To properly operate and maintain the existing irrigation systems for increasing the agricultural production, reducing the poverty, and improving the food income security.
- To establish the support team for FWUCs.
- To strengthen the capacity building of MOWRAM on Participatory Irrigation Management (PIM), Irrigation Management Transfer (IMT), National Policy for FWUCs, Monitoring and Evaluation on the performance of the irrigation systems.
- To implement the Circular No. 1 on the implementation policy for sustainable irrigation systems in the FWUCs formed in the project areas.

FWUC Responsibilities on the Irrigation Management System

There are two FWUC in Cambodia. One of them is called FWUC for domestic water supply for clean water use and another is called FWUC for agricultural irrigation water user as irrigated water.

The responsibilities of FWUC on the irrigation management system are as follows:

- To comply with government laws and regulations

- To use and preserve irrigation infrastructure consistent with transfer agreement
- To promote productive, efficient, equitable and sustainable use of water for agriculture and other basic needs of all water users
- To follow FWUC constitution, by laws and transfer agreement
- To follow democratic principles of openness, honesty and fairness
- To protect the environment

CONCLUSION

In the case of Cambodia, the investment in irrigation or drainage and land in the Special Program for Food Security (SPFS) is limited. Thus, there is a less impact of SPFS on agricultural productivity improvement. The Food and Agriculture Organization has a beautiful idea to start the SPFS in Cambodia. The FWUCs must be established before the irrigation rehabilitation and construction of the system. All irrigation management systems must have the involvement of the FWUCs. All members of FWUCs know and understand how important is water fee for O&M the irrigation systems.

REFLECTIONS ON BANGLADESH: GUIDELINES FOR PARTICIPATORY WATER MANAGEMENT (2000)

DIRK R. FRANS¹

INTRODUCTION

In some countries, such as Nepal, participation of farmers in irrigation is common practice. In other countries there is now a lot of talk about participation of direct stakeholders in water management, but in practice there is still a long way to go. Water management in general takes place in a rapidly changing context, as acknowledged in the title of this conference. This paper highlights the dynamic theoretical and practical context of stakeholder participation in water management in Bangladesh.

The government of Bangladesh has recognized that people are central in water resource management. Its *National Water Policy* (NWPo) (Ministry of Water Resources, 1999) stresses this again and again. This policy calls for guidelines and manuals to be developed to ensure that the policy is implemented. One of the first such guidelines to be approved is the *Guidelines for Participatory Water Management* (GPWM) (Ministry of Water Resources, 2001). This paper then deals with people, participation and water management in general and with the GPWM in particular.

Before dealing with the core issues, the next section first clarifies the key terminology, i.e. what 'people' and 'participation' mean. The third section looks at the dynamics of the process of producing these guidelines and at the actual guidelines drafted before the GPWM. On the basis of this context the strengths and the weaknesses of the GPWM are highlighted. In the final section conclusions are drawn on how the guidelines may contribute to improved water and wetland management.

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CLARIFYING TERMINOLOGY, COSTS AND BENEFITS

Nowadays everyone is in favor of more ‘people’s participation’. But what do financiers, bureaucrats, consultants, NGO workers, policy makers, politicians and local people mean when they say they support ‘people’s participation’? When these groups have to work together to implement participation, it usually does not take too long before they realize they actually mean rather different things. This confusion about what we mean is one of the reasons why grassroots people have seen so little of what participation means in practice. We will therefore first clarify what ‘people’ and their ‘participation’ might mean and what the costs and benefits to the various stakeholder groups are.

People?

In the 50s and 60s ‘community development’ was the approach. All the big donor agencies were involved in community development and the expectation was that it would improve life for billions in villages worldwide. The results were disappointing. Research showed that a major reason for this failure was a simplistic understanding of village life. Community development was the brain child of specialists living in cities, educated in universities following a western type of education. Financiers were from a similar, middle class background and themselves came mostly from the West. Those who designed such project and programs shared a simplistic and often idealistic view of rural life in the Global South. To them villages seemed ideal, almost romantic places, with people living in harmony with each other and their surroundings. With a little help from the outside, some scientific knowledge and infrastructural development, the villagers were expected to come out of poverty.

At the end of the 60s and early 70s alternative worldviews and social research presented a different picture; villages were not inhabited by a single, homogeneous group of people, but by a variety of people related to each other through various networks of power. Concepts such as ‘class’, ‘interest and target group’ and ‘gender’ became common ground. The NGO sector in Bangladesh developed relatively successful approaches based on this new understanding. Later development financiers and the government moved from the community development towards a much more targeted approach.

The trend away from a homogeneous community approach can also be seen in water management in Bangladesh. In the 60s and 70s project design was based on the understanding that all villagers were farmers. If water management could be improved to suit them, then development would occur almost automatically. In the early 80s, first in some of the smaller schemes, it became clear that rural life was more complicated than that (Datta, 1999). From then on social analysis slowly got a foothold in water resource management. In the early 90s the need for a much more comprehensive understanding of rural society was put firmly on the agenda, mainly through the extensive studies of existing schemes done under the Flood Action Plan (FPCO, 1992a and FPCO, 1992b).

Nowadays, the concept of community development has lost most of its appeal². However, no other single term or approach has replaced it. For instance in the National Water Policy of Bangladesh the following words are used: people of Bangladesh (7 x); women (7x); stakeholders (4x); individuals (4x); people's participation (2x); people at large (1x); public as a whole (1x); public participation (1x); public support (1x) and farming community (1x). The term 'community' is found 17 times, 'beneficiary' is used seven times, 'target groups' are mentioned three times and there is one reference to 'rural poor' and to 'project affected persons'. Fishers or fishermen are not mentioned at all.

These different terms can be grouped into three different categories. Generally speaking it may be assumed that terms like the people, the public, villagers, etc. come from a worldview and an understanding which sees villages from a global perspective and as undivided units. It is similar to the view that gave birth to the 'community development' approach. The same top-down perspective applies to the word 'beneficiary'. The second category is of very specific terms such as women, farmers, fishermen, target groups, etc. These terms come from an understanding of society as full of different interest and therefore conflicts. The third category of words is that which acknowledges differences in society but without being specific, such as in 'stakeholder' and 'interest group'.

² There are signs from the NGO scene in Bangladesh that the stress on heterogeneity and conflicts between the various interest groups may have gone to far. For example, some of those who champion the rights of women and have therefore targeted them to the exclusion of men, now say they must also involve men. After all many of the problems faced by women are caused by men and solving these problems will require the active cooperation of men. However, those involved, usually stress that they are not moving back to a simplistic community-based approach.

Participation?

