INSTITUTIONAL OPTIONS FOR SUSTAINABLE IRRIGATION: AN EVIDENCE FROM BULGARIA

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ABSTRACT

This paper investigates a local problem of common pool resources (CPR), 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 cannot protect the individuals or eventually back the collective decisions. The above problem is investigated in the case of irrigation in Bulgaria where water usage declined by 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 the above case led the author 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 state intervention, not in the area of CPR provision, but in supporting local co-ordination.

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1. INTRODUCTION

During the last decade, the countries form 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 (CPR) share some features with public goods, such as lower excludability. But in a case of scarcity, they are subject to high rivalry. Therefore, the extraction of the common pool resources through these polar institutions (market and state) has significant imperfections.

This paper investigates a local CPR problem, the solution of which needs a balance between collective and private interests. It is also a typical social dilemma 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 cannot protect the individuals or eventually back the collective decisions.

The above problem is illustrated by the case of irrigation in Bulgaria. The irrigation water usage in Bulgaria declined by nearly 85% during the period of transition. In addition, many parts of the existing canal systems were abandoned. Water resources and main canal systems have continued to be controlled by the state. The study was carried out in the Plovdiv region, sufficiently rich with water resources. Main crops grown in the area are fruit, vegetables and rice. The farm structure in this region is dominated by many elderly small-scale subsistent farmers.

The main questions investigated are: How can farmers use the irrigation water in the Plovdiv region in a better way and how to make the Irrigation Company supply water in a more reliable way? These questions refer not only to water usage and allocation efficiency, but also to organising maintenance of irrigation infrastructure. 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 the above case led 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 the author calls for state intervention, but not in the area of CPR provision. He sees the role of the state in supporting the local coordination development, and providing additional instruments for conflict resolution and sanctioning mechanisms.

The arguments in the paper are presented as follows. First, introduction of problem and literature regarding institutional choices. Second, presentation of 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, the author derives 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 as well as by improvement of communication among them. Rules that require water users to cover all operational and maintenance costs 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 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. She argues that the institutional development is at least as important as the investments in the physical infrastructure. In this respect, Ostrom identifies several basic principles of self-organised irrigation systems: 1) clearly defined boundaries of the service area and clearly specified water rights; 2) relating the rules of water allocation to the rules of cost distribution; 3) including all individuals affected by the rules for water usage in the group that creates these rules; 4) water monitoring and sanctioning to be performed by the water users or individuals accountable to them; 5) a low-cost local conflicts resolution mechanism to be available and 6) the water users' rights to devise institutions not to be challenged by external government authorities.

Ostrom's principles have been defined for less developed countries. In the opinion of Sarker and Itoh (2001), they are also valid for developed countries with some modification. The authors arrived at 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) point out that the user-group or community-based approach is not equivalent to the withdrawing of the state from the problem, but it is connected with reshaping of the state intervention. They see the role of the state in institutionalising the collaboration between administration and resource users.

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

Scheumann (2002) compares the institutional reforms in irrigation in Turkey and Pakistan. In the case of Turkey in the early eighties, the General Directorate for State Hydraulic Works (DSI) initiated establishment of irrigator 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, these groups had a positive impact on irrigation water management as compared to the previous situation, although they showed a range of deficiencies, such as misuse of collected water charges, appointment of relatives and exempting them from fines. The water user 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 organisational form for management of irrigation. The associations are legal entities which are 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 factors for these problems is that the devolution process was not fully implemented.

What is the "right" organisation form in the case of irrigation? Sabates-Wheeler (2002) investigates co-operation among the farmers. Although her cases investigate the production activities, the conclusions may also be relevant for irrigation. Sabates-Wheeler considers three organisational forms: individual farming, co-operation in small groups (among relatives), and formal large associations. According to her, the superiority of one of the three forms is not something fixed, but it changes with the shift in access to resources.

Baland and Plateau (1996: 346) also suggest that any dogmatic attitude concerning superiority of one organisational form regarding management of CPR over the others is unjustified and damaging. According to these authors, a careful analysis for each case is needed in order to determine the appropriate organisational 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 and, (2) the existing features of the social structure and resource characteristics. Baland and Platteau think that state- and community-based models can be combined in various ways and can, thus, 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. Furthermore, private groups are complementary and mutually non-exclusive, hence, they play important roles 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 systems and the institutional settings. He suggests two steps in the restructuring of irrigation. First, evaluating and ranking of the privatisation options with the features of the regions. Second, implementing the options in the

regions. In this respect, the author considers two strategies: (1) encouraging implementation of all options; (2) implementing the politically and administratively less sensitive options first and institutionally more mature options later.

