Deliverables D41: Pilot case study results and D51: Best practice recommendations from pilot case studies

Pilot Case Study Po Basin

Author(s) : Meri Raggi, Davide Ronchi, Laura Sardonini, Davide Viaggi

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Contact information AquaMoney Partners

Institute for Environmental Studies (IVM),
Vrije Universiteit Amsterdam
De Boelelaan 1087, 1081 HV Amsterdam
THE NETHERLANDS

Institute for International and European Environmental Policy (Ecologic)
Pfalzburger Strasse 43/44, D - 10717 Berlin
GERMANY

Department of Systems Ecology and Sustainability
University of Bucharest (UNIBUC)
Spl. Independentei 91-95,
Postal Code: 050095 Sector 5, Bucharest
ROMANIA

Norwegian University of Life Sciences (UMB)
Department of Economics and Resource Management
P.O. Box 5003, N-1432 Aas
NORWAY

Institute for Water and Environmental Engineering,
Universidad Politecnica de Valencia (UPVLC)
Camino de Vera s/n, 46022 - Valencia
SPAIN

Bureau de Recherches Géologiques et Minières (BRGM)
Direction de la Recherche
3, Av. Claude-Guillemin
BP 36009 45060 Orléans, cedex 2
FRANCE

University of the Aegean (AEGEAN)
Faculty of Environment
University Hill 81 100 Mytilini
GREECE

Research Institute for Soil Science and Agricultural Chemistry (RISSAC),
Hungarian Academy of Sciences
Herman O. street 15. 1022 Budapest
HUNGARY

School of Environmental Sciences
University of East Anglia (UEA)
Norwich NR4 7TJ
UNITED KINGDOM

Center for Environmental Policy (AAPC)
A. Juozapaviciaus 6/2, Vilnius LT-09310
LITHUANIA

Flemish Institute for Technological Research (VITO)
Boeretang 200, B-2400 Mol
BELGIUM

Department of Agricultural Economics and Engineering (DEIAGRA)
Faculty of Agriculture
University of Bologna,
Viale Fanin, 50, 40127 Bologna
ITALY

Norwegian Institute for Water Research (NIVA)
Brekkeveien 19, 0411 Oslo
NORWAY

Royal Veterinary and Agricultural University (RVAU)
Food and Resource Economics Institute
Rolighedsvej 25, 1958 Frederiksberg C
DENMARK

Institute for Advanced Studies Carinthia (IHSK)
Domgasse 3, 9020 Klagenfurt
AUSTRIA

Corvinus University of Budapest (CUB)
Fovám tér 8., 1093 Budapest
HUNGARY

European Commission
DG Research
Unit I.2 - 'Environmental Technologies and Pollution Prevention'

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Summary

- This paper reports the final results of the AquaMoney pilot case study concerning the Po Basin. It includes a description of methodologies and of results of two evaluation exercises performed in the area.
- Each one of the two evaluation exercises include both Choice experiment (CE) and Contingent valuation methods (CVM) exercises. They differ in terms of basin, sample selection and design. The IT1 survey was located in the sub-basin having as administrative reference the ATO 4, Modena (Po Basin), and was performed following the common design of the Aquamoney scarcity group. The IT2 survey involved a sample split between the Po and the Reno basins and followed a design were allocation of water to the environment is confronted with allocation to economic sectors.
- The results show a relevant Willingness to pay (WTP) for environmental uses of water, with WTP per household and year up to 140 euro, depending on the range of variation of environmental improvements. However, this relevance is moderated when confronted with productive uses.
- A tentative testing of scale effects did not allow to identify a clear-cut reaction to scale. Rather, they hint at the idea that respondents perceived the difference between the two basins and answered consistently with the prevailing feature of, respectively, the whole and the sub-basin.
- The experience draws also attention to non-monetary information arising from the surveys, to the difficulties to provide an effective common design for a very locally specific issue such as water management and to the need to involve appropriate expertise in the design and implementation of “real world” evaluation exercises.

1. Introduction

This report includes the final results of the AquaMoney pilot case study concerning the Po Basin.
Chapter 2 to 7 represent the content of deliverable D41, while chapter 8 includes contents of the deliverable D51.
The main objective of the case study was to test methodologies for the evaluation of components of the full cost of water services and related best practices for evaluation and use of information for policy purposes.
In the case study, two evaluations were performed:

1. Evaluation of water scarcity according to the common design and questionnaire agreed in the water scarcity group (coded as IT1);
2. Evaluation of water scarcity and preferences for sector allocation developed exclusively for the Italian case study (coded as IT2).

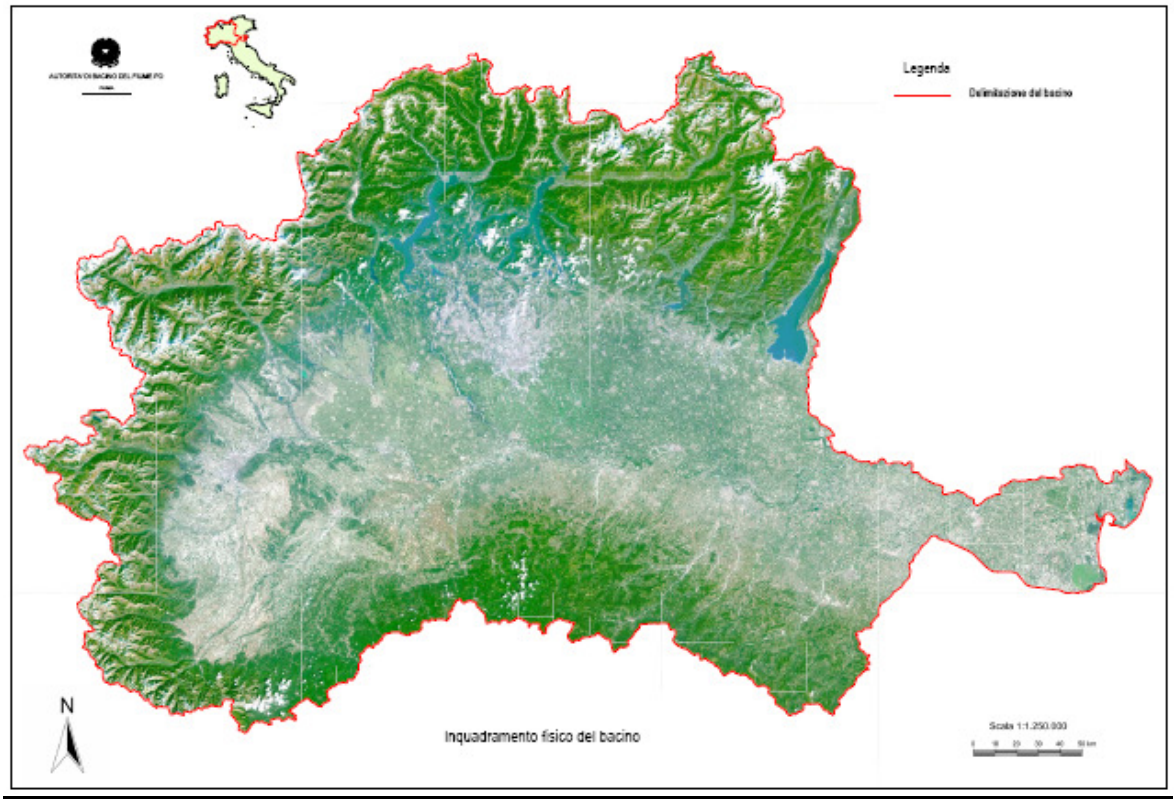
A detailed description of the Pilot Case Study can be found in Case Study Status Report Po River Basin (D31).

2. Description of the case study

2.1 Location of the case study area

The Po river basin is located in the North-West of Italy. The basin area is around 74.000 km^2 (40.606 of mountain and 29.372 of plain) with 16 milion inhabitants (Figure 1).

Figure 1: ***Po Basin Area.***



As such, the Po basin is the widest in Italy and characterised by a great variety of soil and climate conditions, as well as of water uses (from energy production to agriculture use). Due to its dimension, the basin is also split between different regional authorities (from the administrative point of view) and divided into different sub-basins (from the hydrological point of view).

2.2 Water system characteristics

Total water resources in the basin amount at 80 billions of m^3/year. Water abstraction from surface water bodies is about 25,1 billion cubic meters per year and 5,3 billion cubic meters from groundwater. A detailed water balance can be found in Case Study Status Report Po River Basin (based mainly on information drawn from Autorità di Bacino del Po, 2006).
The river flows are fed by glaciers on the Alps and by rainfall and groundwater on the Appennines. Lakes have an important role in particular in Lombardia where the main lakes of the basin are located. Groundwater is an important source throughout the plain area. Delta length is 25 km and its structure is variable in time and in space. In this area there are wetlands as the dominant feature.
The river flow is characterised by the important pieces of artificial tracts, for about 375 km (from Tanaro to Po di Goro). Some sub-basins are used for energy production. Artificial reservoirs along all rivers are exploited for several uses (flood control, etc.). CER canal transports water from the Po to the neighbouring Reno basin and Romagna basins, hence connecting the Po with the neighbouring South-Eastern basins.

Urban runoff is unmeasured, but important in drought seasons in some areas for irrigation. It goes only partially through wastewater treatments and can cause water quality problems. Wastewater treatment is compulsory in principle, but is actually absent or hardly working in many important towns. The hydrographic network is affected by flows from treatment facilities in Emilia Romagna. A big emphasis is given now to water reuse (through incentive policies), though it is almost irrelevant in practice. Desalinisation is not relevant.

