Institutions change in Bulgaria’s irrigation sector in transition – power resources of local actors

by

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1 Introduction

During Socialism the Bulgarian irrigation system was built to serve large production units. Today, it does not meet the needs of the new landowner and agricultural production structure that has developed from the land restitution process. At present, the facilities are largely deteriorated, and only a small percentage of the fields equipped with irrigation devices is actually irrigated. In the irrigation sector, we observe chaotic water appropriation rules and insecure and ineffective property rights (Penov et al., 2003). These conditions are often outcomes of opportunistic behavior of strategic actors (Theesfeld, 2001).

Irrigation water and infrastructure are common-pool resources. Recently, common-pool resource scholars call to take distributional aspects and power relations into account when analyzing institutional change in common-pool resource management (Meinzen-Dick, Raju and Gulati, 2002: 652; Agrawal, 2001: 1650-1656). The way benefits are distributed among various actors is decisive and the respective political weight of the latter can influence the likelihood of institutional change (Baland and Platteau, 1998: 649). When social dilemmas are solved and new rules implemented, some people benefit more than others. Indeed, some may even benefit at the expense of others. Local actors use power asymmetries to maintain and strengthen their opportunistic strategies.

In this paper, the author investigates power resources of local actors in the irrigation sector. Inspired by the distributional theory of institutional change mainly developed by Knight (1992), the author elaborates a method to analyze power resources empirically. Statistical procedures reveal the ranking of power resources by local actors.

2 Distributional Theory of Institutional Change

The Distributional Theory of Institutional Change (Knight, 1992; 1995) seems to fulfill the requirements of a theory that is able to explain the phenomenon of institutional change in a transition country and, moreover, the complexity of interactions in the irrigation sector. Knight’s (1992: 126) approach focuses on power asymmetries of actors as the main determinant of institutional change. Knight argues that institutions should better be explained as a by-product of strategic conflicts over distributional gains than in terms of a Pareto-superior response to collective goals or benefits.

The asymmetries of power in a community are those factors that influence the capacity of strategic actors to determine the content of institutional rules. Knight (1992: 41) defines power as follows: “to exercise power over someone or some group is to affect by some means the alternatives available to that person or group”. The institutional development is determined by the parties’ relative abilities to force others to act in ways contrary to their unconstrained preferences. This explains why institutional development becomes an ongoing bargaining game between actors (Knight, 1992: 127).

To explain interactions as bargaining problems, Knight (1992: 128) transforms the Prisoner’s Dilemma game into a bargaining problem (Table 1). It is a game with two alternatives for
each player and two equilibria which differ in their distributional consequences, favoring one or the other actor (Knight, 1995: 107).

### Table 1 The basic bargaining game

<table>
<thead>
<tr>
<th>Player A</th>
<th>Player B</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>$\Delta_A, \Delta_B$</td>
</tr>
<tr>
<td>R</td>
<td>$x + \epsilon_A, x$</td>
</tr>
</tbody>
</table>

Source: Knight (1992: 129)

If we set $\Delta_A, \Delta_B < x$, there will be two equilibrium outcomes, the R, L and the L, R strategy combination that can solve the bargaining problem. The $\Delta$ values are the breakdown values, i.e. the payoffs the actors receive if they fail to achieve one of the equilibrium outcomes or in other words a measure of the costs of non-coordination. Setting $\epsilon_A, \Delta_B > 0$, the $\epsilon$ value represents the distributional advantage belonging to one of the actors if a particular equilibrium outcome is chosen. The main goal for all actors is therefore to achieve $\epsilon$.

The different actors are characterized by different payoffs. If breakdown values are unequal ($\Delta_A > \Delta_B$ or $\Delta_A < \Delta_B$) we must assume an asymmetric bargaining power. The strategic and powerful actor can bind the rational choice of the other actor by adhering to a strategy, which means a distributional disadvantage for the latter (Knight, 1992: 127). This single interaction is repeated later on with other actors having a similar power distribution. Repetition creates stabilized expectations and common knowledge, if actors are clearly identifiable and if features are characteristic for a large part of the society. Under these conditions a self-enforcing informal institution can be established (Knight, 1997: 698). The powerful actor in turn estimates the usefulness of formalizing this norm (Knight, 1992: 182). When either the relative bargaining power changes or the distributional consequences, institutional change will emerge once again, and institutions will be adapted to the currently prevailing power distribution (Knight, 1992: 145-151).