In the next section we will return to stakeholders and interest groups in relation to participation in water management. But first we will turn to what people mean when they use the word 'participation'. Participation has many definitions. One definition that captures the main elements is the following:

- Participation is a process through which stakeholders influence and share control over development initiatives and the decisions and resources which affect them. (World Bank, 1996:1)

While the definition is quite clear, the words 'influence and share control' raise the questions to what extent stakeholders can participate. Other questions are how stakeholders can ensure that their voice is heard and at what stage of an intervention they participate. To start with the extent of participation, Pretty (Pretty et. al., 1995), as quoted in Bron, describes 7 types of participation:

- I. Passive Participation
- People participate by being informed about what is going to happen or what has already happened. It is a unilateral announcement by an authority.
- II. Participation by Giving Information
- People participate by providing factual information asked for in the formal context of a prepared questionnaire or similar techniques for data collection.
- III. Participation by Consultation
- People's views are solicited by external agencies who defined the problem. The extent to which these opinions are considered when formulating the solutions remains the prerogative of the external professionals who are under no obligation to take on board any of the people's views.
- IV. Participation for Material Incentives
- People participate by providing resources -usually labor -in return for a reward.
- V. Functional Participation
- People participate by forming groups to meet predetermined objectives. These objectives are defined by the external professionals who already have made the
- Initial major decisions and who continue to retain final authority.

- VI. Interactive Participation
- People participate in joint analysis and decision-making with the external agencies. The people, through their groups or representatives, take control of local decisions and assume a range of responsibilities.
- VII. Self-mobilization
- People participate by taking initiatives independent of external agencies. They mobilize and organize themselves around common needs and decide how their
- Environment should be developed. External agencies may provide resources and
- Technical assistance, but the people retain full control (Bron, 1998:16-17)

From this quote it is clear that participation can mean anything from being the passive recipient of say government information to complete independence and self-control. While one can debate the details (is IV, being paid to do work, 'participation'?), two things can be said. The first is that there are a number of levels, or intensities in which one can participate. Secondly, based on evaluations of water management interventions (Soussanm, 1997 and Datta, 1999), etc., there is a need to move from the more passive towards the more active types of participation.

The next element of participation to look into is how local people can make sure their opinions are taken into account. The most comprehensive form is the kind of one-man-one-vote practised in referenda in some countries such as Switzerland. While being the most comprehensive form of participation, it may not always be necessary nor possible. A second form is that of participation through representation or delegation. Stakeholders appoint people to represent them and they have to report back on what happens. This too is a fairly active form of involvement. Finally participation may be through those who hold positions of leadership and as such act on behalf of the people.

Which form of participation is appropriate in a particular situation depends on who you ask. Outsiders may point out that the more unequal and less transparent a society is, the more there is a need to get as many stakeholders as possible, actively involved. In the water sector in Bangladesh this would mean developing mechanisms to ensure that not only the elite, but also less powerful and vocal groups are heard. This desire is reflected in both the National Water Policy (Ministry of Water

Resources, 1999:8, 9, 18) and the GPWM (Ministry of Water Resources, 2001:2, 4, 5). However local stakeholders may have a different perspective. They may prefer a form of participation that ensures them the best chance of getting what they want from the government bureaucracy. They may therefore prefer to participate through individuals, often the elite, with experience in dealing with government agencies.

Finally two more facets of participation need to be looked at; the level and the stage at which local stakeholders are involved. There is general agreement that decentralization is necessary to enhance development. Here the concept of subsidiarity comes into play, namely that decisions should be taken at the lowest level possible. In water management this means that local stakeholders should participate and decide on all local issues unless there are external impacts that require involvement of a higher authority. The question of what stage local stakeholders should get involved is also undergoing change. In the tradition top-down approach outside authorities decide on (national) objectives, define the problem involved, select a preferred solution and then inform those directly affected. In such a case it is easy to understand the indifference, if not hostility, of the local stakeholders. However, if those directly affected are involved in identifying the problem as well as potential solutions and in weighing of the pros and cons of each of those, then participation is likely to be meaningful. This early involvement of local stakeholders is slowly becoming part of the government led development initiatives in Bangladesh (Ministry of Environment and Forest, 1995; and WARPO, 2001:1).

Costs and Benefits of Participation?

Although participation is now widely acclaimed as necessary and worthwhile, it might be helpful to briefly recollect what possible costs and benefits of participation are. Oakley, in his classic book, summarizes the cost as follows:

- Many planners would argue that there are potential risks and costs implicit in greater people's participation. These could include:
- Project start-up delayed by negotiations with people;
- Increases in staff required to support participation;
- The possibility that, when consulted, people might oppose a project;
- Unpredictable participatory methodologies;
- Over-involvement of less experienced people. (Oakley, 1991:14)

Experience in the water sector in Bangladesh suggests the following additional difficulties and costs:

- Potential for 'leakage' of project resources as interest groups demand a share for themselves;
- Possible reduced accountability/transparency as more groups are involved in a project;
- Difficulty to implement projects where the people are divided or where law & order is poor.

All of the above mentioned costs are seen from the perspective of an outsider. The people themselves too make a cost/benefit analysis about whether or not they will participate. Wittfogel highlights the holistic and straightforward weighing of pros and cons that individuals and households went through millennia ago, when confronted with the question of whether or not to join others to manage water:

- Special effort is required to attain the new objective; and this effort may involve not only increased work and a shift from pleasant to unpleasant operations, but also social and cultural adjustments, including a more or less serious loss of personal and political independence. When the sum-total of the accruing benefits clearly and convincingly exceed the required sacrifices, man is willing to make the change; but problematic advantages usually leaves him cool. Here, as elsewhere, the human budget is compounded of material and non-material items; any attempts to formulate it exclusively in terms of smaller or larger quantities of things (goods) will prove unsatisfactory. To be sure, the material factor weighs heavily, but its relative importance can be reasonably defined only when full recognition is given to such other values as personal safety, absence of oppression and time-honored patterns of through and action. [Wittfogel, 1957 no. 125:15-16]

This then is simple institutional bottom-line: people will only be interested in investing time, effort and money in participating in water management if they perceive the benefits to outstrip the cost by a considerable margin (Brett, 1996).

