

## THE ROLE OF ADAPTATION TO CLIMATE CHANGE IN RURAL DEVELOPMENT

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### ABSTRACT

*One of the most important consequences of global climate change is expected to be the joint appearance of extreme weather phenomena such as flood, inland inundation, and drought. Human populations living along rivers are most seriously affected by those phenomena. In the frame of the WateRisk-project (financed by the National Research and Technology Office of Hungary), we focused on the small communities living along the river Tisza, exploring the citizens' opinions regarding the most acceptable possible solutions to water-related problems. Their conformity – also called willingness of adaptation – has been analyzed by two survey methods. Our questionnaire contained several questions on water-related issues, including the willingness of respondents to pay for increasing the proportion of natural and nature-close areas. It also examined the value system and priority setting of inhabitants towards water-related problems, local patriotism, community relationships, economic opportunities, and the natural environment, which opinions have been assessed via Q-methodology (Brown, 1996; Schmolck, 2002). With the help of Q-methodology, a value- and attitude-based behavioral profile of inhabitant groups will be shaped and their willingness and capability of adaptation will be evaluated.*

Keywords: climate change, rural development, willingness to pay (WTP), Q-methodology

### INTRODUCTION

A lot of consequences of global climate change affect people's everyday life, the prosperity of individuals. As a result, the emerging extreme weather phenomena (flood, inland inundation, drought) can cause serious damages in the area of agriculture or tourism etc. One of the aims of rural development is to maintain local communities, to ensure their local prosperity, to which is essential to eliminate or mitigate the harmful consequences.

The „Extreme-risk area of water resources for effective, sustainable alternatives to the medium and long-term treatment” project, also called WateRisk-project (financed by NKTH, TECH-08-A4/2-2008-0169) started in 2006. In the project we focused on local communities, what preferences they have to maintain and develop their local residence and to eliminate or reduce the impacts of extreme weather phenomena. Two survey methods were performed, the results of which were used for the estimation of the future water use and an integrated cost-benefit analysis in

a later part of the project. The first test applied the so-called contingent valuation, which is a method based on direct questioning of people which can be used for evaluating non-market goods, namely through the willingness to pay. The other survey applied the Q-methodology in the framework of a focus group discussion by which the public attitudes to various issues can be figured out. The study presents the most important results of these two research parts.

## **MATERIALS AND METHODS**

In the course of our research two methods were applied to discover the preferences of people from three regions: a questionnaire survey with contingent valuation and a focus group discussion with Q-methodology. According to the environmental literature there is a lot of ways to assess the changes in ecosystem services. In the first group there are such procedures which identify benefits as development costs. These methods do not estimate the values on the basis of individual preferences so, economically they can not be considered theoretically well founded, but they provide good basic information for decision making.

The theoretically correct group of the methodologies is created from those which estimate a demand curve: these are the stated preference and revealed preference procedures. In practice, it means that we are looking for the people's willingness to pay<sup>1</sup> (WTP – willingness to pay) related to a certain change. The willingness to pay analysis can be done by the contingent valuation method.

The contingent valuation method (CVM – contingent valuation method) is the oldest (for a detailed description see *Mitchell and Carson*, 1989; *Marjainé Szerényi*, 2005), and thus, methodically the most advanced revealed preference procedure. It is a direct method meaning that people are asked directly about their willingness to pay, so it is always based on a questionnaire survey. Since this is best known method, its application is still the most widespread in research. The range of goods evaluated by the CVM is almost unlimited, because due to its hypothetical nature any changes can be written in the questionnaire, even those which have not yet happened. However, it is important that the analysed change should be credible as much as possible. With the contingent valuation method only the whole program can be evaluated, its individual components separately cannot.

Recently, we evaluated the population's preferences and willingness to pay in relation to the expansion of the proportion of the near-natural areas<sup>2</sup> with CVM. This can be one of the adaptation tools to damp and balance the extreme flow regime events along the river, because the on site and natural storage of water coming from the huge quantities of floods may reduce the periods of drought water shortage and the severity of adverse consequences. The questionnaire survey was carried out in three sub-regions, among inhabitants of Nagykőrű, Bereg and

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<sup>1</sup> Beyond people's willingness to pay, their willingness to accept (WTA) can also be examined, but this is irrelevant to our subject, so it can be neglected.