The bargaining power of the actors is a function of their resource provision (Knight, 1992: 42) and thus, we can limit the sources of power asymmetries to differences in resources of the actors, which are described in the next paragraph.

In game theory, the term 'power' stands for the fact that one actor is able to survive several rounds of the game without a co-operative solution. This could be due to his stock of assets, or it might stem from the fact that he would bear relatively lower opportunity costs (Knight, 1992: 132). This power resource can be named exit costs (Schlüter, 2001: 91) and describes the breakdown values, which measure the costs of non-coordination. Risk behavior is the second power resource. Risk behavior is closely linked to resource availability. A higher provision with resources leads to a higher level of risk acceptance (Knight, 1995: 109). Knight (1992: 44-47) points out that uncertainty hampers the establishment of institutions that can produce distributional advantages. Uncertainty leads the actors to an increasing discount of the future. The more we discount our future, the more we will base our present institutional choices on short-term distributional gains (Knight, 1992: 46; Knight and North, 1997: 352). Accordingly, time preference represents another power resource. Bargaining is expensive and those actors with higher patience, i.e. with a lower time preference, will have advantages in the bargain (Knight, 1992: 135). Another power resource is credible commitment. The crucial point is to convince a social actor to accept the commitment of another actor (Knight, 1995: 108-109). By a binding commitment, an actor determines the choice of others (Knight, 1992: 129). Sanction power enables actors to push their alternative, but this is mostly unequally distributed. Sanctioning is a mecanism that ensures commitment. In general, sanctions reduce

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the expected benefits of non-compliance and make compliance a more beneficial long-term strategy (Knight, 1992: 179). The **organisability of a group** is mentioned as a power resource by Knight (1992: 197-202), particularly at the political level. The bargaining power of actors depends on their ability to organize and act collectively. It is a crucial ability of group leaders to maintain discipline and unity and to resolve the free-riding problem, which reduces the groups’ bargaining power. **Information** represents the key power resource (Knight, 1992: 41). Information and information asymmetries are important in influencing actors’ evaluations of individual alternatives, hiding institutional alternatives, or adding new alternatives (Knight, 1992: 46). In environments of imperfect information, advanced education, and privileged access to specific media and sources of information, or greater experience become increasingly important. Therefore, we should expand the variable information to the notion of **knowledge** which comprises information and skills. We should not neglect additional determinants, which represent sources of power asymmetries. Thus, the **relative transaction costs** of an alternative are a power resource (Schlüter, 2001: 99). Transaction costs represent rather an aggregated category including aspects of other power resources, such as access to information or sanction power. Transaction costs change the distributional consequences of the bargaining outcome for an actor, as it affects the payoffs of co-operation. **Positional power** is an additional power resource. Positional power could come from the strategic position, which gives an actor for example access to important information, controlling power over assets or the opportunity to carry out credible threats (Schleifer and Treisman, 1998: 20). A special form of positional power refers to the positional power of existing networks. The bargaining power of existing **networks** is a significant source of power, which is of extreme importance in transition countries. The nomenklatura effect is especially obvious here and refers to the fact that the former communist elite continues to hold positions of power (Balcerowicz, 1995: 54, 160, 355).

### 3 Methodology

The study is based on six months of empirical fieldwork subdivided into three phases spanning two and a half years. In addition to interviews with experts in Sofia and with representatives of the regional administration, two kinds of case studies were conducted: 1) In the first research phase, 17 village case studies provided an overview of the irrigation situation in the villages and allowed for a rough analysis of the main hypotheses. 2) In the two following research phases, four in-depth village case studies were carried out. Two irrigation catchment areas were selected. In each area, two villages were chosen with one village located directly behind the water dam (top-ender) and the other further back – at the middle or tail-end of the canal and river system.

