



Commons in Transition

**INSTITUTIONAL OPTIONS FOR SUSTAIN-
ABLE IRRIGATION:
A EVIDENCE FROM BULGARIA**

IVAN PENOV

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ABSTRACT

This paper investigates a local CPR problem, the solution of which needs a balance between the collective and private interests. In the political context we have a large group of actors with a short planning horizon and a lack of trust among them. CPR provision is organised in a centralised way. The state enforcement mechanism is weak and can not protect the individuals or eventually to backup the collective' decisions. The above problem is investigated in the case of irrigation in Bulgaria where water usage declined with nearly 85% during the period of transition. In addition, large parts of the existing canal systems were abandoned. Three groups of institutional options are investigated in the paper: improvement of the local level co-ordination; limiting the market imperfections, and strengthening the external conflict resolution and sanctioning mechanisms. The investigation of above case led us to conclusions that can be generalised for the case of CPR management during the period of transition. The transition process is not just a process of transferring western institutions to Eastern Europe, but also a process of spontaneous emerging of new institutions at ? local level. Therefore, we call for a state intervention, not in the area of CPR provision but in supporting the local co-ordination.

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1. INTRODUCTION

During the last decade the countries from Eastern Europe experienced a fast change in their economic systems. These countries need to develop new institutions. The economic theory suggests that private goods are supplied best through the market, and the public goods- collectively by the state, through the political process. The common pool resources share some features with public goods, such as lower excludability, but at the same time they are subject to high rivalry. Therefore, the extraction of the common pool resources through these extreme institutions (market and state) has significant imperfections.

This paper investigates a local CPR problem, the solution of which needs a balance between the collective and private interests. It is also a typical social dilemma problem where people pursuing their private interests at the cost of collective goods cause sub-optimal outcomes. In the political context we have a large group of actors with a short planning horizon and a lack of trust among them. CPR provision is organised in a centralised way. The state enforcement mechanism is weak and can not protect the individuals or eventually to backup the collective' decisions.

The above problem is investigated in the case of irrigation in Bulgaria. The irrigation water usage in Bulgaria declined with nearly 85% during the period of transition. In addition, many parts of the existing canal systems were abandoned. The water resources and main canal systems are controlled by the state. The study was carried out in the Plovdiv region, sufficiently rich with water resources. The main crops grown in the area are fruit, vegetables and rice. Many small old age subsistent farmers dominate the farm structure in this region.

The main questions investigated are: How farmers can use the irrigation water in the Plovdiv region in a better way? and also how to make the Irrigation Company to supply water in a more reliable way? These questions refer not only to the water usage and allocation efficiency, but also to organising irrigation infrastructure maintenance. Three groups of institutional options are proposed in the paper. The first group aims at improving the local level coordination; the second group aims at limiting the market imperfections, and the third one aims at strengthening the external conflict resolution and sanctioning mechanisms.

The investigation of above case led us to conclusions that can be generalised for the case of CPR management during the period of transition. The transition process is not just a process of transferring western institutions to Eastern Europe, but also a process of spontaneous emerging of new institutions at ? local level. Therefore, in this situation we call for a state intervention, but not in the area of CPR provision. We see the role of the state in supporting the local coordination development, and providing additional instruments for conflict resolution and sanctioning mechanism.

The arguments in the paper are presented as follows. First, introduction of problem and literature regarding institutional choices. Second, presentation of the Bulgaria's case regarding irrigation. Third, discussion concerning the relevant features of transactions; actors involved; property rights' system and existing governance structure. Fourth, assessment of the possible institutional options. Finally, we derive recommendations for the CPR management in Eastern Europe.

2. INSTITUTIONAL CHANGE AND IRRIGATION

Ostrom (1992) identifies the major problems for all irrigation systems: free riding, rent seeking, and corruption. Free riding evokes lack of trust between the actors. Potential rents stimulate efforts to influence public decision-making and evoke corruption. Free riding can be overcome, according to Ostrom, when farmers are convinced that the benefits exceed cost and by improvement of communication among them. Rules that require water users to cover all operation and maintenance cost can fight the rent seeking behaviour. Devising institutions that do not allow single officials to have full control over the resources can help to reduce corruption. Improvement of communication between the farmers, Irrigation Company, and state institutions could make the parties to be more aware of the problems and reduce both rent seeking and corruption.

Ostrom (1992), criticises the assumption that after an irrigation system is built, the farmers would organise themselves to distribute the water and maintain the system. According to her this assumption in most cases is wrong and therefore she argues that the institutional development is at least as important as the investments in a physical infrastructure. In this respect, Ostrom identifies several basic principles of the self-organised irrigation systems: clearly defined boundaries of the service area and clearly specified water rights; relating the rules of water allocation to the rules of cost distribution; including of all individuals affected by the rules for water usage in the group that creates these rules; water monitoring and sanctioning to be performed by the water users or individuals accountable to them; a low-cost local conflicts resolution mechanism to be available; the water users' rights to devise institutions not to be challenged by external government authorities.

Ostrom's principles have been defined on the basis of experience of less developed countries. In Sarker and Itoh's (2001) opinion, they are valid also for developed countries with some modification. The authors derived this conclusion investigating the organisation of irrigation in Japan.

The devolution of irrigation systems modifies the role of the state from an active service provider to facilitator of the process. According to Grafton (2000), the existing property rights' relations regarding the common pool resources represent a mix of rights among individuals, firms, communities, and the state. His idea is that the state could act as a facilitator and to support an active participation of resource users in the management of common pool resources. Sarker and Itoh (2001), also point out that the users' groups or community based approach is not equivalent with withdrawing of the state from the problem but it is connected with reshaping of the state intervention. They see the role of state in institutionalising the collaboration between administration and resource users.