<sup>2</sup> The research project was conducted in the following framework: „Extreme-risk area of water resources for effective, sustainable alternatives to the medium and long-term treatment” (WateRisk), TECH\_08\_A4/2-2008-0169.

Homokhátság in May, 2010. In the aggregate, 325 people were sampled. The questionnaire consisted of three main parts. One part focused on the general attitude questions. Another one examined the willingness to pay and act related to the expansion of the proportion of near-natural areas. In the third main block the respondents could demonstrate their own social-economic-environmental attitudes partly in the present and also partly for the future. Evidently, the socio-economic characteristics were also inquired.

Q-methodology was developed by William Stephenson (see *Stephenson, 1953*), in order to systematically analyse human subjectivity. “The Q-methodology is listed among qualitative methods due to the emphasis on the subjective nature of attitudes and opinions” (*Hofmeister-Tóth, 2002, 2. p.*), and “is primarily used to explore opinions, attitudes/orientations and value systems” (op.cit. 3 p.). The methodology is predominantly used in Anglo-Saxon countries (see inter alia *Brown, 1996, Barry and Proops, 1999*). The International Society of Scientific Study of Subjectivity has been organising Q-conferences since 1985 on every year, which have proved to be outstandingly useful in discussing the application of the methodology and its further potentials. In Hungary the methodology is not well-known, although it has already been applied in a few cases, also in the field of environment protection (*Szabó, 2002, Nemcsicsné Zsóka, 2005*).

Based on *Hofmeister-Tóth (2002)* the most important areas of Q-methodology applications are as follows:

- political public opinion and attitude research,
- clinical psychology, pedagogy,
- research into marketing-, media-, and advertising,
- research into consumer behaviour,
- research into environmental awareness,
- research into gender specificities.

The main objective of the Q-methodology is to typify opinions related to a given issue by means of quantitative analytical techniques. In reality this is a “reverse” factor-analysis, which instead of creating latent variables from variables puts respondents into various factors – into so-called opinion-groups – based on the similarity or divergence of their opinions. The qualitative nature of the methodology is due to the fact that it requires neither a certain sample size as precondition for reliable quantitative analysis, nor representativeness. The methodology by generating typical opinions assists the researcher in shape recognition, but it is not suitable to generate representative types. The analysis generally involves 10-50 respondents, selected according to fixed criteria. Owing to its specific features, Q-methodology serves as bridge between qualitative and quantitative research methodologies, combining the advantages of both research traditions (*Brown, 1996, 561. p.*).

Q-methodology applies a special technique for data collection, called *Q-sort technique*. The essence of the technique is that the researcher provides the respondents with cards showing statements, words, possibly pictures. Respondents are supposed to rank the randomly numbered cards according to their preferences. They are assisted with an evaluative scale provided in advance. Respondents first

get acquainted with the topic and the content of the cards, then start sorting them. Usually, they first divide cards into three groups. One group is composed of cards containing statements which respondents agree with, the second group is made up of statements respondents do not agree with, and the third one contains statements which respondents have a neutral attitude to. Afterwards respondents continue sorting the statements according to the categories of the scale, comparing cards to one another and giving special consideration to each and every statement, in order to be able to rank them. The evaluative scale usually contains 7 (-3...+3), 9 (-4...+4), or 11 (-5...+5) categories, depending on the number of cards.

The sorting will result in the individual rank order of each respondent. These rankings are called *Q-sorts*. In the evaluation process the method compares preference orders in pairs (that is Q-sorts) and determines their correlations. The process results in an inter-correlation matrix, out of which *factors*, i.e. *typical Q-sorts* containing the “common denominator” of individual opinions, can be generated by means of principal component or centroid method.