With the help of explorative and qualitative methods in the first two research phases, the author analyzed the institutional change in Bulgaria’s irrigation sector. Among other aspects, driving forces and constraints for institutional options to govern the common-pool resource were investigated. The author revealed power resources of local actors in the irrigation sector, which were assessed as decisive by the local actors. Further, the author validated these resources (see Table 2).

In the third empirical phase, interactive interview techniques were applied. A set of six cards representing the main power resources of local actors, which came out of the previous analysis, was handed out to 78 interviewees in the four case study villages. Besides village affiliation (Village A, N=18; Village B, N=22; Village C, N=20 and Village D, N=18), interviewees were further classified into two subgroups. The first group included both local community leaders (N=17), such as the mayor, the co-operative manager, certain tenants, the spokesman of the Turkish minority or very active agricultural producers, whom other community members attested leader functions, and non-leaders (N=61). The second group represented subsistence farmers (N=44) and agricultural producers (N=34).
Interviewees could arrange and rearrange the cards until they were satisfied and would present their rankings. As compared to the questionnaire technique, this technique ensures that interviewees choose more consciously and are able to reflect what they answer. The interviewees were asked to rank the features of actors in the irrigation process in descending order.

4 Empirically Derived Power Resources

When analyzing power, various actors have to be compared. A major difficulty is that one power resource might be offset by another resource of an opposed actor (Morris, 1987: 144). Moreover, power cannot be directly studied, we can only infer on power from other evidence. There are some difficulties with Knight’s resource provision as a power resource. First, the important factor is not resources possession of a person and potential use of, but the actual use of power. Thus, the willingness of the actor is decisive to put his power resource into the bargain and not the potential. Second it is not the use of power which is decisive, but the subjective perception of an actor to determine the power of the opposed actor. Therefore, we cannot simply measure a resource, because the resource is determined by the effects it produces on other actors (Morris, 1987: 139).

The comparison of the theoretical examination of power with the empirical research on power is a challenge. The problem of empirical studies on power has not yet been solved satisfactorily (Morris 1987: 124). In the following, the theoretical examination of power is compared with its empirical examination and empirically derived power resources of local actors are presented.

Table 2 Empirically derived power resources

<table>
<thead>
<tr>
<th>Empirical power resources</th>
<th>Comparability with theory</th>
<th>Effects on the bargaining model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to information</td>
<td>Possessing information as a key power resource (Knight, 1992)</td>
<td>Distributional consequences of bargaining outcomes</td>
</tr>
<tr>
<td>Personal relationship</td>
<td>Credible commitment as a key power resource (Knight, 1992)</td>
<td>Relative bargaining power</td>
</tr>
<tr>
<td>Trustworthiness</td>
<td>Credible threats of retaliation as a minor power factor (Knight, 1992)</td>
<td>Relative bargaining power</td>
</tr>
<tr>
<td>Cash resources for bribing</td>
<td></td>
<td>Distributional consequences of bargaining outcomes</td>
</tr>
<tr>
<td>Menace</td>
<td></td>
<td>Relative bargaining power</td>
</tr>
<tr>
<td>Physical power and violence</td>
<td></td>
<td>Relative bargaining power</td>
</tr>
</tbody>
</table>

It is not surprising that the empirical study confirms possession of information and the possibility to govern information as power resources (Theesfeld, 2004). The local actors focus on a slightly different aspect, namely accessibility, by naming the variable unrestricted access to information.

**Personal relationship** is here understood as good personal relationship to the ‘right’ person. When we recall that we analyze rural communities, it is not astonishing that social networks are highly appreciated. Actors who cultivate good personal relationships to decision makers in the irrigation process are more powerful.

**Trustworthiness** is closely linked to credible commitment and is one of the key power resources also highlighted by Knight (1992).