2.3 Short characterization of water use and water users

Table 1 reports the water uses and services in the Po basin, divided by sector. The main water using sector is agriculture (46%), followed by industry (20%) and idropower (18%). The household sector uses only 16% of total water use in the basin. The distribution among different water uses is very heterogeneous in space. For example, the use for energy is almost totally concentrate in the area of the big lakes (Northern of the Po river). In the plain area, agriculture uses the large majority of the water available.

Table 1: Uses and services of water by sector

Sector	Distribution	Uses & services
Household	16%	Drinking, cooking, washing and other household uses
Industry	20%	Manufacturing, thermoelectric cooling and others industrial uses
Agriculture	46%	Irrigation of crops, livestock watering, aquaculture
Energy	18%	Hydroelectric generation power
Recreation and environment	-	Irrigation of parks and golf courses, swimming, boating, maintenance of biodiversity, etc.

Driving forces behind the use by sector show diverging trends. Population has decreased in the last years, about -1,5% each year. In many areas, people move from mountains to urban areas, which gives rise to concentration of human pressure. At the same time, in other areas population flows from city centres to surrounding settlements. The industry sector is more or less stable, while the total farms number decreases, but those remained increase their dimension. Irrigable agricultural area is increasing, while irrigated area is decreasing.
The amount of water used for recreation and environmental purposes is partly unknown and partly accounted in the other sectors. The role of water in maintaining ecosystems and environmental services is very important. Environmental flow requirements (EFR) are not well defined in Italy. In fact, the decree 152/99 underlines the importance of EFR but there is not an unique criteria: for example, in Lombardia the EFR is taken equal to 10% of annual average natural capacity (Regione Lombardia, 2005). In general there is a EFR deficit between May and September in Emilia Romagna. Planning documents provide for assuring the EFR in 2008 for all basin rivers. Given the weak definition and uniformity, EFR tends to be an important source of conflicts.

In the Po basin there are 816 different areas protected under EU and/or Italy law (national or local park, etc.). The area of protected areas is about the 15% of the basin. Many protected areas are characterised by their aquatic environment (e.g. the Po delta).

2.4 Main water management and policy issues in the context of the WFD

Water management issues relate to different problems. Scarcity problems have not been particularly important in the past, but are now one of the main focus of future scenarios. However, several allocation issues are in the policy agenda, involving different geographical levels in the Po basin. At the higher scale, there is an issue of distribution of quantitative water rights among different Regions. A larger amount of water is used by upstream regions (Piemonte, Lombardia). Along rivers streaming from the Alps, the right to retain water in dams for electricity is an important issue, particularly during summer. A property right issue is water abstraction from wells. Though in principle groundwater should be public property subject to concession, in practice a large number of wells is unregulated.
Scarcity is also a seasonal issue as in the summer a lot of areas suffer droughts; the lack of snow and rainfall during winter and/or autumn has increased this problem in recent years, also reducing the natural and artificial stocks (glaciers, lakes). Policies under consideration include artificial reservoirs.
Water use efficiency is an issue, also in relation to water scarcity problems. The main concerns regard in house misuses, percolation and evaporation from canals and leakage from pipes, as well as excessive water use in agriculture. Policy actions concerns information, infrastructure renovation and diffusion of water saving technologies.
Main quality problems appear in between two regions: Emilia-Romagna and Lombardia (Parma, Panaro Lambro and Olona, rivers), due to the bad quality of Lambro-Olona river (considered HMWB in according to the WFD definition),. Lombardia is also responsible of a large share of pollution, which affects downstream regions and the Adriatic sea. Downstream effects of pollution along the coast are a cause of major concern due also to the touristic relevance of the Adriatic sea area (Massarutto et al. 2007 RVEBP).
Flood risk issues are historically of paramount importance in the basin. Traditionally they include flood defence in the lower Po valley, during exceptional rainfall event. However, also floods in the bottom part of mountain valley have become an issue following urbanisation. Several disasters mark the area.
The coastal area is deeply affected by the problem of subsidence. This is partly related to the gas abstraction made around years '40s-'50s. Presently the main cause is groundwater abstraction. Subsidence produced problems related the reclamation actions, flooding and harbour infrastructures (Autorità di Bacino, 2006).

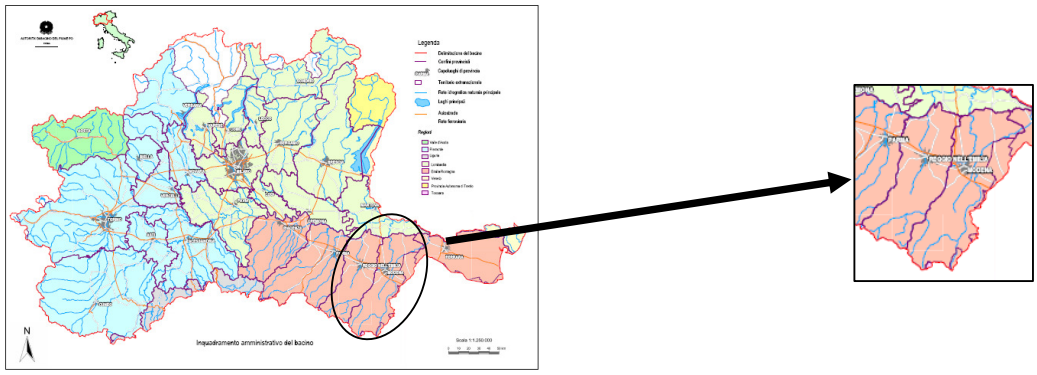
Presently, the WFD is not implemented in Italy. The Italian government approved the decree 152/2006 that implemented the WFD, but it was basically stopped at the end of 2006 (decree 284/2006 that established to maintain the previous situation). At the moment, water issues are regulated by a number of laws, but mainly by decree 152/1999. Main responsibilities are centralised and delegated to regions. As a consequence, each region may produce its own laws and provinces have their responsibilities in local implementation.
However, basin authorities exist, dealing mainly with flood control and general water concessions. There is not a hierarchy between regional administration and basin authorities.
ATO (Ambiti Territoriali Ottimali), are in charge of water distribution for human consumption and industrial use. Reclamation and irrigation boards are responsible for land reclamation, (local) flood control and distribution of irrigation water.
The present institutional framework is undergoing major changes which result is still unclear. ATO have been recently abolished. Also Regional administration have the possibility to abolish irrigation boards, though this would mostly result in a "simple" restructuring of the irrigation boards.
Key planning documents are PTA (Water Protection Plan) made by the regions and the BP (Basin Plan) made by the Basin authorities.
The existing laws already mentioned cost-benefit studies as a desirable tool to support decision making, particularly for very important issues. On this basis and anticipating the WFD, some regions are including economic studies within their planning documents, mainly in relation to very specific and localised problems. References are informally made to WFD-related documents (e.g. WATECO).
However, to date, a comprehensive economic analysis of water use related to the Po basin has not been done yet. There are some specific and local analyses done by some regions and reported in their PTA. The available economic analyses are usually based on an analysis of cost for water provision and treatment. In some areas, e.g. Lombardia region, a

"full" cost for water has been calculated taking into account depreciation costs of new infrastructures. This information is generally used to allow a rough evaluation of cost recovery. Resource and environmental costs are mentioned in some documents (e.g. PTA Piemonte), though the origin of their calculation is unclear.

2.5 Survey areas: characteristics and motivations

The IT1 survey was located in the sub-basin having as administrative reference the ATO 4, Modena. The area is located in the extreme south of the Po Basin (Figure 2). The sub-basin area is about 3000 km^2 (60% mountain and 40% plain) with about 670000 inhabitants. In this area there are three main rivers (Secchia, Panaro and Enza) flowing from south-west to north-east and flow in the Po river.

Figure 2: Po ***Basin Area and in detail the Modena area.***



Several reasons justify the choice of this area:

1. The area is the one with the highest scarcity problems in the whole Po basin; scarcity concerns in particular the highest part of the plain area at the foot hill of Apennines.
2. Scarcity problems reflect substantially also in quality issues; the main conflicts arise during summer between agriculture and the environmental uses.
3. The location was convenient for the interviewers; in fact the distance between Bologna and Modena is only about to 50km.

The IT2 survey was conducted partly in the area of Po basin and partly in an area of the neighbouring Reno basin. The choice of this area was driven by the following reasons:

1. It allows to compare the perception of water issues in the Po basin and in another basin, heterogeneous as regards water management problems, but similar in terms of socio-economic context.
2. The location of the Reno basin was also convenient for the interviewers (Bologna is included in the basin).

The partial overlapping among the two surveys (IT1 and IT2) also allows some comparison of the results under two different design.

3. Survey 1 (Common) - Set up of the survey

3.1 Questionnaire design (common)

This evaluation is based on the use of CE to estimate the environmental value of quantitative water uses and the willingness to pay to reduce the risks of water shortages. This survey followed the Common questionnaire and Common design of the CE proposed by the Group on water scarcity within the AquaMoney consortium.

3.2 Sampling procedure and response rate

The survey was made using face to face interviews in Modena with a response rate equal to 17% (242 respondents out of 1381 people contacted). We started the survey at the beginning of July 2008 but we stopped because of the rain

(submitting questions about water scarcity during rainy period was not taken seriously by respondents). In August it was impossible to continue because the most part of families went on holiday so the survey was conducted during the first half of September. The survey realization was difficult because of the length of the questionnaire (more than 20 minutes). In addition, other problems depend on the lack of available time of people (work, shopping, etc.), the distrust of people to answer to questions and a large presence of foreigners (difficulties to understand questions) and people outside the basin.

4. Survey 1 (Common) - Valuation results

4.1 Respondent characteristics and sample representativeness

4.1.1 Demographic characteristics

The sample is balanced as for sex, with a presence of 60% of male and 40% of female. The population distribution in Italy show a larger presence of female (51.4%, Istat 2005). The average age in the sample is 40.4 years and the median age is 36. In the sample, we have a large group under 45 years old (63%); this depends on the fact that 23.1% of interviewees are students. The age distribution is presented in Table 2

Table 2: Age distribution in intervals.

