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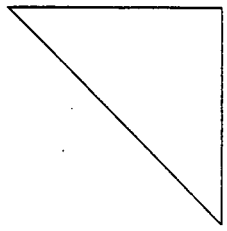

THE RESPONSE OF FARMERS TO POLITICAL CHANGE

decentralization of irrigation in the Red River delta, Vietnam

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF MAPS

1 INTRODUCTION

For several years, international donors have been promoting irrigation management transfer from central authorities to farmers (Ostrom, 1992). Although the expected impact of such a transfer is stated to be to the benefit of farmers, this policy has often been managed by central administrations in a top-down, limited way (*ibid.*). This paper analyzes changes in the Red River delta irrigation system over the last 30 years. Such a study is of additional interest to former ones written on irrigation management transfer, because the process of decentralization described is one of the few cases where peasant farmers have taken the initiative. This point is introduced through a descriptive case study of the evolution of the An Binh commune irrigation system.

In the first section, I discuss changes in An Binh irrigation against the background of North Vietnam's overall economic and political situation. I emphasize that the failure of centralized irrigation has to be understood as one of the facets of the general collapse of agricultural collectivization. Moreover, in the second section I suggest that peasants' social pressures and demands affected State policy and led to economic reforms in the 1980s. Then, I move on to the point that irrigation management provides an interesting case for the study of peasants-state relations. The mode of governance of multi-user infrastructure like irrigation, is closely linked with the institutions that govern the people of that country.

However, it would be reductionism to state that the mode of governance of irrigation systems is affected by the state institutions only. In the third section I focus on the local scheme of Da Xa, which is part of the commune of An Binh. The discussion highlights a range of irrigation decision-making processes, concerning pumping, ricefield water supply and canal maintenance. This part contends that from a competitive traditional[1)] system sharing scarce water supplies, via a strict centralized management of modern irrigation, an efficient and flexible system evolved. The study of this system, whose management is based on peasant farmers' water demands, is instructive in the sense that it incorporates modern and traditional technologies as well as collective and individual management choices.

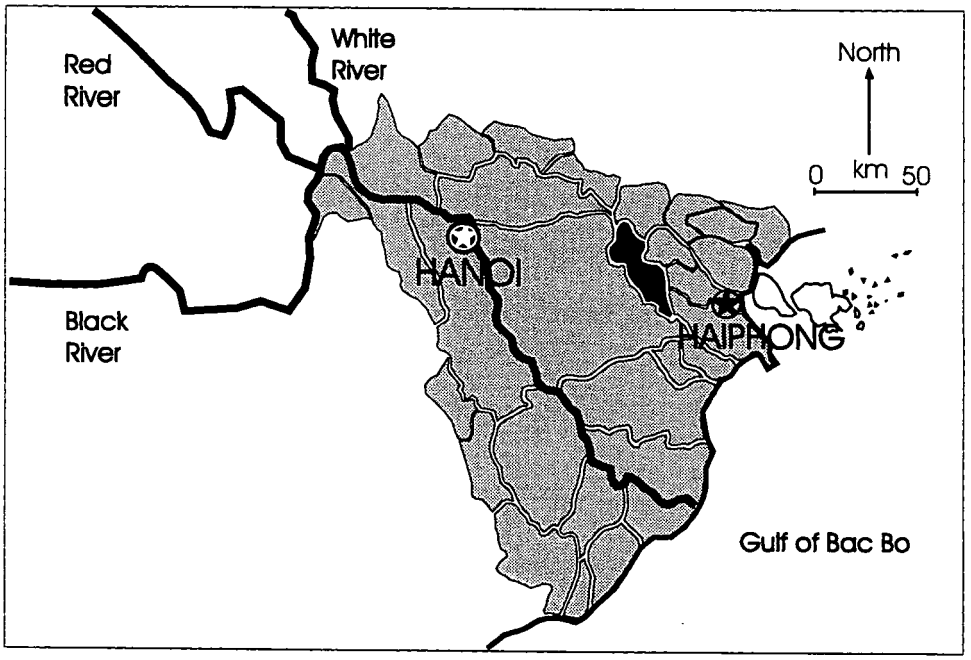
Section four argues, in conclusion, that the local-scale historical approach adopted in the study, leads us to suggest that the evolution of irrigation systems is not only related to external factors such as global economy and national policy. Peasants-state relations are of some impact on irrigation evolution, but a technological model such as irrigation infrastructure has to be understood as the result of the confrontation between overall external factors and social internal factors which are shared by users. The mode of governance of an irrigation multi-user infrastructure is both the result of peasants-state and peasants' internal relations.

[1)] We describe as "traditional" all references made to the period prior to 1960s collectivization.