The self - organisation can take different forms, which have both advantages and problems. Aggarwal (2000), in the case of small water users' groups, finds that while the tasks for water allocation is managed effectively, the maintenance and especially investment activities are not performed regularly by the groups. In their case they find out that single individuals had done the investments in new wells and over time the ownership has been divided between the inheritors or shares have been sold to other people outside the family. Group investments in new wells were observed only in areas where government or other committed agency has intervened.

Scheumann (2002), compares the institutional reforms in irrigation in Turkey and Pakistan. In the case of Turkey in early eighties, the General Directorate for State Hydraulic Works (DSI) has initiated establishment of irrigators' groups that contributed to maintaining the tertiary irrigation infrastructure. These groups were based on the administrative units - village headman or the town council. Then the groups entered into contracts with the state agency (DSI). According to Scheumann, although these groups had a range of deficiencies such as misuse of collected water charges, appointment of relatives and exempt them from fines, they had positive impact on irrigation water management compared with previous situation. The water users' groups also played a positive role later when the irrigation reform in Turkey was fully completed.

The association of water users is the most frequently recommended organisation form for management of irrigation. The associations are legal entities supposed to have a full control over the irrigation infrastructure in the territory they serve. However, researchers often observe, even in this case, problems with underfinancing of irrigation maintenance and investments (Vermillion, 1999; Vermillion and Carces-Restrepo, 1998). One of the important factor for these problems is that the devolution process was not carried to end.

What is the "right" organisation form in the case of irrigation? Sabates-Wheeler (2002) investigates the co-operation among the farmers. Although they are concerned with the production activities, their conclusions are also relevant for irrigation. Sabates-Wheeler considers three organisational forms: individual farming; co-operation in small groups (among relatives); and formal large associations. She finds out that there are substantial production advantages to participate in small groups (family society) at certain levels of resource access. According to her, the superiority of one of the three forms is not something fixed, but it changes with the shift in the resources access.

Ballad and Plateau (1996) also suggest that any dogmatic attitude concerning superiority of one organisation form regarding management of common property resources over the others are unjustified and damaging (page 346). According to these authors a careful analysis for each case is needed in order to determine the appropriate organisation form. Private ownership, according to these authors, may be very costly and inadequate due to factors such as high cost of exclusion; direct state control may be inefficient because of high information cost and lack of monitoring devices. Community -based management may be unrealistic because of the existing local conditions and insufficient collective actions due to (1) recent changes in the rural scene; (2) the existing features of the social structure and resource characteristics. Baland and Platteau think that the state and community based models can be combined in various ways and thus to produce solutions that go beyond the three standard approaches: state, private, self-governance.

According to Saleth (1999) irrigation privatisation involves multiple actors with different capabilities. Further, the private groups are complementary and mutually non-exclusive, therefore they play important role at different stages of irrigation development and management. This author argues for promotion of all forms of privatisation whenever they are feasible. Privatisation according to him will reduce the role of government in financing and day to day management, but will enhance the state facilitative and regulatory responsibilities. The most appropriate mixture of forms will depend on the technical characteristics of local system and the institutional settings. He suggests

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two steps in restructuring of irrigation. First, evaluating and ranking of the privatisation options with the features of the regions. Second, to implement the options in the regions. In this respect the author considers two strategies: (1) encouraging implementation of all the options; (2) implementation first of the politically and administratively less sensitive options and latter institutionally more mature options.

In summary, the recent literature regarding irrigation argues that the solution of the irrigation problems is neither state nor market, but somewhere between, i.e. involvement of farmers in the decision making process. Key elements of this approach are (1) establishment of organisations of water users and transferring the management responsibilities, maintenance and investment decisions to them; (2) restricting and changing the role of the state. The self-governance of irrigation can be conducted through different organisation forms. The forms may be complementary rather than competing. The choice of the appropriate institutions, however, depends on the local conditions and resource features.

3. DETERMINANTS OF THE INSTITUTIONAL CHANGE

Drawing from Hagedorn, Hintzsche, Peters (1999) and Sikor (2002) we investigate two groups of determinants of institutional change on nature components. First, we look at the interaction between the actors and the nature components. The features of transactions related to nature and the characteristics of actors are important items in this respect. Second, we look at the institutions for sustainability. The property rights on nature components and the governance structure on nature resources are the items of importance here.

The research approach followed in this part of the paper is to investigate the determinants of institutional change on a concrete level and then bring the determinants on an abstract level. In order to investigate the determinants of institutional change on a concrete level, a survey was carried out in the Plovdiv region of Bulgaria.

3.1. FEATURES OF TRANSACTIONS

Drawing from Ostrom (1994), we distinguish between appropriation transactions and provision transactions. In the case of irrigation, the appropriation transactions are related to water usage and distribution. The provision transactions are related to the infrastructure for water usage.

It was found out that the farmers from investigated areas take water whenever it passes near their plots. However, the water often can not reach the plots located aside from the main canals. In addition, the small farmers grow crops with different water requirements in fields served by the same irrigation system. They also have difficulties in estimating the quantity of water they will need and hence, the Irrigation Company can not plan the water it needs to supply. Therefore, on abstract level the water appropriation transactions are characterised by low excludability, subtractability, and heterogeneity in water usage and also uncertainty.

The irrigation systems in Bulgaria have been built during the sixties and were intended to supply water to large production units. Now, however, they are supposed to provide water to many agricultural producers often with different economic interests. There is also interdependency between the actors involved. The Irrigation Company controls the

water in the main canals and wants to sell it. The farmers want to have access to the water. Therefore, the provision transactions at abstract level are characterised with assets specificity, complexity, and also connectiveness.

