MEGA

The Codru Quest:

Methodology

Methodological guidebook to economic valuation with choice modelling technique on the example of the study on valuation of ecosystem services and biodiversity conservation in the Codru Nature Reserve and the Codru forest.

Dear Friend,

We are researchers from the Moldovan Environmental Governance Academy (MEGA; www.megageneration.com), an organization in Moldova that specializes on environmental research and education by using the approaches of gamification, open-source eco-innovations, and citizen science. We are interested in nature conservation and its relation to people's well-being in Moldova.

In November 2016 – August 2017 we conducted the research project entitled "The Codru Quest". This was a study on the economic valuation of ecosystem services and biodiversity conservation in the Codru Nature Reserve and the Codru forest in Moldova. The main goal of the project was to estimate and present the economic indirect use and non-use values of ecosystem services and biodiversity conservation in this protected area. It was needed to understand people's attitudes to these environmental goods and valuation of benefits coming from the Codru Nature Reserve when it is better managed and expanded through reforestation and biodiversity conservation activities.

In this guidebook we present you the methodology of economic valuation with choice modelling technique applied in the Codru Quest project to prepare for the research work, design the economic valuation survey, test and improve it, gather and analyze data from respondents, and present the final results to stakeholders. By using the guidebook you can follow the steps of the Codru Quest methodology to prepare, design, test, and realize your own economic valuation study with the use of choice modelling technique. The detailed explanation of the technique will help you to understand what to do, why to do it, and how to do it; and the example of the Codru Quest project will allow you to visualize the entire process of an economic valuation study and every step of it.

We hope you will find the guidebook useful for your environmental research and wish you MEGA great success in realizing it.

Yours Truly,
The MEGA Team

Moldovan Environmental Governance Academy (MEGA)

Moldovan Environmental Governance Academy (MEGA) is the social entrepreneurial organization focused on delivering services of gamification, game development, gamified trainings, and e-learning with environmental and social value.

MEGA represents an innovative solution for addressing the modern world's most pressing social and environmental issues, including inefficient natural resource management, environmental pollution, loss of biodiversity, climate change, etc. The organization tackles these issues through community participation and collaborative environmental governance.

The vision of MEGA is a sustainable world, where every person lives an eco-friendly life, has open access to practical learning opportunities, constructs own open-source eco-innovations, and thus contributes to sustainable development and creation of positive social and environmental impact in a collaborative, enjoyable, and fun way anywhere in the world.

The purpose of MEGA is to create this sustainable world on the basis of such positive and motivating feelings as fun, enjoyment, and optimism about the future. To achieve this the organization combines psychology + technology + ecology in an innovative way and uses their combined advantages. More specifically, MEGA applies gamification, open-source eco-innovations, and citizen science for granting communities the "power" to create the clean, green, and environmentally prosperous world they dream of with their own hands and minds.

The core product of MEGA is MEGA Game: The Game with Impact. It is the unique gamification system, where creating positive impact becomes a habit. MEGA Game represents a web platform with elements of gamification that connects individuals with Green Tech companies and environmental organizations and educates them on different aspects of nature conservation and sustainable development through practical real-world tasks and e-learning trainings linked to each task.

More information is available at www.megageneration.com.

Contents

www.megageneration.com

Abbreviations

CAPI	Computer-assisted Personal Interviews
CBA	Cost-benefit Analysis
CE	Choice Experiments
CM	Choice Modelling
CV	Contingent valuation
ES	Ecosystem Services
HP	Hedonic pricing
IIA	Independence of Irrelevant Alternatives
MDL	Moldovan Lei
MEGA	Moldovan Environmental Governance Academy
NGO	Non-governmental Organization
PA	Protected Area
PES	Payments for Ecosystem Services
RP	Revealed Preference
RUM	Random Utility Model
RUT	Random Utility Theory
SP	Stated Preference
TC	Travel cost
TEV	Total Economic Value
WTA	Willingness-to-Accept compensation
WTP	Willingness-to-Pay

Introduction

"The Codru Quest: Methodology" is a methodological guidebook for environmental researchers, who would like to conduct economic valuation study by using choice modelling technique for estimating willingness to pay of attributes of a non-market environmental good, but who have no or very little experience in doing it. The guidebook is written on the basis of standard process of conducting a choice modelling study and the experience of the researchers from the organization Moldovan Environmental Governance Academy (MEGA; www.megageneration.com), who implemented the research project "The Codru Quest" (www.megaimpact.md/the-codru-quest).

The Codru Quest was a scientific research initiative on the economic valuation of ecosystem services in the protected area the Codru Nature Reserve and the Codru forest in the Republic of Moldova (Photo 1).

Photo 1. The Codru forest in the Codru Nature Reserve. Source: Alexandr Iscenco, 2016.

The problem addressed by the project was the degradation of the Codru forest and other forest ecosystems in the Republic of Moldova and biodiversity in them caused by lack of awareness about indirect use and non-use values of these ecosystems for society and their undervaluation in cost-benefit analysis, land use planning, and environmental policy making.