2 EVOLUTION OF AN BINH IRRIGATION SYSTEM: 1960s - 1990s

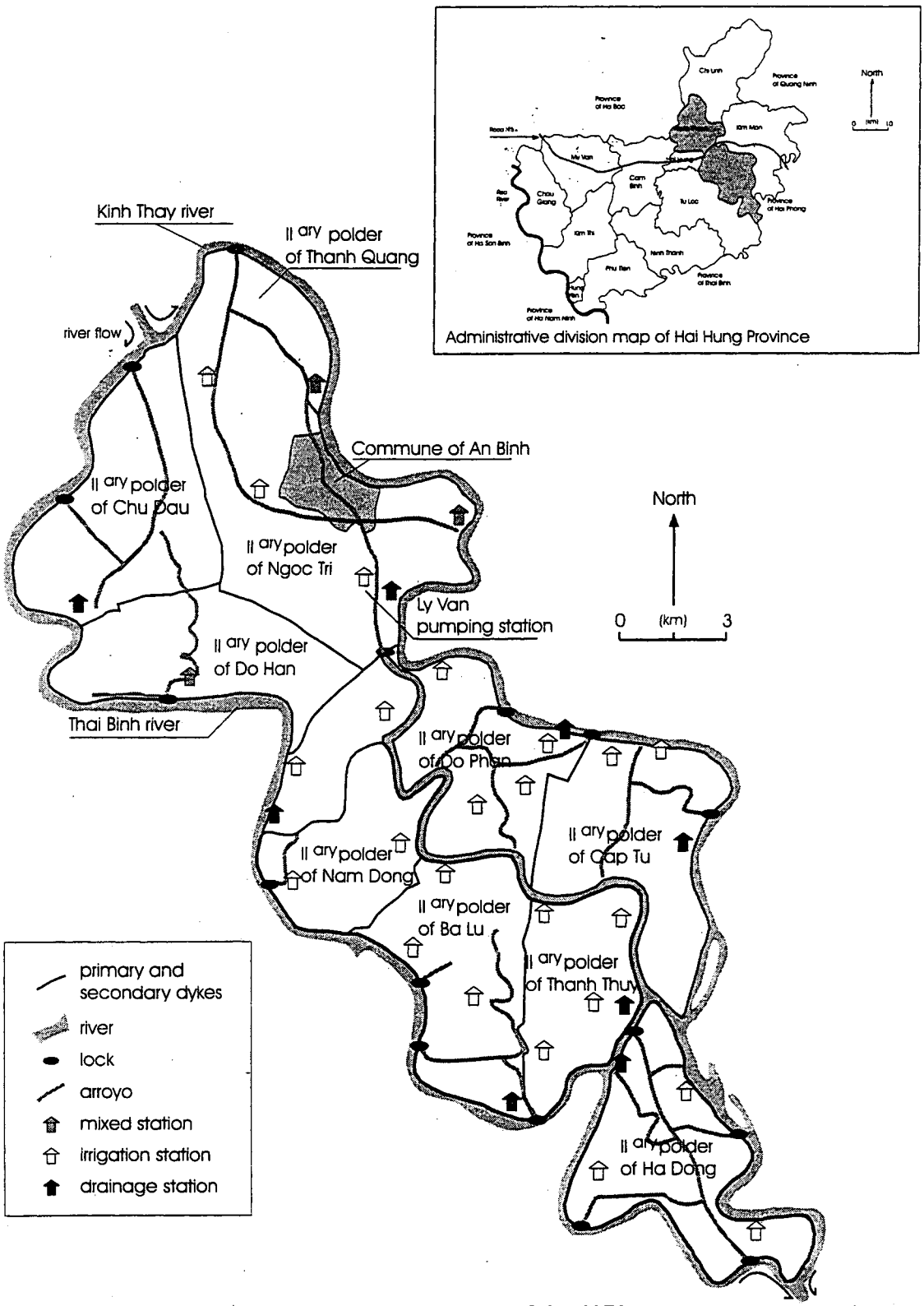
The commune

The commune of An Binh belongs to the district of Nam Thanh, province of Hai Hung, in the Red River delta (see map 1 and 2). It is situated in the northern part of the district, where the elevation is higher as compared to the south. This leads to the absence of flooded land during the summer rainy season. An Binh is an agricultural commune of 2,000 households cultivating 354 hectares of rice fields; that is to say an average of 1,770 square meters per household. The population is divided between the four villages of An Doai, An Dong, Da Dinh and Dao Xa. This commune is characterized by a high land use intensity of 2.5 crops per year. This means two crops of spring and summer rice, and one winter "dry" crop[2] of vegetables (sweet potato, garlic, shallot) or maize, on 50% of the area. Rice yields are above 3.5 metric tons per hectare per season.



Map 1 Localisation of Nam Thanh primary polder in the Red River delta

[2] By "dry crop" we mean an irrigated crop other than inundated rice, thus having a much lower crop water requirement.



Map 2 **Primary polder of Nam Thanh at the beginning of the 1970s**

2.2 Pre-collectivist irrigation, before 1960

Technical practices

Before the modernization of irrigation, water either came from lowlands submerged in the summer, from ponds dug between ricefields, or from *arroyos* linked to Kinh Thai river[3]. These *arroyos* could be connected to a network of ponds used as water reservoirs for irrigation. Each village had several reservoirs in order to provide water to its paddy fields. Several irrigation canals were connected to each pond and *arroyo*. They were filled with water either by gravity during high tides[4], or by lifting water. Lifting tools were mainly of two types: the scoop water basket (cái gâu dai) and the tripod scoop (cái gâu sòng) (see figure 1). These tools are native of China. Their use has been described through prints in an agricultural manual from 1210 named Keng tche t'ou (Chassigneux, 1912).

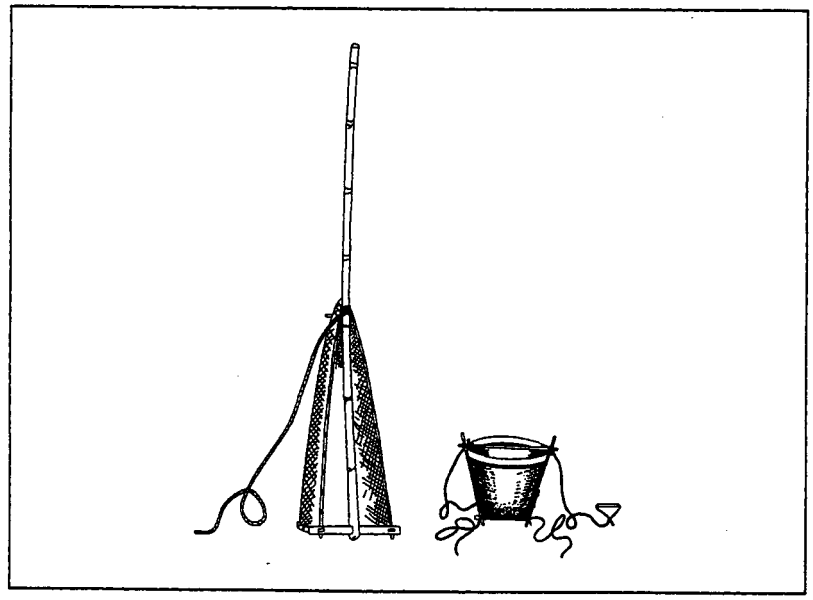


Figure 1 The scoop water basket (Cái gâu dai) and the tripod scoop (Cái gâu sòng)

The rhythm of irrigation was based on tidal rhythms. There are two tides a month, each of them lasting 14 days. For the first five days water level is increasing, then during five days it is stable, and decreasing during the final four days.

Field access to water depended on reservoir proximity as well as field elevation. One crop of spring rice was grown on low ricefields and one crop of summer rice on upper ones. Some medium level fields could get two crops of rice depending on water access and annual weather conditions. The only fields, which could be supplied by gravity, were close to lowlands. Others

3) An arroyo is a canal or channel connecting two rivers in a tropical country. It can be either natural or man-made.
4) The effect of tides is marked in most of the Red River delta. "We are in a delta which is a zone of siltation with very low slope and elevations. During the dry season river discharge is low. It allows seawater to go back up rivers during high water tides. Sea water blocks fresh water flow which rises river water level" (Gourou, 1936).

needed a water lift either in a transportation canal, or directly in the field. In order to lift water, a specific place or "bail out" station was set up on reservoir sides. Water could not be lifted higher than 80 centimeters at once. Installation of a set of several stations was sometimes needed along one single canal. Some stations belonged to the village collectivity but the majority of them were private. Whatever the status of the station, collective or private, village customary law decided water access regulations.

Water management

During land preparation, priority was given to paddy fields closer to the station, whoever its owner. Then, water was flowing through the first field into the second, the third and so on. Plots were 0.5 to 1 hectare large. The total duration of irrigation was one to two days depending on the proximity and the size of the plot. During rice growing stages, the owner of the "bail out" station had priority until all his fields were supplied. Then, other farmers came and asked him for authorization to use the station for their own fields. The village customary law guaranteed free access to stations for everyone, whatever his socio-economical status in the village (Mai Van Hai and Bui Xuan Dinh, 1997). In theory, the owner did not take part in the discussions between farmers. The organizational method was to observe water levels in own plots as well as others' in order to judge who would be the first to need water. Another way was to wait for the turn near the station or to put a basket near the station and form a queue. After negotiation, it was also possible to drain a plot close to the station into a far away plot, and to refill it later. This method was simple because digging of a small ditch from the first plot in order to convey the water into the second one was not required (field to field irrigation).

Depending on weather conditions, rice growing stage, soil characteristics and tide levels, farmers had to supply water to their fields every seven to ten days. "Bail out" private stations were maintained by their owner and village stations by their users. *Arroyos*, which controlled and conditioned farmers water access, were maintained once a year in December before the rice spring season. The work was in theory done by all villagers under the control of the chief of the village (*Ly Truong*).

Water conflicts

According to elderly farmers interviewed in Dao Xa village: "if supplying water to a dry paddy field was laborious, waiting for a turn in the sun was a torture". This waiting, imposed by the necessity of providing water during drought periods, seems to have been perceived as worse than lifting water for fields of 1 hectare large. Information gathered in written documents as well as interviews always stresses the tough competition existing for water access during drought periods. This competition often led to conflicts, "wild" water diversion or even fights between farmers. The village guaranteed the overall co-ordination of irrigation, ensuring that water would be accessible to the majority. But due to the difficulty of getting water, there were interactions between farmers who had to negotiate together. Negotiations were often influenced by existing rivalries, resentments and clientelisms among farmers. As some of them said, physical work was sometimes easier than the effort made to get access to water.

Table 1 Main characteristics of An Binh water control system before 1960

Hardware	Natural drainage canals, ponds, short irrigation canals
Technical practices	Scooping, gravity when high tides
Administrative set-up	Villages (*lang xa*)
National policies	Protection against floods and droughts along the main rivers, private property
Weight of local political networks	Local laws fix all the rules
Main cropping pattern	One crop of spring rice or summer rice

2.3 Collectivist irrigation, from 1960 to 1980

An Binh irrigation modernization

The construction of the modern collectivist irrigation system of An Binh was started in 1964. The commune belonged to the secondary polder of Ngoc Tri and was irrigated by the pumping station of Ly Van (see map 2). The discharge capacity of the pumping station was 8,000 m^3/hour. This station was supposed to provide water for the 2,000 hectares of Ngoc Tri polder, which embraces eight communes: Ai Quoc, An Binh, An Lam, Cong Hoa, Hop Tien, Phu Dien, Quoc Tuan and Thanh Quang.