Age	%	Age	%
<=25	24.48%	55-65	10.79%
25-35	24.07%	>65	11.20%
35-45	14.52%	-	0.00%
45-55	14.94%	Tot	100.00%

The joint distribution of sex and age shows how the sample is balance enough (see Table 3):

Table 3: Joint distribution of age and sex.

	Sex		
Age	**Male**	**Female**	**Tot.**
<=25	27	32	59
25-35	40	18	58
35-45	22	13	35
45-55	20	16	36
55-65	17	9	26
>=65	16	11	27
-			1
Tot	142	99	242

Here, we investigate the family structure. In the sample there are 177 families without ‘under 18’ people and the median value of number of people per family is 3. The 9.5% of sample are single and only the 26.8% of families have one or more ‘under 18’. In Table 4 it is shown the joint distribution between the number of ‘under 18’ and the number of household members.

Table 4: Family structure: joint distribution between under 18 and number of household members

	Number of people								
Under 18	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**-**	**Tot**
0	23	53	43	46	7	1	1	3	177
1		1	24	13	9				47
2			1	12	2	2			17

3					1				1
Tot	23	54	68	71	19	3	1	3	242

4.1.2 Socio-economic characteristics

Socio-economic characteristics investigated are: education level, job and family income. In Italy the education system is composed by four steps (primary, junior high school, secondary and university). The higher education level completed is the secondary school in most cases. A large part of older people have completed only the primary school, while the youngest have completed the secondary and/or university (Table 5).

Table 5: Joint distribution of age and education level

	education level					
Age	**primary**	**junior high school**	**secondary**	**university**	**-**	**Tot**
<=25		6	34	19		59
25-35		3	32	23		58
35-45		8	14	12		34
45-55	1	9	17	9		36
55-65	4	12	5	5		26
>65	18	5	2	2		27
no answer		1			1	2
Tot	23	44	104	70	1	242

The 23.1% of people are students and 16.1% retired; this fact depends on that in these classes people have more free time so it is more frequent to meet them in the street. The higher job frequency is for the employers in the service sector (29.3%) and factory workers (12.0%). Fisherman category is not present. However, the classification procedure was difficult because some work categories were not clear for respondents (i.e. free lancers are classified in the service sector so the class percentage increases). In the report, the low percentage of some worker classes (such as employed in tourism sector, health care sector) is caused by difficulty to identify these categories during the day, in the working hours (Table 6).

Table 6: Job distribution

Job	**Tot**	**%**
Unemployed/looking for work	5	2.1
Farmer	2	0.8
Employed in the tourism sector (hotel, restaurant, camping etc.)	4	1.7
Employed in the service sector (bank, administrator, etc.)	71	29.3
Employed in the industry sector (factory worker)	29	12.0
Employed in the health care sector	6	2.5
Employed in the education sector	14	5.8
Retired	39	16.1
Student	56	23.1
Housewife/man	14	5.8
Other	2	0.8
Tot	242	100.0

In the question about annual income per household, only 25 people refused to answer. The higher annual income frequency is the interval C. The monthly amount, presented in Table 7 (and also in the questionnaire), was an help to people in the computation of the family income. The annual average income is 18,248€/year, equal to 1,520 €/month.

Table 7: Family income distribution

Total annual income for household	Tot
J less than € 6,000 per year (less than 500€ month)	24
H € 6,000 – 12,000 per year (500 –1000€/ month)	34
C € 12,000 – 18,000 per year (1000-1500€/month)	60
S € 18,000 – 24,000 per year (1500-2000€/month)	44
X € 24,000 – 30,000 per year (2000-2500€/month)	30
N € 30,000 – 36,000 per year (2500-3000€/month)	15
A € 36,000 – 42,000 per year (3000-3500€/month)	4
F € 42,000 – 48,000 per year (3500-4000€/month)	3
L € 48,000 – 54,000 per year (4000-4500€/month)	2
R more than € 54,000 per year (more than 4500€/month)	1
no answer	25
Tot	242

Table 8 reports the joint distribution of annual income per household and education level. As expected, high education level corresponds to higher income levels even if the mean income level is quite low (this likely depends on the distrust of people in revealing their true income).

Table 8: Joint distribution of annual income per household and education level

	Education level					
Total annual income per household	**primary**	**junior high school**	**secondary**	**university**	**-**	**Tot**
J less than € 6,000 per year (less than 500€ month)	1	4	10	9		24
H € 6,000 – 12,000 per year (500 –1000€/ month)	13	11	8	2		34
C € 12,000 – 18,000 per year (1000-1500€/month)	7	13	27	13		60
S € 18,000 – 24,000 per year (1500-2000€/month)	1	4	22	17		44
X € 24,000 – 30,000 per year (2000-2500€/month)		3	13	13	1	30
N € 30,000 – 36,000 per year (2500-3000€/month)		3	6	6		15
A € 36,000 – 42,000 per year (3000-3500€/month)		1	2	1		4
F€ 42,000 – 48,000 per year (3500-4000€/month)			2	1		3
L € 48,000 – 54,000 per year (4000-4500€/month)			1	1		2
R more than € 54,000 per year (more than 4500€/month)			1			1
no answer	1	5	12	7		25
Tot	23	44	104	70	1	242

4.1.3 Water use characteristics

The most part (61%) of people do not currently practice water recreation activities. The large part (61%) of the respondents do not practice any recreational activities (Table 9).

Table 9: Water users

Water Users	Tot
No	148
Yes	94
Tot	242

The question about activities carried out is multiple so we obtain several answers. In the sample (Table 10), walking (57) results the most frequent water-related recreation activity, then fishing (28), pic-nic (20) and swimming (19).

Table 10: Activities

Activities	Tot	Activities	Tot
bird-watching	3	walking	57
pic-nic	20	hunting	9
swimming	19	boating	1
Fishing	28	other	9

Activities are taken near rivers (61.70% of people) or lakes (15.96%) and creek s(15.96%) (Table 11).

Table 11: Water body

Water body	Tot
River	58
Creek	15
Lake	15
Estuary	1
Other	4
-	1
Tot	94

The 81% of respondents practice water recreation activities in a distance equal or less than 30 km from their home. The nearest water bodies are rivers or/and creeks (Table 12 and Table 13).

Table 12: Distance between house and the water bodies

Km	Tot
<= 5	24
5- 15	28
15-30	25
30-100	11
>=100	4
no answer	15
Tot	242

Table 13: Joint distribution of distance and water bodies

	Distance km						
Water body used	-	<=5	5-15	15-30	30-100	>=100	Tot
River	1	19	18	16	2	2	58
Creek	1	2	5	4	3		15
Lake		2	3	3	6	1	15
Estaury						1	1
Other		1	2	1			4
no answer				1			1
Tot	2	24	28	25	11	4	94

People that remember the water bill amount are 123 (50.83%), people that do not remember the water bill amount are 112 (46.28%) and only 7 (2.89%) do not have a water bill. The bill distribution is presented in Table 15.

Table 14: Distribution of people who remember or not the water bill

Bill	Tot	%
I don't have a water bill	7	2.89
I don't remember	112	46.28
Remember amount	123	50.83
Tot	242	100.00

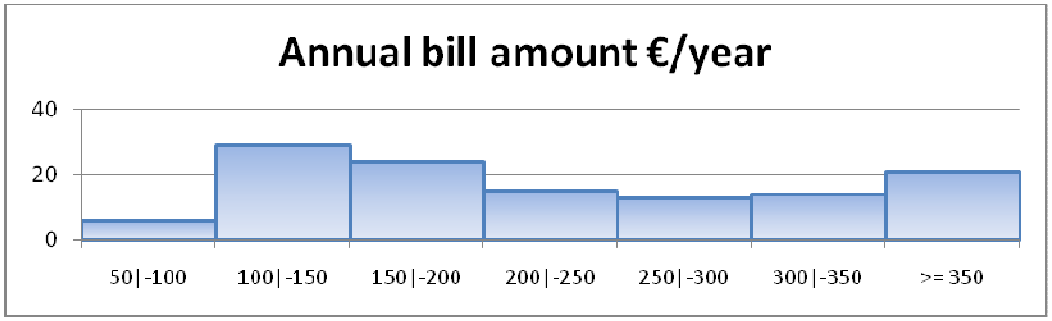
Most often, young people do not remember the annual amount of the water bill (Table 15) because parents pay the bill.

Table 15: Bill and age distribution

	Bill			
Age	no bill	not remember	remember	Tot
<=25	2	45	12	59
25-35	2	33	23	58
35-45		9	26	35
45-55	3	8	25	36
55-65		10	16	26
>65		6	21	27
no answer		1		1
Tot	7	112	123	242

The average annual water bill is about 250€, although with a wide variability range (Figure 3). The mean value results higher than the reality probably because of the people payment perception.

Figure 3: Annual bill distribution in intervals



4.2 Public perception of water management problems

In this part we ask about the three most important general problems in the respondents area.
In Table 16 we present the most frequently problems mentioned. The most frequent problems are: economic problems, safety/crime and traffic. These items represent the most evident and observable problems in Italy.
In the sample there are few people that mention environment/water problems as one of three most important problems.