The main goal of the Codru Quest project was to estimate and present the economic indirect use and non-use values of ecosystem services and biodiversity conservation in the Codru Nature Reserve and the Codru forest in the Republic of Moldova. It was envisioned that achievement of the goal would help to understand how Moldovan citizens perceive these non-market environmental goods and how much they value environmental benefits coming from the PA and the forest when they are better managed and expanded through reforestation and biodiversity conservation activities.

The main focus of the guidebook is to present and explain the process of conducting an economic valuation study by using specifically choice modelling technique, which is part of the stated preference methodology. There is a plethora of different stated preference methods; however, the choice modelling technique is the one which has been chosen for the Codru Quest project in order to carry out economic valuation of ecosystem services and biodiversity conservation in the Codru Nature Reserve and the Codru forest.

The guidebook starts with a brief introduction of the economic valuation theory and continues with the explanation of the choice modelling technique and the rationale behind using it in the Codru Quest. Further, it informs the reader how to prepare an economic valuation study, define target population and its representative sample, create, test, and improve a choice modelling survey, analyze data, test the results for reliability and validity, elaborate conclusions, prepare the final study report, and present it to stakeholders.

Besides the theoretical background and step-by-step description of the methodological process of the choice modelling technique, the guidebook extensively uses the examples and lessons learnt from the aforementioned Codru Quest project. The latter is included in order to illustrate how the economic valuation theory and methodology are applied in practice.

Lastly, it is important to mention that the guidebook is not a detailed statement but a user-friendly guide to assist environmental researchers in their first economic valuation studies. We trust that the researchers will not limit to this guidebook and will use additional readings of relevant scientific literature to complement the information and knowledge shared here.

Economic Valuation Methodology

A cost-benefit analysis (CBA) by using economic valuation methodology is a widely used approach to evaluate projects and policies related to environmental goods and impacts on them. The methodology has the property of eliciting the economic value of a good or service, e.g. tangible natural resources and intangible ecosystem services, by finding out the willingness to pay (WTP) for benefits received from them or willingness to accept (WTA) compensation for the losses incurred in the context of economic efficiency.

According to Bateman (2002), the definition of benefits is the amount of the personal value of what an individual is willing to give up for receiving something else. This indicates the measurement of how large the benefits are and is evaluated as willingness to pay for receiving these benefits. For example, a tourist is willing to pay a certain visitor fee to enter a nature reserve and receive pleasure from enjoying picturesque views, watching wildlife, and improving his/her health due to the fresh air around.

Conversely, by knowing individuals' preference when analyzing negative changes, it is possible to measure how large the cost of these changes is through the amount an individual would be ready to accept compensation for incurring them from the other side responsible for the negative changes. This is known as an individual's willingness to accept compensation for a change. For instance, residents of a village near a landfill may demand compensation from the city waste management company for the fact that it worsens the quality of soil, water, and air for them by dumping urban waste near their village. This process of revealing individuals' preferences in order to value goods is important in the context of forest ecosystems, where there are other values apart from the goods (for example, timber and non-timber products) that can be sold on a market in exchange for money. Such values can include biodiversity, carbon sequestration, and intangible ecosystem services (Andersen & Gomes, 1997).

Money is the purchasing power and the unit of value, which people use to transform environmental problems into policy. Money as an indicator allows valuing the benefit and the cost of a certain change to environmental goods and services, such as the expansion of a nature reserve or the preservation of endangered species. By using economic valuation techniques, the researcher can infer the monetary values from real market transactions or, if this is not possible, create a hypothetical market, where individuals can express their

preferences in monetary terms. In this hypothetical market it is then possible to allocate resources in an efficient way in order to achieve higher social benefits (Bräuer, 2003).

Before commissioning an economic valuation study, the relevant methods have to be decided upon, such as the choice between revealed and stated preference techniques and their more concrete methods. These techniques have different conceptual bases, as well as their own advantages and disadvantages, so the choice of one technique over the other is likely to give very different results (Figure 1).
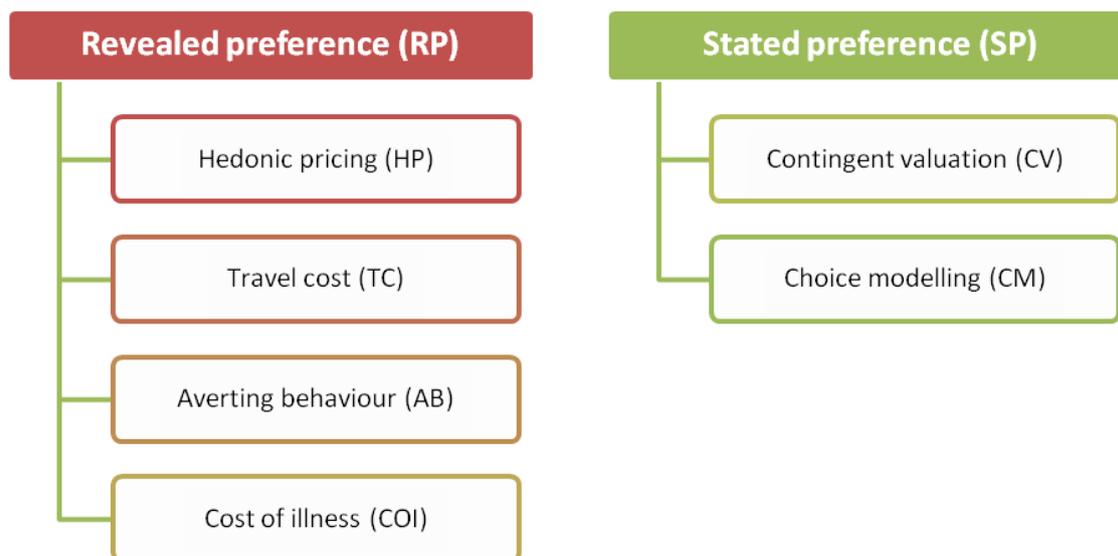
Figure 1. Main categories and different approaches of economic valuation studies.
Source: Adapted from Pearce et al., 2002, and UN, 2014.