However, in reality Ly Van pumping station was providing water to only 1,000 hectares. Hop Tien, Ai Quoc, Thanh Quang and a part of Cong Hoa communes were supplied by other pumping stations, respectively Hop Tien, Thanh Quang and Cong Hoa (Bousquet, 1994). This was due to the following reasons. With crop water requirements of 5 mm/day and a transportation efficiency of 0.65 (Dang The Phong and Fontenelle, 1995), the supply needed was 0.89 l/s/ha on a 24 hours per day supply basis. With a canal system designed on the basis of a water allowance 1.1 l/s/ha, it meant more than 19 hours of supply to satisfy water requirements of 2000 hectares, without including canal-filling time. But, for some reasons[5)], it has not been possible to manage water supplies on such a tight schedule with day and night supplies. Within three years, from 1965 to 1967, the command area dropped from 2000 to 1000 hectares to fulfil rice water needs. This restricted command area was supplied within 10 hours per day, without including canal-filling time. It seems that this shorter duration of water supply was more convenient to cooperatives than day and night supplies of 19 hours.

Despite the issues presented above, the introduction of modern irrigation and drainage in the An Binh commune resulted in a noticeable improvement of former pre-collectivist agriculture. At the end of the first phase of investment, in 1968, the commune of An Binh was able to grow two crops of rice on all collective rice fields and started a winter "dry" crop on some of them.

5) In theory night supplies were supposed to be better paid than daily ones. But, we do not know if night supplies have been refused by the cooperative's irrigation brigade workers due to financial issues on salary, or by the cooperative's production brigade members due to fieldwork organisation preferences.

Centralized irrigation deregulation

In theory the duration of rice transplantation was equal to one month in order to satisfy water needs of all the communes. During the growing stages of rice, an irrigation interval of 7 days was planned. Every week, the heads of production brigades from each cooperative had to join a meeting organized by the official in charge of Ly Van pumping station. The irrigation calendar was decided at these meetings. At the beginning of the 1970s, difficulties appeared in the irrigation system. Due to several reasons such as homogeneity of weather conditions and similarity of rice varieties grown in each cooperative, peak water requirements were concentrated in a few days. On the scheme of Ly Van, this led to the situation that water was demanded simultaneously by about twenty village cooperatives. But, due to the limited design pumping capacity of the pumping station and the fact that cooperatives already refused day and night supplies, it was impossible to follow water users' demand. This lack of management flexibility initiated local reactions from the cooperatives, which started to take water without respect to the planned irrigation calendar. This situation is illustrated in the table 2. This table dates from the beginning of the 1980s but is still relevant for explaining what were the problems 10 years earlier.

Table 2 Comparison between the planned and observed irrigated communes of Ly Van pumping station during spring season at the beginning of the 1980s (Mai Van Hai and Bui Xuan Dinh, 1997)

Day	Planned irrigated commune	Observed irrigated commune
1	Co Phap	Co Phap
2	Phu Dien	Phu Dien
3	An Binh	Phu Dien
4	An Binh	Phu Dien
5	Phu Dien	Phu Dien
6	None	Co Phap
7	Phu Dien	An Binh

We can see that competition existed between upstream and downstream communes. Phu Dien, within which Ly Van pumping station was built, was not following the planned calendar, at the cost of An Binh which was at the end of the scheme (see map 2). Cooperative members of Phu Dien did not let the water flow through the primary canal until they considered that rice water requirements of their fields were satisfied. The table shows that irrigation authorities were unable to run the system with equity. They were under the pressure of upstream cooperatives that wanted to satisfy their needs first before letting the water go through. The situation was bad enough to motivate reactions from the district water control service. They tried to secure water distribution by posting guardsmen along the primary canal, but water diversions continued.

Cooperatives reaction

Distribution issues occurred because cooperative members refused to comply with collective rules for water distribution. On the one hand they did not accept day and night water supplies. On the other hand they wanted to get water as soon as they asked for it. Central station discharge capacity was sufficient to satisfy crop water requirements when the established distribution regulation would be respected. Given the limited pumping capacity of the pumping station, already doubled by decreasing the command area, and the limited pumping time per day, already cut down by half, the existing distribution issue led State irrigation services to

lengthen irrigation intervals in order to provide water to the whole scheme. Thereby, cooperatives located upstream were more likely to divert water, which was becoming scarcer.

An irrigation interval of more than seven days needed an increase of daily irrigation duration, which seemed to be unacceptable to cooperative members. On the other hand, downstream cooperatives such as An Binh, were getting less and less water. Tertiary canals did not receive the required water levels for efficient gravity irrigation. Therefore, cooperatives downstream compensated for this handicap by building small petrol pumping stations in order to complement the unsatisfactory irrigation provided by Ly Van. Between 1971 and 1975, the pumping stations of An Dong, Dong Quan and Da Dinh were put into service by some of the village cooperatives of An Binh. Out of the 354 hectares of An Binh, originally supplied by Ly Van pumping station, 71 (20% of rice fields area) were taken out of the centralized[6] scheme to create small schemes irrigated by locally managed petrol pumping stations.

Actually, cooperatives did not accept any tight organization of water supplies, neither in terms of timing nor in terms of duration. This was constituting the main issue, which led to low deliveries of water. Ly Van discharge capacity was less to be questioned than the centrally planned distribution schedule of water supplies.

Table 3 Main characteristics of An Binh water control system between 1960 and 1980.

Hardware	High density of drainage and irrigation canals, hydraulic unit of a large irrigation scheme, first local stations
Technical practices	Gravity irrigation
Administrative set-up	District water control services, cooperatives, brigades
National policies	Centralized management of water from the river to the field intake, high subsidies, collectivization of agriculture
Weight of local political networks	Rules are made at central level, local level is not officially involved in decision making
Crops	Two crops of rice

2.4 Process of decentralization, after 1980

The shift to localized pumping can be observed at different levels, from the cooperative of An Binh up to the whole primary polder of Nam Thanh, and in different places all over Red River delta.

The process of separation of An Binh irrigated area from Ly Van command area, went on till An Binh completed its localized pumping schemes. In 1982, 116 additional hectares (33%) were individualized in the larger scheme of An Dong. In 1988, the scheme of An Dong was split into two. A new scheme at Chua Mai was created, which included 37 additional hectares (10%). Lastly, in 1993, the 96 remaining hectares (27%) were separated off as Da Xa local scheme[7].

6) We use "centralized" to refer to management of large collectivist schemes, in opposition to "local" schemes management.

7) There are 10% of land missing in our calculations. This land has been attached to a local irrigation scheme from a neighboring commune.

A look at the overall evolution of Ly Van command area, shows the same evolution as described above for An Binh commune. From the 1,000 hectares supplied in 1964, the command area has been limited to 64 hectares of Phu Dien commune in 1997, the commune on which Ly Van pumping station was constructed. The reduction of Ly Van's overall command area was not restricted to downstream communes which struggled to get access to water. Communes located upstream, such as An Lam, Cong Hoa and even an important part of Phu Dien, also built their own systems of irrigation. Each of them is now managing by itself. Several local stations are pumping water from the neighbouring *arroyos*. Out of the 220 hectares of Phu Dien ricefields, 156 are now supplied by three local pumping stations.
Figure 2 presented below, highlights the evolution of the irrigation system of Ngoc Tri polder with a comparison between local and district irrigation pumping stations' cumulative discharges.

