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ROGUN – HYDROPOWER GENERATING CONTROVERSY IN CENTRAL ASIA

Lea Melnikovová[1], Bohumil Havrland[2], Radim Valenčík[3]

[1] Department of International Business, Metropolitan University Prague, Dubečská 900/10, 100 31 Praha 10-Strašnice, Czech Republic
[2] Department of Sustainable Technologies, Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague, Kamýcká 129, 165 21 Praha 6-Suchdol, Czech Republic
[3] Department of Economics and International Affairs, Faculty of Economic Studies, The University of Finance and Administration, Estonská 500, 101 00 Praha 10, Czech Republic

Abstract

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The aim of this paper is to analyse the current conflict between Uzbekistan and Tajikistan over shared water resources, and propose an adequate solution. The tensions between the two countries are associated with the completion of a huge dam on a river on the Tajik territory. Such construction may have a negative impact on Uzbekistan's irrigation needs since it may restrict inflow to the Amudarya River which is Uzbekistan's key water resource. While Tajikistan intends to use water for hydropower, Uzbekistan needs water mainly for its cotton fields. This paper analyses the background, benefits and risks of the dam, roots of the tension, and suggests methods of resolving them. Based on the current dispute, the problem of shared water resources is generalized, discussed and two complementary approaches are presented. The international water law offers a set of guidelines applicable on transboundary water conflicts; the significance of the 1997 UN Convention concerning the law of the non-navigational uses of international watercourses is emphasized. Another instrument to grasp this problem is the game theory. The water allocation problem can be described using the Nash bargaining solution. This paper demonstrates that both approaches can contribute to resolving existing disputes over shared water resources.

Keywords: hydropower, irrigation, shared water resources, water allocation, international water law, game theory

INTRODUCTION

Water has always been a scarce resource and a source of conflicts in the Central Asian region. The Central Asian republics, once a raw materials and agricultural base of the Soviet Union, used to be managed from the centre. Moscow was in charge of water and energy resources and provided funds for building, operating and maintaining various kinds of infrastructure. However, inequitable water resources re-allocation in order to increase irrigated areas in the Soviet republics and a series of extremely dry years in the decade of 1980s have resulted in political tensions among the Central Asian republics. Subsequently, in 1987 the Scientific and Technical Council of the USSR Ministry of Water resources determined water allocation quotas for the five Soviet republics sharing the Aral Sea Basin. In terms of water utilization, while Uzbekistan and Turkmenistan were apparently favoured by the Soviet water management system, Tajikistan and Kyrgyzstan became water suppliers and runoff regulators. The above mentioned quotas were confirmed in the 1992 Almaty Agreement although they did not reflect the situation at that time. Disagreements over water resources have become a source of permanent conflicts since the mid-eighties, especially between Kyrgyzstan and Tajikistan on one side, and Uzbekistan and Turkmenistan on the other.

This paper discusses effects of the completion of a huge dam, Rogun, on the Vakhsh River in Tajikistan on relations between Uzbekistan and Tajikistan. Such structure may significantly change the water regime of the Amudarya River. The paper analyses benefits and risks of the dam, which is now under construction, suggests ways of resolving current disputes between the two countries and tries to gather experience and useful findings and guidelines for future use in neighbouring countries.

MATERIALS AND METHODS

Based on the current conflict between Uzbekistan and Tajikistan, two methods can be suggested to contribute to resolving such situations. First, the international water law and relevant agreements between interested countries can provide general directions for settling disagreements over the use of transboundary watercourses. Second, the game theory can provide a useful concept applicable in this particular situation with respect to its specifics. The presented model is a simplified overview of the reality but provides us with a satisfactory explanation of the issue.

There are many publications related to water resource disputes dedicated to the Central Asian region as seen from different points of view. For example Wegerich (2009) focuses on the results of the current water allocation strategies and explains the roots of lack of trust between Uzbekistan and Tajikistan. Elhance (1997) describes the initial chaotic situation after the disintegration of the USSR and gives a rather good evaluation of the situation in the 90s predicting a peaceful resolution of water related disagreements. Further Elhance (2000) postulates that all countries sharing a basin are inevitably tied up into a complex web of economic, environmental, political, and security interdependencies. Such statement is entirely valid for the Aral Sea Basin. Some experts, including Kasymov (2011) and Ziganshina (2012) emphasize the role of international water law. Kasymov (2011) states that the UN Convention[1] can stop the longstanding conflict between the principles of absolute territorial sovereignty and absolute territorial integrity since it introduces the principle of limited territorial sovereignty. He proposes that the Convention is to be used as a reference base in transboundary water sharing.