In summary, the recent literature regarding irrigation argues that the solution of the irrigation problems is neither state nor market, but somewhere in between and that it requires the involvement of farmers in the decision-making process. Key elements of this approach are: (1) establishing organisations of water users and transferring the management responsibilities, maintenance, and investment decisions to them and (2) restricting and changing the role of the state. Self-governance of irrigation can be conducted through different organisational forms. These 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 et al. (1999) and Sikor (2004), investigations are made into two groups of determinants of institutional change on nature components. First, the author looks 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, the institutions for sustainability are studied. The property rights and the governance structure on nature components 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 them 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 (1990, 1992), the author distinguishes 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.

In the areas under investigation, it was found that the farmers take water whenever it passes near their plots. However, the water often cannot reach the plots at remote distance from the main canals. In addition, the small farmers grow crops with different water requirements in fields served by one irrigation system. They also have difficulties in estimating the quantity of water they will need and, hence, the Irrigation Company cannot plan for the water it needs to supply. Therefore, on an abstract level, the water appropriation transactions are characterised by low excludability, substractability, and heterogeneity in water usage and also by uncertainty.

The irrigation systems in Bulgaria were 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 an abstract level are characterised by assets specificity, complexity, and also connectiveness.

Table 1. Features of transactions on concrete and abstract level

CONCRETE LEVEL	ABSTRACT LEVEL
Appropriation transactions: water	
• The farmers take water whenever it passes near their plots	• Low excludability
• The water cannot reach the plots remote from the main canals	• Substractability
• Farmers plant different crops with different crop requirements	• Heterogeneity in water usage
• The prices of agricultural products are difficult to predict. Therefore farmers cannot estimate their water consumption. The irrigation company, in turn, cannot precisely plan demand on water supply.	• Uncertainty and complexity
Provision transactions: Irrigation infrastructure	
• 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.	• Assets specificity and hold up problems • Complex systems
• 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	• 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.

Small agricultural producers. The small producers have knowledge of the local irrigation systems, but not sufficient organisational 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 to organise the irrigation process. However, co-operation is at a level that is too low 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, lack of organisational 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, as a result, 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 large 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. The main characteristics of the large farmers are organisational capacity and strong bargaining position.

Table 2. Characteristics of actors

CONCRETE LEVEL	ABSTRACT LEVEL
Small farmers	
• Because of old age many of the subsistence farmers avoid making important decisions.	• Short planning horizon
• Farmers cooperate, but in smaller groups.	• Insufficient trust
• The small farmers believe that the irrigation company does not care about their interests.	•
• The small farmers rarely participate in the monitoring process. Many of them will find it acceptable to use water without paying.	• Opportunistic behaviour
• Most of the small producers previously were workers in the former cooperatives with no or little managerial experience.	• Lack of organisational capacity
• The small farmers cultivate tiny plots. The revenue that the irrigation company receives from an individual small farmer is negligible.	• Weak bargaining position
Large farmers	
• Many of the large farmers have the required education and also many of them had some managerial position before.	• Organisational capacity
• The large farmers cultivate large plots. The revenue that the irrigation company receives from an individual farmer may be considerable.	• Strong bargaining position
Irrigation company	
• The Irrigation Company has organised the water supply in the area for many years.	• Organisational capacity
• In most cases the only way the water can reach the field is through assets controlled by the firm.	• Strong bargaining position
• The company believes that the small farmers, if left without control, will cheat.	• Lack of trust
• The company avoids providing water to small plots and rather maintains the systems in the area with high water fees.	• Strategic behaviour
Local municipalities	
• The municipalities organise different types of activities.	• Organisational capacity
• The villagers respect the mayors in the small villages.	• Reputation

The Irrigation Company has organised the water supply in the areas for many years. The specialists working in the firm have organisational skills and also global information for 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 organisational capacity, strong bargaining position, lack of trust, and strategic behaviour.

The local municipalities have knowledge about the local irrigation systems and also possess 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 often act as mediators in irrigation conflicts. The local municipalities are important actors for implementation of any strategy for building participative water institutions. Therefore, the main characteristics of these actors are organisational capacity and reputation.