Corruption is a strategy occurring quite frequently in irrigation systems, because irrigation institutions create many such opportunities. **Cash resources for bribing** can change the distributional consequences of bargaining outcomes and are, consequently, a power resource. The
power resource menace ranges from the ability to threaten people with social sanctioning, including social exclusion, libel and slander to fears of harming business relations, extortion or violence. Menace as a power resource is the threat posing power to keep people in fears and misgivings. For Knight (1992: 136), threat is no direct power resource as he does not consider it explicitly. In the empirical context of this study, fears and misgivings turn out to be present and therefore the ability to credibly menace others is a power resource.

Physical power and violence is still common practice in Bulgaria. Physical strength and use of violence is a power resource of local actors. The participative observation provided much evidence that this power resource is still important, such as brawls in the pubs or in the fields.

5 Nonparametric Modeling for the Assessment of Power Resources

The 78 probationers ranked six power resources of local actors by importance in descending order. These power resources are the six dependent variables listed in Table 3. Some of those variables are correlated, such as 'menace' and 'physical power and violence'. However, they are not combined to one power resource, as this would lead to a loss of the precise gradation by the local actors.

Table 3 Structured variables and statistical tests

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Unrestricted access to information</th>
<th>Personal relationship</th>
<th>Trustworthiness</th>
<th>Cash resources for bribing</th>
<th>Menace</th>
<th>Physical power and violence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Village A</td>
<td>INFO</td>
<td>PERE</td>
<td>TRUST</td>
<td>BRIBE</td>
<td>MENACE</td>
<td>VIOL</td>
</tr>
<tr>
<td>Village B</td>
<td>Kruskal-Wallis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Village C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Village D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Nonparametric procedures are performed, because this is appropriate if rank data in an ordinal scale are available for analysis (Daniel, 1978; Bortz et al., 2000). For the purpose of this analysis, the Spearman correlation coefficient, the Kruskal-Wallis H test and the Mann-Whitney U test are computed. To facilitate orientation, Table 3 gives an overview of variables and statistical tests performed. Tied values occur when two or more observations are equal. For instance, more probationers scored 1 or 2 on the variable PERE. In practical empirical work, those ties often occur (Bortz et al., 2000). The statistical programs used, deliver results corrected for ties.

5.1 Spearman Correlation Coefficient

The Spearman correlation is a commonly used nonparametric measure of correlation between two ordinal scaled variables. Two prominent methods for examining the relationship between pairs of ordinal variables are available – Spearman’s rho (\( \rho \)) and Kendall’s tau (\( \tau \)). Since Spearman’s rho is more commonly used it is preferable to report this statistic unless there are obvious reasons for thinking otherwise. The raw data fulfill the assumptions required for this
The Spearman correlation is a nonparametric version of the Pearson correlation coefficient, based on the ranks of the data rather than on the actual values. For all the cases, the values of each of the variables are ranked from smallest to largest, and the Pearson correlation coefficient is computed on the ranks. Values of the coefficient range from -1 to +1. The sign of the coefficient indicates the direction of the relationship and its absolute value indicates the strength, with larger absolute values indicating stronger relationships. The significance levels depict the probability of obtaining results in the population as extreme as the one observed in the sample. The author used a two-tailed test which refers to a null hypothesis in which the direction of an effect is not specified in advance. The Spearman coefficient is computed to test in a first run the relationship of the assessment of ‘leaders’ and ‘non-leaders’ and in a second run the relationship of the assessment of ‘subsistence farmers’ and ‘agricultural producers’.

The correlation coefficient of 0.943 for the first run shows a relatively strong positive correlation of both groups. Thus, there is a tendency for ‘leaders’ and ‘non-leaders’ to assess the variables in a similar way. For the second run, the Spearman coefficient also reveals a strong positive correlation between ‘subsistence farmers’ and ‘agricultural producers’. Accordingly, there is a high tendency that these subgroups assess the variables similarly.