The revealed preference (RP) technique is based on real-life observations of behaviour and choices of individuals in existing markets related to environmental goods and ecosystem services being evaluated. Its main advantage is that the valuation data come from real observations and experiences on the real markets. The disadvantages of the RP approach, however, include the need for quality data on market transactions, inability to valuate non-use values and intangible benefits of ecosystem services, and high costs and time needed for its successful implementation (UN, 2014). The RP technique includes such methods as:

- Hedonic pricing (HP), where the consumers' value for environmental goods can be elicited from the fact that these goods are part of the characteristics bundle of some market goods or bads, where price is clearly observable (most common examples here are market prices for property in a housing market and salary determinants in a labour market that are affected by various characteristics, including environmental ones);

- Travel cost (TC), where the value for environmental goods is obtained from the complementary market goods and costs, specifically from the fact that people need to spend money on travelling and accessing a specific site in order to benefit from the environmental goods;

- Averting behaviour (AB), or defensive expenditures, where the value sought is estimated from people's choices and purchases of market goods in order to avoid negative intangible impacts due to decreasing physical quality of environmental goods.

- Cost of illness (COI), where the target value is elicited through consumers' expenditures on health services and medical products made in response to morbidity and other health effects of non-market impacts.

The stated preference (SP) technique is based on interviews and surveys asking respondents for their WTP / WTA for an environmental good or offering them to choose different scenarios of provisioning the good, and these choices help the researcher to infer the respondents' WTP / WTA. This is the only economic valuation technique to elicit non-use values (described in the next chapter) and benefits of environmental goods, which cannot be uncovered using the RP technique (Pearce et al., 2006).

The purpose of the SP technique is to create hypothetical scenarios of changes in the provision of ecosystem services to elicit people's behaviour and choices in a constructed market (Bateman, 2002). The results of the economic valuation study through SP surveys offer different possibilities for future projects, policies, and governmental actions related to environment. The use of the SP methodology goes beyond standard economic tools, and therefore always causes heated debates between its proponents and critics (Carson, 2000).

There are several SP methods that the researcher can use in economic valuation study:

- Contingent valuation (CV), where respondents are directly asked for their WTP / WTA for a change in the provision of the environmental goods, or they are offered to choose between "bundles" of attributes of these goods, thus indicating their WTP / WTA values.

- Choice modelling (CM), where respondents are asked to choose their most preferred scenario of provisioning the environmental goods from a choice set of different scenarios, one of which is the "do nothing" / status quo / baseline scenario that represents the current situation. The respondents' WTP / WTA is then estimated from their choices in each choice sets presented to them in the interview or survey.

Definition of Choice Modelling

It has been mentioned before that the SP technique is a way of revealing WTP / WTA of individuals through constructing hypothetical markets in order to evaluate the economic efficiency of a certain project or policy that can affect the provisioning of certain environmental goods. Choice modelling (CM), also known as Conjoint analysis and Conjoint choice analysis, is one of the SP methods designed for the valuation of non-use benefits of non-market goods. It is based on the idea that any good can be defined according to a range of distinctive characteristics (attributes) that can be represented in a variety of levels. This is basically the concept of the Lancaster's consumer theory, which states that goods are defined by their attributes and the levels that these attributes take, so a good in itself does not give utility to a person – the attributes and their levels do (Lancaster, 1966).

Changing the levels of attributes of a good will give the provision of a somewhat different "good", and CM technique focuses on determining the value of these changes (Pearce et al., 2002). So, in a CM survey an individual is asked to choose between various scenarios with goods that have certain changes in their attribute levels, to rank or rate them based on personal preference, or to choose between one scenario, the other one, and the "do nothing" / status quo / baseline alternative (UN, 2014). Inclusion of a payment vehicle attribute (visitor price, increase in local tax, voluntary donation, etc.) in the survey, which represents the measure of wellbeing of the respondents, enables estimation of WTP for each attribute of the good.