Table 1. Features of transactions on concrete and abstract level

CONCRETE LEVEL	ABSTRACT LEVEL
Appropriation transactions: water	
<ul style="list-style-type: none"> • The farmers take water whenever it passes near their plots • The water can not reach the plots aside from the main canals • Farmers plant different crops with different crop requirements • The prices of agricultural products are difficult to predict therefore farmers can not estimating the water they will need.. The irrigation company also can not precisely plan the water they need to supply 	<ul style="list-style-type: none"> • Low excludability • Substractability • Heterogeneity in water usage • Uncertainty and complexity
Provision transactions: Irrigation infrastructure	
<ul style="list-style-type: none"> • The irrigation systems were built to supply water to large production units, now they are supposed to provide water to many agricultural producers with different interests. • There is interdependency between the actors involved. The irrigation company controls the water and wants to sell it. The farmers want to have access to water 	<ul style="list-style-type: none"> • Assets specificity and hold up problems • Complex systems • Connectiveness

3.2. CHARACTERISTICS OF ACTORS

Four types of actors are involved in irrigation in Bulgaria: small producers, large producers, irrigation company, and local municipalities.

The small agricultural producers. The small producers have knowledge of the local irrigation systems, but not sufficient organisation skills. In addition, many of them are either in, or close to retirement age. They invest modest resources in agricultural activities and thus their benefits and losses from irrigation are not significant. Agriculture, however, is an important income generating activity for many of them. The small farmers co-operate in order to organise the irrigation process. However, the co-operation is in a scale, that is not enough to run the existing complex irrigation infrastructure. In addition, since they cultivate small plots, the revenue that the water supplier receives from an individual producer is negligible. In their opinion the Irrigation Company does not care sufficiently about their interests. Therefore, the main features of this group of actors are short planning horizon, insufficient trust, and lack of organisation capacity and poor bargaining position.

The large producers have organisational skills. Many of them also have knowledge about the local irrigation systems. They invest considerable recourses in agricultural activities and therefore their eventual losses and benefits from irrigation are also substantial. Since they cultivate large plots, the revenue that the Irrigation Company receives from an individual farmer is considerable. Some of them do not live in the villages, but rent land. Several large farmers complained that the small ones divert the water flow and thus disturb the water supply to their fields. Therefore, the main characteristics of the large farmers are organisation capacity and strong bargaining position.

Table 2. Characteristics of actors

CONCRETE LEVEL	ABSTRACT LEVEL
Small farmers	
<ul style="list-style-type: none"> • Because of the old age many of the subsistent farmers avoid taking important decisions • Farmers cooperate, but in a smaller groups • The small farmers believe that the IC does not care for their interests • The small farmers rarely participate in the monitoring process. Many of them will find acceptable to use water without paying • Most of the small producers previously were workers in the former cooperatives with no or little managerial experience • The small farmers cultivate tiny plots. The revenue that the irrigation company receives from an individual small farmer is negligible. 	<ul style="list-style-type: none"> • Short planning horizon • Insufficient trust • Opportunistic behaviour • Lack of organisation capacity • Weak bargaining position
Large farmers	
<ul style="list-style-type: none"> • Many of the large farmers have the due education and also many of them had some managerial position before. • The large farmers cultivate large plots. The revenue that the irrigation company receives from an individual farmer may be considerable. 	<ul style="list-style-type: none"> • Organisation capacity • Strong bargaining position
Irrigation company	
<ul style="list-style-type: none"> • The Irrigation Company has organised the water supply in the area for many years • In most cases the only way the water can reach the field is through assets controlled by the firm • The company believes that the small farmers, if left without control, will cheat • The company avoids providing water to small plots and maintains better the systems in the area with high water fees collection. 	<ul style="list-style-type: none"> • Organisation capacity • Strong bargaining position • Lack of trust • Strategic behaviour
Local municipalities	
<ul style="list-style-type: none"> • The municipalities organise different types of activities • The villagers respect the mayors in the small villages. 	<ul style="list-style-type: none"> • Organisation capacity • Reputation

The Irrigation Company has organised the water supply in the areas for many years. The specialists working in the firm have organisation skills and also global information for the irrigation systems. The knowledge of the firm's specialists concerning the irrigation infrastructure is indispensable. Often, the only way the water can reach the fields is through canals controlled by the company. The company tries to provide reliable water supply to the large farmers, but believes that the small farmers, if left without their control, will steal water. Therefore, the main characteristics of this actor are organisation capacity, strong bargaining position, and lack of trust and strategic behaviour.

The local municipalities have knowledge about the local irrigation systems and also the due organisational skills. They are not directly, but indirectly affected by the irrigation problems. Currently they manage the small water dams and receive revenue from tenants who are doing fishery there. The local mayors are respected by the villagers and therefore often they act as mediators in irrigation conflicts. Therefore, the main characteristics of this actor are organisation capacity and reputation. The local municipalities are important actors for implementation of any strategy for building participative water institutions.

3.3. PROPERTY RIGHTS ON NATURE COMPONENTS

The Water Law, passed in 1999, granted state, municipal, and private ownership to water resources. Private ownership however is very restricted and can be considered an exception rather than a rule. We need to mention that landowners can use water from wells free of charge up to a certain limit above which they must apply for permission and pay a tax. Therefore, the formal property rights on water are held by the state, but there are some limited private property rights on underground water resources.