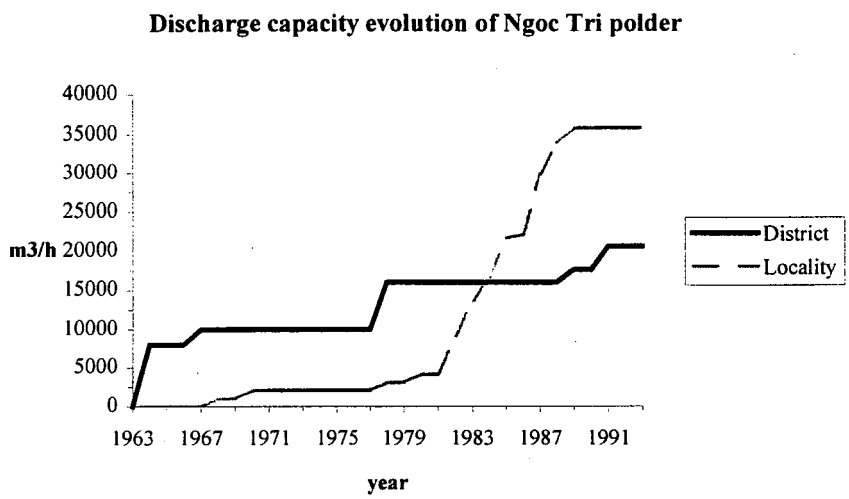


Figure 2 Comparison of discharge evolution between local and district irrigation pumping stations in Ngoc Tri polder (Bousquet et al., 1994)

The evolution described above is not restricted to Ngoc Tri secondary polder. The same process has been followed by the whole primary polder of Nam Thanh as well as the other polders of the Red River delta (*Questions posées sur [...], 1993*).

Nam Thanh primary polder fits the administrative limits of Nam Thanh district. It is 28,871 hectares large, out of which agricultural land surface is equal to 18600 hectares. 5,000 hectares of the southern part of the district are irrigated by gravity without any pump. 8,954 hectares are irrigated by 167 pumping stations belonging either to district water control services or cooperatives. Centralized district pumping stations are supplying 3,242 hectares only, with 48 pumping stations. The 5,712 remaining hectares are irrigated by 119 local pumping stations managed by commune cooperatives. Nam Thanh pumping irrigation management is now controlled for 63% by cooperatives. The average area supplied by district stations is equal to 68 hectares, where the average is only 48 hectares for local stations. Another main difference exists in the design discharge of pumping stations : the average capacity of local stations is above 5 l/s/ha where the planned capacity of centralized station was only 1 l/s/ha. This difference is an important point as it allows a more flexible management of local pumping stations than was possible with centralized ones (see below in third section).

Table 4 Main characteristics of An Binh water control system after 1980

Hardware	Irrigation and drainage canals, increasing number of local irrigation schemes with their own pumping stations
Technical practices	Water scooping and gravity irrigation
Administrative set-up	Commune, hydraulic company
National policies	Protection against floods and droughts, land private re-distribution, laws on cooperatives of irrigation, hydraulic companies and water fee
Weight of local political networks	Local level is taking over irrigation management, hydraulic company manages water catchment and drainage
Crops	Two crops of rice and one winter dry crop (50%)

Changes in irrigation within Nam Thanh polder, by the implementation of local pumping stations, were not restricted to downstream cooperatives only. Moreover, these changes did not occur in the specific conditions of Nam Thanh district only, but were shared by most of the communes of the delta. Such common and overall changes strengthen the idea that irrigation evolution was directed by deeper reasons than just technological reasons such as limited discharges and distribution issues. We suggest that more than a strict logic of complementing existing centralized schemes, local pumping stations have been built by cooperatives in order to get autonomy in irrigation from the central State. The main target was to get decisions taken at local level directly by users, and to avoid State services interference. To strengthen this hypothesis, we need to look at the overall conditions of agricultural production during the period mentioned above. Political as well as economic strategies followed by Vietnam have been of some influence on irrigation organization during the last 30 years.

3 POLITICAL AND ECONOMIC FRAMEWORK OF IRRIGATION DECENTRALIZATION

3.1 The resistance of North Vietnamese farmers to collectivization

Modernization of water control

In 1960 the North Vietnamese State initiated a policy of collectivization of agriculture. Agricultural land became collective, progressively managed by production cooperatives, which farmers were supposed to join, "in accordance with the principle of voluntariness" (*The Constitutions of Vietnam,* 1995). New cooperative members were assigned different specialized activities such as distributing irrigation water, keeping buffaloes, raising fish, transplanting and harvesting crops. They were organized in working groups called brigades or *doi*. Within this framework of collectivization, heavy investment was initiated in the water control system[8]. Unlike in earlier interventions which were restricted to flood control and water diversion from main rivers' intakes, the State put direct emphasis on mechanized drainage and irrigation, in order to modernize agriculture. Traditional agriculture was considered "backward" (*ibid.*). It needed improvement through the use of experience gathered in "advanced science and technology" (*ibid.*). Large drainage and irrigation schemes of more than 1000 hectares were created within polders, through the construction of secondary and tertiary dikes. *Arroyos* giving access to rivers were dug. Along them, large scale mixed irrigation and drainage pumping stations were built. Collective plots of rice fields were levelled. Meanwhile, complete networks of gravity irrigation canals were constructed. Pumping station dimensions were based on theoretical water needs established by the Ministry of Hydraulic Affairs for the average rice growing stage, that is to say 0.9 to 1.1 l/s/ha in the Red River delta conditions. Water distribution was organized through the rotation of a strict irrigation-turn amongst each cooperative belonging to the scheme. The management of this system was given to state, provincial and district water control services. They controlled the whole water control activity from river intake from the locks, the *arroyos*, the water outlets and inlets at the irrigation-drainage pumping stations, the irrigation canal networks, to the collective rice fields. Peasant farmers were absent from the water distribution process.

Local reaction to collectivization

The first local irrigation pumping station emerged in Nam Thanh in 1967-68, only three years after the implementation of large centralized schemes. The agricultural collectivization policy was being implemented in northern Vietnam but the creation of agricultural cooperatives was facing difficulties. Several figures indicate that villagers were "not deeply attached to cooperatives" ("Sau 30 Nam", 1990, quoted by Kerkvliet, 1995). Irregularities such as over-distribution of private plots to households were frequent. In theory, they were limited to 5% of village agricultural surface. In practice, they were often close to 10% and even 15 to 20% (Yvon-Tran, 1994). Cooperative members as well as cooperatives authorities gave priority to these privately

8) "On ne peut [...] concevoir au Nord Viet Nam une coopérative agricole stable sans un programme hydraulique bien conçu, et la réalisation d'importants travaux d'hydraulique est impossible en dehors de l'agriculture coopérée" (Duong Binh, 1973).

tended lands instead of to the collective land[9]. Embezzlement of improved seeds and chemicals in favour of privately tended lands was frequent (*ibid.*). According to the National Committee of Statistics quoted by Yvon-Tran (*ibid.*), 70% of produced goods were shared among the villagers. This situation was possible due to the behaviour of local authorities who modified what central directives stipulated in order to meet some of their villagers' needs and demands (Beresford, 1988; Kerkvliet, 1995). An important private market for rice, vegetables, livestock and poultry existed in the countryside. Households derived 60-75 per cent of their income from private plots and animal breeding (Beresford, 1988 ; Fforde, 1989 ; Dao The Tuan, 1995). In some provinces such as Hai Hung, Vinh Phu and Hai Phong, rice production contracts were already tested with cooperative members in order to motivate them to work on collective lands which were underused (Kerkvliet, 1995). These contracts, unilaterally introduced by regional and local officials, represented an attempt to improve production out of collective fields, so that established production plans could be reached and compulsory rice deliveries paid to the State. But, apart from these few attempts, which have been punished by central State, collectivization results fell far short from expectations, with a decrease of 20% in the official rice production rate per head between 1960 and 1975 (Pillot, 1995).

3.2 An increasing collectivization policy facing stronger local reactions

Collectivization process in a difficult situation

The decisions taken by the Vietnamese State just after the end of the war in 1976, reinforced the impression of an existing local resistance to the national policy of implementation of a centralized organization of production. The fourth congress of the Vietnamese Communist Party (VCP) held in December 1976, was used to criticize the north Vietnamese villages independent attitude, to confirm the chosen economical directions and to speed up the process of Vietnam's unification through the implementation of a great socialist agriculture. On that occasion, the First Secretary of the VCP, Lê Duan, criticized the peasant population for its lack of "ideological stubbornness" (Féray, 1984). According to him "the socialist cooperative even at the commune level is still too small, favourable to parochialism. Almost each of them forms an autonomous organization. In order to transform each cooperative in a big agricultural factory, we need to let it loose of *lang* (village) context within which farmers are stuck into shady *ho hang* (kinship) networks" (Nguyen Duc Nhuan, 1992). For some authors, the situation of collectivization at the beginning of the 1970s, was that 75 to 80 per cent of cooperatives were only theoretical without any effective meaning (Fforde and Paine, 1987). Central government, due to war priorities, had to tolerate peasant households attitude toward collectivism (Beresford, 1988). This policy changed in 1975 with the reunification of South and North Vietnam.