Table 16: The most important problems

First Problem	Freq	Second Problem	Freq	Third Problem	Freq
economic problem	48	economic problem	38	economic problem	24
safety/crime	32	traffic	36	safety/crime	23
traffic	28	safety/crime	36	traffic	16
pollution	27	politcs/policy	18	social problems	14
social problems	18	pollution	17	pollution	13
labour/unemployment	16	social problems	17	other	13
Immigration	14	labour/unemployment	13	politcs/policy	13
politcs/policy	12	immigration	12	immigration	10
other	11	other	11	environment/water	7
environment/water	11	environment/water	9	labour/unemployment	6
public transport/infrastructure	6	public transport/infrastructure	4	climate change	5
drug	4	climate change	3	drug	3
climate change	3	drug	2	public transport/infrastructure	2
no answer	12	ageing	2	no answer	93
		no answer	24		
Tot.	242		242		242

The second question of the survey is about the importance of environmental issues. A very large frequency (92.15%) considers important/very important the environment, in spite of the fact that this seems to contradict the answer to the first question (Table 17). This should suggest a cautious evaluation of the importance given to the environment when this is known to be the issue why people are interviewed and that protecting the environment is somehow an obvious commitment.

Table 17: Environmental importance

Importance of environment	Tot
Not important	0.83%
Not important/not unimportant	6.61%
Important	50.00%
Very important	42.15%
Don't know	0.41%

After the importance of environmental issues, it is requested the perception of water scarcity problems. In the Table 18 it is shown that the problems in most cases are not considered as relevant.

Table 18: Perception of scarcity problems

Perception	%
Not a problem at all	14.46%
Not a problem	30.58%
Somewhat of a problem	31.82%
A problem	15.70%
A big problem	5.37%
Don't know	2.07%

In the questionnaire, the perception of a relation between environmental quality and water scarcity is asked and the 61.5% believe that environmental situation/condition is affected by water scarcity problem. Table 19 shows the number of people that have suffered water restrictions, due to several reasons, in the last 10 years. Only 29% of people have really suffered restrictions in the last 10 years. The stated causes of restrictions do not represent specific water scarcity problems in the area, such as for example water pipes problems.

Table 19: Restrictions in water uses

Restrictions	Tot
My household never experienced any water use restrictions due to limited water availability	171
My private well ran low on water	1
Households in my area were prohibited from using water for certain types of uses such as washing cars, watering gardens, and so on.	42
Households in my area had water pipe cuts in the past	23
Households in my area were prohibited from using tap water due to water pollution	8
Information campaigns were organized to voluntarily reduce water consumption	40
no answer	71

In spite of this the perception of future restrictions is high, in fact 48% of people believe that in the future they will experience water restrictions, while 25% of people don't know (Table 20).

Table 20: Perception of water restriction in the future

Restrictions in the future	Tot
No, definitely not	29
No, probably not	38
Don't know/not sure	59
Yes, probably	100
Yes, definitely	16

Beside question on the perception, we asked how is the expected frequency of restriction in the next 10 years. As expected, people who had suffered in the past expect to have restriction in the future (see Table 21).

Table 21: Joint distribution: restriction in the future and expected years of restrictions

	Restrictions in the future					
Years of restriction in the next 10 years	**no, definitely not**	**no, probably not**	**don't know/not sure**	**yes, probably**	**yes, definitely**	**Tot**
1				13		13
2				15		15
3				21	3	24
4				14	1	15
5				28	6	34
6				3	2	5
7					2	2
8					1	1
10				6	1	7
do not answer	29	38				67
-			59			59
Tot	29	38	59	100	16	242

4.3 Estimated economic values for water resource management (CVM)

In the Italian version of the questionnaire we also asked the maximum willingness to pay to have the best attributes level. In Table 22 the willingness to pay for the two attributes are derived as the average given by all respondents. The value of the willingness to pay is lower than values found in literature. In the previous parts of the questionnaire the importance about environmental problems results high but when we ask to translate words in money people are dubious. More than 15% of people are not willing to pay for measures to ensure the best level for the attributes. People giving wtp show a mean value equal to 36.04 €/year per household for environmental improvement and 34.44 €/year for external water restriction.

Table 22: Willingness to pay derived from CVM

	Mean (€/household)	**Median (€/household)**	**Sd**	**Frequency wtp =0**
Environmental improvement	36.04	30	39.37	16.20%
External household water restriction	34.44	25	44.87	18.30%
Tot	70.19	52.5	79.83	14.90%

4.4 Results of the Choice Experiments (CE) IT1

In this section, we analyse results derived from the Choice Experiment method.
In spite of the fact that the design, following the literature, tried to keep an easy understanding of the pictures and of the trade-offs involved, in our case many respondents had a not easy understanding of the mechanism of CE. The choice process was not simple for respondents and this represents one of the reason for the length of the survey. In fact the large part of time was spent to clarify attributes meanings and example card to interviewees. Difficulties arise because of the attributes definition and the status quo which is very far from reality.
Before analysing the CE results, we propose in Table 23 the joint distribution between the status quo choices related to the credibility perception of the all scenarios presented. When people believe in the scenarios then they choose more frequently the status quo.

Table 23: Joint distribution of status quo choice in the card and scenario credibility

	not credible at all	not credible	somewhat credible	credible	very credible	don't know
CARD 1	2.89%	7.44%	8.26%	5.37%	0.00%	5.79%
CARD 2	2.48%	5.37%	7.02%	4.55%	0.00%	3.31%
CARD 3	2.89%	4.96%	2.89%	4.55%	0.00%	4.13%
CARD 4	2.48%	6.20%	3.72%	4.96%	0.83%	5.79%

The statistical analysis, using the MNL model, gives the results in Table 24 and Table 25.

Table 24: Parameter estimates considering only the good characteristic

Variable	B	WTP	Sd	Sig
Environmental improvement sufficient	0.869	62.07	0.212	0
Environmental improvement good	1.674	119.57	0.208	0
Environmental improvement very good	1.9	135.71	0.228	0
External household water restriction	0.015	1.07	0.062	0.804
Bill	-0.014	/	0.002	0
ASC	-1.153	/	0.075	0

The analysis shows that people are willing to pay for an environmental improvement, in fact the estimate are significant and positive. In particular they pay to increase from the poor environmental status to another one and the amount is given in the second column in
Table 24.. The amount increases when the level of improvement increases, though the increases are non-linear. The estimate for the external household water restriction is positive but not significant. The ASC is negative and significant.

Table 25: Model fitting information

	Model fitting criteria	Likelihood Ratio Tests		
Model	- 2Log Likelihood	Chi-Square	df	Sig.
Intercept only	469.436			
Final	276.689	192.75	5	0

Including the individual characteristics (Table 26 and Table 27), we obtain that the individual characteristics are not significant. As in the previous model, the estimate for the environmental improvement is positive and significant but the estimate for the external household water restriction is negative and not significant so people are not interested in avoiding restrictions on their external uses of water.

Table 26: Parameter estimates considering individual characteristics

	Variable	B	WTP	Sd	Sig
	Bill	-0.015	/	0.002	0
	ASC	-1.094	/	0.322	0.001
	Environmental improvement sufficient	1.148	76.53	0.229	0
	Environmental improvement good	1.84	122.66	0.224	0
	Environmental improvement very good	2.062	137.46	0.247	0
	External household water restriction	-0.076	/	0.067	0.254
	Members	0	/	0.043	0.994
	Child	0.001	/	0.079	0.988
	Education	0.001	/	0.058	0.984
	Income	0	/	0	0.925
	Sex	-0.012	/	0.091	0.899
	Age	0	/	0.003	0.942
Importance of environmental problems	Not important	0.003	/	0.454	0.994
	Not important/important	-0.014	/	0.204	0.044
	Important	-0.004	/	0.093	0.964
	Very important		/		

Table 27: Model fitting information considering individual characteristics

	Model fitting criteria	Likelihood Ratio Tests		
Model	- 2Log Likelihood	Chi-Square	df	Sig.
Intercept only	2919.61			
Final	2768.383	151.23	14	0

The survey was carried out with two subsamples, each one using a different reference basin, described trough a different map. A subsample was showed the map of the whole Po basin, while the other was shown the sub-basin of ATO4 (Modena-Reggio).

The results of the CE for the two subsamples are illustrated in Table 28. The results for the small sub-basin show a higher WTP for the shift from poor water quality level to the sufficient level, contrary to expectations. The contrary happens for the shift to the higher level.

The result do not allow to identify a clear scale effect. Rather, they hint at the idea that respondents perceived the difference between the two basins and answered consistently with the prevailing feature of, respectively, the whole and the sub-basin. In addition, the highest commitment to pay for the area close to the pace of living seems to prevail on the expectation that a higher basin would induce a higher WTP.

Table 28: Comparison of subsample with different basin size

	Po			Mo-Re		
	B	wtp	Sig.	B	wtp	Sig.
Intercept	-0.944	/	0	-1.369	/	0
External household water restriction	-0.113	/	0.23	0.132	9.43	0.112
Bill	-0.014		0	-0.014		0
Environmental improvement very good	2.009	143.50	0	1.866	133.29	0
Environmental improvement good	1.686	120.43	0	1.712	122.29	0
Environmental improvement sufficient	0.662	47.29	0.042	1.12	80.00	0

5. Survey 2 - Set up of the survey

5.1 Questionnaire design (only Italy)

The second questionnaire is based on one of the previous version of the common design questionnaire; in particular we referred to November/December version as the starting point. For this reason, several questions in the questionnaire are the same or similar of the final common questionnaire and it is possible to use the two surveys for comparison. The main difference regards the attributes definition. In fact, in this second survey, we focus on water in the environment and the allocation between economic sectors (agriculture, energy, industry). This is because, in the Po area, scarcity is more a matter of allocation among sectors than absolute scarcity (at least for the time being).
The rationale behind this design is to try to elicit the social component of water use value associated to different sectors. Hence, the values estimated, do not intend to substitute the private value of water use (e.g. for agriculture), but rather the public component of the total economic value associated to each sector.