Table 3. Formal property rights on water and irrigation infrastructure

CONCRETE LEVEL	ABSTRACT LEVEL
Water	
<ul style="list-style-type: none"> • Water resources (surface and underground) in Bulgaria are generally state owned, with some exceptions • Irrigation Company has to supply water to farmers that sign contract • Farmers can use water from wells free of charge up to a certain limit. 	<ul style="list-style-type: none"> • State property rights of water resources • User-rights to the surface irrigation water • Limited private property rights to underground water resources
Irrigation infrastructure	
<ul style="list-style-type: none"> • The Ministry of Agriculture is responsible for the irrigation systems (the main canals and some of the large dam-lakes). The management is carried out by the state controlled firm • The secondary canal systems and some small dams are intended to be transferred to water users' associations. Currently the local municipalities manage the small water dams 	<ul style="list-style-type: none"> • State property rights of the main canal systems and the large water dams • Unclear property rights of the secondary canals. • Local municipalities have temporary rights and duties regarding the small water dams

The Ministry of Agriculture through the Irrigation Company controls the infrastructure for water usage. The secondary canal systems are intended to be transferred to water users associations. The local municipalities are responsible for the small water dams. Therefore we have state ownership on the water resources and main canal systems, unclear property rights on the secondary canal systems, and temporary rights and duties granted to the local municipalities regarding the small water dams.

3.4. GOVERNANCE STRUCTURE

A state-controlled firm supplies the water in Bulgaria, however the farmers decide on the quantity of water that they want to purchase. In addition, the water price is determined by the state. On a local level, the Irrigation Company signs contracts, mainly with large producers, and the local water guards together with the local mayors prepare water usage timetables. The contracts however are not binding and the water usage timetables are violated.

The water is monitored on the main canals, but not on the secondary ones. In addition the water pumped from wells by the small farmers is not monitored. There are poorly developed social mechanisms for conflict resolution. The local water guards and local mayors are expected to solve the conflicts. No one, from the interviewed farmers knew

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somebody who have been sanctioned through the formal court procedure for violating the rules of water usage. The Irrigation Company refuses to supply water to farmers who have obligation left from the previous year. However, in order do isolate the offenders, the company often delays or does not release water in the branches of canals around which their plots are located. Two of the large water users, have been sanctioned through the formal procedure for breaking the rules of water supply.

Therefore, water transaction happens on a market-local monopoly, it is regulated by an hierarchy- state, and distributed on a local level by weekly enforceable contracts and water usage timetables. The monitoring is confined to the main canal system. There are incomplete conflict resolution and sanctioning mechanisms especially in the case of the small water users.

Table 4. Governance structure

CONCRETE LEVEL	ABSTRACT LEVEL
Rules of water supply	
<ul style="list-style-type: none"> • The water is supplied by a state controlled firm and the farmers decide about the quantity of water they want to have • The water price per a cubic meter is determined by the State. The water is subsidised 	<ul style="list-style-type: none"> • Market: local monopoly • Hierarchy: the price is set by the government
Factors influencing the process	
<ul style="list-style-type: none"> • Contracts for water supply offered by the Irrigation Company are not binding • Water use time tables are prepared, but often violated • There are devices for water monitoring on the main canals, but no on the secondary canals • The water that small farmers pump is not monitored • Irrigation company water guards are supposed to serve a large area and they can not resolve all conflicts • Local mayors act as mediators to soften the conflicts • Poorly developed social mechanisms • No one knew somebody who has been sanctioned for violating the formal regulation of water supply • The irrigation company refuses to supply water to farmers with obligations from the previous year • Two large water users have been sanctioned through the formal mechanisms 	<ul style="list-style-type: none"> • Poor local level coordination • Monitoring: limited to the main canals • Incomplete conflict resolution mechanisms • Ineffective sanctioning mechanisms, in the case of small producers

3.5. PROPERTY RIGHTS IN PRACTICE

The irrigation systems in Bulgaria were designed to transport water from large water dams located in mountains. The main canals are long and difficult to guard. Stealing water and irrigation equipment is not a rear event and hence loses in the system are considerable. The secondary canal systems in most places are in a bad condition. These systems are maintained occasionally by the local municipalities or small groups of water users. Therefore, in practice we have limited effectiveness of the formal property

rights on water and the main canal systems and a process of privatisation on the secondary canal systems.

Table 5. Property rights in practice

CONCRETE LEVEL	ABSTRACT LEVEL
Water	
<ul style="list-style-type: none"> • Stealing water is not a rare event. • The losses in the main canal systems are high • The water that small farmers use from the wells is not monitored • The Irrigation Company avoids signing contracts with small producers. • The contracts are not binding • No body can guarantee the water supply, after the water enters the secondary canal system 	<ul style="list-style-type: none"> • Limited effectiveness of the formal property rights of water • Limited effectiveness of the property rights to ground water resources • Limited effectiveness of users rights to irrigation water
Irrigation infrastructure	
<ul style="list-style-type: none"> • Stealing irrigation equipment is a problem • The secondary canal systems in most places are destroyed. In the places where they are still operating, they are maintained either by the municipality or small informal water users' groups • Local municipalities and the tenants make only short-term investments in the small water dams 	<ul style="list-style-type: none"> • Limited effectiveness of the formal property rights on main canal systems • Private use rights on the secondary canal systems

3.6. DETERMINANTS OF INSTITUTIONAL CHANGE AND TRANSITION ELEMENTS

In the previous sections we found that the water resources in Bulgaria are formally state owned, and that the state also controls the main canal systems. The property rights on the secondary canal systems are unclear. The water is supplied through market: local monopoly and regulated by a hierarchy: state. There is a poor local coordination, monitoring- limited to the main canals, incomplete conflict resolution and ineffective formal sanctioning mechanisms.

The transitional elements which initiated these problems are: (1) the land restitution process that led to severe land fragmentation; (2) liquidation of the former cooperatives, which coordinated the economic and social life in the Bulgarian villages; and (3) weakening of the state.