While all the above mentioned reservations about participation are often very real, the benefits of participation too may be very clear. Uphoff, quoted in Oakley, summarizes these benefits as follows:

- More accurate and representative information about the needs, priorities and capabilities of local people; more reliable feedback on the impact of government initiatives and programs;
- Adaptation of programs to meet local conditions so that scarce resources can be employed more efficiently;
- Lower cost of access to the public for agricultural extension programs, nutrition education, immunization, supervised credit, etc., through local organizations and institutions;
- Tapping local technical information that can otherwise be costly to obtain;
- Mobilization of local resources to argument or even substitute for central government resources;
- Improved utilization and maintenance of government facilities & services;
- Cooperation in new programs, which is more likely to occur when local organizations having the confidence of rural people share responsibility for innovation (Uphoff, 1986, 425-226) (as quoted in Oakley, 1991:15)

Since this list was written in the mid 80s at least two other ways of describing the benefits of participation have emerged. The first is a sense of ‘ownership’ by the local people of interventions. This ownership is particularly relevant as time moves on and changing circumstances and needs have to be accommodate. Without that sense of direct involvement and responsibility, projects quickly turn into monuments and not too long after that into ruins. The second additional benefit of more local participation is increased transparency. Such transparency is a need voiced worldwide, but again particularly in countries where government services and private contractor activities have not traditionally been open to scrutiny. Bangladesh is a point in case (Transparency International - Bangladesh, 2001).

GUIDELINES FOR PARTICIPATORY WATER MANAGEMENT

After clarifying ‘community participation and issues in wetland management’ above, this section will look in detail at the *Guidelines for Participatory Water Management* (GPWM). In the next subsection we briefly look at the predecessors of these guidelines as well as at the process

of producing the guidelines. The second and third subsections cover the strengths and weaknesses of the guidelines. In the final subsection the author briefly suggests why the guidelines have not been able to move away from an agency-driven approach and highlights the consequences of this in the field.

The Birth of the GPWM

In the 80s various Bangladesh Water Development Board (BWDB) projects, such as EIP, developed guidelines on how to deal with social issues at the feasibility stage. In 1986 the Local Government Engineering Department (LGED) developed a guideline for Operation and Maintenance (O&M) of its Small Scale Flood Control and Drainage Schemes. These documents can be seen as the precursors to the 1993 *Guidelines for People's Participation*, issued by the Flood Plan Coordination Organization (FPCO). A year later, in 1994, the Ministry of Water Resources (MoWR) issued an edited and updated version of that paper, called the *Guidelines for People's Participation in Water Development Projects* (GPP). The 1993 and 1994 guidelines were the first full fledged guidelines covering people's participation in all stages of project development, from feasibility to O&M.

After applying the GPP it soon became clear that it was rather difficult to put into practice. As a result, between mid 1998 and mid 1999, at least five separate attempts were made to produce more appropriate guidelines. The main differences were in the proponents (BWDB, LGED, individual consultants), the donors (ADB, WB, EU, GON, etc.), the concept of 'participation', the number of institutional tiers (2 – 4), the power distribution (agency staff, local government and direct stakeholders), whether or not the water user organizations are registered and if so, where, and who pays for the cost of O&M. For a comparison of the GPP, the 5 interim proposals and the GPWM, see the **Table 1**.

In January 1999 the government promulgated its first National Water Policy (NWPo). The NWPo called for the GPP to be implemented and adhered to in all public sector water resource interventions (Ministry of Water Resources, 1999: section 4.5.b). The policy also requires the periodic revision of the water related guidelines (ibid: section 4.2.h). The problems with the GPP and the fact that different agencies used rather different guidelines for participation in water management spurred the Ministry of Water Resources into action. In May 1999 the MWR established an Inter-Agency Task Force of officials from the BWDB and

officials and experts from LGED. Its brief was to formulate a “uniform Guideline for Participatory Water management by all agencies working in the water sector” (Ministry of Water Resources, 2001. The author of this paper was facilitator to the Task-Force.

The Task-Force met more than once a month for over a year. It started by co-opting a number of professionals such as the Project Director of LGED’s Small Scale Water Resources Development Sector Project (SSWRDSP), the Aquaculture Specialist and Sociologist of the SSWRDSP Technical Assistance team and a Senior Scientific Officer of WARPO. This made the Task-Force more multi-disciplinary. The Task-Force started by making an inventory of the previous guidelines and proposals, their strengths and weaknesses (for a summary see **Table 1**). The Task-Force also discussed at length whether or not Water User Organizations (WUOs) had to be registered. There was also considerable discussion about the desirable level of detail in the guideline. Some favored a short, enabling guideline with different agencies then making their own manuals. Others proposed a more detailed, prescriptive guideline including model agreements, bye-laws etc. Given the nature of Bangladesh’s bureaucracy it is probably not surprising that the latter approach found favor.

As facilitator, the author proposed to reverse the traditional approach in which government agencies are in charge of water management interventions and the local people participate in projects of the agencies. Such a local stakeholder-centered approach, with government agencies playing only a supporting role, turned out to be a non-started. Again this is not really surprising. A recent evaluation of the Indian experience with participatory watershed development called for a paradigm switch, observing and recommending the following:

- Even today the mindset of government functionaries and NGO volunteers is conditioned by the compassion to help the peasantry as saviors. Work culture and ethos are inspired more by charity and welfare by outsiders rather than development of the people, for the people and by the people. Villagers are considered beneficiaries, and not the prime movers and not even partners in development...Thus watershed development should become peoples’ program and GOs/NGOs should participate in it in a manner that would enable rural households to enhance their livelihood. (Government of India Planning Commission, 2001:26)

After many drafts the Task Force circulated its proposal for feedback to key actors in April 2000 and held a National Workshop on 10 June 2000. Participants gave much useful feedback that was included in the next draft which was then sent to the executive committee of the National Water Resources Council (NWRC). One of the main comments of that committee was that a number of government departments, indirectly related to water resource development, had to be actively involved in producing the guideline. Therefore officers from the Bangladesh Agricultural Development Corporation (BADC), Department of Agricultural Extension (DAE), Department of Environment (DoE), Department of Fisheries (DoF) and the Department of Livestock (DoL) were co-opted as member of the Task Force. After their input was included the final draft was sent to the NWRC and approved on 28 November 2000. The guideline was translated into Bangla and distributed to the relevant agencies.

Strengths of the GPWM

Compared with the GPP the GPWM has a number of obvious strengths. At least seven points can be identified:

(1) This guideline has the backing of the NWPo

Previous guidelines did not have that formal/legal backing and it was therefore difficult for local stakeholders to challenge government agencies when they did not comply with them.

(2) The GPWM applies to all public supported water resource development interventions

This is an advantage because the previously different guidelines caused a lot of confusion on the ground where different government agencies implemented water schemes side by side, following very different guidelines. The GPWM apply to all government projects and make participation in water resource management more straightforward for direct stakeholders.

(3) The GPWM includes a number of sample Agreements, bye-laws etc.

This makes it relatively easy to implement by staff with little experience.

- (4) The GPWM calls for at least one level of WMOs in each water scheme to be formally registered under the Cooperative Societies Ordinance (1984) and the Cooperative Societies Rules (1987).

While it is questionable whether the Cooperative framework is appropriate (see below as well as the next subsection), the legal framework and its operation structure give local stakeholders and government officials a comprehensive set of ‘rules and regulations’ to interact and deal with eventualities. This has already proven to be an advantage when things go wrong and legal action has to be taken.