In the next stage it is more suitable to transform factors into a simpler factor structure by means of VARIMAX or manual rotation, to make findings easier to interpret. It goes without saying that every preference ranking has to do with all factors, but individuals can very well be associated with one of the typical Q-sorts, based on their responses. This means that the method based on the otherwise latent divergences and similarities classifies respondents into the most homogeneous groups possible. Individual opinions thus will surface in a structured form, which is easy to interpret in statistical terms. The final outcomes, factors, contain respondents with very similar preferences and their rankings.

Q-methodology is “an innovative process in social sciences, which might supplement both quantitative and qualitative research” (*Brown*, 1993, cited by *Hofmeister-Tóth*, 2002, 12. p.). Supplementary, because it requires a small sample and does not demand representativeness, therefore it cannot substitute representative surveys. “The Q-methodology can especially be applied in cases where behaviour is difficult to communicate, or no conscious standard standpoints are disposable, as yet” (*Hofmeister-Tóth*, 2002, 12. p.). We are of the opinion that the integration of environment protection into corporate culture is by all means such a case therefore it is worthwhile to apply the method in order to test hypotheses.

## **RESULTS AND DISCUSSION**

The first step of the method is to create the hypothetical market. In this framework, the current characteristics of the assessed ecosystem service (good) is presented, then a program is also introduced what we would like to perform and for which we ask for the (hypothetical) contribution of locals. In the three sub-regions practically the same program was used. Some minimal differences in the program were caused by the need of adaptation to the specificities of the regions, in order that the program is more realistic and believable. The rate of the change was the same everywhere. In the questionnaire, a brief description of each of the three sub-regions was given first about the current land use situation. Then a program was

drafted. The essence of the program would be a change in the land use and it would be realized with the help of the so-called Tisza River Development Centre. The changes in the characteristics of the three regions were formulated as follows: a more mosaic landscape would grow up, there would be less drought, the frequency and severity of floods would decrease, and the proportion of near-natural areas would grow (from 10% to 30%). Respondents got the information that the program could be realised partly with the help of the state and partly with the contribution of local people.

The willingness to pay was inquired as follows:

„What would be the maximum amount which your household would be willing to pay per year for the ongoing 10 years in order that a balanced system of water management could be implemented by a land use change in Nagykörű/Homokhátság/Bereg region? Please note in your answer, that your income could be reserved to many other purposes as well!”

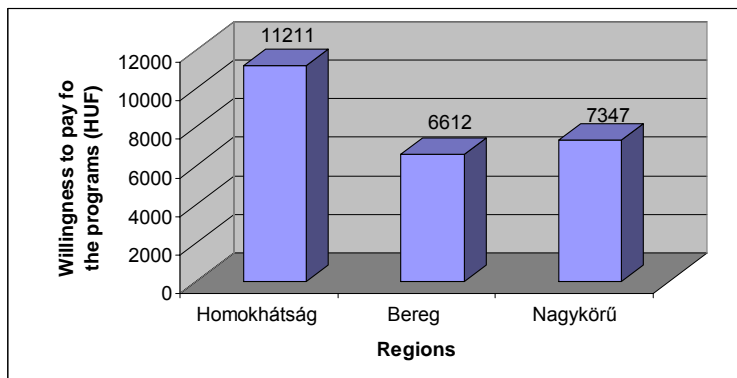
After methodological considerations defined by the literature (for example examining those who indicate zero WTP), the estimation of willingness to pay (WTP) is the main task. In our case, it was 8 738 HUF per year per household in the total sample, 0.547% of the average net income per year. Regarding the averages, there were differences between sub-regions: The inhabitants of the Homokhátság sub-region offered 11 211 HUF on an annual basis, which is significantly higher than the WTP of other two sub-regions. The inhabitants in Nagykörű would pay 7 347 HUF. The offers of the inhabitants in Bereg was the lowest, 6 612 HUF on average (the last two sums do not differ in statistical terms.) (Figure 1)

The significant difference disappears when we compare the offers relative to income (although the order will remain the original). In Homokhátság, the inhabitants would offer 0.62% of their income for the expansion of near-natural areas and for the program of changing the land use, in Nagykörű this proportion is 0.50%, while in Bereg 0.49%. Based on the results and taking into account the number of stakeholders it can be determined, what benefit the implementation of the program generally means for local inhabitants (aggregation).