The features of transactions related to the nature components further deepened the problems. The lower excludability in the Bulgarian case is strongly influenced not only by the land fragmentation, but also by the size of the irrigation systems in the country. The canal systems are long and hence the costs for exclusion are high. Assets specificity (site and capital) currently prevents the full restructuring of the irrigation infrastructure. The subtractability of water resource, in the case of scarcity provides motives for conflicts. In addition, the actors' characteristics such as: many with short planning horizon, insufficient trust, the existing power location make it difficult to change the current situation in a short run.

Table 6. The determinants of institutional change and transition process

	Abstract level	Relation to transition element	Transaction feature	Characteristics of actors
Property rights	<ul style="list-style-type: none"> • State property rights of water resources • Some limited private property rights of underground water resources • State property rights of the main canal systems and the large water dams • Unclear property rights of the secondary canal systems. 	<ul style="list-style-type: none"> • Liquidation of cooperatives 	<ul style="list-style-type: none"> • Assets specificity 	
Governance structure	<ul style="list-style-type: none"> • The rule: market- local monopoly; hierarchy • Weak local level coordination • Monitoring is limited to the main canals • Incomplete conflict resolution mechanisms • Ineffective sanctioning mechanisms especially in the case of the small producers 	<ul style="list-style-type: none"> • Liquidation of cooperatives • Land fragmentation • Land fragmentation and • Liquidation of cooperatives • Weakening of the state 	<ul style="list-style-type: none"> • Asset specificity • Heterogeneity in water usage, Connectivity • Water - low excludability • Subtractability, Uncertainty • Low excludability 	<ul style="list-style-type: none"> • Irrigation Company: Organisation capacity; Strong bargaining position • Small producers: Short planning horizon; lack of organisation capacity • Many small producers, Insufficient trust • Lack of trust among the actors, • Many small producers; lack of trust between the Irrigation Company and the small producers
PR in practice	<ul style="list-style-type: none"> • Limited effectiveness of the formal property rights on water 	<ul style="list-style-type: none"> • Land privatisation 	<ul style="list-style-type: none"> • Low excludability 	
	<ul style="list-style-type: none"> • Limited effectiveness of the formal property rights on main canals 	<ul style="list-style-type: none"> • Weakening of the state 	<ul style="list-style-type: none"> • Asset specificity 	
	<ul style="list-style-type: none"> • Private use rights on the secondary canal systems 	<ul style="list-style-type: none"> • Liquidation of cooperatives 		

4. INSTITUTIONAL OPTIONS FOR SUSTAINABLE WATER USAGE

In this part of the paper we introduce the institutional alternatives and evaluate their impact. Then we derive recommendations concerning suitability of the options. The choice of institutional options is done considering our field observations and the relevant literature. To evaluate the response of actors we used information from interviews conducted during the summer of 2001 in the Plovdiv region. We draw information from different case studies in order to evaluate the match with the features of transaction; effects on resource usage; and the cost for implementation. Using this approach, the evaluation of options need to be considered rather an approximation than an outcome of systematic evaluation procedure.

4.1. DESCRIPTION OF THE INSTITUTIONAL OPTIONS

Following the analysis from the previous part, several types of institutional options regarding irrigation water supply are discussed: local municipalities; non-state organisation; participation of farmers in the Irrigation Company management; improvement of the court procedure. Although we discuss these options as distinct ones, we consider them also complementary.

Option 1: Local municipalities. Under this option, the local municipalities organise the irrigation water supply on their territory. This option is a reaction to the insufficiency of local coordination through hierarchy and it requires changes in the property rights' system on the secondary canals and increased rights and duties attributed to the local municipalities. There are several reasons for this option. First, the local mayors are being elected and therefore the villagers respect them. Second, irrigation is important for the village economy. Under this option, the agricultural producers are indirectly involved in the decision making process (through the political process). The local municipalities however, are institutions designed to solve problems other than irrigation ones and they have many other obligations. Therefore, it may be necessary that municipalities hire irrigation specialists. The administrative boundaries often do not coincide with the boundaries of the irrigation systems, hence the cooperation among the municipalities is obligatory.

Table 7. Institutional options for irrigation water usage in Bulgaria

OPTIONS	ABSTRACT CHANGES IN TERM OF GOVERNANCE STRUCTURE AND PROPERTY RIGHTS' SYSTEM	RESPONSE TO PROBLEM
• Local municipalities	• Change in the PR on secondary canals; • Increased rights and duties to LM (GS)	• Poor local level coordination
• Non state organisation: Shareholding company Small groups; WUA;	• Change in the PR on secondary canals • Increased rights and duties to the water users (GS)	• Weak local level coordination
• Water users participation in the Irrigation Company management	• Changing the rules of water supply (GS)	• Local monopoly
• Improvement of court procedure	• Strengthening the formal conflict resolution and sanctioning mechanism (GS)	• Weak hierarchy

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Option 2: Non-state organisation. Privatisation in irrigation can take different forms involving various ways of allocating the rights and duties among the actors. This option is also a response to the insufficiency of local coordination through self-governance and it requires changes in the property rights system on the secondary canals and increased rights and duties attributed to the agricultural producers. There are four organisation forms in this respect: shareholding company; small water users' groups; water users' associations. Under all organisation forms, it is necessary water users to acquire the capacities to operate the irrigation systems.

Creation of a *shareholding firm* has serious disadvantages compared with the other options. First, creating such a firm may not be acceptable from political and economic point of view. Such a firm would behave as a profit maximiser and provided that the irrigation systems are natural monopoly in the area they serve, the result would be monopoly pricing. Second, one of the problems with irrigation is connected with the exclusion of ones that do not pay. Hence, even if the firm does not behave as a monopolist, the cost of exclusion may be too high for the firm to operate in an efficient way.