In relation to policy-making, CM is a valuable method to use, as it can point out what characteristics of a project or policy are significant based on people's values for the changes in provisioning the non-market environmental good they can potentially bring. The method can also indicate the level of preference or level of acceptance of these characteristics among the relevant population. Furthermore, CM can reveal the value of altering more than one of these characteristics at once. Last but not least, it describes the **Total Economic Value (TEV)** of an environmental good, which represents an all-encompassing measure of the economic value of that good (Figure 2).
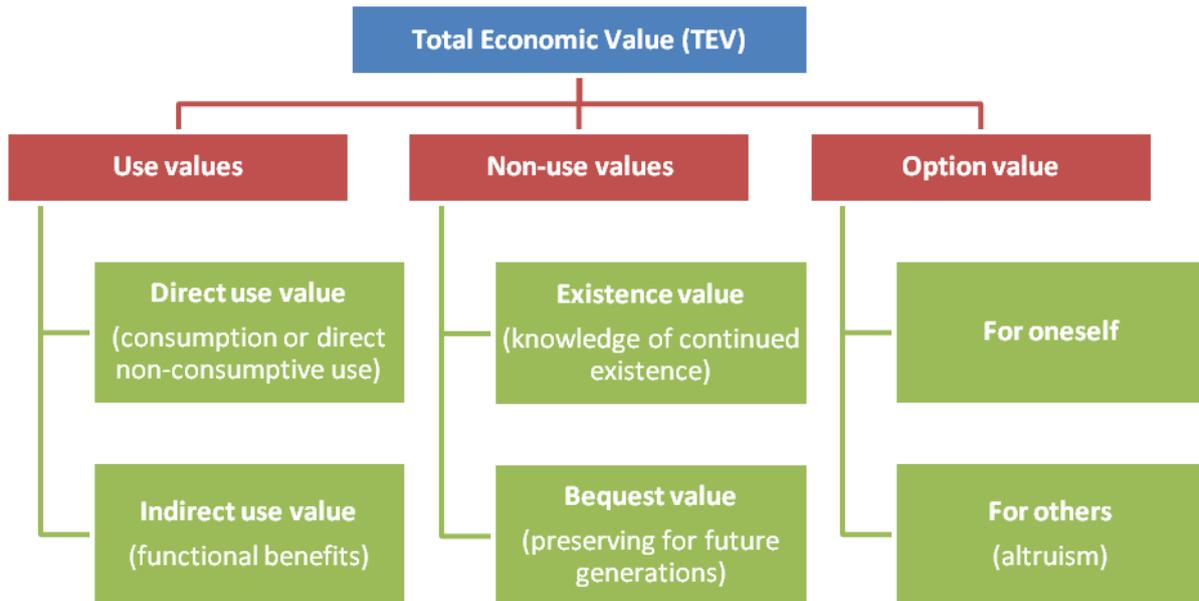
Figure 2. The Total Economic Value (TEV) framework for valuation of ecosystem services.
Source: Adapted from Ledoux & Turner 2002, Chee et al. 2004, Saunders et al. 2010, and UN 2014.

Using economic valuation methodology in general and the CM method in particular to measure individuals' preferences can give an estimate on how much certain environmental attributes and ecosystem services, for example, in a forest, are worth to these individuals and the entire society. In order to know the overall gain or loss from forest conservation and development projects, the two forms of aggregation are necessary. The first one presumes the aggregation of all individuals' preferences, and the second one is the aggregation of their values over time. This means that TEV can be found by the net sum of all relevant WTPs / WTAs of any change of wellbeing due to the change of an environmental attribute, e.g. forest development through reforestation efforts.

TEV is comprised of use and non-use (or passive use) values of an environmental good, as well as option value of caring for that good, but not using it at all. Use values are values, which can be consumed either directly or indirectly. For example, use values for a standing forest could include stem from timber harvesting, non-timber products like nuts and fruits, recreation and tourism, and genetic material that can be utilized in medical research and products (Andersen & Gomez, 1997). These are examples of values that people have from actually using the forest. Non-use values refer to benefits of a good that one cannot actually use, but might be willing to pay for in order to ensure the provision now and in the future, or because one feels that it might be a loss that needs to be avoided. For instance, non-use

values of the forest include carbon sequestration, biodiversity and wildlife, scenic landscape, historical and/or cultural significance, etc. that are present now and should be also present for future generations.

CM is able to estimate both use and non-use values. It elicits WTP / WTA for different attributes of a non-market environmental good, as well as its benefit or loss. To do this there is a variety of CM specific methods to choose from: Choice Experiments (CE), Contingent Ranking (CR), Contingent Rating (CRT), and Paired Comparisons (PC) (Pearce et al., 2002). The focus of this guidebook is only on the CE method for estimating WTP for changes in ecosystem services and biodiversity conservation, because it was chosen for the Codru Quest study as the one closely linked to the economic theory, where the welfare economics can be applied, and therefore the one providing estimates consistent with it (Table 1).

Table 1. Main Choice Modelling methods and their consistency with welfare economics.

#	Methods	Respondent's Task	Consistency of Estimates
1	**Choice Experiments**	Choose between status quo and two or more alternative scenarios	Yes
2	**Contingent Ranking**	Rank a series of alternative scenarios	Depends on the options
3	**Contingent Rating**	Score alternative scenarios on a certain scale (for ex. from 1 to 10)	Doubtful
4	**Paired Comparisons**	Score pairs of scenarios on similar scale	Doubtful

Source: Adapted from Pearce et al., 2002.