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. It must be mentioned 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	
• Water resources (surface and underground) in Bulgaria are generally state owned, with some exceptions	• State property rights on water resources
• Irrigation Company has to supply water to farmers that sign contracts	• User rights on surface irrigation water
• Farmers can use water from wells free of charge up to a certain limit.	• Limited private property rights on underground water resources
Irrigation infrastructure	
• The Ministry of Agriculture is responsible for the irrigation systems (main canals and some of the large dam-lakes). Management is carried out by a state firm	• State property rights on main canal systems and large water dams
• The secondary canal systems and some small dams are intended to be transferred to water user associations. Currently the local municipalities manage the small water dams	• Unclear property rights on secondary canals • Local municipalities have temporary rights and duties regarding the small water dams

The Ministry of Agriculture controls the infrastructure for water usage through the Irrigation Company. The secondary canal systems are intended to be transferred to water user associations. The local municipalities are responsible for the small water dams. Hence, we have state ownership to 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

in Bulgaria, a state-controlled firm supplies the water, although the farmers decide on the quantity of water that they want to purchase. In addition, the water price is determined by the state. On local level, the Irrigation Company signs contracts, mainly with large producers. 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. Likewise, 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 such conflicts. None of the interviewed farmers knew anybody who had 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 obligations left from the previous year. In order to 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 were sanctioned through formal procedure for breaking the rules of water supply.

Therefore, water transaction happens on a market local monopoly. It is regulated by the state and distributed on local level by weakly enforceable contracts and water usage timetables. The monitoring is restricted 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	
• The water is supplied by a state firm and the farmers decide about the quantity of water they want to have.	• Market: local monopoly
• The water price per cubic meter is determined by the State. The water is subsidised.	• Hierarchy: the price is set by the government
Factors influencing the process	
• Contracts for water supply offered by the Irrigation Company are not binding. • Water use timetables are prepared, but often violated.	• Poor local coordination
• There are devices for water monitoring on the main canals, but not on the secondary canals. • The water that small farmers pump is not monitored.	• Monitoring: limited to the main canals
• Irrigation company water guards are supposed to serve a large area and they cannot resolve all conflicts • Local mayors act as mediators to soften the conflicts • Poorly developed social mechanisms	• Incomplete conflict resolution mechanisms
• No one knew anybody who had 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 were sanctioned through formal 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 reservoirs located in mountains. The main canals are long and difficult to guard. Stealing water and irrigation equipment is not a rare event and, hence, losses in the system are considerable. The secondary canal systems are in a bad condition in most places. 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 to 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	
• 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. • Nobody can guarantee the water supply after the water enters the secondary canal system.	• Limited effectiveness of the formal property rights of water • Limited effectiveness of the property rights on groundwater resources • Limited effectiveness of user rights on irrigation water
Irrigation infrastructure	
• Stealing irrigation equipment is a problem. • The secondary canal systems are destroyed in most places. In the places where they are still operating, they are maintained either by the municipality or small informal water user groups. • Local municipalities and tenants make only short-term investments in the small water dams.	• 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 to the secondary canal systems are unclear. The water is supplied through market local monopoly and regulated hierarchically by the state. There is poor local co-ordination, monitoring that is 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 co-ordinated 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 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. In addition, the actors characteristics such as: short planning horizons, insufficient trust, and the existing power location make it difficult to change the current situation in the short run.

4. INSTITUTIONAL OPTIONS FOR SUSTAINABLE WATER USAGE

In this part of the paper, the author introduces the institutional alternatives and evaluates their impact. Then, recommendations are derived concerning suitability of the options. The choice of institutional options is done with the view to the field observations made and the relevant literature studied. To evaluate the response of actors, information was studied from interviews conducted during the summer of 2001 in the Plovdiv region. The results from different case studies were used 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 needs to be considered rather an approximation than an outcome of systematic evaluation procedure.