Increased water demand leads to more frequent conflicts between water users and water providers. Another option to resolve them, a more practical and demonstrative one is the game theory concept. Some applicable principles were elaborated by Nash (1950), Kalai and Smorodinsky (1975), Kalai (1977), and Raiffa (1953). Game theory has been used in several works regarding problems of international water resources but none of them concerns the specific issue of the tense Uzbek – Tajik relations where the cooperative game theory framework can be applied.

RESULTS AND DISCUSSION

In 1991 the Central Asian countries inherited unequal water-use quotas and a highly interdependent system of reservoirs, dams, pumps and canals. Uzbekistan continues to be reliant on its agricultural sector and on cotton as the leading export commodity. During the Soviet era, Uzbekistan became dependent on irrigation particularly due to increased acreage of cotton crop which demands enormous water resources. While Uzbekistan appears to have a strong influence on the region's water allocation, agricultural developments and water infrastructure projects in neighbouring upstream states could weaken its position of the most populated power in Central Asia. It is obviously the most vulnerable country among the five post-Soviet Central Asian republics in terms of water resources availability and irrigated agriculture. According to the World Bank (2010), it has the largest area of irrigated land (4.28 mil. ha), the largest rural population (about 17 million) and the highest population density with a maximum exceeding 600 inhabitants per square km in Andijan oblast. It has, however, little control over its water resources. The country's agricultural sector would not function without river water, 80% of which originates in upstream countries – particularly Kyrgyzstan and Tajikistan. The problem resides in the fact that both countries plan to manage their rich water resources in favour of their own interests and to use their huge hydropower potential to avoid dependency on foreign energetic resources. In the case of Tajikistan, this desire should be fulfilled by the Rogun hydroelectric power plant which should double Tajikistan's power-generating capacity. The plans were drawn up back in the Soviet times. The Tajik president considers the project and hydroelectric power in general a cure for the country's numerous economic problems. Tajikistan is the poorest of all post-Soviet countries. The country survived a civil war in the 90s and it still faces its consequences. Tajikistan deals with poverty, lack of natural resources (or difficulties extracting them), unemployment which causes enormous labour emigration, and other issues such as drug trafficking. Another problem which, however, cannot be solved by revenues from hydroelectric power, is widespread corruption. It scares off foreign investors and this way significantly limits economic development.

1 Convention on the Law of the Non-Navigational Uses of International Watercourses

The dam generates concerns that it would limit water available for irrigation purposes in downstream Uzbekistan since Tajikistan could focus only on electricity production to gain higher economic returns. Uzbekistan is expecting a reduced water flow in the growing period – in a time when water resources are already deficient. Tajikistan was therefore forced to approach the World Bank and request a study of the Rogun dam feasibility.

Hydropower in Tajikistan

During the Soviet times, irrigation systems and power distribution were not organized on republic level, but both were planned for the Central Asian region as a whole. The Tajik SSR, along with the Kyrgyz SSR, represented a great opportunity to profit from building hydroelectric power plants (HPP). With its mountainous terrain and numerous rivers, Soviet engineers drew up several plans for such constructions. The Vakhsh River in Tajikistan, providing the most promising hydropower potential, has become a major object of regard of scientists and hydropower engineers since the early 30s. That led to construction of a hydroelectric power chain on the river. Currently there are six hydroelectric power plants which have been successfully operated with total installed capacity of 4525 MW and they provide 93% of electricity production of the country. Nearly three quarters of electricity are generated by the most powerful Nurek HPP which has the highest dam at 300 meters.

Dukhovny and Sokolov (2003) state that during the Soviet times, the system was operated primarily for irrigation purposes with power generation having a secondary role. Hydropower plants of the upstream republics (Tajikistan, Kyrgyzstan) operated in a so-called *irrigation regime*. In summer they released water from their dams to generate electricity and help irrigate downstream republics, especially Uzbekistan's thirsty crops, cotton and rice. In winter, when there were shortages of energy, the upstream countries were compensated with fossil fuels (Uzbekistan delivered gas).