5.2 Kruskal-Wallis H Test for More Than Two Unrelated Samples

The Kruskal-Wallis one-way analysis of variance by ranks is the most widely used nonparametric technique for testing the null hypothesis stating that several independent samples -- here four villages -- have been drawn from the same sample. It is the nonparametric equivalent to one-way ANOVA. The Kruskal-Wallis test is considered more powerful than the Median test, another nonparametric multisample test. The Kruskal-Wallis test assumes that the underlying variable has a continuous distribution and the sample tested is similar in shape. Also, the data fulfill the other assumptions required by this test. The Kruskal-Wallis test is preferred when the available data are measured on at least the ordinal scale (Daniel, 1978: 200). If the p-values are less than 0.05, the null hypothesis for the Kruskal-Wallis test, which is outlined in the following, can be rejected.

H₀: The four populations distribution functions are identical or there is no difference in the assessment of one variable between the villages.

H₁: The four populations do not all have the same median or there is a difference between the village distributions.

The Kruskal-Wallis test is computed six times. One run for each dependent variable, representing the assessment of one power resource. The independent variable ‘village’ denotes the four different case study villages. Table 4 summarizes the p-values. Only for the variable BRIBE, the p-value is <0.05. This leads to rejection of the null hypothesis. Accordingly, a significant difference in the assessment of BRIBE between the VILLAGE samples exist. All the other p-values show no difference in the assessment of the variables for the villages at the 0.05 level of significance.

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1 The data consist of a random sample of n pairs of numeric or nonnumeric observations. Each pair of observation represents two measurements taken on the same object. B) If ties occur among the X’s or among the Y’s, each tied value is assigned the mean of the rank positions for which it is tied (Daniel, 1978: 300).

2 ANOVA stands for ‘analysis of variance’

3 The data were successfully tested for their continuous distribution with the Chi-Square test.

4 A) The data for analysis consist of k random samples of sizes n₁, n₂, ..., nₖ. B) The observations are independent both within and between samples. C) The variable of interest is continuous. D) The measurement scale is at least ordinal. F) The populations are identical except for a possible difference in location for at least one population. (Daniel, 1978: 2001)
Although, the Kruskal-Wallis test depicts the significant difference of BRIBE, it does not precisely specify between which of the four samples. To answer this question in detail, it has to be tested which samples in pairs differ from one another. According to statistical procedure, this is done in a second step with the Mann-Whitney U test.

5.3 Mann-Whitney U Test for Two Unrelated Samples

The Mann-Whitney test compares the number of times a score from one of the samples is ranked higher than a score from the other sample rather than the number of scores which are above the median. The latter is the statistic procedure of the Median test which is therefore considered less powerful. The Mann-Whitney test is a nonparametric equivalent to the T test. It tests whether two independent samples are from the same population. The assumptions required for the Mann-Whitney test are fulfilled. Two-sided nonparametric analyses are performed which test null hypotheses in which the direction of an effect is not specified in advance. This implies the following hypotheses:

H⁰: The populations have identical distributions.

H¹: The populations differ with respect to location.

In Table 3 an overview is given of the eleven different runs of the Mann-Whitney test. The first and second runs of the test specify the results of the Spearman correlation. In the first run, the two-sample data 'leaders' and 'non-leaders' are compared. It is questioned if there is a significant difference in the distribution in the assessment of 'unrestricted access to information' between the populations 'leaders' and 'non-leaders'. The asymptotic significance, the p-value of 0.025 leads to the rejection of the null hypothesis (with a significance level of 5 %). Accordingly, there is a significant difference between 'leaders' and 'non-leaders' in the mean ranking of the ordinal scaled variable INFO.

In the second run, the Mann-Whitney test is used to test the null hypothesis that there is no difference in the assessment of 'cash resources for bribing' between the populations 'leaders' and 'non-leaders'. With an asymptotic significance level of 0.931 H⁰ cannot be rejected.

A third run tested the null hypothesis that there is no difference in the assessment of 'cash resources for bribing' between the populations of 'subsistence farmers' and 'agricultural producers'. A probability of 53 % indicates that the null hypothesis cannot be rejected. There is no significant difference between these groups in the assessment of BRIBE.