Supporting development of *small water users' groups* is another form of self-governance. This option is connected with the fact that it is comparatively easier to cooperate in small group, moreover small informal groups of water users already exist in Bulgaria. Second, starting from smaller groups and stimulating an increase of the group's size would provide opportunity for the water users gradually to acquire and gain managerial experience and to develop conflict resolution mechanisms. This option, however, has several disadvantages. The integrated water management and monitoring of small groups is more difficult compared with WUA. Second, the conflicts between individuals may grow into conflicts between groups. In addition this option could have doubtful success without external assistance in institutional building and financing and also without clear strategy for establishment of associations of water users.

Associations of water users are often recommended self-governance organisation form. Under this option, farmers cooperate in order to operate a distinct large part of the irrigation infrastructure. According to Ostrom (1992) this form provides opportunity for a sustainable water management. The conflict would be almost fully internalised and providing that the rights and duties are clearly identified the water users soon will develop conflict resolution mechanisms. There are several problems connected with the WUA. First, the farmers have no the special technical knowledge necessary for managing large-scale irrigation equipment, and therefore they need to hire irrigation specialists. Second, only farmers with comparatively large planning horizon can initiate a process of establishment of WUA. Third, the process of establishment and operating of WUA is strongly influenced by policy considerations, existing pre-reform institutional settings, farm structure and so on.

Option 3: Participation of farmers in the Irrigation Company management.. Under this option farmers' representatives are included in the water allocation and investment decision making process of the Irrigation Company. This option is a response to the local monopoly problem. It decreases the bargaining power of the company and requires changes in the governance structure- the rule of water supply. Depending on the rights and duties granted to the representatives, it may or may not require changes in the property right on the main canals. There are several possible problems connected with this

option. First, farmers may not be able to participate effectively in the water allocation decisions, or only certain groups of them may be able to do this. Second, it would be difficult to elect farmers' representatives if there are not viable organisations of agricultural producers in the region. This option does not provide a real solution to the problem of secondary canals, although it may soften it to some extent.

Option 4: Improvement of the court procedure. This option provides the actors with effective formal mechanisms for conflict resolution, sanctioning, and contract enforcement. Therefore, it brings changes in the governance structure but not in the property right system. This option is a general requirement for a social system to operate. Even in the case of self-governance, it is necessary the state to back up the group decisions.

4.2. RESPONSE OF ACTORS

The actors involved have different expertise and incentives regarding irrigation and would have different preferences to the institutional options.

The small agricultural producers have different motives for involvement in agriculture and therefore different attitude towards their participation in the water management. First of all, under all discussed options their obligation for covering the cost of operation will increase and this will lower the incentives to participate. The study in the Plovdiv region, however, demonstrated that various types of informal cooperation regarding irrigation already exist. Therefore, the benefits from such cooperation must exceed the cost. This cooperation, is on a smaller scale that is necessary to run the existing complex and large irrigation systems in the region. Insufficiency in the scale of cooperation will impede the farmers to meet the increased responsibilities required by WUA. In the case of WUA, the small farmers need a broader awareness of the large farmers' interests since this can reduce per unit costs of water supplied to their plots. Mixing together the large and small producers in an association at least initially will increase the conflicts between them. The small farmers also need somebody else to initiate the process of establishing the association. Currently, they lack the needed organisation capacity. Therefore, the small farmers will strongly support the first option-local municipality and weakly support the non-governmental organisation of irrigation water supply. They will be indifferent to participation in the Irrigation Company management and also will not support the improvement of the court procedures.

The large agricultural producers also will have different attitudes to the three organisation options regarding the non-governmental irrigation water supply. On one hand, they would have limited incentives to support the establishment of water users' associations. There are several reasons for this. First, because of large economy of scale, the water supply can be organised in an efficient way for them and for the Irrigation Company without any association. Second, currently they need to negotiate only with representatives of the Irrigation Company. After establishing of an association, they need to take into account the interests of many small farmers. Third, many of them have already established good relations with the Irrigation Company. Similar arguments apply to the first option local municipality and also to the small groups option. The large producers, however, may have some incentives to participate in establishment of a Shareholding Company and participation in the Irrigation Company management since they would dominate in the management of both entities. They have organisational capacity to initi-

ate an institutional change, but only in case they can get water at lower cost or in a more reliable way, which is unlikely under the current situation.

On the other hand, the large and small producers are mixed in the landscape. Therefore, the network of canals can not be maintained effectively without including both types of farmers. The large farmers can have benefits if cooperate with the small ones. In addition, a new organisation form, such as association of water users, is more likely to attract capital and investments (from internal or external donors or/and investors) from which not only the small, but also the large farmers will benefit. Hence, it may turn out that the benefits from cooperation between the large and small producers be higher than the cost incurred by the conflicts among them. Therefore, the large producers will resist to the local municipality option. Regarding the other options their support will vary from weak to strong.

The Irrigation Company. The increased involvement of farmers in the decision making process will affect the company's activity in two directions. First, it eventually will increase the firm's revenues and reduce the cost of water fees collection. Second, it will reduce the power of the company over farmers and the control over water resource. Therefore, these options will be partially supported by the company. Even though the company is state controlled, it may be expected to act in its own interest and in the interest of the managers. Irrigation Company could support the institutional change in areas with low water tax collection, or as a result of a political pressure. The company will strongly support the improvement in the court procedure in relation to sanctioning of the violators of water usage rules. However, it will resist the elements of the legislation, which will make the company liable to agricultural producers for the timely water delivery. In summary we may expect that the Irrigation Company will resist the non-government organisation of irrigation water supply, and will provide a medium support to the improvement of the court procedure. The Company will resist or weakly support the other two options-Local Municipality and Participation of water users to Irrigation Company management.