The first plans of the Rogun HPP were drawn up in 1959. It took six years to finish technical specification and another 10 years to get it approved by the Soviet government. Official preparations started in 1976 and in 1980 the project was confirmed. The plans involved a 335 m high, rock filled dam. After the Soviet Union break-up, the construction was suspended, also due to the Tajik civil war (1992–1997). In 2005 a German company (Lahmeyer International) revised the project and suggested some changes such as different dam type and height. Russia's metal giant RUSAL, who had become a partner in the construction, accepted Lahmeyer's suggestions. However, Tajikistan refused these changes and due to subsequent disputes, the contract, which had been concluded with much anticipation, has been terminated. The works have been renewed in 2008 and financed from the Tajikistan state budget. After a severe winter in 2008–2009, Rogun was considered a "strategic" project which got priority over irrigation needs. This provoked a strong response from neighbouring Uzbekistan – the Vakhsh River is a key tributary to the Amudarya which is used for irrigation. In 2009 Uzbekistan requested an international expertise on hydropower projects on transboundary rivers because any constructions should have, according to Uzbekistan, an approval from all riparian countries as stated by international law[2] provisions. Such expertise should summarize possible consequences of natural and technogenic disasters, environmental damages, conservation of water balance in region and a guarantee of flow regime of rivers. The World Bank agreed to conduct assessments of viability and sustainability of the project, and the dam construction is therefore on hold. The studies examine issues related to public safety, dam height options, potential downstream impacts, and the technical and financial viability of the dam.

Rogun – its Benefits and Risks

To understand the current conflict of interest between Uzbekistan and Tajikistan, it is necessary to take into account standpoints of both sides. The Rogun project is a very complex problem. There are multiple positive and negative features that have to be taken into consideration. Among the positive aspects of Rogun we can mention the following facts.

One of the unequivocally positive features of Rogun and all HPPs is the fact that they produce clean, environmentally friendly energy. Tajikistan's energetic balance is dependent on hydropower; their biggest HPP, Nurek, produces up to 80% of the whole energetic production of the country. However, in the near future it will be necessary to modernize this HPP, and the construction of Rogun is expected to facilitate this process and prolong Nurek's lifetime. Rogun reservoir would also protect the Nurek's reservoir from siltation because another problem for the storage of large volumes of water is a so-called dead volume. It is the amount of water that will eventually be replaced by siltation. Batuca and Jordaan (2000) state that the silting process is unavoidable and the dead volume usually makes up at least half of the total volume of the reservoir; it ends when the reservoir basin is practically filled with sediment. Its existence begins to seriously affect the electricity production. Ikrami (2012) suggests that Rogun's reservoir will

2 The UN Convention on the Law of the Non-Navigational Uses of International Watercourses

extend the operation term of the Nurek HPP, almost completely reducing the process of silting up of its water collecting area.

Rogun's energetic production should also solve electricity shortages in Tajikistan. Such power deficits were especially evident in recent years during extremely cold winters. On top of that, in January 2013 Uzbekistan, the sole energy supplier, cut off gas shipments to Tajikistan, which proved the fragility of Tajikistan's energetic balance. Not only people had to struggle without electricity but also some of Tajikistan's industrial plants cannot operate all year long. Rogun HPP would strengthen energetic security since Tajikistan is not rich in natural resources or they are difficult to extract.

Rogun's supporters see a huge potential in selling electric energy to other countries facing power shortages such as Afghanistan and Pakistan. Respective power lines to South Asia need to be built first. Central Asia-South Asia (CASA) Regional Electricity Market is a concept for developing electricity trade among the countries of the two regions through a set of projects. The first phase is referred to as "CASA-1000". The World Bank (2014) informs that the project, expected to be completed by 2020, is envisaged to provide 1300 MW of electricity to Pakistan and Afghanistan by Tajikistan and Kyrgyzstan with power transit through Afghanistan.

Tajik officials suggest that since Rogun is located upstream from the Nurek Dam, the new system of dams would also enable the water flow to be managed more effectively, to the benefit of all riparian, i.e. downstream countries. Only Rogun reservoir is said to be able to fully regulate the Vakhsh River. With adjustable water volume of 8,600 million m^3, Rogun together with the Nurek HPP would be able to prevent all natural disasters in the region. Rogun's reservoir would keep to a minimum the risk of water shortage for the lower reaches of the Amudarya, especially in drought years. The Rogun HPP would therefore act as a guarantor of energy production by the whole Vakhsh hydropower plants chain and irrigation of lands located in the lower reach basin of the Amudarya.