In Village D, a tenant cultivates a large percentage of the village agricultural land. His decisions on the village have even further impact than those of the mayor. Moreover, he enforces his production techniques, including his irrigation practices, against the villagers with physical power. These findings lead to the hypothesis that villagers in Village D will add more weight to the power resources MENACE and VIOL in the irrigation sector than villagers from the other case study villages. Therefore, the Mann-Whitney test is computed for the null hypothesis that the population of Village D and the population in all three other villages have

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Table 4  Kruskal-Wallis p-values

<table>
<thead>
<tr>
<th>Variables</th>
<th>Run I</th>
<th>Run II</th>
<th>Run III</th>
<th>Run IV</th>
<th>Run V</th>
<th>Run VI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significance (p-values)</td>
<td>.101</td>
<td>.573</td>
<td>.402</td>
<td>.019</td>
<td>.606</td>
<td>.231</td>
</tr>
</tbody>
</table>

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5  A) The data consist of a random sample of observations in both population 1 and 2. B) The two samples are independent. C) The variable observed is a continuous random variable. D) The measurement scale employed is a least ordinal. E) The distribution functions of the two populations differ only with respect to location, if they differ at all (Daniel, 1978: 82).
identical distributions in the assessment of MENACE. The outputs of the statistic procedure indicate that with a p-value of 0.233 $H_0$ cannot be rejected. The statistical inference for the variable 'physical power and violence' is similar. The null hypothesis that the population of Village D and the population in all three other villages have identical distribution in the assessment of VIOL cannot be rejected.

One result of the Kruskal-Wallis test was the significantly different assessment of the variable BRIBE in the four villages, which can be further analyzed in pairs with the Mann-Whitney test. The p-values show that there are significant differences between the assessment of BRIBE in villages A and B as well as between villages A and C. Likewise, the differences between the assessment of BRIBE between villages D and B as well as between villages D and C are significant.

According to the analyzed sample, the statistical inferences of the nonparametric modeling could be summarized as follows:

1. The relationships of the assessment of 'leaders' and 'non-leaders' and of the assessment of 'subsistence farmers' and 'agricultural producers' are in both cases strong and similarly directed.
2. With the present sample, significant differences in the assessment of the power resources between the different subgroups could not been proven. Exceptions are INFO showing significant differences between 'leaders' and 'non-leaders' and BRIBE revealing significant differences between the various case study villages.
3. No proof could be obtained for the assumptions drawn from qualitative research that subgroups rank differently, such as a higher ranking of MENACE and VIOL in Village D.

6 Conclusions

The abuse of power resources can affect the choice of institutional options in the irrigation sector, such as water appropriation rules or the foundation rules for water user unions. Based on empirical work, six power resources of local actors in the irrigation sector are revealed. Some of those are similar to the ones discussed in the Distributional Theory of Institutional Change, others may complement the theoretical debate.

The author attempts to statistically weight each power resource and to develop a feeling for their influence. Theory usually stops at listing important determinants but the relation between them is lacking. Morris (1987: 144) already points out that we have to compare the power resources and add different weight on them.

Using statistical procedures, it is tested if there are differences in the assessment of the power resources between different subgroups. However, sample analysis show that living in different villages, being a leader or not and being a subsistence farmer or an agricultural producer had no significant influence on the ranking of power resources. The cases in which the assessments significantly differ between the samples can be neglected. The latter emphasizes that the power resources and their ranking are robust against the impact of belonging to different territorial, social and agricultural producer groups.

The power resources hold the following mean ranks: 1) unrestricted access to information is assessed as most important followed by 2) personal relationship, 3) trustworthiness, 4) cash resources for bribing, 5) menace, and 6) physical power and violence. This clear gradation of power resources at the local level is important to explain observed phenomena in the irrigation sector, such as the collection of water fees without maintaining of the irrigation system, the existence of water user unions on paper without the real participation of the water appropriators, or the frequent violation of the formal water appropriation rules. Moreover, the importance of power resources could be relevant when implementing national policies at local
portance of power resources could be relevant when implementing national policies at local level as they contribute to success or failure of such policies.

References