- (5) The guidelines acknowledge the limitations of the cooperative framework

In the preface Mr. Azad Ruhul Amin, Secretary, Ministry of Water Resources writes: “To ensure effective WMOs, the Government is considering formation of a separate and appropriate Act or Rule for registration of the WMOs for Participatory Water Management.” (Ministry of Water Resources, 2001:ii).

- (6) The GPWM has been drafted by an inter-agency group comprised mainly of officials from BWDB and LGED

For various reasons the relationship between these two government agencies had been strained. By working together to produce the GPWM officials from these agencies realized that they had much more in common than they thought. It also became clear that each agency has its own strengths and that by sharing their experience they could complement each other, creating a win-win situation.

- (7) Last but not least the GPWM is full of statements that increase the scope for active and decisive local stakeholder participation (Ministry of Water Resources, 2001).

The main examples are (italics added):

- Participatory water management is a process by which the local stakeholders are directly and actively involved in identification, planning, design, implementation, operation & maintenance and evaluation of a water resource project/sub-project/scheme (ibid:viii)

- The immediate objectives of the Guidelines are to give the local stakeholders a decisive voice at all stages of water management” (ibid:2).
- It will be ensured that the Project Affected Persons (PAPs) are appropriately compensated for any loss of negative effect, that the PAPs will not be worse off due to project intervention and that the issue will be monitored (ibid:4)
- The WMG/WMA/WMF representing the stakeholders will be the driving force in water resource management. They would have decision-making power at all stages (ibid:6)
- A thoroughly participatory feasibility study is needed for identification of constraints, solutions proposed and alternatives thereof to ensure that public funds are spent on widely beneficial and sustainable interventions (ibid:11)
- Social assessment involving both beneficiaries and project affected persons and those living inside and adjacent to the proposed scheme area (ibid:12)
- At (the stage, before construction, of signing the Implementation Agreement) it will be essential to ensure that the decisions on scheme designs and subsequent O&M would reflect the interest of the beneficiary population at large, instead of a small number of interest groups (ibid:15)

Weaknesses of the GPWM

The GPWM then has quite a few strengths and is an obvious improvement over the GPP of 1994. However, at the same time it has at least the following weaknesses:

- (1) In the guidelines the concept of participation is applied inconsistently

When the objectives of the guidelines are worked out in detail in later parts of the document, the role for the local stakeholders seems to be much less active than earlier envisaged. In fact it seems that the implementing agency remains firmly in the driver seat. A few examples (*italics added*) are:

- The NGOs/Community level Self-help Groups will carry out participatory process and social mobilization activities on behalf of the implementing agency to ensure appropriate involvement (ibid:7)

- The implementing agency of a new or existing project/sub-project/scheme will undertake all necessary steps for the formation of local stakeholder groups (ibid:8)
- Participatory water management should be demand driven by the requirements of the institutional process and not exclusively supply driven by the needs of the project (ibid:9)

These quotations are an indication of how the implementing agencies try to accommodate local stakeholders having a ‘decisive voice’ in water management. At the same time these quotes indicate that they try to do so without losing control, as can also be seen in the following paragraph:

- The purpose of the (Implementation) Agreement is to ensure smooth construction of project in time and with desired quality with active involvement of the local stakeholders (ibid:15)

It is fully understandable, from their own perspective, that the implementing agency describing the purpose of the agreement in this way. However, in the eyes of the local stakeholders the purpose of the agreement may be different. If anything they will want to make sure they get what they have been promised, that the infrastructural works will be of agreed quality and that the system will be able to control the water as intended. In the guidelines these points are not highlighted. In the sample implementation agreement in Annex 4 (41, 43) there are hints about what the local stakeholders may want, but these are not as clear as the purpose of the implementing agency (40, 42).

- (2) The guideline is unclear about how “the local stakeholders will examine, suggest and agree to the best possible alternative design prepared by the experts of the implementing agency” (ibid:13).

The fact that the WMO, and particularly its managing committee, has been formed with the direct and prolonged help of that agency results in the process lacking transparency. A proposal was made to ensure that local stakeholders indeed have a ‘decisive voice’. It stipulating that the draft design should be explained at a general meeting of all WMO members and that all the members could then vote for or against the proposal. This proposal did not make it in the GPWM.

- (3) Overall it is difficult to avoid the impression that these guidelines allow local stakeholders to assist the implementing agency with

the development, implementation and particularly operation and maintenance of agency schemes (ibid:14-19).

In spite of the positive statements in the guidelines (quoted above) there are too many words, phrases (“local stakeholders will give feedback” (ibid:13); “assist the team” (ibid:14); “assist the implementing agency” (ibid:16)), and paragraphs that reflect the traditional top-down, agency-driven approach. For instance section 4.5, covering the implementation and trail operation, deals in more than two full pages with construction, but not a word is said about the actual trail operation. It is during that part of the process that the implementing agency has to prove to the local stakeholders that the scheme is operation and can deliver the promised benefits.

- (4) A weakness of the GPWM, as already hinted at above, is that the cooperative framework is not really appropriate for water management organizations.

There are a number of reasons for this. First of all cooperatives provide an institutional framework for business enterprises of a group of homogeneous producers. Examples are milk or rickshaw driver cooperatives, where the members have the same interests in ensuring low cost of their inputs (rickshaw hire rates or cattle vaccination) and a high price of their outputs (rickshaw trip fares and milk). Cooperatives work well if the members are more or less of the same status and when all members know each other. The cooperative rules and regulations are made to enable that kind of small scale, single focus, business type of cooperation. However, water management is quite different. It is not a business type of activity and there are usually a number of stakeholder groups with different, if not conflicting, interests. One only has to think of farmers and fishermen. Another difference is that the stakeholders are usually not of the same status, with the elite and various minorities involved. Furthermore water management units are often of such a size or shape (long drainage channels), that stakeholders are unlikely to be close enough to know each other. Finally, the century old cooperative department in Bangladesh is bogged down in ‘rules and regulations’ and is not know for the kind of dynamism and enthusiasm that stimulates true cooperation. These limitations were known during the design of the SSWRDSP (ADB, 1994), which nevertheless stipulated the cooperative framework. The reason is that after reviewing all the available options

there was no better alternative³. The GPWM and the government (see previous section) both acknowledge the need for a new purpose-made institutional framework.

(5) One final weakness has to be mentioned: that of implementation.