5.2 Sampling procedure and response rate

The survey procedure was made using face to face interviews in cities of Po and Reno basins. We started the survey at the beginning of February 2008 and finished in June. The interviews were conducted by students of the Faculty of Agriculture of the University of Bologna. Each student had to interview people distributed in different age classes such as to have a representative sample distribution.

Results are shown at an aggregated level to have general information of the sample. However, in the section 7.3 we give some element for a comparison of results between the sub-basins. In particular the basins are Po (159 interviewees) and Reno-Romagna (191 interviewees divided in Reno 158 and Romagna 33). The decision to divide the sample depends on the possibility to maintain two groups geographically close and with substantially the same characteristics.

5.3 Choice experiment design (attribute and level)

The choice experiment design (attributes and levels) in the IT2 questionnaire is different respect to the IT1 version. Design is composed by three different attributes with several levels. In the following a brief explanation and overview of attributes is given.
The first attribute (water in environment) is related to the redistribution of the total actually used water. In particular, a reduction in the actual uses of the economic sectors (except the civil sector because it is guaranteed by law) is assumed, consequence of the assumption is the increasing of the water quantity left in the environment (rivers, lakes, ect.). Possibility of water quantity increasing in the environment entails a series of social benefits such as improvement of the biodiversity and aquatic ecosystem (environmental flow requirements - EFR), improvement of the water quality as consequence of a minor concentration of pollutant substance, increase of water recreation activities opportunity (e.g.

fishing, boating, etc.), reduction of the subsidence, etc. The levels proposed for this attribute are express in percentage, as: +1,5%, +3% and +6% of increase of water in the environment, that correspond to a reduction of -2,5%, -5% and -10% of the actual economic uses (the relation between increase of water and reduction of uses originates from the data of the river basins). The attributes and levels are summarized in the Figure 4.

Figure 4: Overview of attributes and levels correspondent of the choice experiment

ATTRIBUTES	LEVELS			STATUS QUO
Water increasing in environment	+6% = -10%	+3% = -5%	+1,5% =-2,5%	Actual resource distribution
Guaranteed economic sector	AGRICULTURE  Reduction for:  	ENERGY  Reduction for:  	INDUSTRY  Reduction for:  	AGRICULTURE 
Water bill increasing (€/year)	180 150 120	90 70 60	40 30 10	0

The second attribute is related to the choice of guaranteeing one of the economic sectors (between agricultural, industrial and energetic) from the water reduction specified in the first attribute. In this situation, the sector chosen uses are guaranteed and the reduction is attributed to the other two economic sectors, based on the actual uses. In this attribute the sectors to guarantee are:

- Agricultural: guaranteeing the agriculture means to divide equally the reduction between industrial (50%) and energy (50%) sector;
- Industrial: guaranteeing the industry means to divide the reduction between agricultural (75%) and energy (50%) sector;
- Energy: guaranteeing the energy means to divide the reduction between agricultural (75%) and industrial (50%) sector.

The percentage previously mentioned derives from the actual distribution of the uses among sectors (agriculture uses actually a quantity of water equal to three time that used by industry and three time that used by idropower generation).
The third attribute is the payment required for the two previous attributes and it consists in an increasing of the household annual water bill. The levels of increasing of the water bill are: 10, 30, 40, 60, 70, 90, 120, 150 and 180 €/year. The interviewee can express his preference, into a card, between two scenarios (each composed by three attributes), or eventually opt for the status quo (which is to maintain the present situation). In the status quo scenario the distribution and uses remains constant, the sector guaranteed after the civil is the agricultural (although not all the crops are guaranteed, such as for example the arable crops) and the annual water bill does not suffer variations.
In the questionnaire there are 4 cards with different levels for each attribute (see the example card in the Figure 5)

Figure 5: Example card

ATTRIBUTES	SCENARIO 1	SCENARIO 2	STATUS QUO
Water increasing in environment	+6% = -10%	+1,5% =-2,5%	Actual resource distribution
Guaranteed economic sector	ENERGY  Reduction for:  	INDUSTRY  Reduction for:  	AGRICULTURE 
Water bill increasing (€/year)	60€	40€	0€
	☐	☐	☐

6. Survey 2 - Valuation results

6.1 Respondent characteristics and sample representativeness

6.1.1 Demographic characteristics

The sample size is 350 interviewes in the two sub-basins. The sample is balanced as for sex, with a presence of 54% of male and 45% of female (1% is missing). The sex distribution shows a larger presence of male respect to the Italy sex distribution. The average age in the sample is 48.4 years and the median age is 48. The age distribution is presented in Table 29 and it is balanced between the different classes of age even if the classes 35-45 and 45-55 are about half of the sample.

Table 29: Age distribution in intervals.

Age	%	Age	%
<=25	12.57%	55-65	10.86%
25-35	13.71%	>65	13.43%
35-45	28.57%	-	0.57%
45-55	20.29%	Tot	100.00%

Table 30 shows the joint distribution of age and sex.

Table 30: Joint distribution of age and sex.

	Sex			
Age	**Male**	**Female**	**-**	**Tot.**
<=25	30	14		44
25-35	21	27		48
35-45	41	58	1	100
45-55	41	29	1	71
55-65	25	13		38
>=65	30	17		47
-	1		1	2
Tot	189	158	3	350

The family structure (Table 31), shows that half of the interviewees have at least one child 'under 18', in particular 100 have one and 60 have more than one 'under 18'. The remaining 190 families do not include 'under 18' people. The median of the number of people per household is 3. These data respect the mean Italian statistics.

Table 31: Family structure

	Number of people									
Under 18	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**-**	**Tot**
0	1	21	66	57	27	15	3			190
1			3	45	32	14	5	1		100
2				4	39	6	2			51
3						6	1			7
-				1					1	2
Tot	1	21	69	107	98	41	11	1	1	350

6.1.2 Socio-economic characteristics

Socio economic characteristics investigated are: educational level, job and family income. The higher education level completed by the respondent is the secondary school in most cases (see Table 32). A large part of older people have completed only the primary school or junior high school, while the younger have completed the secondary and/or university (first level of Italian university).

Table 32: Age and education level

	education level							
Age	no education	primary	junior high school	secondary	university	Other	-	Tot
<=25			6	34	4			44
25-35			2	25	19	1	1	48
35-45	1	1	21	50	27			100
45-55		1	16	31	20	2	1	71
55-65		4	13	18	3			38
>65	1	17	17	8	4			47
-					1		1	2
Tot	2	23	75	166	78	3	3	350

Table 33 shows family income distribution. At this question only 34 interviewees (9.7%) refused to answer. The most frequent classes of family income are 24,000–30,000 and 30,000–50,000 €/years. The average family income is 29,250 €/year (2,400 €/month). The income revealed in the IT2 survey results higher than the IT1 (that was quite low respect the Italian statistics).

Table 33: Family income distribution

Income	Freq.
less than € 6,000 €/year	15
6,000 - 12,000 €/year	25
12,000 - 18,000 €/year	56
18,000 – 24,000 €/year	50
24,000 - 30,000 €/year	63
30,000 – 50,000 €/year	72
50,000 - 80,000 €/year	26
more than 80,000 €/year	9
-	34
Tot	350

The sample job distribution is shown in Table 34. The most frequent employements are in service sector (16%) and industrial sector (13%). The 15% are retired and 18% belongs to category “other” (i.e. freelancers). The frequency of the ‘other’ category show that the job categories use were not completely able to represent the job population structure. The farmers were only 8% of the total.

Table 34: Job distribution

Job	Tot	%
Unemployed/looking for work	6	1.71%
Farmer	30	8.57%
Employed in the tourism sector (hotel, restaurant, camping etc.)	12	3.43%
Fisherman	5	1.43%
Employed in the service sector (bank, administrator, etc.)	57	16.29%
Employed in the industry sector (factory worker)	46	13.14%
Employed in the education sector	16	4.57%
Retired	53	15.14%
Student	33	9.43%
Housewife/man	25	7.14%
Other	65	18.57%
-	2	0.57%
Tot	350	100.00%

Table 35 shows the joint distribution of job and educational level. As expected, a higher education level corresponds to a higher income level.

Table 35: Joint distribution of job and the educational level.

Total annul income for household	no education	primary	junior high school	secondary	university	other	-	Tot
less than € 6.000 €/anno		3	2	8	2			15
6.000 - 12,000 €/'year	1	8	9	6	1			25
12.000 - 18.000 €/year		7	19	25	5			56
18.000 - 24.000 €/year	1	4	12	23	10			50
24.000 - 30.000 €/year		1	15	32	15			63
30.000 - 50.000 €/year			12	39	20	1		72
50.000 - 80.000 €/year			3	9	12	2		26
more than 80.000 €/year			1	3	5			9
-			2	21	8		3	34
Tot	2	23	75	166	78	3	3	350

6.1.3 Water use characteristics

In the survey, water use characteristics are investigated, in particular water recreation activities frequency, type of activities, and water bill. Water recreation activities are summarized in Table 36. The most part of respondents (64%) do not practice any water recreation activities.

Table 36: Water users and non-users

Water Users	Freq.
No	63.71%
Yes	36.29%
Tot	100.00%

The question about activities carried out is multiple choice and the outcome is summarised in Table 37. The principal activities of the respondents are: walking (50), fishing (39) and swimming (28).