CE is a survey-based method, where a respondent faces two or more alternative compositions (scenarios) regarding the quality and/or provisioning of the target environmental good, and he/she should choose the most preferred alternative from this choice set. Besides alternative scenarios, the respondent can select the status quo alternative. Its inclusion in the choice set is required to obtain welfare-consistent estimates in the end, but it is not always relevant to include it.

The respondent continues to choose the most preferred alternative repeatedly through a series of choice sets, which usually contain 4 – 8 choice sets per respondent. In such way he/she states his/her preferences and WTP for the target environmental good and its attributes.

Certainly, like any other method, CE has its advantages and disadvantages:

- Advantages: CE can be treated as a binary discrete choice of Contingent Valuation (CV). A binary choice CV study cannot value characteristics of the change. The CE is better used in measuring the marginal value of changes in the characteristics of environmental goods. It can reduce the multi-collinearity problems and can help avoid difficulties such as dichotomous choice designs in CV (yea-saying, strategic behaviour, and moral satisfaction problems). Last but not least, CE gives welfare-consistent estimates in accordance with the economic theory.

- Disadvantages: The welfare value estimates obtained by CE are very sensitive to study design, attributes and their levels, and framing of the valuation scenario. Choice complexity can be a cognitive problem to respondents. It is also more difficult for CE to derive values for a sequence of elements. Finally, it is not yet clear whether the value of the total environmental change is really equal to the sum of the value of the individual environmental attributes (assumption of an additive utility function).

Therefore before preparing and commencing the CE study, the researcher should carefully weigh the advantages and disadvantages of the CE method, compare them to other methods, check what is the environmental good and the changes to it that should be valued, what values are necessary to be estimated, etc., and only them make the final decision on which method to use. In the Codru Quest the researchers chose the CE method not only for its clear consistency with the economic theory, but also because it allowed them to estimate the values of such non-market attributes of the Codru Nature Reserve and the Codru forest as biodiversity of its flora and fauna and conservation of two of the symbolic endangered species, the plant small-flowered black hawthorn (*Crataegus pentagyna*) and the insect stag beetle (*Lucanus cervus*).

Preparation of Choice Modelling Study

A typical CM study has a specific work process that is recommended to be followed in order to conduct the study in an effective and cost-efficient way and deliver valid and reliable results (Figure 3).

Prepa-ration
- Initial research and determination of purpose and scope of the study
- Choice of economic valuation method and survey approach
- Preparation of the detailed budget and action plan of the study

Phase I
- Determination of target population and representative sample
- Design and testing of the pilot survey
- Analysis of first respondents' feedback and preliminary data

Phase II
- Improvement of the survey on the basis of feedback received
- Determination of the full population sample
- Release of the improved survey and econometric analysis of the data

Phase III
- Testing of the results on validity and reliability
- Aggregation from the representative sample results to the target propulation
- Preparation of the report and its presentation to stakeholders

Figure 3. Work process of a standard CM study with its key phases and steps to be taken. Source: Adapted from Pearce et al., 2002.

The process can have slight variations in the names and number of phases and steps in each phase. Still, the "backbone" of the process should be followed, as any major deviation from it may compromise the validity and reliability of the study and its results.

The budget of a single CM study can be quite substantial and therefore should be considered beforehand. A thorough and reliable study usually has the budget of about 20 000 – 30 000 EUR (Pearce et al., 2002). The Codru Quest was done with the budget of about 8 000 EUR, which was sufficient for the CM study on the population sample size of 201 respondents (with the costs of about 10 EUR per face-to-face interview with one respondent) and in the developing country of Moldova, where prices and costs are lower

than in a developed one. To meet the milestones and the deadline of the Codru Quest study, part of the surveying and data collection process were outsourced to a marketing research company, while the rest of the work was done by the researchers and interviewers within the organization MEGA. This was reflected in the budget as external and internal costs, and these costs were planned beforehand. Nevertheless, the budget of 8 000 EUR for the Codru Quest study was very tight and imposed certain limitations on the work process that ultimately affected its results.

Before initiating a CM study, the researcher should clearly define its purpose and scope. On the basis of these essential components he/she can then construct realistic and trustworthy valuation scenarios with meaningful choice sets.

In the case of the Codru Quest, the purpose of conducting the CM study was to understand people's attitudes towards ecosystem services and biodiversity conservation in the Codru Nature Reserve and the Codru forest and valuation of benefits coming from this protected area and forest when they are better managed and expanded through reforestation and biodiversity conservation activities. The researchers assumed that having these objective economic input and knowledge it would be possible to use it for educating citizens and local communities about the importance and benefits of such non-market environmental goods, suggesting for environmental NGOs to use them in their own educational and raising awareness initiatives, and presenting to the Codru Nature Reserve administration, the Ministry of Environment of Moldova, and other decision makers for lobbying the inclusion of economic values of ecosystem services and biodiversity conservation in cost-benefit analysis, land use planning, and environmental policy making affecting the Codru Nature Reserve and the Codru forest. It was envisioned that through these stakeholders using the Codru Quest results it would be possible to engage more people into nature conservation in the study area, improve PA management strategies, and design and implement more effective environmental policies. All this would help reduce or ideally eliminate the major anthropogenic threats that the Codru Nature Reserve and the Codru forest face nowadays, leading to better quality and provisioning of their ecosystem services (Figure 4).