4.1. DESCRIPTION OF THE INSTITUTIONAL OPTIONS

Following the analysis in 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, and improvement of the court procedure. Although these options are discussed as distinct ones, the author considers 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 6. The determinants of institutional change and transition process

	Abstract level	Relation to transition element	Transaction feature	Characteristics of actors
Property rights	• State property rights on water resources • Some limited private property rights on under-ground water resources • State property rights on main canal systems and large water dams • Unclear property rights on secondary canal systems.	• Liquidation of cooperatives	• Assets specificity	
Governance structure	• The rule: market local monopoly; hierarchy • Weak local level coordination • Monitoring is limited to main canals • Incomplete conflict resolution mechanisms • Ineffective sanctioning mechanisms especially in the case of small producers	• • Liquidation of cooperatives • Land fragmentation • Land fragmentation and liquidation of cooperatives • Weakening of the state	• Asset specificity • Heterogeneity in water usage, connectivity • Water - low excludability • Subtractability, uncer-tainty • Low excludability	• Irrigation Company: Organisational capacity; strong bargaining position • Small producers: Short planning hori-zon; lack of organisational capacity • Many small producers, insufficient trust • Lack of trust among the actors, • Many small producers; lack of trust between the Irrigation Company and small producers
PR in practice	• Limited effectiveness of the formal property rights on water • Limited effectiveness of the formal property rights on main canals • Private use rights on the secondary canal sys-tems	• Land privatisation • Weakening of the state • Liquidation of cooperatives	• Low excludability • Asset specificity •	

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. It requires changes in the property rights system on the secondary canals and increased rights and duties assigned to the agricultural producers. There are three organisation forms in this respect, shareholding company, small water user groups, and water user associations. Under all organisation forms, it is necessary for 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 points 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 those 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 user 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 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 as 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 as an appropriate self-governance organisational form in the case of irrigation. Under this option, farmers cooperate in order to operate a distinct large part of the irrigation infrastructure. According to Ostrom (1992) this form provides the opportunity for 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 do not have 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 horizons can initiate the 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 prop-

erty 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 rights system. This option is a general requirement for a social system to operate. Even in the case of self-governance, it is necessary for the state to back up the group decisions.

Table 7. Institutional options for irrigation water usage in Bulgaria

OPTIONS	ABSTRACT CHANGES IN TERMS 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	Poor local level co-ordination
Non-state organisation: • Shareholding company • Small groups; • WUA	Change in the PR on secondary canals Increased rights and duties to the water users	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

4.2. RESPONSE OF ACTORS

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

The small agricultural producers have different motives for involvement in agriculture and therefore different attitudes toward 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 their incentives to participate. The study in the Plovdiv region, however, revealed that various types of informal cooperation regarding irrigation already exist. Therefore, the benefits from such cooperation for them must exceed the costs. This cooperation is on a smaller scale than is necessary to run the existing complex and large irrigation systems in the region. Insufficiency in the scale of co-operation will impede the farmers' ability 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 among 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, i.e. 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 will also not support the improvement of the court procedures.

The large agricultural producers also will have different attitudes towards the three organisational options regarding the non-governmental irrigation water supply. On one hand, they would have limited incentives to support the establishment of water user 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 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 of "local municipality" and also to the "small groups" option. The large producers, however, may have some incentives to participate in the 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 initiate an institutional change, but only in case they can get water at lower cost or in a more reliable way, which are both unlikely under the current situation.

On the other hand, large and small producers coexist in the area and the network of canals cannot be maintained effectively without including both types of farmers. Therefore, the large farmers can benefit from the cooperation with the small ones. In addition, a new organisational form, such as an 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 will be higher than the costs incurred by potential conflicts between them. Therefore, the large producers will resist 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 ways. First, it eventually will increase the firm's revenues and reduce the cost of water fee collection. Second, it will reduce power of the company over farmers and control over water resources. 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 political pressure. The company will strongly support the improvement in the court procedure in the part related to sanctioning of the violators of water usage rules. However, it will resist the elements of the legislation which will make the company responsible 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, i.e. local municipality and participation of water users in 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 skills to initiate and facilitate any of the institutional options under discussion in this paper. Many of them are also agricultural producers, but they became 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 they vote for a person who may solve the local problems. We may assume that mayors will have strong incentives to solve local problems, and would support all options that lead to a better irrigation water supply under the actual conditions of the region. However, they will also take the rules of the political game into consideration.

If water user 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 the establishment of WUA, because they will lose revenues from the rent. On the other hand, organising irrigation is an additional burden for the local administration that has to solve other problems. Therefore, the local municipalities would only organise water supply provided the activity is profitable or agricultural production is heavily dependent on irrigation and is the main source of income in the area. Otherwise, they prefer somebody else to do this job.