Technically speaking it is not a weakness of the GPWM itself, but of the implementing agencies. At a national workshop on 11 March 1998, LGED presented its own draft guideline. Dr. Hossain Zillur Rahman of the Bangladesh Institute of Development Studies (BIDS) pointed out that while the approach was very promising, earlier models failed in implementation. The same will apply to the GPWM, unless the following complementary provisions are made:

- Planning that allows time and flexibility for stakeholder participation in the project design;
- Engaging experienced and capable agencies, including the funds, for the formation of WUOs;
- Effective arrangements for two-way interaction between direct stakeholders and engineers;
- A long term capacity development plan for agency staff and direct stakeholders;
- Close supervision, monitoring and evaluation to ensure implementation and lessons learned.

DISCUSSION

Why are the GPWM not consistent in ensuring real and effective stakeholder participation? Based on experience in the field and literature from other countries, three reasons spring to mind:

- The NWPo is not always clear and consistent about the level and purpose of participation;
- Few of those who drafted the GPWM have training in sociological and institutional fields;

³ One way in which the SSWRDSP has tried to make the best of the cooperative framework is to develop the Water Management Cooperative Associations into multi-purpose bodies involved in various business-like activities. This has clearly facilitated their continuation. It is too early to determine whether or not such multi-purpose cooperatives will facilitate operation and maintenance of the water management infrastructure.

- Giving stakeholders a decisive voice in decision making in water management by implication means taking away control from vested interests, which are unlikely to give that up easily.

It is unlikely that much progress can be made towards real stakeholder participation and successful and sustainable water resource management until all three obstacles are addressed. In the mean time a comprehensive, but step-by-step approach along all fronts will continue to move the process forward.

CONCLUSIONS

In concluding, where do the GPWM leave the local stakeholders and the government of Bangladesh in their desire for more useful, effective and sustainable water management? The government states:

- Decisions regarding water resources management can affect nearly every sector of the economy and the public as a whole, and stakeholder participation should be established in a form that elicits direct input from people at all levels of engagement. Stakeholder involvement should be an integral part of water resources management, at all stages of the project cycle. Towards that objective there should be a complete reorientation of the institutions for increasing the role of stakeholders and the civil society in decision making and implementation of water projects (Ministry of Water Resources, 1999:18)

At this point in time, one-and-a-half year after the guidelines were approved, the conclusion must be that they are a step ahead, but also that rather much remains to be done. As the quote from the NWPo indicates, the government is aware that “ *a complete reorientation of the institutions for increasing the role of stakeholders and the civil society in decision making*” is needed. Such massive change involves radically different attitudes on the part of the personnel of government agencies. New guidelines, even if they were radical and consistent, would not suffice. Much more is needed, such as simultaneous, mutually supportive changes in a number of areas, and time (Korten and Robert, 1989).

How then can the GPWM play a role in enhancing local participation in water and wetland management? Six suggestions come to mind:

1. Implementing agencies apply the GPWM as a guide, not a straightjacket or blueprint;
2. The government name a permanent body or committee that will collect suggestions for improvement to the GPWM and ensure that the experience gained is shared;
3. Implementing agencies make a complaint procedure so local stakeholders who think elements of the GPWM are not implemented or perceive misconduct in construction, can complain;
4. The government develop a long term strategy to change attitudes, skills and capacity of university graduates and agency staff, so as to facilitate participatory water management;
5. The government speed up the process of developing a more appropriate legal framework for institutionalizing stakeholder participation in water management;
6. The critics of the GPMW seen it as but a stepping stone and remain engaged in the process.

Table 1: Matrix Summarizing⁴ and Comprising seven Guidelines for People's Participation in Water Management

Produced by	MWR GPP '94	SRP	Maloney	Choudhry	BWDB/MWR	SSWRDSP/LGED	GPWM
Document title	<i>Guidelines for People's Participation in Water Development Project</i>	<i>A Proposal for Guidelines for Participatory Water Management</i>	<i>Guidelines for Participatory Water Management (draft)</i>	<i>The Guidelines for Participatory Water Management (Draft 1)</i>	<i>Guidelines for Participatory Management in Water Resources Development Project</i>	<i>Guideline for the Participatory Process of Small-Scale Water Resources Development</i>	<i>Guidelines for Participatory Water Management</i>
Publication date	August 1994	June 1998	September 1998	December 1998	January 1999	April 1999	June 2000
Pages (main/app.)	21/2	103/-	13/10	11/23/30/29	19	9/17	30/46
Production process	Initial draft by FAP projects, final version made by SRP	Outcome of studies, surveys, workshops, seminars and National Workshop	Single handed effort by Dr. C. Maloney	Single handed effort by Dr. Yusuf A. Choudhry	By a limited number of BWDB staff	Produced by the BPPM , TA team of the SSWRDSP	Produced by an Inter-Agency Task Force of BWDB and LGED officials and experts
Concept of "participation"	Beneficiaries	Stakeholders	Stakeholders who are managers	Stakeholders	Stakeholders	Local stakeholders driving development	Local stakeholders
Institutionalization	5 tiers; related to BWDB; WUGs, WUCs, WUAs, WUFs, Project Council	2 tiers; WUGs and Local Government Committee	3 tiers; flexible and linked to Local Government System	4 tiers; WMG, WMA, JWM Committees and a JWM Council	4 tiers; WMG, WMA, FWMA and a WM Council	1 tier; Water Management Cooperatives Associations	3 tiers; WUG, WUA, WUF

⁴ Based on a five page comprehensive chart developed by the Task Force that produced the GPWM, which itself was based on the "Comparison of Concepts in Guidelines for Water Management" (1998) by Dr. Clarence Maloney and "Comments on the January 1999 GPMWRDP" by BWDB.

Table 1: Matrix Summarizing⁴ and Comprising seven Guidelines for People's Participation in Water Management