Increasing investments linked to a strengthened centralization of decision making

The reaction of central authorities led to a return to original ideology. This policy was implemented with the concentration of village cooperatives brought under the umbrella of newly created commune cooperatives. As for commune cooperatives, they came under the control of a strengthened *huyên* (district) administration, which was given the responsibility of production

[9] To get back to irrigation, we noticed that out of the three stations built in An Binh at the beginning of the 1970s, two were supplying the 5% privately tended lands.

planning, monitoring and evaluation. Administrative district services increased in size, particularly in water management, which benefited from considerable new central investments. Until 1976, Vietnam was at war and could not invest a lot in water control infrastructure. Priority was given to the war industry. The Northern government was hardly maintaining production capacity, which had been weakened by American bombings. With the coming of peace, agricultural investments were doubled within two years. They remained stable even under the serious budgetary crisis that the government faced during the end of the 1970s (Yvon-Tran, 1994). Achievements were made mainly on drainage capacity, which was inadequate. From 0.46 l/s/ha in 1974 (that is 25 days to drain off a rainfall of 100 mm), Nam Thanh drainage capacity was raised to 3,96 l/s/ha in 1979 (that is 3 days to drain off 100 mm)[10]. Centralized drainage pumping stations were built all over the delta during this short period of 5 years. Mixed stations specialized in drainage or irrigation in order to improve water control systems management.

In spite of the wilful and centralized policy displayed by the central government, centralized irrigation schemes were still regressing. The example of the Ly Van scheme shows a fall of 30% of the command area between 1975 and 1980. Paradoxically, local pumping stations were built by some commune cooperatives during a period of the strengthening of the central authority. This is only one of numerous indicators which showed the failure of the second phase of collectivism at the end of the 1970s[11] (Beresford, 1988). Central authorities were unable to get an effective hold on local reality and economy. They were encountering great difficulties extracting produce from the countryside, and food shortages in the cities were mounting (Kerkvliet, 1995).

3.3 The directive 100's strong effect on irrigation

A bad economic situation

The serious economic crisis, which Vietnam was facing at the end of the 1970s, was worsened by a number of external factors, such as the Vietnamese involvement in Cambodia, the boycott from western nations and the halting of Chinese aid. It led VCP leaders to recognize the failure of "great socialist agriculture" and to propose through the *Khoan 100* (directive 100), a new contract of production with peasant households. This directive developed on the basis of former informal contracts (see above), aimed to lease paddy land to households for a fixed contribution with excess yields to be kept by farmers. This institutional reform really only mirrored most local practices, and gave back to farmers "the right to decide the use of their labour and the return of their labour" (Dao The Tuan, 1995). It is clear that confronted with a severe economic crisis, the Vietnamese authorities had to make concessions to grass-roots pressures (Fforde, 1989 quoted in Kerkvliet, 1995). Unlike the former constitution of 1959, the new constitution of 1980 aimed to build a "centrally-run economy while developing the local economy" (*The Constitutions of Vietnam,* 1995). In irrigation and drainage, investments in centralized systems were stopped, benefiting local schemes, which increased fast. The central government authorized cooperatives to build their own stations, and directly helped in financing some of these, plus ensuring and financing their electrification[12]. Official figures for water control services show that in 10 years,

10) Rice can resist up to a 4 days submersion (Gourou, 1936).

11) In the North of Vietnam, the gross production of rice decreased more than 1 million tons (20%) between 1976 and 1980, while payments to the State through public taxes decreased 30% (Pillot, 1995).

12) Some examples show that the main motivation of some cooperatives can have been more to electrify villages than to get a pumping station (Tessier, 1993).

the number of local pumping stations multiplied by 20 in Nam Thanh district: from 5 in 1980 to 101 in 1990[13].

The introduction of a water fee

On the 25th of August 1984, through directive 112/HDBT (Hoi Dong Bo Truong, 1984), the central government slightly decreased its commitment to water management, by partly privatizing water control services. Dike management and overall planning of water control was kept under the responsibility of public administration at province and district levels, within the water control boards. The catchment and transportation of water, irrigation and drainage were given to newly established hydraulic companies. These structures, which are still in operation, were based on water control as well as administrative divisions. There was one head company in each primary polder, and subsidiary companies in each district, when a polder was embracing several districts. They had and still have to finance themselves through the collection of a tax, paid by cooperatives, specifically set up to cover hydraulic fees. The tax amount, decided at province level for each district, was valued in kilos of paddy per irrigated area unit. 45 per cent of the tax was allotted to the company to pay water catchment, transportation and drainage costs, whereas the 55 per cent left for irrigation fees, were shared among cooperatives and companies, depending on their respective involvement in supplying water for irrigation.

In practice, the percentage restored to companies was not based on the area effectively supplied by centralized pumping stations. Cooperatives were underdeclaring drained and irrigated surfaces in order to keep for themselves part of the paddy due. It was a way to increase their investment capacity in irrigation, through retaining as much financial resources as possible. Moreover, cooperatives were still getting local collective tax remittances for services they were no longer carrying out, such as fertilizer and seed supplies. Actually, agricultural cooperatives services were disorganized and farmers were *de facto* assuming all the tasks carried out on rice fields, while still paying for them.

On the one hand, the underestimation of supplied area combined with the remaining local taxes on services, allowed cooperatives to invest a lot in local irrigation pumping stations implementation. On the other hand, newly established companies were not able to balance their accounts as they were supposed to, but were bailed out thanks to central government subsidies. This period, called the *khoan trang* (white directive), is considered to be the most favourable to irrigation investments. But, despite increasing local investments in favour of production, the pressure on farmers was so acute that it led to a number refusing to pay contracts and others did not want to take all the paddy land they were entitled to. In 1987, the bad economic situation characterized by high inflation rates (Beresford, 1988), combined with unfavourable climatic conditions, brought about an increase in rice costs and a food shortage in cities and areas with insufficient food production (Pillot, 1995).

3.4 The reform 10's negative effect on water control organization

The Vietnamese government went a step further in 1988 with the launching of *Khoan 10* (directive 10), which consisted of land redistribution to peasant households, the abolition of

[13] We think that the initial number of 5 stations is underestimated, considering that An Binh already possesed 4 local stations in 1980. The fact is that, during the 1980s, some of the original petrol pumping stations were closed while others were electrified and their command area increased.

subsidies and liberalization of production activities and costs. Official rice prices were aligned with market prices. Farmers had the choice of the crop they grew. They could provide for themselves and sell their crops to private shops. Collective contracts were abolished and farmers had to pay taxes directly (landed, hydraulic, social) to the cooperative, on the basis of main labour force and land area. Within few years, cooperative services, which had survived during the 1980s thanks to contract collection, were dismantled. Irrigation was the only service still, to a greater or lesser degree, carried out by cooperatives. But, in the context of economic liberalization, water control was to suffer from a transition crisis due to the increase of electricity costs. Between 1988 and 1993, in addition to rice price market alignment, the cost of a kilowatt of electricity multiplied ten times, parallel to hydraulic tax freezing. The central government also discontinued the subsidizing of hydraulic and electricity companies. Within the context of increased working expenses, companies were unable to pay their electricity bill in time and to maintain properly the system of centralized schemes and stations. For their part, farmers did not want to pay hydraulic taxes because of the bad quality of service provided by the company (electricity cuts, canal and pump deterioration). In An Binh, at the end of the 1980s, farmers had even dismantled tertiary drainage canals in order to widen their paddy fields and dug tertiary irrigation canals as ditches in order to stock scarce water and to mix their use (irrigation and drainage). It led to an increased difficulty in maintaining the gravity irrigation of household paddy fields, due to the depth of dug tertiary canals[14]. Farmers had then to complement pumping with a lift irrigation system completed by farmers using the manual scoop water basket method (*cai gâu giai*).