The researchers also intended to use the Codru Quest study and its results to lay scientific foundation for the first Payments for Ecosystem Services (PES) scheme in Moldova to preserve and improve ecosystem services and biodiversity in the Codru forest. This would help establish collaborative governance of the forest that will include participation of both Codru Nature Reserve administration and local communities of the villages around it and would secure sustainable management of the forest ecosystem and its natural resources.
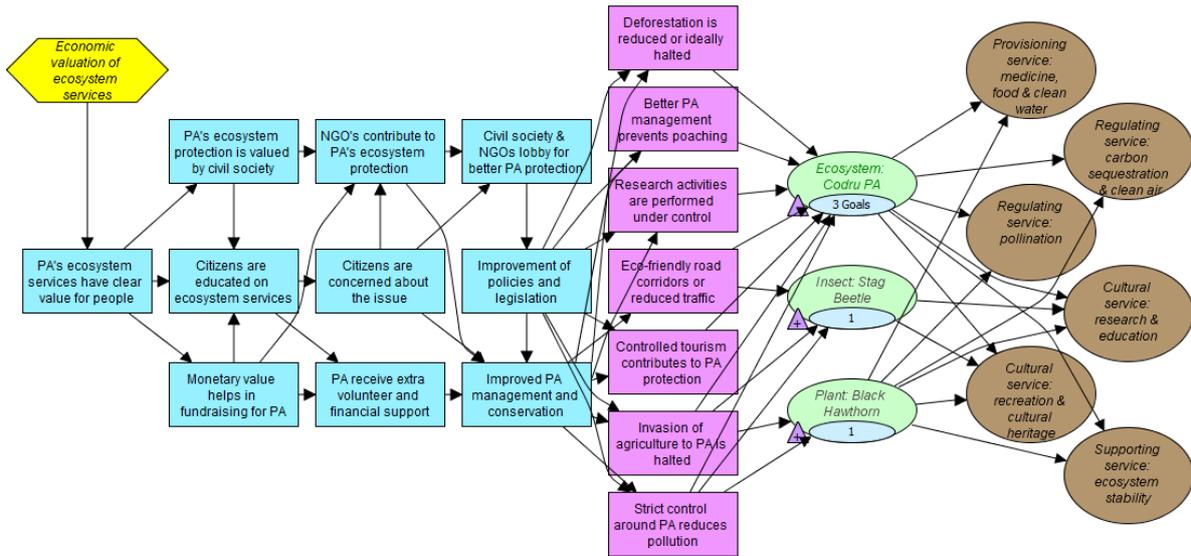
Figure 4. Miradi results chain showing the assumed influence (yellow) of the Codru Quest project on the short-term outputs (light blue) and long-term positive impact (purple) on the Codru forest ecosystem services (brown). Source: Iscenco, 2017.

While preparing a CM study, especially if the CE method is chosen for it, the researcher should think about a series of different scenarios with changing levels of attributes of an environmental good in question. These series of alternative scenarios should be compared to a baseline alternative of non-change (status quo). Every alternative scenario should have certain monetary value represented by the payment vehicle (such as visitor price, increase in local tax, voluntary donation, or any other suitable one), which should also be considered and chosen by the researcher. The concrete description of the alternative scenarios, their attributes, levels, and the payment vehicle selected are then written during the survey design stage in the first phase of the CM work process.