Produced by	MWR GPP '94	SRP	Maloney	Choudhry	BWDB/MWR	SSWRDSP/LGED	GPWM
Focus of committee membership	Farmers, but others could be involved	All stakeholders incl. fishermen, boatmen, etc.	All stakeholders	All stakeholders	Mainly farmers	All stakeholders	All stakeholders, i.e., beneficiaries and project affected people
Power distribution	Dominated by GOB employees	Dominated by Local Government representatives	Local stakeholders, no GOB employees	Dominated by Local Government representatives	Local stakeholders + GOB employees	Local stakeholders, no GOB employees	Local stakeholders, no GOB employees
Registration	None, but WMA "recognized" by BWDB	None	Flexible, Society, Cooperatives, non-profit Company	Undecided	Undecided	Cooperative Department	Cooperative Department
Mobilization by	Not covered	Briefly touched upon	Initially by TA, with NGOs at field level and BWDB or BRDB nationally	Unclear	BWDB and in time BRDB	NGO Facilitators and the Cooperative Department	Implementing Agency will make arrangements
Role of Local Government	Union Parishad and TDCC involved	Union Parishad members heavily involved	Depending on system size any of the 4 LG Parishads involved	Union Parishad members heavily involved	From WMA upwards involved	Union Parishad identifies sub-projects, thereafter role unclear	LGIs have an advisory role towards WUOs
Contribution to Operation and Maintenance cost	Mentioned but not detailed	Contribution in cash and kind mentioned but not detailed	Starting with partial contribution leading to 100%	Contribution in cash and kind mentioned but not detailed	Resource mobilization mentioned but few details	100% except in the case of a calamity	Depends on the size of the scheme
Main strengths	<ul style="list-style-type: none"> Formalized people's participation on the water sector agenda Formed the basis for further field- 	<ul style="list-style-type: none"> All potential stakeholders had a chance to give their input Very systematic 	<ul style="list-style-type: none"> Conceptually consistent Short/concise Schemes size fully taken into account Covers ultimate 	<ul style="list-style-type: none"> Makes the SRP raw material more easily accessible 	<ul style="list-style-type: none"> Conceptually strong and based on NWP Short and to the point 	<ul style="list-style-type: none"> Conceptually strong and based on NWP Short/concise Clear on the decision-making power of the local 	<ul style="list-style-type: none"> Acceptable to BWDB and LGED Applicable to all WR schemes Does not require registration of village level WUOs

Table 1: Matrix Summarizing⁴ and Comprising seven Guidelines for People's Participation in Water Management

Produced by	MWR GPP '94	SRP	Maloney	Choudhry	BWDB/MWR	SSWRDSP/LGED	GPWM
	level experimentation and implementation	on roles, tasks, responsibilities, and duties	aim and action now <ul style="list-style-type: none"> • Non-BWDB agencies do institutional work 			stakeholders <ul style="list-style-type: none"> • Clear on the complementary roles of the departments 	<ul style="list-style-type: none"> • Flexible as to the need for a WUF in schemes up to 5000 ha
Main weaknesses	<ul style="list-style-type: none"> • Institutions dominated by GOB people • Project Council too large in large projects • WM institute without legal status • Project size not fully considered • Capacity and mandate of BWDB to mobilize people not considered 	<ul style="list-style-type: none"> • So detailed and repetitive that it is difficult to understand/implement • WM institutions without legal status • Project size not considered • Capacity and mandate of BWDB to mobilize people not taken into account 	<ul style="list-style-type: none"> • Depends heavily on 4-tier Local Government structure, much of which itself is still in its childhood stage 	<ul style="list-style-type: none"> • WM institutions without legal status • Project size not fully taken into account • Capacity and mandate of BWDB to mobilize people not taken into account 	<ul style="list-style-type: none"> • Focused on agricultural development • Too much BWDB focused, overlooking role of LGED and other GOB agencies, etc. 	<ul style="list-style-type: none"> • only applicable to small schemes • institutionalization only under Cooperative Framework which may not be sustainable 	<ul style="list-style-type: none"> • Institutionalization only under Cooperative Framework which may not be sustainable

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IRRIGATION PRIVATIZATION AND ROLE OF SHALLOW TUBEWELLS IN THE CONTEXT OF SMALLHOLDER RICE FARMING IN BANGLADESH

TOFAZZAL HOSSAIN MIAH¹

INTRODUCTION

Bangladesh's agriculture was basically characterized by twin problems of drought during the dry season (December to May) and floods during the monsoon (July to October) that often adversely affected the successful crop production. As a consequence, food deficit was a chronic problem for this country. The situation has now improved and the country has become almost self-sufficient in food-grain production. One of the most success stories of this improved rice production is the availability of ensured irrigation water supply to the crop field, more especially for the cultivation of Modern Variety (MV) of Boro rice. There are three types of minor mechanical irrigation devices such as: Low Lift Pump (LLP), Deep Tubewell (DTW) and Shallow Tubewell (STW), which have been using in the dry season for MV Boro rice farming in Bangladesh.

Given the dense population and high level of rural poverty, efforts to develop a mechanized irrigation system for the country by various agencies from mid fifties could not come out with suitable results. Meanwhile, with privatization of irrigation equipment some changes in the irrigation service delivery system and management have taken place. In this paper, an attempt has been made to present background information on privatization of minor irrigation equipment in Bangladesh and also to assess the importance of STWs in producing MV Boro rice taking into account the smallholder rice farming.

EVOLUTION OF MECHANICAL IRRIGATION TECHNOLOGY IN BANGLADESH

Mechanical irrigation technology, as stated before, was introduced in Bangladesh in the early 1960s. Before introduction of this mechanical

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technology, farmers usually used to cultivate local Boro rice by lifting surface water through traditional manually operated irrigation technology like *Doon* (conical shaped 10-15 feet long wooden container) and sewing baskets. Its coverage, unlike the present situation, was limited to the low and very low topographical areas of the country. The evolution of mechanical irrigation technology in Bangladesh agriculture passed through a series of phases, which started from heavily dominated public sector at the beginning until it became absolutely a private sector enterprise (Table 1). However, this privatization transition has briefly been discussed below:

The period between 1950 to 1973/74

In this period, Bangladesh Water Development Board (BWDB) was created and involved in developing canal irrigation. Similarly, Bangladesh Agricultural Development Corporation (BADC) and Department of Agricultural Extension (DAE) started mechanized cultivation and power pump irrigation program. BADC introduced LLP in 1961 and DTW in the following years. At the beginning, LLPs were operated by BADC's own field staff with diesel fuel supplied by them and the client farmers had to pay water fees on the basis of per unit area of cropland. In 1969, of course, BADC started renting LLPs on yearly basis and the farmers had to pay for fuel themselves with 70 to 75 percent subsidized rate. In 1971, just after the War of Liberation, BADC expanded its LLP and DTW rental program and started renting STW in 1972. However, this rental program of BADC was converted to a sale program after 1974/75.

The Period between 1974/75 to 1978/79

In this period, BADC maintained its control over DTW and LLP procurement, installation and rental system. In 1975, BADC stopped operating LLPs and began to continue renting them out. At the same time, it also started selling STWs through the Bangladesh *Krishi* (i.e., agriculture) Bank (BKB) with little subsidy.

The Period between 1979/80 to 1983/84

In this period, the irrigation equipment rental programs were recognized as being too expensive from the viewpoint of the public budget, there were simultaneous moves to discontinue LLP and DTW rental programs and shifts selling both new and old LLPs and DTWs to the private sector. Liberalization of credit distribution, reduction of import duties and

involvement of the private sector in equipment importation led to a rapid increase in the number of wells.