Completing the Rogun HPP will also have positive social consequences, such as creating new job opportunities in Tajikistan and therefore reducing poverty of the population. Tajik labour migration is enormous and it has a serious negative impact on social life.

Last but not least, Rogun can make a contribution even to its main opponent, Uzbekistan. No matter how unrealistic it may seem, there is one clear benefit for Uzbekistan and that is improvement of irrigation technologies. This country, with a prospect of water shortages due to climate change, will have to realize how important good water management is. Efficient use of irrigation water is highly desired. Uzbekistan will be forced to speed up implementing water saving technologies and distributing water strictly following the rules. In the long run, this will help the efficiency of Uzbek water management and improve agricultural output as a whole.

One of the main objections is seismic activity of the area. Tajikistan tries to take all possible measures to limit this risk to minimum and has rich experience thanks to the Nurek dam with similar seismic dangers. Ikrami (2012) claims that thorough data review has showed that the earthquakes with an intensity of more than 6 points on the MSK scale[3] have never been recorded in the construction area of these high-altitude dams.

Another risk may pose landslides and debris flows. The Ionakhsh tectonic fault filled with rock salt is located right under the dam basis. Tajik observers have pointed out that a layer of salt under the future dam makes it susceptible to landslides if the salt melts. It has been determined by the World Bank (2013b) that viable alleviation measures could be taken and monitored to prevent the salt wedge from endangering dam safety.

Higher salinization is another danger emphasized by Uzbek experts. After the Nurek HPP was put into operation (1984–1990), the river flow was cut down and the problems escalated in summer months. The deputy head of the State Committee for Nature Protection in Uzbekistan Shakirov (2013) also claims that water that would come from the Rogun dam would already have a higher level of salinization. He says it will be due to accumulating and mixing water from different sources and also due to the wedge of salt along the Ionakhsh tectonic fault which may melt. The higher mineralization of water and its shortage will consequently lead to higher salinization of soils, one of the biggest problems of Uzbek agriculture.

Besides environmental problems, financial issues are very important. Rogun is a very ambitious project, demanding colossal funds – 6 billion USD according to The Economist (2013). It has attracted some promising investors. However, after terminating cooperation with RUSAL, the state had to find another source of funds. In early 2010 most Tajiks, even students, were forced to make "voluntary" contributions to Rogun and buy its shares in order to supply cash for the construction. However, little information about shareholder rights or maintenance of funds has been released, as investigated by the US Department of State (2012). That further lowered the government's credibility. Attempts to put together an international consortium to finish the HPP have not been successful yet.

3 Medvedev-Sponheur-Karnik scale which has 12 intensity degrees

The "Afghan" factor that destabilizes Tajikistan's neighbourhood is another problem that discourages possible investors. Due to the ongoing withdrawal of international forces from Afghanistan and strengthening of Islamic movements, the situation might become tenser and such atmosphere of danger is likely to lower Tajikistan's chances of getting more funds from foreign partners.

Last but not least, widespread corruption and nepotism have had a huge impact on every aspect of life in Tajikistan, including the construction of the Rogun dam. The country ranked very low on the 2012 Transparency International Corruption Perceptions Index; it scored 22 out of 100, placing it 157 on a list of 178 countries. Tajikistan's current hydroelectric output is badly mismanaged, and the construction of Rogun would likely further enrich the corrupt leaders of Tajikistan's hydroelectric companies. If the completion of Rogun is accompanied by continued corruption, then broader economic benefits for both Tajiks and foreign investors will be limited. International investors or donors are hesitant to trust the country leader. The Economist (2013) suggests that two-fifths of Tajikistan's electricity is diverted to a state-run aluminium smelter, TALCO. Why are not its profits used for Rogun? This question worries any foreign investor.