In the Codru Quest study the alternative scenarios with their attributes were related to the non-use values of the Codru forest and included changes in the territory of the protected area, the number of species of plants and insects under protection, the abundance of certain vulnerable and endangered species (specifically *Crataegus pentagyna* and *Lucanus cervus*), and the price of visit to the Codru Nature Reserve and the Codru forest. The baseline scenario was also included and described the current state of all the attributes of the target environmental good and the forest as it is. All these were designed by the researchers during Phase I of the Codru Quest study (Figure 5).
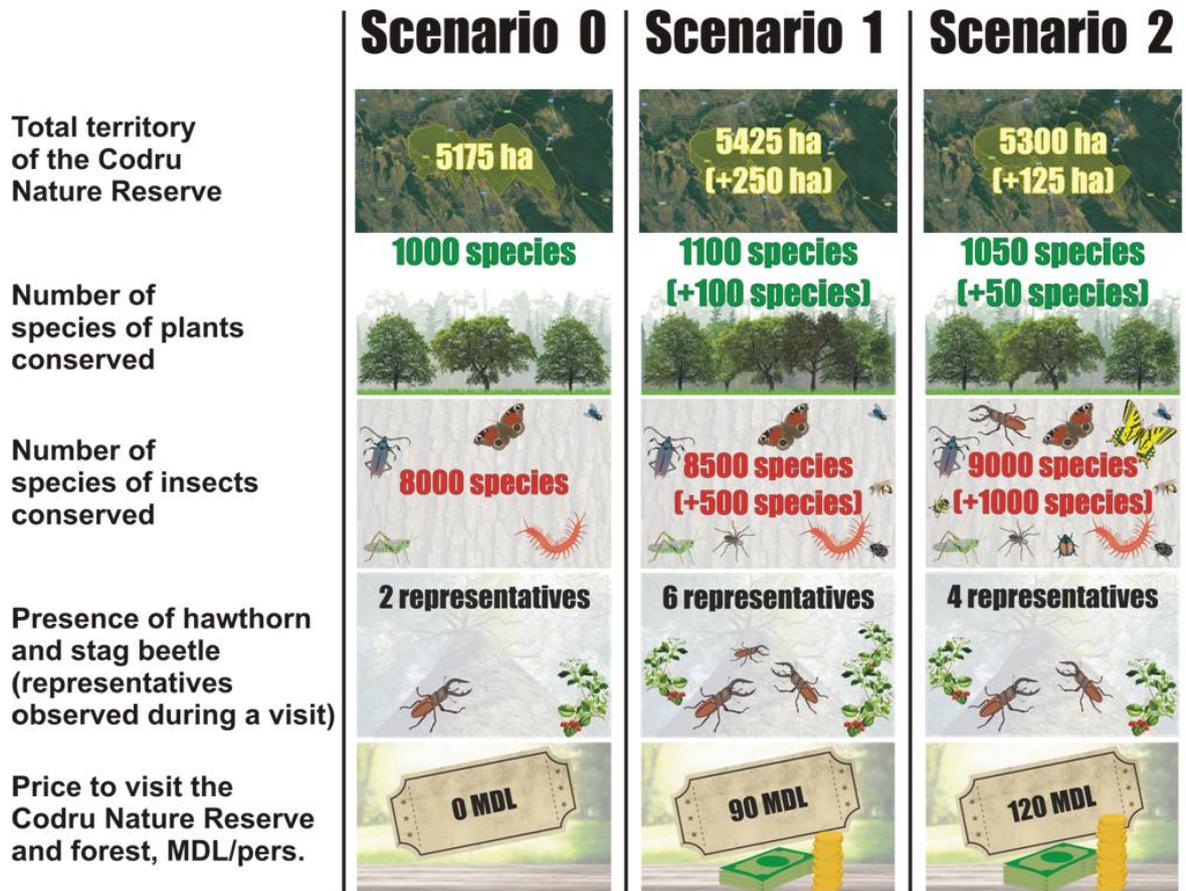
Figure 5. Example of choice set from the Codru Quest survey with status quo and alternative scenarios, each with changing attribute levels. Source: MEGA, 2017b.

When preparing the CM study, the researcher should also have a clear understanding of the CE method gives welfare-consistent estimations and hence why it is a valid method for the study. The main reason is that such method can guide the respondents to opt for between the changes in attribute levels and the costs of making these changes. The researcher can use econometric techniques in a way that are in accordance with the theory of probabilistic choice and can derive WTP / WTA estimates from the respondents' answers to a CE survey.

The application of the CE method in an economic valuation study can be split into three phases, as it was done in the Codru Quest. Next comes the detailed description of each of these phases with their steps and concrete examples from the Codru Quest for each step.

Phase I: Pilot Survey and Preliminary Data Analysis

Before diving into the full-scale CM study and releasing the main survey to the respondents in the target population sample, the researcher needs to determine this sample, prepare a pilot version of the CM survey, and test it with a small group of respondents. This will result in preliminary data and valuable feedback received from this group of respondents that the researcher can use to identify and correct possible biases and generally improve the CM survey to get more realistic, valid, and trustworthy results. This is what the first phase of the study is about, and the researcher should not underestimate its importance.

1.1. Determine Target Population

Determining the right target population is the first critical step of the CM study, as failure to do it correctly might lead to biased results and undermine the credibility of the entire study. In order to find the right population, the researcher needs to consider different stakeholder groups, specifically who will receive the benefit from the change in the target environmental good (gainers) and who might lose due to the change (losers). For example, in relation to the Codru forest, the scenario with better and more restrictive biodiversity conservation measures the gainers can be visitors, tourists, and local community enjoying improved recreation value of the forest, while the losers can be timber companies and loggers, who will have fewer opportunities to cut trees and sell timber from it.

While choosing the right population the researcher should also be careful to avoid population choice bias, which may lead to unreliable WTP / WTA estimates. He/she should focus on avoiding or minimizing as much as possible two forms of bias (Pearce et al., 2002):

- Sampling error, when the sample chosen is not representative of the entire population;

- Non-response error, when a number of people in the sample do not respond to the survey for various reasons.

Minimization of these errors is possible through careful analysis of the target good and the forms of its value that are of interest among the stakeholders. The information of the good, the values, and the stakeholders can be obtained from various sources, such as environmental organizations, ministries, protected area management, local tourism

agencies, and others. The researcher can then decide what sample of population can be affected by changes in the provision of the target good, what is at stake for them in relation to these changes, and what might be the reasons of protesting to answer the survey questions.