The local municipalities. Mayors are the most active actors in the local municipalities. In small villages they have the necessary reputation and due skills to initiate and facilitate any of the institutional options under discussion in this paper. Many of them are also agricultural producers, but they become mayors through elections and political process. There are indications that during national elections in Bulgaria, the citizens vote for a party (or idea), but during local elections - for a person who may solve the local problems. We may assume that mayors will have strong incentives to solve local problems, therefore they would support all options that would lead to a better irrigation water supply, given the conditions in the region. However, they will also take into consideration the rules of the political game.

If water users' associations are created, the municipalities have to transfer the dam's ownership to them. Therefore, from a financial point of view, the municipalities do not have incentives for establishment of WUA, because they will lose revenues from the rent. On the other hand, organising irrigation is additional burden for the local administration. Municipalities are institution designed to solve different types of problems. Therefore, the local municipalities would organise water supply if the activity is profitable, or if the agriculture is heavily dependent on irrigation and it is the main source of income in the area. Otherwise, they prefer somebody else to do it.

4.3. MATCH WITH THE FEATURES OF TRANSACTIONS

With regard to appropriation transactions, water exhibits the property of subtractability. In the case of scarcity this property induces high rivalry and conflicts. The low excludability in the Bulgarian case is a property influenced by the size of the irrigation systems and land fragmentation. This property causes free riding. In addition to these general water properties for the Bulgarian case, we found the heterogeneity of water usage and uncertainty to be also important features of transactions. Heterogeneity and uncertainty cause a coordination problem.

With regard to the provision transactions the investments in irrigation systems are specific (site and capital), which is one of the reasons for opportunistic behaviour. In addition, the property of connectiveness creates interdependence between water users and water supplier, and also among water users.

Each one of the four options will improve the match with the water resource characteristics compared to the current situation, but to a different degree. The first three options aim at improving the local co-ordination and in this respect they stress on development of relations among the actors involved in the irrigation process. The fourth option introduces an external for all actors, coordination, conflict resolution mechanism, and contract enforcement.

Excludability will increase under all options as a result of the clarified property rights and increased farmers' participation. None of options will affect the subtractability since this is a general water property. Heterogeneity and uncertainty of water usage will decrease as a result of the improved co-ordination and better accountability of the cost regarding water delivery. Specificity of assets will not be affected by any of the options. This is a characteristic that could be changed only by a technical solution. The connectiveness will be improved as a result of the better coordination. The effect of the options over the appropriation and provision transactions will be strongest under the second option - non-state organisation of irrigation water supply since the relations between the cost and benefits are more direct compared with the other two options.

4.4. EFFECTS ON THE RESOURCE USAGE

With regard to the water resources we consider the effect of the institutional options on water usage and allocation efficiency. The water usage efficiency conveys the notion that crops must be grown with optimum quantity of water. The water allocation efficiency conveys the notion that the water has to be allocated between the different crops in an optimum way (in the case of scarcity to the highest value crop). With regard to the irrigation infrastructure we consider the effect of the institutional options on maintenance and investment decisions.

Under all the options there will be improvement of the water usage and allocation efficiency and also maintenance and investment activities. The strongest improvement will be under the second option - non-state organisation: small water users' groups and water users' associations. The problem with low incentive to invest and maintain the systems however will be still exists to some extent (Vermillion, 1999; Vermillion and Carces-Restrepo, 1998).

4.5. COST FOR IMPLEMENTATION OF THE OPTIONS

There is an agreement among the scientists that in carrying out economic activities except production (financial) cost, there are also transaction costs involved. The problem is that there is no widely accepted definition and clear classification of these costs. In many cases, instead a definition, examples are provided for relevant transaction cost, in other words, time for negotiation of contracts; cost for co-ordinating the economic activities, etc. According to Falconer and Whitby, 1999¹, the root of the transaction costs is the information deficiency that both transacting parties face with, and hence the transaction costs are the costs of removing this deficiency. These authors outline three main categories of transaction costs for agri-environmental schemes: information, contracting, and policing. In addition, they specify several sub-categories. They also distinguish between transaction costs that are fixed and transaction cost that vary with the level of participation (variable cost). According to Flaconer and Whitby the initial stages of the schemes implementation are marked by high fixed cost for setting up and evaluating the programmes.

Challen (2000) distinguishes between transition and transaction cost. Transition costs are the costs for establishing the new institutional structure and transaction costs are these for running the system (after the system is being established). Milligrom and Roberts, (1992) also define the transaction costs as costs for operating the system i.e. the costs for co-ordination and motivation etc.

Three types of cost concerning implementation of the options are discussed in the paper: transition and transaction cost (following Challen's definitions); and financial cost. Financial costs are the necessary investments (in terms of money for the option implementation). As transition cost we consider items such as: time and efforts for farmers to organise themselves and to build capacity; time and efforts to negotiate with the irrigation company. As transaction costs we consider items such as time and efforts for negotiating between the IC and farmers after the options are implemented; organising collective actions for every day activities; development of conflict resolution and monitoring mechanisms.

The implementation of first, third, and fourth options would have low transition, but higher transaction costs as compared to the second option, i.e. non-state organisation. This is due to the higher water users' participation, which at the initial stage requires considerable efforts to organise the farmers, but once, the system is established, the monitoring cost, co-ordination and conflict resolution mechanisms would eventually be more effective as compared to the other options.

In the Plovdiv region the irrigation systems were initially designed to serve large production units. Hence, the infrastructure is not adequate to serve large number of small farmers growing different crops. Therefore, under all the options investments in restructuring the technical systems are necessary. In the case of second option investments are necessary to separate the system that will be operate by the non-governmental entity. In the case of the third option (IC and participation of farmers in the company management) investments in measuring devises are important. In addition, the investigated in-

¹ Falconer and Whitby quote Dahlman, 1979 "The problem of Externalities, Journal of Law and Economics, 22, 141-162.

stitutional solutions can be combined also with technical solutions to attack the problems that arise from the water and irrigation systems specific properties. Without considerable investments in physical infrastructure the success of the all institutional options will be doubtful.