4.3. MATCH WITH THE FEATURES OF TRANSACTIONS

With regard to appropriation transactions, water exhibits the property of substractability. In 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 in the Bulgarian case, heterogeneity of water usage and uncertainty were also found to be 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 of the four options will improve the match with the water resource characteristics as 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 development of relations among the actors involved in the irrigation process. The fourth option, i.e. improvement of the court procedure, provides to all actors an external measure of coordination, conflict resolution, 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 costs associated with 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 better coordination. The effect of the options on the appropriation and provision transactions will be strongest under the second option, i.e. non-state or-

ganisation of irrigation water supply, since the relations between costs and benefits are more direct as compared with the other two options.

4.4. EFFECTS ON THE RESOURCE USAGE

With regard to water resources, the effect is considered of the institutional options on water usage and allocation efficiency. Water usage efficiency is understood as growing crops with optimum quantity of water. Water allocation efficiency means that the water has to be allocated between the different crops in an optimum way (in 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.

All options provide for improvement of water usage and allocation efficiency as well as maintenance and investment activities. The strongest improvement will be under the second option, i.e. non-state organisation: small water user groups and water user associations. The problem with low incentive to invest and maintain the systems, however, will still exist to some extent (Vermillion, 1999; Vermillion and Carces-Restrepo, 1998).

4.5. COST FOR IMPLEMENTATION OF THE OPTIONS

There is an agreement among scientists that economic activities involve not only production (financial) costs but also transaction costs. The problem is that there is no widely accepted definition and clear classification of the latter costs. In many cases, instead of a definition, examples are provided for relevant transaction costs, such as time for negotiation of contracts, cost for co-ordinating economic activities, etc. Milligrom and Roberts (1992) define transaction costs as costs for operating the system, i.e. the costs for co-ordination and motivation, etc. According to Falconer and Whitby, (1999[1]), transaction costs result from the information deficiency that both transacting parties are faced with, and, hence, 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 Falconer and Whitby (1999), the initial stages of scheme implementation are marked by high fixed cost for setting up and evaluating the programmes. Challen (2000) distinguishes between transition and transaction costs. Transition costs are the costs for establishing the new institutional structure and transaction costs are these for running the system (after the system had been established).

Three types of costs concerning implementation of the options are discussed in the paper: transition and transaction costs (following Challen's definitions), and financial costs. The latter are the necessary investments (in terms of money for the implementation of an option). Transition costs are, among others: time and effort for farmers to organise themselves and to build capacity as well as time and effort to negotiate with the irrigation company. Transaction costs comprise costs, such as time and effort for negotiating between the IC and farmers after implementation of the options; organising

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

collective actions for every day activities; development of conflict resolution and monitoring mechanisms.

The implementation of the 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 user participation, which, at the initial stage, requires considerable effort to organise the farmers, but once the system has been 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 a large number of small farmers growing different crops. Therefore, under all the options, investments are necessary in restructuring of the technical systems. In case of the second option, investments are necessary to separate the system that will be operated by the non-governmental entity. In case of the third option (IC and participation of farmers in the company management), investments in measuring devices are important. In addition, the investigated institutional solutions can be combined also with technical solutions to attack the problems that arise from the specific properties of the water and irrigation systems. Without considerable investments in physical infrastructure the success of 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 horizons. 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 reactions 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 origin of the problem. In this respect this option could be considered a transitional one.

The second option: Non-state organisation of water supply is appropriate for places with sufficient social capital. It matches the features of transactions best and has the strongest positive effect on resource usage. This option requires high transition but low transaction cost. Therefore, in this case the problem arises of how and who will initiate the process of institutional change. There are three organisational forms under this option: shareholding firm, small water user groups and water user associations. Large commercial farmers can initiate the process of establishment of shareholder 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 user groups. This organisational form, however, matches the features of transaction less and has a lower effect on resource usage as compared with the other two organisational forms under the option of non-state organisation. Therefore, small water user groups could be considered a transition step toward establishment of water user associations. Only small to middle farmers with long planning horizons can initiate establishment of water user 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 well-established organisations of agricultural producers. Applied alone, this option will have poor match with features of transactions and effect on 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 is a general precondition for the success of the other three options. It provides the actors involved in irrigation with external coordination, conflict resolution, and enforcement mechanisms.

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 for 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 maintenance and investments. The 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. The local municipalities to organise water supply are recommended as a transitional option for small villages with insufficient social capital. Non-state organisation of irrigation water supply is recommended in villages with sufficient social capital. In this respect, stimulating the development of small water user groups is seen as an intermediate step toward establishment of water user 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 only feasible 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 social system to operate.