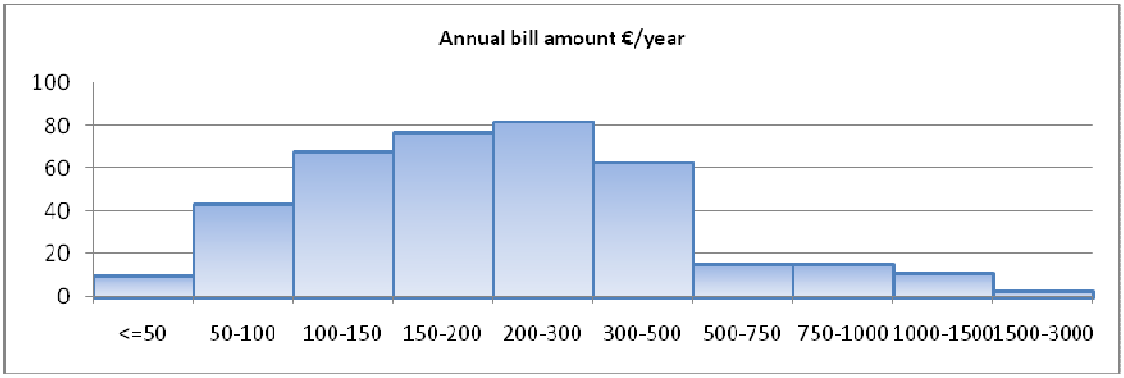
Table 37: Activities near water bodies

7.

Activities	Tot	Activities	Tot
pic-nic	12	hunting	16
swimming	28	boating	3
fishing	39	other	14
walking	50		

In the IT2 survey, details concerning the distance from home to the nearest open freshwater for recreation and the kind of water body are not asked, so it is not possible to make a parallel between IT1 and IT2. The average annual water bill is 327€/year and Figure 6 presents its distribution per classes of watr bill amount. The most frequent class of annual water bill is between 200 and 300 €/year, followed by 150-200 €/year. The higher water bills are stated by farmers, likely taking into account the cost for irrigation water, rather than the household water bill, which explain the very high amount stated by some respondents. Only 22 people did not remember their annual water bill.

Figure 6: Annual bill distribution in intervals



7.1 Public perception of water management problems

In the following we report the principal questions of the Italian questionnaire type (some questions are similar/equal to the common questionnaire design while other are different. The questionnaire starts with general questions until focus to specific questions about water scarcity and restriction problems).
Note: The numbers of the questions are referred to the number in the questionnaire.
In Table 38, the three most important problems stated by the interviews are shown. The most frequent problems are traffic, pollution and environment/water (that includes general environmental problems, water scarcity and quality, etc.).

Table 38: (Q1))Most important problems in the area

First Problem	Freq	Second Problem	Freq	Third Problem	Freq
Traffic	56	Traffic	54	Public transport/infrastructure	47
Pollution	51	Pollution	42	Other	34
Environment/water	39	Environment/water	32	Pollution	29
Safety/crime	34	Social problems	29	Safety/crime	27
Social problems	29	Safety/crime	29	Traffic	20
Economic problems	28	Economic problems	29	Environment/water	19
Public transport/infrastructure	26	Public transport/infrastructure	23	Economic problems	18
Immigration	22	Other	19	Social problems	14
Labour/unemployment	12	Immigration	14	Politics/policy	13
Politics/policy	12	Politics/policy	14	Labour/unemployment	9
Wastes	6	Labour/unemployment	8	Wastes	8
Other	4	Wastes	6	Immigration	8
Drug	2	Drug	2	Climate change	4
Climate change	1	no answer	49	Drug	1
no answer	28			no answer	99
Tot	350	Tot	350	Tot	350

In the question about the importance of the environment, almost the totality of the respondents (90%) considers important or very important the environment.

Table 39: (Q2) Importance of the environment

Importance of environment	Freq.
Not important at all	0.86%
Not important	2.29%
Not important/not unimportant	6.57%
Important	44.29%
very important	46.00%
Tot	100.00%

Beside question related to the most important problems in the area, we also asked to people which are the most important environmental problems. This question was made to better understand the perception of people regarding environmental and water problems. Analysing the answers (see Table 40), the most important problems noticed are: pollution (general, noise, electromagnetic, soil, etc.), air pollution, wastes (urban, management, etc.), water quality (drink water, rivers and lakes problems, etc.) and water scarcity (summer drought, aquifer resources, etc.). Problems specifically related to water represents about 18% of responses (as first environmental problem). The 'other' category includes: fog, deforestation, forest fire, geologic problems, law respects, absence of conservation area, etc.

Table 40: (Q3) Most important environmental problems in the area.

First Environmental problem	Freq	Second environmental problem	Freq	Third environmetal problem	Freq
Pollution	148	water quality	34	other	48
Water quality	39	air pollution	35	wastes	32
water scarcity	16	other	40	water quality	18
climate change	5	biodiversity	6	climate change	18
waterworks	9	water scarcity	23	air pollution	17
air pollution	34	pollution	34	water scarcity	16
wastes	20	no green area	23	no green area	14
no green area	9	resources management	6	landscape problems	12
other	14	wastes	28	Pollution	10
landscape problems	13	climate change	14	biodiversity	8
biodiversity	5	landscape problems	15	resources management	5
resources management	2	waterworks	4	waterworks	2
-	36	-	88	-	150
Tot	350	Tot	350	Tot	350

In the question about the importance of scarcity problems (see Table 41), people states to consider this issue very important or important (80%).

Table 41: (Q4) Importance of water scarcity problems

Importance of water scarcity respects to environment	Tot
Not important at all	2.86%
Not important	6.29%
Not important/not unimportant	8.57%
Important	51.71%
Very important	28.86%
no answer	1.71%
Tot	100.00%

Also restriction problems (see Table 42) are considered important by the people (66%), while only 16% considers these problems as not important.

Table 42: (Q6) Importance of water restrictions

Importance of water restriction in the uses	Tot
Not important at all	5.14%
Not important	11.43%
Not important/not unimportant	17.43%
Important	52.57%
Very important	13.43%
Tot	100.00%

They high percentage of 'important' or 'very important' attributed to restriction problems contrasts with the fact that, in the past, only 19% of the respondents suffered of restriction problems (Table 43). This perception may depend on the

wide information campaigns concerning environmental problem and water scarcity carried out by mass-media in recent years.

Table 43: (Q7)Restriction cases in the past

Restriction	Tot
No	80.29%
Yes	19.14%
no answer	0.57%
Tot	100.00%

The probability to suffer in the future of water restriction problems is perceived as very high (68%) and only 32% considers future restrictions as not probable or not probable at all (Table 44).

Table 44: (Q11) Probability of problems in the future

Future restriction	Freq.
Not probable at all	10.86%
Not probable	21.43%
Probable	48.00%
Very probable	13.71%
Sure	6.00%
Tot	100.00%

Table 45 presents the joint distribution of the first environmental problems and importance of water scarcity. Problems specifically related to water scarcity represents only 4.5%. People consider important/very important water scarcity problems, but they do not mention the item in the environmental problem question (Table 40).

Table 45: (Q3_1 vs. Q4) Joint distribution of the first environmental problem and importance of water scarcity

		Q4						
		Not important at all	Not important	Not important/not unimportant	Important	Very important	-	Tot
First most important environmental problem	air pollution	0.57%	1.14%	1.14%	5.43%	1.43%	0.00%	9.71%
	biodiversity	0.29%	0.00%	0.00%	0.29%	0.86%	0.00%	1.43%
	climate change	0.00%	0.29%	0.00%	0.86%	0.29%	0.00%	1.43%
	landscape problems	0.00%	0.00%	0.00%	2.29%	1.43%	0.00%	3.71%
	no green area	0.00%	0.00%	0.29%	1.14%	1.14%	0.00%	2.57%
	other	0.00%	0.57%	1.14%	1.43%	0.86%	0.00%	4.00%
	pollution	1.14%	3.43%	4.00%	22.29%	11.43%	0.00%	42.29%
	resources management	0.29%	0.00%	0.00%	0.29%	0.00%	0.00%	0.57%
	wastes	0.00%	0.00%	0.29%	3.71%	1.71%	0.00%	5.71%
	water quality	0.29%	0.29%	1.14%	6.57%	2.86%	0.00%	11.14%
	water scarcity	0.00%	0.00%	0.00%	2.57%	2.00%	0.00%	4.57%
	waterworks	0.00%	0.00%	0.00%	1.43%	1.14%	0.00%	2.57%
	no answer	0.29%	0.57%	0.57%	3.43%	3.71%	1.71%	10.29%
	Tot	2.86%	6.29%	8.57%	51.71%	28.86%	1.71%	100.00%

In the Table 46, it is presented the relation between the importance attributed to family water restrictions and the presence of water restriction. Although, the most part of people does not suffer water restriction a large part (almost 66%) considers family water restrictions as an important or very important problems.

Table 46: (Q7 vs. Q6) Joint distribution of suffering family water restriction and importance of water restriction

		Q6					
		Not important at all	Not important	Not important/not unimportant	Important	Very important	Tot
Q7	No	4.57%	10.29%	16.29%	40.57%	8.57%	80.29%
	yes	0.29%	1.14%	1.14%	11.71%	4.86%	19.14%
	no answer	0.29%	0.00%	0.00%	0.29%	0.00%	0.57%
	Tot	5.14%	11.43%	17.43%	52.57%	13.43%	100.00%

In Table 47, future perception of water restrictions is related to having suffered of restriction in the past. People who suffered of water restriction in the past are slightly more likely to think that a future situation of water restrictions could be probable/very probable.