The Period between 1984/85 to 1986/87

In the dry season of 1983, a serious drawdown of groundwater was experienced in some northern districts of the country. As a result, the government took some discouraging actions against STWs such as: (a) a ban on STW sales in 22 northern sub-districts ; (b) an embargo on the importation of STW engines; (c) standardization of engine brand; (d) formulation of Groundwater Management Ordinance imposing a mechanism of spacing requirements on all tubewells. As a consequence, STW expansion slowed down in 1984 (Amin, 2001) and practically stopped during 1985 to 1987 (Ministry of Agriculture, 1995).

Table 1: Liberalization Policies of Irrigation Water Markets in Bangladesh

Policy Changes	Period	Remarks
Irrigation Markets		
1. BADC sold LLPs to farmers	1980 - 1982	Good response from farmers
2. BADC sold all tubewells to farmers and cooperatives supported by credit	1983 - 1985	Good response from farmers
3. Restriction of import of engines and pumps withdrawn	1988	Drastic fall in prices of engines
4. Standardization restrictions withdrawn	1988	Drastic fall in prices of engines
5. Import duties removed	1988	Drastic fall in prices of engines

Source: Adapted from Ahmed (1995).

Period from 1987 to onward

The slow growth of the minor irrigation sector of the previous years prompted the government to remove the restriction imposed earlier. Removal of ban on the importation of small-engine in 1987 and removal of import duties on small diesel engines in 1988/89, private sales of STWs picked up and increased quickly.

As a consequence of liberal importation of irrigation equipment, shifting of irrigation management to the private sector, withdrawal of sitting restrictions and standardization of irrigation equipment, total area irrigated and number of irrigation equipment have significantly increased. It has, in fact, appeared to be the driving force for increasing food-grain production in Bangladesh, especially rice.

LARGE-SCALE VERSUS FARMER MANAGED MINOR IRRIGATION PROJECTS

Although the superiority of farmer managed minor irrigation over large-scale irrigation projects might be debatable, but many researchers (Miah and Hardaker, 1988) still agree that the minor irrigation is less capital intensive, generates extra production more quickly, and easily replicable to small holdings than large-scale irrigation projects. Large-scale projects, on the other hand, not only take a considerable time to construct but also suffers from a lot of constraints, for example, lack of skilled man-power, high foreign currency costs for purchasing plant and machinery from abroad. Thus, minor irrigation devices have become very popular and one of the leading agricultural inputs among the farmers.

ROLE OF STWS IN SMALLHOLDER RICE FARMING

The major source of irrigation expansion in Bangladesh has been the groundwater technologies, predominantly STWs. Both DTWs and LLPs have virtually not increased in the recent years (**Appendix Table 1**) due to serious capacity under-utilization of the equipment and hence, increased the cost of irrigation, which in turn increased production cost of individual farmers.

A recent study (Islam et. al., 2001) shows that the landholding per farm family in Bangladesh has gradually been decreasing from 1.2 ha in 1990 to 0.33 ha in 2000, due to high pressure of population on land together with the country's Muslim Laws of inheritance. Another study (Miah, 2001) indicates that the average size of a plot of cultivable land in three villages of Tangail district was only 18.7 decimal (0.08 ha) and each farm family possessed on an average 5.3 plots. This implies that each farm family, at present, has only 99.1 decimals (0.40 ha) of cultivable land. These studies hint that the average cultivable land is very small and is gradually becoming smaller with passage of time in this country. Under such smallholders' agriculture, STWs have been found as the most appropriate technology for rice farming in this country.

PROFITABILITY OF STWS FROM THE VIEWPOINT OF INVESTORS

Investors are required only Taka² 9,500.00 as investment cost for purchasing a new STW having 4 Horse Power (HP). In practice the command area (i.e., Boro rice-field) under this STW on an average is 2.5 ha and its Operation and Maintenance (O & M) cost is around Taka 15,700.0 per season (**Appendix Tables 2 and 3**). Three discounted methods (see Gittinger, 1994) such as: Benefit-cost Ratio (BCR), Net Present Value (NPV) and Internal Rate of Return (IRR) were employed to assess the profitability of this farmer managed STW minor irrigation project. It is evident from the results presented in **Table 2** that this STW project is highly profitable investment from the viewpoint of individual investor, since its BCR is greater than the unity, NPV is greater than zero and IRR is much higher than the opportunity costs of capital.

Table 2: Summary Results of Financial Analyses of Diesel Operated STW from the Viewpoint of Individual Investors

Discounted Measures	Profitability of a Minor STW Project	
	Considering 25 Percent Crop-share for Water	Considering Cash-payment (Taka 30/decimal) for Water
BCR at 14%	1.23	1.08
NPV at 14% (Taka'000)	18.50	6.58
IRR (per cent)	206.9	52.5

Source: Appendix Table 2 and 3

Note: Investors of STW received 25.0% physical product of MV Boro rice from client farmers as water charge under crop-share payment system, while this was Taka 30.0 per decimal under cash payment system.

In other words, the results of financial analyses indicate that these STW projects are highly attractive investment to the individual investors whether they are following crop-share payment system or cash-payment system for water. The investors, however, are making more profits from minor STW projects having crop-share arrangement than the projects following cash-payment system for water. This is one of the clear indications of expanding STW projects in rural Bangladesh.

² US\$ 1 = 58.40 Taka

PROFITABILITY OF IRRIGATED RICE FROM THE VIEWPOINT OF FARMERS

It can be seen from **Table 3** that individual farmers are making profits from MV Boro rice production under STW projects, whether they are producing under 25.0 percent crop-share or cash-payment system of irrigation water. However, it is evident from the results that farmers are making higher profit (Taka 10,640/ha) under the cash payment system than the 25.0 percent crop-share payment system (Taka 9576/ha) (**Appendix Tables 3 and 4**).

Table 3: Per Hectare Profitability of MV Boro Rice Production under STW Projects Considering Crop-share and Cash-payment for Irrigation Water

Items	Under 25% Crop-share	Under Cash-payment
Yield (kg/ha)	4500	4500
Gross return (Taka/ha)	34,875	34,875
Gross cost (Taka/ha)	25,299	24,235
Net return (Taka/ha)	9576	10,640
BCR (Undiscounted)	1.38	1.44

Source: Appendix Table 4.

The above-mentioned discussions clearly indicate that both investors of STWs and individual farmers, who have been growing MV Boro rice, are making profits. It can, therefore, cautiously be concluded that STW irrigation technology is the most appropriate and sustainable mechanical irrigation technology for Bangladesh.

POLICY IMPLICATIONS AND CONCLUSIONS

On the basis of the ultimate findings of the present study, some policy considerations arise which are highlighted below:

This study reveals that STWs are highly profitable investment. Policy makers and extension personnel should pay an immediate attention to expand this STW technology where topographies are similar to this study area is found. The study also clearly indicates that in crop-share payment system, investors of STW are making more profits than the cash payment system for water. This study, therefore, suggests that crop-share should be reduced from 25.0 to 20.0 percent, if per hectare yield of MV Boro rice and inputs as well as output prices remain the same. Efforts could also be taken to reduce O & M costs of these minor STW projects by improving

tubewell management efficiency and increasing command area under each of the STWs.