The poor water management situation was not limited to An Binh, and neither to the district of Nam Thanh. It appeared to be common to many areas of the Red River delta at the beginning of the 1990s.

On the one hand this situation motivated central government to subsidize companies again in order to avoid electricity breaks[15]. There was indeed an increasing risk of poor yields of precarious household crops. On the other hand, this reform also affected the management of centralized as well as local irrigation schemes, which were unable to remain organized as they were under collectivism. Land distribution to peasant households included peasants to diversify rice varieties and to intensify cropping patterns. They increased the size of their plots, through dismantling drainage tertiary ditches, and secured water deliveries to these plots, through digging irrigation tertiary canals. This shows that the newly emerged peasants farmers were also becoming water users who wanted to engage in water control activities. The difficulties faced by hydraulic activity in the late 1980s are directly linked to the autonomy that peasant farmers gained in production activities. This autonomy meant new ways of labour organization, as compared to collectivism, which included irrigation organization. Peasant farmers undertook to pay an individual hydraulic tax, on the basis of electricity market prices, but were expecting for their part effective services from irrigation management groups. The ability of irrigation systems to be suited to peasant farmer's new practices was the main challenge at the end of the 1980s and beginning of the 1990s.

14) In the An Binh Da Xa scheme, cross sections of tertiary canals were enlarged to four times the size: from 0.5m x 0.3m to 1m x 0.7m.

15) In theory, electricity costs should not exceed 20% of the total expenses of the company. In practice, it often reached 50 to 60%.

4 FARMERS' IRRIGATION PRACTICES AND THEIR IMPLICATIONS: THE CASE OF DA XA LOCAL IRRIGATION SCHEME

Da Xa local scheme was created in 1993 when it was separated off from the An Binh system. It embraces 100 hectares and two villages, Dao Xa (brigade 1) and Da Dinh (brigades 2 and 3) (see map 3). Da Xa pumping station is equipped with two pumps of 1,000 m^3/hour each, which is equivalent to a total discharge capacity of 5.56 l/s/ha. Through water balance experiments done in brigade 1, we can say that the rice water needs of this scheme are satisfied (Dang The Phong and Fontenelle, 1995). Before describing the irrigation practices of Da Xa irrigation system, we must first understand the overall communal irrigation organization.

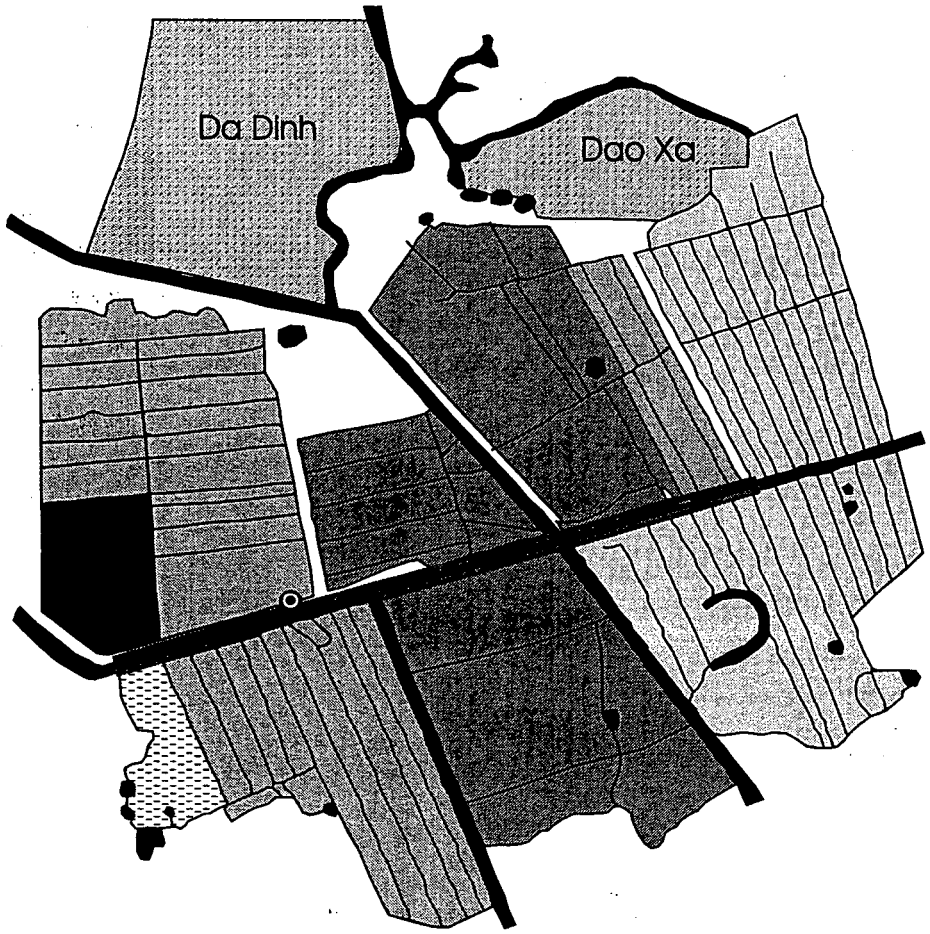
4.1 An Binh current irrigation system

Irrigation in An Binh commune cooperative comes under the responsibility of the cooperative's water control group. This group draws up a contract every year, covering water supplies and drainage with the hydraulic company. The water control group manages local pumping stations, plans maintenance and looks after repair work. It oversees and supervises the work done by each of its members, and organizes the collection of the hydraulic tax together with the cooperative's accountant. An Binh territory is divided into three water control sectors (*khu*) based on brigade and village divisions, except for *khu 1* which embraces Dao Xa and Da Dinh villages (see table 5).

Table 5 Water control sectors of An Binh

Khu	Production Brigades	Villages
Khu 1	1, 2 and 3	Dao Xa and Da Dinh
Khu 2	4, 5 and 6	An Doai
Khu 3	7, 8, 9 and 10	An Dong

Each *khu* is independent from other *khu's*. It is managed by an official helped by some assistants (6 in *khu 1*, 3 in *khu 2*, and 4 in *khu 3*). Each *khu* official is responsible for supplying water in time to farmers' paddy fields. Assistants guide water into primary, secondary and tertiary canals and on to the planned irrigated unit. In practice, *khu* officials are also helped by the chiefs of each production brigade, who also collect hydraulic tax from farmers. Each pumping station also has one caretaker and one or two workers in charge of activating the pumps (see below figure 3).



Map 3 Da Xa local irrigation scheme

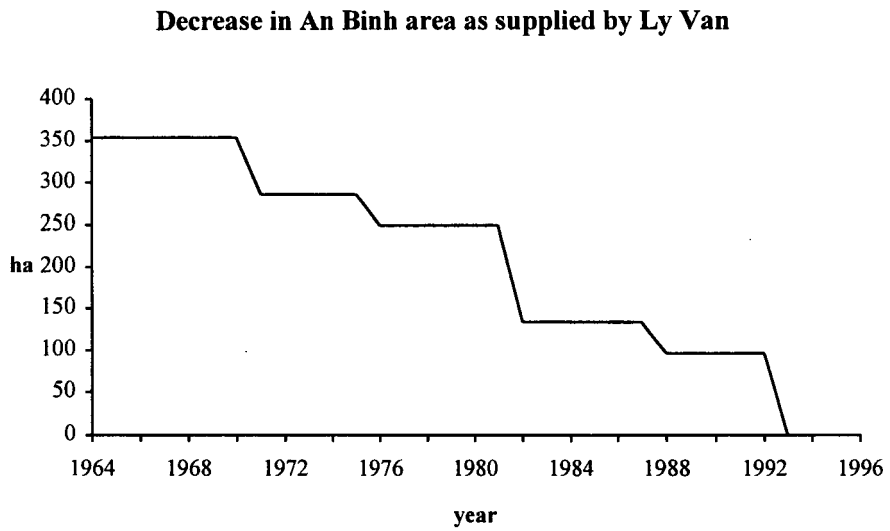


Figure 3 Organizational structure of An Binh commune cooperative for water management

4.2 Da Xa pumping organization

There is no fixed pumping schedule. Pumping is started on the basis of the effective demand of each brigade chief who is in charge of agricultural production. In theory, cooperative authorities decide the transplanting date for each rice season. In practice, we observed some adaptations based on individual farmer's agricultural practices.