Table 47: (Q7 vs. Q11) Joint distribution of suffering family water restriction and future perception of water restriction

		Q11					
		not probable at all	not probable	probable	very probable	sure	Tot
Q7	No	8.86%	18.86%	38.57%	9.71%	4.29%	80.29%
	Yes	1.71%	2.57%	9.14%	4.00%	1.71%	19.14%
	no answer	0.29%	0.00%	0.29%	0.00%	0.00%	0.57%
	Tot	10.86%	21.43%	48.00%	13.71%	6.00%	100.00%

7.2 Results of the Choice Experiments (CE) IT2

In this section, we show results from the CE method. The analysis shows that the estimate for the water increase in the environment is positive but not significant, while the coefficient attached to other attributes are significant, but with opposite signs. In particular, the respondents are willing to pay for the protection of water use in agriculture and production of energy. On the opposite, the coefficient for the use of water in industry is negative showing not availability to pay for it.. The ASC is negative but not significant (Table 48).

Table 48: Estimate of parameter

Variable	B	WTP	Sd	Sig
water increases in environment	0.039	5.57	0.24	0.11
agriculture protection	0.329	47	0.14	0.02
energy protection	0.417	59.57	0.1	0
industry protection	-0.675	\	0.11	0
bill	-0.007		0.001	0
ASC	-0.569		0.452	0.21

Table 49: Model fitting

	Model fitting criteria	Likelihood Ratio Tests		
Model	- 2Log Likelihood	Chi-Square	df	Sig.
Intercept only	670.581			
Final	2152.808	318.77	5	0

In the questionnaire we also used the CVM method to ask directly the maximum wtp for the economic sectors and environment. In this case the highest WTP obtained by the environment. Among sectors, the ones with the highest WTP are confirmed to be agriculture and energy production.

Table 50: Willingness to pay derived from CVM

	Mean (€/famiglia)	Median (€/famiglia)	Sd	Frequency wtp =0
Environment	42.96	30	63.03	23.70%
Agriculture	29.95	10	43.12	34.90%
Energy	23.38	10	42.63	44.80%
Industry	13.87	0	25.74	55.80%

7.3 Comparison between sub-basins

This section is devoted to the comparison between the two sub-samples belonging to the two main basins considered. In particular, we compare the characteristics and the results of CVM for the data coming out of the IT2 sample. We split the data in two parts related two different basins. The first sub-sample is located in the Reno-Romagna basin with a size of 159 people and the second sample in the Po basin with a size of 191 people.
In the following a description of the main sample characteristics is reported. The aim of the description is to know how the samples differ.
In both samples the sex distribution shows a larger presence of male respect to the Italy sex distribution (see Table 51).

Table 51: Sex distribution in the two samples

Sex	Reno	Po
Male	54.97%	52.83%
Female	45.03%	45.28%
-	0.00%	1.89%
Tot	100.00%	100.00%

The average age is 47 in the Reno sample and 43 in the Po sample. In particular in the Po basin the presence of people over 65 years old is less than in Reno and the interval class with the highest frequency is 35-45 years old (see Table 52).

Table 52: Age distribution in the two samples

Age	Reno	Po
<=25	11.52%	13.84%
25-35	16.75%	10.06%
35-45	20.94%	37.74%
45-55	20.42%	20.13%

Age	Reno	Po
55-65	10.99%	10.69%
>65	19.37%	6.29%
-	0.00%	1.26%
Tot	100.00%	100.00%

Differences between samples can be understand analysing the job distribution (Table 53). In fact, in the Reno basin the presence of retired is larger than in the Po (21% vs. 8%) and the farmers presence is larger in the Po basin than in the Reno (13% vs. 5%). In the Po basin the presence of fisherman depends on the possibility to make the activity as a job.

Table 53: Comparison of job in the two samples

Job	Reno	Po
unemployed/looking for work	1.05%	2.55%
Farmer	4.71%	13.38%
employed in the tourism sector (hotel, restaurant, camping etc.)	2.62%	4.46%
Fisherman	0.52%	2.55%
employed in the service sector (bank, administrator, etc.)	16.75%	15.92%
employed in the industry sector (factory worker)	13.09%	13.38%
employed in the education sector	5.76%	3.18%
Retired	21.47%	7.64%
Student	10.47%	8.28%
housewife/man	5.24%	9.55%
Other	18.32%	19.11%
Tot	100.00%	100.00%

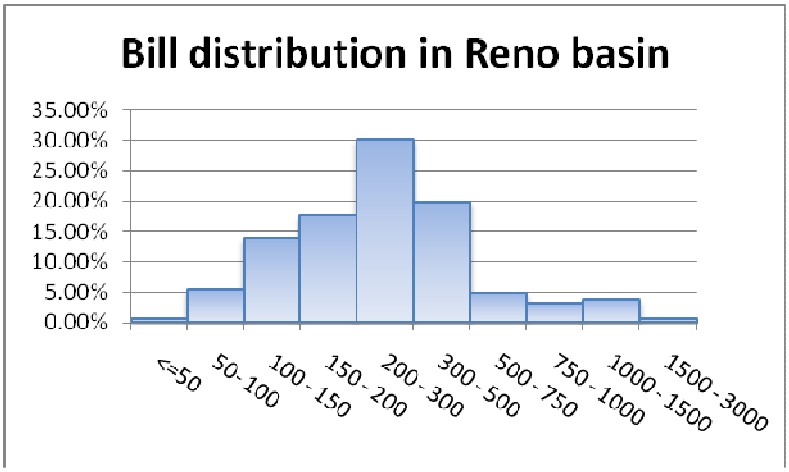
As shown in the Table 54 the Reno income distribution is on average higher than the Po income distribution. In fact, Reno income average is 10520.23€/year and the Po income average is 9510.5€/year. In both samples the 10% of people do not answer to the income question.

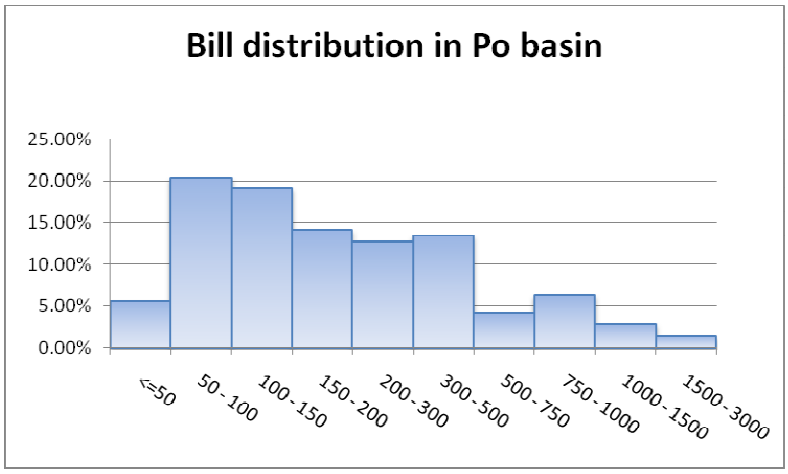
Table 54: Income distribution in the two samples

Income	Reno	Po
less than € 6,000 €/year	5.24%	3.14%
6,000 - 12,000 €/year	7.85%	6.29%
12,000 - 18,000 €/year	16.23%	15.72%
18,000 – 24,000 €/year	12.04%	16.98%
24,000 - 30,000 €/year	18.32%	17.61%
30,000 – 50,000 €/year	22.51%	18.24%
50,000 - 80,000 €/year	8.38%	6.29%
more than 80,000 €/year	0.00%	5.66%
-	9.42%	10.06%
Tot	100.00%	100.00%

Figure 7 shows the water bill distributions of the two basins. In spite of the different distribution in the samples, the average water bill is similar: 339€/year in the Reno basin and 311€/year in the Po basin. The values are raised because of some high values (e.g. over 1000€/year).

Figure 7: Water bill annual distribution €/year in Reno basin and in Po basin





The general perception of importance of the water restrictions in the uses (Table 55) results important and very important (more than 60% of people expressed this in both samples). It is important to underline that about 80% of people in the basins do not suffer of water restriction, as shown in Table 56. So the high importance to the restriction problems can depend on the increasing attention and concern for the recent climate changes (e.g. rain scarcity, temperature increase, etc.).

Table 55: (Q6) Importance of water restriction in the uses in the two samples

Importance of water restriction in the uses	Reno	Po
not important at all	5.76%	4.40%
not important	13.61%	8.81%
Not important/not unimportant	16.23%	18.87%
Important	50.79%	54.72%
very important	13.61%	13.21%
Tot	100.00%	100.00%

However, Table 56 also shows relevant differences in the water restrictions suffered in the past by the interviewees. In particular, in the Reno basin there are more cases (about 25%) of water restriction problems with respect to the Po basin.

Table 56: (Q7) Water restriction in the past

Restriction	Reno	Po
No	74.87%	86.79%
Yes	24.61%	12.58%
-	0.52%	0.63%
Tot	100.00%	100.00%

Table 57 reports the water recreation activities frequency. In the two basins there are approximately the same percentages.

Table 57: (Q13) Water recreation activities frequency

Water Users	Reno	Po
No	65.45%	61.64%
Yes	34.55%	38.36%
Tot	100.00%	100.00%

After some information about the differences in demographic characteristics and restriction problems, in this section a comparison exercises will be done to better understand differences and similarities between the two basins. In the next two tables (Table 58 and Table 59), the wtp are shown.
From the tables, it appears that in the two basins, all willingness to pay are similar and the level of relevance is the same. Comparing the average, we found that there is no difference in the amount for energy, while for environment and industry, the average in the Po basin are slightly higher (about 2 Euros). Finally there is a difference of about 10 Euros in the wtp for the agriculture, probably because of the higher percentage of farmers in the sample of the Po basin (13.38%).