Private sector initiatives for repair and maintenance equipment at the doorsteps of the farmers should be encouraged. A soft-term financial support through the institutional credit could be provided for setting improved workshops at each of the *Upazilas* (sub-districts) in Bangladesh.

In the existing Integrated Peste Management (IPM) school, necessary training could be imparted to the farmers either for reducing water loss or efficient use of water through increased their on-farm water management system. At present, tubewells are mainly used for irrigating MV Boro rice production, extension personnel should encourage farmers to use supplementary irrigation for their Aman rice as well. Thus, per hectare sustainable yield of MV Aman rice could be increased in this country.

Although no investment analysis was shown for electrically operated STWs in this study, but many studies (for example, Miah and Hardaker, 1988) clearly indicate that electrically operated STWs are more profitable investment than the diesel operated STWs from the viewpoint of individual investors. Policy makers should, therefore, pay an immediate attention to the findings of the present study and topmost priority should be given to electricity connection and ensured supply of electricity for all STWs.

Since the majority Bangladeshi farmers were still illiterate and did not keep any written records for their day to day farm business transactions, the reliability of the data used for this study fully depend upon their memory, sincerity as well as honesty. Despite much care taken for collecting the most accurate information, the possibility of errors in data cannot fully be ruled out. Moreover, the data used in this study were collected from the low-lying areas of Bangladesh. The findings of the present study should, therefore, be interpreted with certain degrees of caution whenever any greater generalizations are sought for different topographies of Bangladesh.

Finally, it could be concluded that STWs under the existing privatization policy of the government have been playing very significant role to provide food security for the rural people and to achieve self-sufficiency in food-grain, and hence, to the growth and stability of the economy of Bangladesh.

Appendix Table 1: Number of Mechanical Irrigation Equipment and Irrigated Area by Minor Technology from 1982/83 to 1997/98

Irrigation Season	Equipment number ('000 unit)			Cropped Area irrigated ('000 ha)			
	STW	DTW	LLP	STW	DTW	LLP	Total
1982/83	93.1	13.8	35.5				
1983/84	120.3	15.5	36.0	480	263	342	1610
1984/85	147.0	16.9	37.0	586	287	351	1772
1985/86	146.9	17.9	37.5	586	304	356	1740
1986/87	160.3	18.7	40.6	639	318	386	1840
1987/88	188.7	20.3	42.3	753	345	402	2064
1988/89	235.9	22.4	50.8	941	380	482	2381
1989/90	260.0	22.6	51.0	1037	384	484	2576
1990/91	270.3	21.5	51.6	1078	365	513	2789
1991/92	309.3	25.5	50.3	1234	434	500	2754
1992/93	348.9	25.7	52.2	1392	437	496	2961
1993/94	359.2	24.5	52.6	1388	389	458	2938
1994/95	488.9	26.7	57.1	1638	502	538	3305
1995/96	576.2	27.3	60.6	2004	540	568	3725
1996/97	629.8	25.2	62.9	2159	475	570	3762
1997/98	664.7	25.3	66.3	2182	465	622	3833

Source: Adapted from Mandal (2000, Pp. 120-21).

Appendix Table 2: Financial Analysis of a STW from the Viewpoint of Individual Investors Considering 25 percent Crop-share Payment System

Item	Year		
	1	2 - 7	8
A. Gross Benefit	Taka	Taka	Taka
Water charge	21,094	21,094	21,094
Salvage value	-	-	1400
Total	21,094	21,094	22,494

B. Gross Cost			
Invest cost	9,500	-	-
O & M costs	14,200	15700	15700
Total	23,700	15700	15700

C. Incremental Benefits	-2606	5394	6794
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Results: BCR at 14% = 1.23, NPV at 14% = Taka 18,495, IRR (per cent) = 206.95%

Note: Engine having 4 HP and 2.5 ha command areas. Data were collected from randomly selected 10 STWs of Tangail and Netrakona districts.

Appendix Table 3: Financial Analysis of a STW from the Viewpoint of Individual Investors Considering Cash Payment System for Water

Item	Year		
	1	2 – 7	8
A. Gross Benefit	Taka	Taka	Taka
Water charge	18,525	18,525	18,525
Salvage value	-	-	1400
Total	18,525	18,525	19,925

B. Gross Cost			
Invest cost	9,500	-	-
O & M costs	14,200	15700	15700
Total	23,700	15700	15700

C. Incremental Benefits	-5175	2825	4225
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Results: BCR at 14% = 1.08, NPV at 14% = Taka 6578, IRR (per cent) = 52.48%

Note: Engine having 4 HP and 2.5 ha command areas. Data were collected from randomly selected 10 STWs of Tangail and Netrakona districts.

Appendix Table 4: Per hectare Costs and Returns of MV Boro Rice Production in Greater Mymensingh Considering Crop-share and Cash-payment for Irrigation Water

Items	Under 25% Crop-share for Water		Under Cash-payment for Water	
	Quantity	Return/Cost (Taka/ha)	Quantity	Return/Cost (Taka/ha)
A. Gross Return				
Main-product (kg/ha)	4500	33,750.0 (96.77)	4500	33,750.0 (96.77)
By product (Straw)	-	1125.0 (3.23)	-	1125.0 (3.23)
Total	-	34,875.0 (100.0)	-	34,875.0 (100.0)

B. Gross Costs				
Human labor (Manday)	159	11,130.0 (43.99)	159	11,130.0 (45.93)
Power tiller use (Taka)	-	1440.0 (5.69)	-	1440.0 (5.94)
Seedlings of 44 kg seed	-	1320.0 (5.22)	-	1320.0 (5.45)
Urea (Kg/ha)	194	1164.0 (4.60)	194	1164.0 (4.80)
TSP (Kg/ha)	34	476.0 (1.88)	34	476.0 (1.97)
MOP (Kg/ha)	18	180.0 (0.71)	18	180.0 (0.72)
Irrigation water (Taka)	-	8438.0 (33.35)	-	7410.0 (30.58)

Pesticide (Taka)	-	295.0 (1.17)	-	295.0 (1.22)
Interest on operating capital	14%	856.0 (3.39)	14%	820.0 (3.39)
Total	-	25,299.0 (100.0)	-	24,235.0 (100.0)

C. Net Return (A – B)	-	9576.0	-	10,640.0
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BCR (Undiscounted)	-	1.38	-	1.44
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Source: Field survey (2001).

Note: Figures within parentheses indicate percentages of total. Data were collected from randomly selected 20 farmers of Tangail and Netrakona districts.

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