Each *khu* official organizes a meeting twice a year with his assistants. In these meetings they decide the different dates for pumping for land preparation, based on observed cropping patterns. For example, due to favourable topographical conditions, farmers of brigade 1 can grow a dry winter crop early in the season, which is promising good yields. Under tight crop calendar conditions, the spring rice land preparation moment is the only time of year when farmers have some flexibility to choose their date of transplanting. The pumping station takes this reality into account by supplying brigade 1 paddy fields earlier than brigades 2 and 3 (Mai Van Hai, forthcoming). Due to the station's high discharge capacity, it takes only six days to supply water to the three brigades.

In the rice season, irrigation assistants have to supervise water levels in the fields in order to plan and organize the next pumping time. They also have to monitor weather forecasts, in order to avoid water excess and drought. Every day one of the assistants goes to the fields in order to check water levels. All the assistants from Da Xa scheme stated that they ask for irrigation when more or less 70% of the area is dry and when the water level in tertiary canals is below 20 to 30 centimetres (Do Thi The Vân, 1995). They take into account that farmers are lifting water to supply their plots[16].

16) Lifting water with a basket (*cai gâu giai*) needs at least 35 centimeters of water depth (Dumont, 1935).

The *khu* official who is managing Da Xa station is supposed to provide water to the first area which needs it. The pumpings are launched within two days after the brigade chief has made the demand to the stations official. In fact, we observed a strong homogeneity of pumpings among brigades as well as villages. Irrigation is mainly defined to an area included within a single brigade. When there is a combination, it is restricted to fields from brigades 2 and 3, from the village of Da Dinh (see table 6). Brigade 1 is supplied alone, especially after brigades 2 and 3 in order to avoid water diversion by farmers from brigades 2 and 3. This suggests that not only irrigation units but also village social units are taken into account during pumpings when irrigation is managed by the locality.

Table 6 Pumpings of Da Xa scheme during spring season 1993 (Collective Gestation Social de l'Eau, 1994)

	Pumpings restricted to the brigade (entirely or in part)	Combined pumpings between brigades*	Sum of pumpings
Brigade 1	10	0	10
Brigade 2	10	5	15
Brigade 3	10	5	15

* Combinations link brigade 2 with brigade 3.

4.3 Field level irrigation practices

There is no organized procedure to inform farmers about a coming irrigation. They can be informed if they ask the assistants, the brigade chief, their relatives, or their neighbours. Farmers stated that they do not feel any damage by not being informed, because they go to their fields at least once every three days. If they missed the day of pumping, they can lift remaining water from the tertiary canal in front of their plot[17]. Some are saying that it would be better to get informed but it does not matter because they have got used to working under these circumstances. In order to know more about farmers irrigation strategies, we conducted a survey on water supply of all individual plots of one water control unit of the brigade 1, during the spring rice season of 1995[18].

Results shown in table 7 illustrate that farmers do not specifically use pumping days to supply water to their fields. The percentage of irrigated plots on the pumping day is very low, which implies that farmers are coming on another day to lift water. Out of the six surveyed consecutive pumpings, the average percentage of irrigated plots on pumping days is equal to only 25 per cent[19]. Moreover, out of these 25 per cent, higher elevation plots required a lift irrigation anyway. They can not be supplied by gravity and need farmers to come and lift water.

17) Almost every individual paddy field has direct access to a tertiary canal.
18) Our protocol was to follow fields water levels around each pumping date. We asked the brigade chief 1 to inform us of each pumping demand so that we could start our measurements the day before the scheduled pumping. Then, during a period of five days, we took measurements of water levels twice a day, in each of the 385 individual plots of the area.
19) The sum of percentages can exceed 100 if some plots are irrigated more than once within the four monitored days.

Table 7 Comparison between numbers of irrigated plots for six pumpings of spring season 1995

Pumping date	12/02/1995		24/02/1995		5/03/1995		21/03/1995		12/04/1995		28/04/1995	
	number of irrigated plots	%	number of irrigated plots	%	number of irrigated plots	%	number of irrigated plots	%	number of irrigated plots	%	number of irrigated plots	%
Day n	113	29	46	12	106	27	194	50	12	3	219	57
Day n+1	26	7	47	12	41	11	22	6	51	13	45	12
Day n+2	52	13	19	5	23	6	9	2	9	2	15	4
Day n+3	11	3	33	9	12	3	12	3	10	3	228	59
Sum	202	52	145	38	182	47	237	61	82	21	507	132

There are some difficulties to provide water by gravity irrigation by means of dug tertiary canals. On the other hand, clayey dug canals make up good reservoirs from which water can be drawn during a few days. It could explain why farmers do not choose to come specifically on the pumping day to get water. Unlike collectivization times, when water distribution was tight and centralized water supplies of collective plots fully done by gravity, farmers now have the technical possibility and institutional legitimacy to manage irrigation supplies by themselves. Besides, farmers opinion about the operation of this scheme, as well as farmers water supplies' organization, allow us to propose that they are fully satisfied with the situation that they have initiated (Fontenelle and Tessier, 1997). We can surmise that the old lift irrigation method is the main technique used on that former gravity irrigation scheme, whatever ricefield irrigation possibilities[20]. This point shows that farmers prefer to lift water even when field elevation does not always compel them to do so, because it gives them the full control over water supply decision-making.

From the viewpoint of the effectiveness of field-level irrigation, there is a good supply of water. This effectiveness is illustrated by the few drought days and the controlled water levels observed in the plots (Dang The Phong and Fontenelle, 1995). Actually, water storage in dug canals increased flexibility. Farmers are now independent from each other and can get available water any day they want. Irrigation practices show independence between pumpings and plot irrigation's frequencies. Farmers are now following their own rhythm based on among other things, manpower availability, and personal experience and cropping pattern diversity. They can provide a small or high water amount with different frequencies. The water lifting technology does not require strength and can be done by children. It is labour intensive, but it takes place in a context of high rural unemployment. Farmers can grow short or long-term rice. They can use transplantation or direct broadcasting techniques. Decision-making flexibility acquired by introducing water-lifting technology allows farmers to easily diversify their cropping patterns whereas centralized gravity irrigation failed and localized collective gravity irrigation struggled.

4.4 Tertiary canals maintenance

The present scheme operations seem to fit in with farmer's aspirations without any visible active participation from their side. In order to get a better understanding of farmer's involvement in

[20] The last pumping gives a good example of lifting irrigation importance. Although 57% of farmers came to irrigate on the pumping day, 59% came again three days after to lift water.

local irrigation schemes management, we shall describe the tertiary canal organization of maintenance in brigades 3 and 1.

The responsibility of tertiary canal maintenance is left by the cooperative to the brigade. A proportion of hydraulic tax is kept by the chief of the brigade to finance this activity. Each year he is making a cost estimate of the work to be done. The modalities of maintenance organization depend on the specific brigade.

In brigade 3, the whole quantity of planned work is divided among all households. As a first step, the brigade chief estimates the amount of work for each tertiary canal. Then, each farmer has to complete the work on the portion of canal in front of each of his paddy plots. Farmers will be paid after completion of the work on the basis of this estimate. This kind of management is based on the former collectivist organization. It is compulsory to come to work on the day chosen, decided in an unilateral way by the brigade chief.

This system is not in use in brigade 1 any more, since the distribution of land in 1993. The brigade chief still makes an estimate of the planned work on each tertiary canal, but organization as well as completion of the work is given to the village "Women's Association"[21]. This association arranges for one adult, man or woman, from each household to come to do the work. The noticeable aspects of this organization are that the working day is chosen by farmers, and that the association does not pay farmers who come. The money is added to the association's fund in order to help organize social activities in the village.