The World Bank Assessment Studies

The World Bank Assessment Studies' goal is to examine potential benefits and risks of the proposed Rogun HPP. The World Bank has committed to an expanded role to ensure "credible, transparent assessments open to international scrutiny and riparian dialogue". The World Bank is supporting two studies to evaluate the technical, economic, social and environmental viability of the proposed Rogun HPP based on international standards and practices: the Techno-Economic Assessment Study (TEAS) and the Environmental and Social Impact Assessment (ESIA). These studies are being prepared upon a request of the Tajik government. They are conducted by international consultant firms contracted on a competitive basis by the Government of Tajikistan and financed through an IDA project with assistance of World Bank experts. According to international practice, construction should not begin on any project before the technical, economic and social viability is fully assessed to avoid significant risks posed to public safety. The World Bank (2013a) informs that the Government of Tajikistan have agreed that no new construction would begin before the Assessment Studies have been prepared, reviewed by the independent Panel of Experts that is providing additional oversight to the TEAS, and shared and discussed with riparian countries.

The Assessment Studies will, however, only serve as an input to decision-making process, they will not decide whether the proposed Rogun HPP will be built or not. When completed, the studies are expected to judge the project itself feasible, but to present nine other options – of differing heights and turbine capacities – that may offer better value, according to The Economist (2013).

The World Bank has been financing the studies and the consultative process but it does not mean that the Bank will be involved in financing the project either (World Bank 2013b).

International Water Law and Transboundary Water Resources

The decreasing availability of water in Central Asia is complicated by the fact that water resources are shared among the countries. Transboundary waters have become objects of disagreements and disputes. To resolve them, the newly independent states have entered into various bilateral, multilateral, regional and international agreements and treaties. They have also expressed their commitment to the principles of international law since they had become new players in the global community.

At the regional level, the key document is the Almaty Agreement (1992). It recognizes water resources as common and shared, and states that "parties have equal rights for their use and responsibility for ensuring their rational use and protection". It confirmed the water allocation quotas set back in 1986 although it did not and does not reflect current political, economic and social situation. The Agreement envisaged establishing of the Interstate Coordination Water Management Commission (ICWC). The ICWC is responsible for strict observance of release regimes and water use limits and takes measures to ensure rational and economic use of water resources. However, the ICWC's efficacy in dealing with such challenges has proven to be rather low.

The role of international law in this field has been partially successful. Relevant principles that can help to resolve the existing disputes do exist. International law consists, for the most part, of treaties and customary international law which comprises the unwritten rules of international law formed over time on the basis of state conduct. Dinar (2007) states, that opposed to domestic law, it is a decentralized system which affects everything from how is the law made to how it is enforced.

The international water law of the non-navigational use related to the transboundary rivers concerns hydropower, irrigation, fishing, water supply, and protection of the ecosystems and environment of international watercourses.

There are two basic legal codifications in this field: The Helsinki Rules and The UN Convention on the Law of the Non-Navigational Uses of International Watercourses (The UN Convention). Dinar (2007) remarks that The Helsinki Rules (1966) is the first effort at a comprehensive codification of the law in this field and together with The UN Convention it covers all the principal uses of international watercourses and certain procedures for the avoidance and settlement

of disputes in relation to shared freshwater resources.

The UN Convention reflects rules of customary international law related to the use of international watercourses for purposes other than navigation, as mentioned above. McCaffrey (2008) claims that it is the only treaty governing shared freshwater resources that is of universal applicability. It incorporates three basic rules: equitable and reasonable utilization, prevention of significant harm and notification and consultation regarding planned measure.

The rule of *equitable and reasonable utilization* of shared freshwater resources requires that states use and protect international freshwater in a manner that is equitable and reasonable in relation to other states. Dinar (2007) suggests that the object of this rule is to achieve a fair balance among the uses of an international watercourse by the states sharing it.

The second rule is an obligation *not to cause significant harm* to other states through activities related to an international watercourse. This rule requires taking all appropriate measures to prevent the causing of significant harm. In case it is nevertheless caused, the states have to try their best to eliminate or mitigate it. The solution must be equitable and reasonable for all parties involved.

The principle of *prior notification of planned measures* stipulates that if a project or other measures, which may have an adverse effect upon other states sharing an international watercourse, are planned, the state in which the measures are intended must provide timely notification to the other states. If the notified states believe that such project or measure does not correspond to the preceding rules (equitable and reasonable utilization, prevention of significant harm), then a process of consultations and/or negotiations follows. Such process is meant to lead to an equitable resolution.