Table 58: Willingness to pay derived from CVM related to Reno Basin

	Mean (€/famiglia)	Median (€/famiglia)	Sd	Frequency wtp =0
Environment	42.29	30.00	71.56	23.60
Agriculture	26.03	10.00	35.26	37.20
Energy	23.41	10.00	35.81	46.60
Industry	13.10	0.00	24.44	58.60

Table 59: Willingness to pay derived from CVM related to Po Basin

	Mean (€/famiglia)	Median (€/famiglia)	Sd	Frequency wtp =0
Environment	43.95	38.75	48.10	23.80
Agriculture	35.84	15.00	52.39	31.50
Energy	23.34	10.00	51.43	42.10
Industry	15.02	0.00	27.65	51.60

8. Conclusions

The main outcome of the two studies in the area is that the environmental benefits from an higher amount of water in the environment are considered relevant and affect the willingness to pay. This is a clear outcome of the IT1 and is partially confirmed in the IT2.

The results of CVM show different WTPs compared to CE. In the common design exercise, in spite of the best environmental alternative proposed (very good condition), the wtp from CVM is lower (even four times less) than CE results. The IT2 survey yielded different results, with a low WTP for the environmental attribute in the CE and a WTP higher than the ones of the production sectors in the CVM exercise.
The implementation of the two design with different attributes drives the analysis in two opposite directions. In the IT1 the respondents are willing to pay mainly for environmental improvement while in IT2 the respondents are willing to pay mainly to guarantee water to agriculture and energy sectors. The comparison between the two designs show the presence of a different trade-off in the two designs; in fact people are willing to pay for the environment improving instead of ensuring the no-reduction of external water restrictions; however, when confronted with water allocation in productive sectors, people are willing to pay for sectors rather than for environmental improvements.
A tentative testing of scale effects did not allow to identify a clear-cut reaction to scale. Rather, they hint at the idea that respondents perceived the difference between the two basins and answered consistently with the prevailing feature of, respectively, the whole and the sub-basin.
In a wider perspective, the experience shows also the need to go beyond pure monetary evaluation and to design appropriate survey means in order to collect the vision of the problem by the respondents. The most interesting outcome of the surveys illustrated in this paper is the difference between the strong statement of importance of the environment when it is taken alone, compared with the low priority in the list of the main problems perceived by citizens. The same tends to apply for water issues in comparison with other environmental problems. This reflects also in the need for a cautious use of monetary evaluation results when single services are evaluated without taking into account the trade-offs with other issues.
The experience with the definition of a common survey design showed the difficulties and the challenges in defining common methodologies for the evaluation related to a very locally specific issue like water uses. This should warn against the use of too generalised tools in environmental evaluation, reducing the ability to adapt to local conditions and possibly leading to misleading results.
Altogether, the study shows the importance of using appropriate evaluation expertise in order to fill the gap between general methodology specifications and specific policy-oriented evaluation exercises,

9. Best practice recommendations

9.1 Organisation

In this section we summarise the main recommendations arising from the Po case study. In doing that, we follow the structure of the Aquamoney Draft Technical guidelines (Brouwer and Gorgiou, 2007, chapter 3.2, plus an additional section about reporting).
This is intended to follow a linear logical structure of the contribution to the evaluation exercise, starting with the analysis of the problem to feeding the results back in the decision making process.

9.2 Formulation of the Research Problem and (Valuation) Objective(s)

This point can benefit only partially from our research driven approach. However, we tested the difficulty in matching theoretically defined concepts with the understanding of respondents in stated preference methods. The explicit consideration of spurious or mixed values should be explicitly taken into account.

9.3 Determination of the Research Design/Mapping Out of the Valuation Approach

Also this point can benefit only partially from our research driven approach. The experience of the Po Case study shows the relevance of caring about the motivations behind the realisation of a valuation exercise. The role of the client and its vision of the problem is of course the main starting point in practical studies. At this stage, the use of focus groups or other participatory approaches are useful in order to understand the problem structure from the point of view of the local population/interest groups, as well as to understand the relevance of the individual problems to be addressed.
This could be structured in two major steps: structure of the specific choice problem; identification of the kind of information needed for the decision making process (including choosing monetary vs. non monetary tools).
In practical terms, if a study is important enough to require an original evaluation study, our experience teaches that a professional analyst is required and should be incorporated in a study group from the very beginning.

9.4 Design of the Valuation Instrument

This should follow partly from the previous step. However our experience prove the need to be prepared to manage the trade of between research questions and practical "representability"/communicability. The main issues and problems encountered:

- Trade off between locally relevant issues/ perceptions and generalized measurements. We tested this with the common scarcity design, that was adopted in IT1. IT2 was more driven by local issues and focused on allocation of water to the environment and between economic sectors. This is because in the Po area scarcity is more a matter of allocation than absolute scarcity (at least for the time being).
- We also experienced that when the number of attributes and attribute levels is small, then people during the choice process do not understand the differences between cards. The status quo was also far from the reality and this perceived, even if most of the people did not looked really informed about water issues.
- IT1: we had a long discussion about the perception of the frequency of water restrictions during the pre-test and we ended up with the one adopted in the common design; though it went smooth during the interviews, it is difficult to say what was the exact perception by respondents; from the analysis we would say that they did not consider the difference very relevant. Generally speaking the understanding of the current situation and the credibility of scenarios was very weak because of people being not informed or not having means to evaluate the credibility of general future situations as the one presented. In addition, external household uses are not perceived as very important in the area. Likely most household have minor restrictions but they are not aware of them. IT2: The meaning of guaranteeing water to a specific sector may be not always easy to understand in terms of implications (there is a discrepancy between total water allocation and guarantee in case of water emergency, which is the concept more diffuse); in addition quantitative measures of water re-allocation may be not so meaningful for respondents and produce in the researcher the perception (illusion) to have an exact monetary value per unit of water, even when it is not so (or when it is not possible to make sure).
- IT: we used maps for water quantity, but only to show the reference basin. Respondents were more or less indifferent: even colourful maps are difficult to understand and the meaning is difficult to translate in the perception of water quality.
- in addition, it is important to use focus groups or similar participatory approaches to analyse what problems are perceived as important and how they should be approached. In Italy as well the issue of allocation among sectors is perceived as somehow more important that water in the environment itself (from which IT2).
- Starting with open questions in the questionnaire is very important to cast the thinking into the overall range of problems of interest of the interviewee.
- Be aware that "symbolic" pictograms or ordering wording on attributes cannot build a real perception of the problems and the derived WTP should be taken cautiously.

9.5 Design of the Sampling Plan

We concentrated our survey in the south of the Po basin with the presence of scarcity problems. The biggest problem is to identify the water body of interest (as many different bodies can be in the mind of the population considered) and the correspondence between population and water bodies (due to the difference between administrative boundaries and water bodies boundaries).

About the survey mean, face to face interview in the street tends to bias sample towards retired people, students, etc.

Here is synthesis the Italian sample strategy.

Balance between male-female and ageing.

(-) The survey was conducted in the street, the response rate was low. Other method (telephone call to fix an appointment) was attempted but without results

(-) the time for surveying is long (20 minutes) and people are busy and there is not the possibility to tell them all information (in particular in the CE part)

(+) Separation between survey and card was good to limit heavy interviewing time.

The main lesson learned concerns the need to design a consistent questionnaire/sampling plan and data collection, based on a previous knowledge of opportunities to contact people.

9.6 Administer the Valuation Instrument/Collection of the Data

The survey took on average 20 minutes and this amount of time represents a large disadvantages because people in street do not have time. In the future, a more focused questionnaire for a specific problem could avoid general questions. A problem is anyway the definition of the problem and attributes which is too long for telephone and street interviews, unless a more focused problem is considered and respondents know it.
Concerning the effect of the timing of the survey, it was implemented in the first half of September, after holiday season (August); most of the interviews were made by street interviews and were casual and driven by places were respondents could be available to answer; weather was reasonably good for most of the survey and the year was not mentioned as a particularly dry and hot one in the area (though water scarcity problems happen). We actually delayed the survey also to avoid rain (in June) and holiday time (in July-August)
The practical way of administering the questionnaire may affect the ability to intercept the population relevant for the issue addressed; this may be more easily done when the study is more focused than the object of evaluation considered here.

9.7 Prepare Data

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9.8 Analyse and Interpret the Data

We used Limdep for the CE. Comparison between areas was mostly made through comparison of descriptive statistics, rather than formal methods.

9.9 Reporting

The actual information content of the results should be evaluated more critically with respect to the actual decision-making problems: what is the perceived object being estimated? To what extent we can trust monetary values or should relax our interpretation to a "voting procedure"? Perceptions and open answers should have a higher place.
Context questions are more often to be ready to arise when the work is discussed with the public. In the case of our design, typical issues raised during discussions occurred till the preparation of the report are:

- IT1: Why did you not include in-house domestic uses? What if the expectations of respondents are wrong? How do you justify the low attention/importance of water issues? What was the amount paid by the respondents through water bill? Did you make sure that the perception of water bill is correct? How was the weather like when you carried out the survey? Why should families pay for the environment? Why should the water bill be the correct payment form? How much is the ratio between costs attribute and water bill?
- IT2: why should families be willing to pay for production sectors? How much water is used by household on the total? How relevant is a change in water in the environment by 3-6%. (questions actually raised during internal presentations)

In the Italian case study, results will be discussed with the Po Basin authority and with the regional administration. An open event will be jointly organised. In fact the project was carried out since the beginning in strong coordination with Po Basin authority and with the Regional administration, including discussion of information need and survey design.
In drafting the reports attention should be focused on how the kind of results obtained fit into the next reporting requirements of the decision makers. It is necessary to have in mind here the differences between reporting a study driven by research funding and a study driven by decision-makers funding for practical decision making.
In real life situation it might be expected that the diffusion of the results will go through different levels of reporting and technicality. This may also imply that results of an evaluation study could also be part of wider planning, evaluation of participation documents mediated by the decision-making authority. In this case, attention should be paid to the consistency between different pieces of information and to avoid misuse/misunderstanding of the evaluation exercise.

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