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	resistance	weak support	strong support	weak support
	Local municipalities				weak support
	Irrigation Company	weak support	resistance	resistance - 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 resource 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 places with insufficient social capital	in places with sufficient social capital	in places with sufficient social capital, and with existing organisations of agricultural producers	general requirement to back up the decisions of the water institutions

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 spontaneous emerging of new institutions or adapting of western institutions to local conditions. In this situation, the author sees 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, legislation does not need to specify concrete organisational forms for management of CPR, but to provide the legal framework for backing up the local level decisions, and at the same time, for setting clear limits to local level decision making.

The above findings confirm the importance of decentralising the decision-making process regarding local CPR problems. As specific finding of the paper, the author suggests a hierarchy (local municipalities) in places with insufficient social capital as a possible institutional option for CPR management. The difference between the options "state to do it" and "local municipality to do it" is that the decision-making process is moved more closely to the area where the CPR problems do exist.

LITERATURE CITED

Aggarwal, R.M. (2000). Possibilities and Limitation to Cooperation in Small Groups: The case of Group-Owned Wells in Southern India, *World Development*, Vol. 28, N8: 1481-1497.

Baland, J. and Platteau, J. (1996). Halting Degradation of Natural Resources. *Food and Agriculture Organisation of the United Nations*. Clarendon Press-Oxford.

Challen, R. (2000). Institutions, Transaction cost and Environmental policy. Institutional Reform for Water Resource, Edward Elgar, Cheltenham, UK, Northampton, MA, USA.

Dahlman, C. (1979). The Problem of Externalities. *Journal of Law and Economics*, 22, 141-162.

Falconer, K. and Whitby, M. (1999). The Invisible Costs of scheme implementation and administration in Van Huylenbroeck G. and Whitby, M. (eds) Countryside Stewardship: policies, farmers and markets. Pergamon, Oxford, 67 - 88.

Grafton, R.Q. (2000). Governance of the Commons: A Role for the State. Land Economics. November 2000. 76 (4): 504-517.

Hagedorn, K.; Hintzsche, K and Peters, U. (1999). Institutional Arrangements for Environmental Co-operatives: a Conceptual Framework. Paper presented at the 64th EAAE-Seminar „Co-operative Strategies to Cope with Agri-environmental Problems“, Berlin, October 27-29.

Millgrom, P. and Roberts, J. (1992). Economics, Organization and Management. Prentice Hall International Editions, New Jersey.

Ostrom, E. (1992). Crafting Institutions for Self-governing Irrigation Systems, ICS Press, *Institute for Contemporary Studies*, San Francisco, California.

Ostrom, E. (1990). Governing the Commons –The Evolution of Institutions for Collective Action. Cambridge, USA: Cambridge University Press.

Sabates-Wheeler, R. (2002). Farm Strategy, Self - Selection and Productivity: Can Small Farming Groups Offer Production Benefits to Farmers in Post-Socialists Romania? *World Development*, Vol. 30, N10: 1737-1753.

Saleth, R. (1999). Irrigation Privatisation in India: Options, Issues, and Experience. *Economic and Political Weekly,* June 26:A86-A92.

Sarker, A. and Itoh, T. (2001). Design Principles in Long-enduring Institutions of Japanese Irrigation Common-pool Resources. *Agricultural Water Management,* 48: 89-102.

Scheumann, W. (2002). Institutional Reform in the Irrigation Sector: The case of Turkey and Pakistan. In: Neubert, S.; Scheumann, W. and van Edig, A. (eds.): *Reforming Institutions for Sustainable Water Management*. German Development Institute, Bonn, Reports and Working Papers 6/2002: 5-17.

Sikor, T. (2004). The Commons in Transition: Agrarian and Environmental Change in Central and Eastern Europe, forthcoming in: Environmental Management.

Vermillion, D. (1999). Property rights and collective actions in the devolution of irrigation systems management. In: Meinzen-Dick, R.; Knox, A. and diGregorio, M. (eds.): Collective action, property rights and devolution of natural resources management. pages 183-218: German Foundation for International Development. Germany.

Vermillon, D. and Carces-Restrepo, C. (1998). Impacts of Columbia's Current Irrigation Management Transfer Program. *International Water Management Institute*. Colombo. Sri Lanka.