These are the three most fundamental rules of customary international law regarding the non-navigational use of international watercourses and they apply to both surface and groundwater. From the above said, it is apparent that international water law does not attempt to provide countries with specific guidelines for dispute resolution; it rather focuses on codifying customary law in the most general terms. Its goal is not to replace individual agreements and treaties negotiated between individual countries. This may be considered a weakness of the Convention, but anything more specific would be hardly acceptable for the international community.

The UN Convention has not yet entered in force. As of 19th May 2014, 35 out of the 35 countries needed for the Convention to enter into force have ratified, approved or acceded to it. However, "the present Convention shall enter into force on the ninetieth day following the date of deposit of the thirty-fifth instrument of ratification, acceptance, approval or accession with the Secretary-General of the United Nations", as stated in the UN legislative documents.

Uzbekistan is among the 35 parties (accessed 2007), Tajikistan has not joined. It may explain Tajikistan's reluctance to fulfil the three principles, and in particular, the one of *not to cause significant harm*. However, Tajikistan agreed and requested the World Bank to provide the feasibility studies on Rogun. We can rate this step to be in accordance with the above mentioned rules which strengthens the international law principles in the Central Asian region.

Game Theoretical Approach

Another instrument to grasp the problem and make the conflicting situation more transparent is the game theory. We can understand the problem of water allocation between Uzbekistan and Tajikistan as an (*S, d*) *Nash bargaining problem* within the cooperative game theory framework. To apply this theory to the above mentioned problem is more than inviting. A brief theoretical introduction is needed before applying the principles to our specific situation.

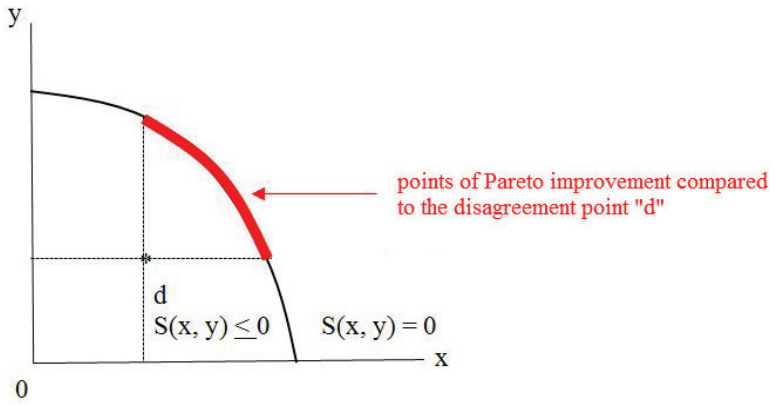
The approach is based on formal definition of Nash bargaining solution for n players as a set **B** of ordered pairs (*S, d*), where *S* is a compact convex subset to R^n and point d belongs to *S*. The elements of **B** of are called instances (examples) of the problem **B**, elements of *S* are called variants or vectors of utility, point d is called the *disagreement point*, or status quo. Every case (*S, d*) from **B** is called *d-comprehensive* (includes d).

The theory suggests several concepts for the one-point solution. The term "solution" is understood as function f from **B** to R^n that assigns the value $f(S, d)$, belonging to *S*, to each example (*S, d*) from **B**.

The best known concept of the cooperative bargaining problem is Nash's solution (1950), the other being the Kalai-Smorodinsky's solution (1975). The egalitarian approach suggested by Kalai (1977) can be also understood as a solution. All mentioned solutions can be expressed by axioms. Kalai-Smorodinsky's solution is the maximum point on *S* in the segment connecting point d and the so called *utopian point*, coordinates of which are defined as

$$U_i(S, d) = max\{x_i : x \geq \in S \, a \, x \geq d\}.$$

For the concept that we develop, Raiffa's solution (1953) is also interesting. Raiffa suggests a dynamic procedure of cooperative bargaining on *S*, where the d point gradually changes. It considers two variants of such process, a discrete one and a continuous one. The discrete Raiffa's solution is a limit of the average, so called *dictated*, revenues. The continuous solution is a limit of movement of the $x(t)$ point so that the initial point $x(0)$ is the d point and $x(t)$ is moving in the direction of average dictated revenues. Diskin (2011) axiomatized and generalized the Raiffa's solution.