The contingent valuation has many advantages in general and also in relation to the other procedures. One of the most important is that methodologically this procedure is the most widespread so we are aware of possible distortions and of techniques how to defend against them. This method is able to determine the total economic value – which is only true for the featured program –, and therefore it is suitable for measuring the value parts which are independent from use. It is important that any goods and any of their development alternatives can be evaluated with the help of the procedure, which comes from its hypothetical nature. Obviously, if the program is close to reality, people will be more confident toward the program. It is suitable for ex ante and ex post evaluation. Among its disadvantages it has to be mentioned, that not only the program is hypothetical, but also the payment of the offered money, which fact can distort the results upwards.

Figure 1

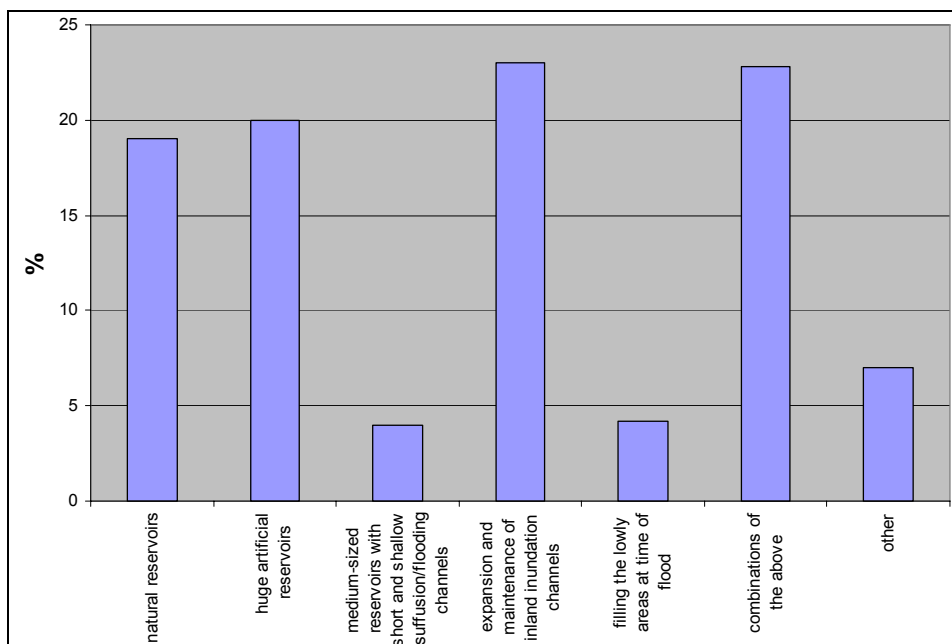
Willingness to pay of the inhabitants of some sub-regions  
(HUF/year/household)



The willingness to adopt was also investigated inquiring what type of water storage options are accepted by local inhabitants. Respondents could choose from seven different alternatives. *Figure 2* shows the results.

Figure 2

The acceptance of different ways of water among local inhabitants (%)





**Table 1**

**The groups of the people from Bereg region**

| <b>The number of the factor</b> | <b>The name of the factor</b> |
|---------------------------------|-------------------------------|
| Factor 1                        | Positively thinking people    |
| Factor 2                        | Pessimistic                   |
| Factor 3                        | Local patriots                |
| Factor 4                        | Future-oriented people        |

Respondents in the *first factor* can be characterised by their *positive attitudes* towards the natural environment. They consider nature and nature preservation important and valuable although they like making use of opportunities given by nature (except the unrestricted use of the water of their own well which they reject). They live in local integrity, support cooperation among farmers and prefer buying local products. Primarily, they prefer shared responsibility; they take a position to act together in decision making. They have contradictory opinions in flood-related issues. They appear to lack information about the environmental impacts of applied water management techniques. They support insurance, but only the passive solution. They clearly see the dangers and they are optimistic, but in the case of flood problems basically they blame the responsibility both from themselves and the local community.