A comparison of the condition of tertiary canals in each of these two brigades' shows a significant difference. The tertiary canals of brigade 3 are in a worse condition, which can be explained by the fact that the chief of this brigade did not succeed to get more than 40 peasant farmers out of the 216 brigade's households to contribute to the work. And yet farmer's low participation is surprising as each of them has a personal interest in maintaining tertiary canals. This job is not only a way to earn some extra money, but the frequency and the quality of the lift irrigation is closely related to the condition of the canals and lateral bunds along their sides. A badly maintained canal with mud in its bottom does not facilitate water lifting. It also increases water loss from paddy fields lateral bunds.

Although irrigation practices appear to be based on individual decision-making, we can not assert that the Red River delta irrigation is evolving from a collective centralized system to a system based on individual organization. The maintenance example suggests that, some work can be well organized amongst farmers collectively, as long as they are really participating in the process of decision-making. From this point of view, brigade 3 must be considered as one of the remains of former centralized top-down irrigation organization, whereas brigade 1 maintenance organization seems to fit in with farmers collective approach of this activity. In brigade 3, maintenance difficulties are due to farmer's opposition directed against the brigade chief's autocratic behaviour. They are not the result of an individualistic evolution of farmers' overall attitude toward collective organization of water resources management. The brigade 1 example highlights farmers' ability to organize themselves collectively in an effective manner. Moreover, it shows how local social control can be one of the necessary conditions of success. Although the Women's Association has an official status, it is led by villagers who want to organize pilgrimages, religious festivals, banquets and welfare to the poorest. The brigade chief is managing through an existing social association. If someone does not come to work the damage will be directly shared by villagers, through the Women's Association which will not then get the

21) This official association belongs to the Vietnamese Patriotic Front, as Youth Association, Veteran Association. Each woman joins it after her marriage.

estimated amount of money for the job. Not coming is no longer a political statement. It has become an individualistic attitude, which is in turn penalizing the village as a whole.

4.5 Convergence between pre-collectivist and present irrigation systems

Present local schemes show a number of characteristics in common with traditional irrigation described in the first section. The command area is always small -below 100 hectares- and local schemes are often restricted to village limits. When schemes are smaller than the total village rice fields area, their management is organized within irrigation management sectors (*khu*) which correspond to village units. Da Xa scheme constitutes an exception in Nam Thanh district because it combines two villages in one *khu.* However, it is not really accepted by farmers. Their present claim is to get a separate scheme for each of the two villages of Da Dinh and Dao Xa.

Fortunately, this question is not harmful to Da Xa scheme operation because the official in charge of the station is taking farmers' claims into account by managing his station in such a way as to avoid confrontation between villages. This is clear at land preparation time as well as during rice growing periods. Brigades 2 and 3 (Da Dinh) are often managed as a single unit, whereas brigade 1 (Dao Xa) is managed separately. We think that, like in the past, the scale of the village seems to be relevant as an irrigation management unit, as far as peasant farmer's social agreement is concerned.

Speaking of farmers' irrigation practices, there has been a transformation of the initial function of tertiary irrigation canals. Farmers have dug them in a way, which makes gravity irrigation difficult and led to the use of a water basket. Actually, we can not assert whether or not it has been a deliberate enlargement, based on collective farmers willingness, or done by default, in order to keep as much water as possible from each pumping. But tertiary irrigation canals have been transformed into ditches which are used as "bail out" stations were in the past. Digging tertiary canals led to the point that field level irrigation became an internal question again, involving each household. Under collective gravity irrigation systems, farmers had to set their supplies on the rhythms of collective pumpings. The manual scoop water basket method "ensured" them autonomy from the pumping station in their field level irrigation practices.

However, some important differences exist between present and traditional irrigation. These are due to the management flexibility allowed by the use of modern technology. Farmers have direct access to water because of the established network of canals. They do not need to come to the "bail out" station, to negotiate, and to await their turn as before. There is no negotiation necessity because tertiary canals are village property unlike former bail out stations. Moreover, high capacity pumping stations ensure a good frequency and speed of water supply, based on paddy water needs rather than tied rhythms. As a matter of fact there is no longer any interaction between farmers, in contrast to the periods before and during collectivization.

Concerning canal maintenance, village local society is willing to organize this activity as it was doing before collectivization. The man in charge of maintenance organization, the brigade chief, belongs to the cooperative. He reminds farmers of the State's former collectivization policy. He got higher social rank and local political power from his given position. Therefore, farmers do not accept his leadership when he does not build it on village social organization. The brigade 1 example shows how the brigade chief now has to organize maintenance activities with Dao Xa village as a whole. He can not manage each household personally anymore, and has to deal with village representatives. In the case of Dao Xa, the Women's Association seems to be leading, but the comparison with other village cases made us think that this situation is mainly

due to the legitimacy of village association leaders, more than to the nature of the association itself. The evolution described is leading to an increasing participation of peasant farmers in irrigation management, through associations that represent the group. Associations owe their existence to official central recognition, but they also constitute socially meaningful units in Red River delta villages. They are acting as collective intermediaries between farmers and local authorities.

5 SYNTHESIS

The emergence of local schemes, initiated during the collectivist period, expressed local claims that production should be managed at a small scale. These claims were justified by the inefficiency of collectivist organization as a whole. This phenomenon in the field of irrigation management supports the validity of more general statements like those of Kerkvliet (1995). We suggest that local claims led to the economic and political reforms of the 1980s. Centralized irrigation schemes were unable to supply cooperatives correctly. This situation was due to local disregard for water distribution's centrally made rules established by the district administration; more than to unsatisfactory pumping stations design. Reactions with regard to irrigation management have to be understood as one aspect of the local rejection of collectivism. Demands appeared to be closely linked to an attitude of independence at village level, which prevailed over the central policy of implementing collectivized, socialist agriculture.

The opposition to State centralism does not imply that farmers showed an individualistic tendency against overall collective organization of irrigation. The new irrigation systems, for which renovation is now in progress, appear mainly to be structured on management flexibility and social identity. Farmers, followed by cooperative officials, tried to avoid some of collective constraints inherent to irrigation, without objecting to all of them. They are not ready to weaken their production capacity for a principle of collective or individual organization of irrigation. But, their attitude toward irrigation suggests that there are some limits beyond which collective management is not socially acceptable. On the basis of the study of Da Xa local irrigation system, we have outlined some criteria, which make the operation of a collective irrigation system acceptable to farmers. These criteria are mainly based on the traditional organization of irrigation, which was prevalent in the Red River delta until the 1960s, but new conditions resulting from the 1980s are playing a part too.

From the farmer's point of view, it seems that local irrigation schemes should preferably be restricted to village units. By decreasing the size of the collective unit down to the village unit, water-users know each other and share common identity based on neighbourhood or kinship relations (Mai Van Hai and Bui Xuan Dinh, 1994). By delegating local leadership to a unit, which represents the village and has some local social legitimacy, farmers do not have to get involved personally in the activity. Their indirect involvement is based on collective village associations which are acting as go-between between them and communal cooperative representatives. By getting full individual autonomy in production, including the water supply to rice fields, farmers can secure and diversify their agricultural activities. Collective irrigation is seen favourably as long as collective constraints do not interfere directly with and do not relegate to the background production activities, which are farmers' present priority. Therefore, individual rice field water supply was not an aim but a means to achieve their target of production autonomy.

The evolution of irrigation management in the Red River delta is a good example of confrontation between local and central levels in the management of common natural resources. Strategies and objectives of users and policy-makers are often different. When the central level aims to take responsibility for the full process of natural resources exploitation, without concern to local users' methods of exploitation, it leads to open and hidden conflicts. These conflicts, which are leading to mismanagement and collapse, can take time to be taken into account at central level. Requirements, such as institutional changes, are needed to create favourable conditions to set up constructive negotiation. Actually, a platform for negotiation has to be found, either officially or informally. Such negotiation establishes roles and duties for all of the actors involved in the exploitation of the resources in question. This process is in progress in Red River delta through

the definition of partnerships between institutional actors involved in water management. More than being a technical issue only, irrigation includes political issues as well as social issues.

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