1: *Nash bargaining solution*

We can illustrate the Nash bargaining problem as follows.

The *d* point is the disagreement point that represents the parties' payoffs in case they do not achieve an agreement. All the red points represent Pareto improvement compared to the original *d* point. Which of the red points to choose and how to allocate the utility between the parties?

As mentioned above, several answers can be found. From the mathematical point of view, it depends what axioms we select. It shows that even only slightly different axiomatic systems which incorporate axioms almost obviously applicable in „our world", give us different results.

In our case we have to take into consideration a few other circumstances if we want to suggest a reasonable concept:

1. Each of the parties (Tajikistan and Uzbekistan) has different possibilities to enforce a solution acceptable for them. Tajikistan has more possibilities to make decisions about water regime, Uzbekistan, on the other hand, is a bigger, economically stronger country and can demonstrate its disagreement quite effectively.
2. When evaluating the water allocation effect it is necessary to take into consideration various aspects that are not easy to convert to a common denominator. Water is used to generate power and to irrigate fields. Vice versa, in case of floods its utility is negative.
3. A related fact is that benefit from water use changes according to season and climate conditions (such as precipitation quantity and precipitation distribution) during the current year.

From the above described, following recommendations can be concluded:

1. It can be highly effective to model the water allocation problems concerning the dam via an apparatus utilizing the *(S, d)* Nash bargaining solution within the cooperative game theory framework.
2. This in not just one task, it is a series of tasks that emerge in different times of the year and in different climatic situations. The first step should be to put together a specific catalogue of situations which can be subsequently resolved using the cooperative game theory apparatus.
3. When searching for an acceptable solution, it would be very helpful if bargaining teams of both parties (countries) were equipped with basic knowledge of the cooperative game theory.
4. Based on the level of willingness to reach an agreement, it is possible to choose one of two bargaining concepts:
   - to maximize the total of payoffs and subsequently compensate the country, payoff of which will be lower;
   - to use the Nash solution which includes an element of diminishing returns from increasing benefits of one or another party. A Kalai-Smorodinsky solution would give a similar result.
5. No matter how elaborated the agreement is, it cannot solve all aspects and foresee all possibilities that can happen. Therefore a definition of general rules should be a part of such agreement in case an unexpected situation occurs.

CONCLUSION AND SUMMARY

The paper deals with analysis of the tense relations between Uzbekistan and Tajikistan due to their conflicting interests in using transboundary water resources. Uzbekistan's main concern are its cotton fields, dependent on irrigation water – most of which comes from Tajikistan. From the Uzbek point of view, Rogun will be likely to retain the water and affect the yields; Tajikistan would this way gain significant leverage against its neighbour. Uzbekistan is therefore strongly opposed although Tajikistan has suggested that the dam's reservoir be filled over a prolonged period of time in order to mitigate any effects on downstream agricultural production in Uzbekistan.

The core problem Tajikistan has to face is the lack of financial resources required for the completion of Rogun HPP. Foreign investors are not flooding the country for a variety of reasons – widespread corruption, unclear status of Rogun before the World Bank Assessment Studies are completed or unstable neighbourhood. Another burning problem is the lack of qualified personnel, especially experienced engineers. This is worrying due to complicated environmental circumstances. They have been actively pointed out by Uzbekistan. Such objections do not contribute to creating an amicable atmosphere but many of them are based on serious scientific findings and they should be definitely reconsidered before construction works continue. The World Bank Assessment Studies should provide the most detailed and independent information and serve as a mediator between the feuding parties. Without doubts, the completion of the Rogun dam would have a positive impact on Tajikistan's economy. However, Rogun is not the simple salvation and solution of all Tajikistan's economic and social problems.

This paper suggests two guidelines that can contribute to resolving this long term dispute. The international water law is a more general yet respected set of norms and rules. The game theory concept is more specific and can be successfully applied to enhance chances to establish cooperation between the two countries. It should be emphasized that the current situation can be beneficial for both countries. The game theoretical concept demonstrates a possibility to find a reasonable compromise. Complex evaluation of the situation is necessary to elaborate a suitable and functioning model that would be mutually satisfying.

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Contact information

Lea Melnikovová: lea.melnikovova@mup.cz
Bohumil Havrland: havrland@ftz.czu.cz
Radim Valenčík: valencik@seznam.cz