4.6. RECOMMENDATIONS

The first option: Local municipality is appropriate for places (mainly small villages) with insufficient social capital and many small farmers with short planning horizon. Its implementation demands low transition cost, and medium transaction cost. The option "the municipality to do it" shares some characteristics with the option "state to do it". Both options are reaction to the coordination problem through a hierarchy. At the same time there is an important difference between them, the option "local municipality to do it" moves the centre of decision making closer to the place of originating the problem. In this respect this option could be considered a transition one.

The second option: Non-state organisation of water supply is appropriate for places with sufficient social capital. It matches best the features of transactions and has strongest positive effect on the resource usage. This option demands high transition, but low transaction cost. Therefore, in this case the problem - how and who will initiate the process of institutional change arises. There are three organisation forms under this option: shareholding firm, small water users' groups; water users associations. Large commercial farmers can initiate the process of establishment of shareholders firms. Although such firms are not acceptable from a political point of view, they could provide a reasonable solution in areas with large-scale commercial farming.

The small farmers with short to medium planning horizon can initiate the process of establishment of small water users' groups. This organisation form, however, matches less the features of transaction and has less effect on the resource usage compared with the other two organisation forms under the option non-state organisation. Therefore, small water users' groups could be considered a transition step towards establishment of water users' associations. Only small to middle farmers with long planning horizon can initiate establishment of water users' associations. The problem is that farmers with such characteristics are few in Bulgaria.

The third option: participation of water users in the Irrigation Company management is appropriate for places with sufficient social capital and with well-established organisations of agricultural producers. Applied alone, this option will have poor match with features of transactions and effect on the resource usage. Therefore, this option could be considered a continuation of the process of devolution of irrigation systems management where representatives of non-state organisations can participate in the Irrigation Company management.

The fourth option: improvement of the court procedure has no significant match with the feature of transactions and effect on the resource usage. However, it is a general precondition for the success of other three options. It provides the actors involved in the irrigation with external coordination, conflict resolution and enforcement mechanisms.

Table 8. Evaluation of the institutional options

Issues \ Options		Local municipality	Non state organisation	Participation of water users in IC management	Improvement of court procedure
Response of actors	Small farmers	strong support	weak support	indifferent	no support
	Large farmers	Resist	weak support	strong support	weak support
	Local municipalities				weak support
	Irrigation Company	weak support	resist	resist - weak support	medium support
Match with the feature of transaction	Water				
	Excludability	medium increase	strong increase	weak increase	medium increase
	Subtractability	no impact	no impact	no impact	no impact
	Heterogeneity	weak decrease	strong decrease	weak decrease	no impact
	Uncertainty	weak decrease	strong decrease	weak decrease	no impact
	Irrigation systems				
Assets specificity	no impact	no impact	no impact	no impact	
Conectiveness	medium improvement	strong improvement	weak improvement	no impact	
Effect on re-source usage	Water				
	Usage	weak improvement	strong improvement	no impact	no impact
	Allocation	weak improvement	strong improvement	weak improvement	weak improvement
	Irrigation systems				
Maintenance	medium improvement	medium improvement	weak improvement	no impact	
Investment	weak improvement	medium improvement	weak improvement	no impact	
Cost	Transition	Low	high	low	low
	Transaction	Medium	low	high	low
	Financial	Medium	high	high	
Recommendations		in place with not enough social capital	in place with enough social capital	in place with enough social capital, and where there are organisations of agricultural producers	general requirement to back up the decisions of the water institutions

5. CONCLUSIONS

In this paper the problems of appropriating of CPR are investigated in the case of irrigation in Bulgaria. It was found that the current institutional settings could not provide sustainable water usage. The appropriation transactions regarding water are regulated by a mixture of market (local monopoly) and hierarchy (state price intervention). Unclear property rights concerning the secondary canal systems affect the provision transactions regarding the maintenance and investments. A poor local level coordination and incomplete conflict resolution mechanisms influence both sets of transactions.

Three types of institutional options regarding irrigation in Bulgaria are discussed in the paper. The first type aims at improvement of local level coordination. A local municipality to organise water supply is recommended as transitional option in small villages with insufficient social capital. Non-state organisation of irrigation water supply is recommended in villages with enough social capital. In this respect stimulating the development of small water users' groups is seen as intermediate step towards establishment of water users' associations. The second type of options aims at limiting the market imperfections (local monopoly). Including of farmers' representatives in the Irrigation Company management is recommended as a way of increasing their bargaining position. However, this option is attainable in areas with well-established organisations of farmers.

Finally, the third type of options aims at strengthening the external conflict resolution and sanctioning mechanisms. This can be also considered a general precondition of each system to operate.

The investigation of the Bulgarian case led us to conclusions that can be generalised for the case of CPR management during the period of transition. The transition process is not just a process of transferring western institutions to Eastern Europe, but also a process of a spontaneous emerging of new ones or adapting the western institutions to the local conditions. In this situation, we see the role of the state, not in the area of CPR provision, but in supporting the development of local coordination, and providing additional instruments for conflict resolution and sanctioning mechanism. In this respect, the new legislation does not need to specify concrete organisation forms for management of CPR, but to provide a legal framework, which to backup the local level decisions, and at the same time to set clear boundaries for the local level decision making.

The above findings confirm the importance of decentralising the decision making process regarding the local CPR problems, and the necessity of external formal mechanisms to backup and constrain the group decisions. What is specific for the finding in the paper is that we also suggest as a possible institutional option for CPR management a hierarchy (local municipalities) in places with insufficient social capital. The difference between the state and the local municipality to do it, is that the decision making process is moved more closely to the area where the CPR problem exists.

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