Compared to other factors, they have very different views in the following things: against the others they do not think that the chemical treatments are bad and also their negative perceptions related to the application of dams and emergency reservoirs really differ from the other factors.

Members of the *second factor* can be featured by their *pessimistic attitudes* towards their environment and future. They precisely perceive risks but they do not believe in that these problems can be solved in a cooperative way. Basically they prefer insurance, and they also agree with those statements what they can do on their own, but they are very negative in relation to people, they do not believe in common solutions. They are characterized by strong individual action. They have the highest willingness to individual sacrifice, but they are very sceptic to other people. They are very critical to ethnic and local social problems. They might have bad experience with loans because they are rather pessimistic in this issue as well.

Compared to other factors their opinions essentially differ from the following things. One of them is their negative attitudes associated with bank loans, which also seems to indicate that currently or previously they had a negative experience in loans. People belonging to this factor willing to sacrifice the most regarding to the better water management. They do not consider ethnic groups as problems probably because not so many ethnics live in that area where they live. Curiously, this group is the only one for whom it is not worth planting in the forest. They rather believe in short term profit. They are not future oriented, which can come from their pessimism. In their opinion, people are not aware of any local problems, so maybe that is why they do not support the common solutions, the common decision/making.



People in the *third factor* are *local patriots*. They take into account the interests of the locals and they are really attached to their residence. They support local cooperation and integration. Although their view on environmental problems is realistic despite they have an indifferent attitude towards water-related problems and there are not willing to sacrifice. In agriculture, they vote for natural farming, refusing modern technology. Their way of thinking is basically future-oriented, which is reflected in their accordance with solutions paying back in the long run.

They have some different views from others in the following issues. They are the only ones who consider tourism as an opportunity for the region. It is an interesting aspect, that the statement 'the border-land of the village should be owned by the villagers' got the most prestigious place in the order of preference in comparison with others (not in absolute terms).

Members of the *fourth group* are the most *future-oriented people*. They prefer nature-based farming, as they respect nature very much and do not want to make use of it for their own purposes. They are inspired by collective solutions, believe in community and are willing to participate in cooperative actions. They do not see the dangers inherent in credit. They are indifferent in relation to the farming. These people can be called solution-oriented.

The opinion of the fourth factor is significantly different on the following issues. They are the only ones, who think that 'farmers help each other in work and in trouble' so accordingly, they are willing to help and act. Their love to nature is characterized by the fact that the nature for them not only valuable, but they do not want to exploit it for their own use.

Limitations of the method are very important to mention here. A special feature of the Q-methodology is that it does not require a large sample size but this also means that the results can not be generalized, the survey is not representative. The comparison between samples is possible but the results are going to definitely different in every case. However, the strength and explanatory power of the results can be justified when the comparison between different samples lead to very similar results. In the case of this research, the Q-methodology survey was carried out in the Nagykörű region as well. We got very similar factors as to those in the Bereg region. Of course further surveys would be necessary to draw general conclusions but the similar outcome is remarkable. The respondents regarded the same values and priorities as important in relation to extreme weather phenomena, local patriotism, environment protection, everyday life and local economy.

## CONCLUSIONS

People's willingness to adopt can be a very important view in decision making situation, because if they want to do such an intervention which does not have the social support, its success a priori doomed to failure. The adaptation can also be examined in several ways. The result of the willingness to pay analysis related to land-use change is desirable to use in the frame of an integrated cost-benefit analysis, details of which can be found in another working paper. This is such a

result actually reflecting the views of local people, which can be used to quantify the benefits related to enhancing the wetlands area and its benefits.

The Q-method is good to capture the perceptions and feelings. The results can be very well integrated into those scenarios in which the changes of the water demand is estimated. The water needs depend on many factors, including the environmental awareness of the local population, their willingness to stay on the area, etc. The concrete data of sub-regions was used to predict the future changes of all of those factors.

Presumably, that the understanding of the local needs and experiences makes it possible to make better decisions.

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