In the Codru Quest survey the target population was all the urban and rural direct and indirect users of the Codru Nature Reserve and the Codru forest, who included Moldovan citizens aged 18+ and living close to the Codru Nature Reserve and the Codru forest and/or having easy access to it. These were the residents of the capital city Chisinau and 9 villages located in close proximity to the Codru forest: Lozova, Stejareni, Capriana, Micleuseni, Huzun (Straseni region); Horodca, Bursuc, Dragusenii Noi (Hincesti region), and Condrita (Municipality of Chisinau region). In the first phase of the study only residents of Chisinau were interviewed to save the costs and efforts. However, in the second phase all the targeted locations were included in the surveying process.

1.2. Calculate Population Random Sample

When the target population is defined, the next step is to identify the sample frame population, from which the sample will be drawn. This should represent the closest approximation of the target population (Pearce et al., 2002). Examples can be all the households with a personal computer within a city, all owners of cars in a particular region, all tourists visiting a certain protected area. In the case of the Codru Quest the sample frame population represented the urban and rural direct users, who actually visit the Codru Nature Reserve and the Codru forest or had visited them previously.

From the sample frame the researcher should calculate the population random sample by using probabilistic designs. It is recommended to use probability sampling, as only this approach satisfies the statistical theory requirements for deriving the properties of sample estimators. In turn this helps the researcher to minimize the sample selection bias and to construct confidence intervals for the population parameters using the data of the sample (Pearce et al., 2002).

There are different types of probability sampling the researcher can use depending on the specifics of the target population and the aims of the study: simple random, systematic, stratified, and clustered multi-stage sampling. In the Codru Quest study the simple random sampling, where every element of the sample frame is given an equal chance to be chosen, was used mostly due to its simplicity.

To calculate the population random sample the researcher can use a simple equation (1), which can be applied to every sample size. For it to work he/she needs to know the following:

a. Population size (for example, the total population of a city or village);

b. Margin of error (confidence interval);

c. Confidence level;

d. Standard deviation.

$$\text{sample size} = \frac{(z\text{-}score)^2 * p\,(1-p)}{(margin\ error)^2} \tag{1}$$

where *z-score* – standard score representing converted confidence level and *p* – population size.

Z-scores are easily computable by using z tables (University of Florida, 2017) or on-line z-score calculators (Z Score Table, 2017).

Then the researcher needs to adjust the sample size to the size of the total population by using the equation (2).

$$\text{sample size (adjusted)} = \frac{\text{sample size}}{1 + (\text{sample size} - 1)\,/\,\text{population size}} \tag{2}$$

For example, we know the population size of 100 000 and take 5% error margin and 95% confidence interval. For the 95% confidence interval the z-score is 1.96. Thus, by applying the equations (1) and (2), we get (3).

$$\text{sample size} = \frac{(1.96)^2 * 0.5\,(1-0.5)}{(0.05)^2} = \frac{3.8416 * 0.25}{0.0025} = \frac{0.9604}{0.0025} = 384.16 \tag{3}$$

Now there is a need to adjust the sample according to the size of the target population, which is 100 000. In the end we have (4).

$$\text{sample size (adjusted)} = \frac{384.16}{1 + (384.16 - 1)\,/\,100\,000} = \frac{384.16}{1.0038316} = 382.69 \tag{4}$$

As a result, the sample size of population size of 100 000 with 5% margin of error and 95% confidence interval is 382.

For calculating the population random sample you can also use the on-line tools available for free, such as the Sample Size Calculator by Creative Research Systems (2012). It is easy to use and has the options to change confidence levels (95% or 99%), determine sample size, and find confidence interval by the sample size.

In the Codru Quest study design we used the equations (1) and (2) and the Sample Size Calculator mentioned above to determine the population random sample size. The total population size consisting of residents of Chisinau and the 8 targeted villages was approximately 500 000. The random sample size resulted from the calculations was 384. In Phase I the team conducted surveying of 100 respondents. In Phase II due to time and budget constraints it was planned to interview only 200 respondents. This relatively small sample size was a necessary trade-off in relation to the quality and precision of the final result of the study. The researchers tried to compensate it to a certain extent by eliciting more information from each respondent. However, this tactic usually meets some statistical concern, and therefore is not always recommended. Further studies capitalizing on the Codru Quest methodology and results should attempt to cover larger population sample size.

1.3. Decide upon Surveying Method

Another important aspect to consider at the beginning of a CM study is the way to approach the respondents for testing the pilot survey design and its questions. It can take place in the form of face-to-face interviews with filling in a paper-based survey, computer-assisted personal interviews (CAPI), telephone interviews, mail surveys, on-line surveys, or combinations of them. The choice of the surveying method is usually related to the time and the budget the researcher has.

In the Codru Quest study the Phase I survey was conducted entirely on-line by sending the link to the publicly accessible survey (https://goo.gl/forms/kQyFZDlZmuL7TdUc2) to the first respondents, posting it on the blog of the organization MEGA and articles on mass-media, and sharing it via social networks. This allowed the team to collect first WTP data and feedback in an inexpensive and cost-efficient way. However, in Phase II a combination of two methods was used: on-line surveying for residents of the capital city Chisinau, and CAPI for the 8 target villages near the Codru forest. To make it happen in a limited time the second method was outsourced to a marketing research company.

1.4. Design Pilot Survey

After deciding on the target population, determining the population random sample size, as well as the way how to approach it, the researcher can start preparing the first design of the CM survey. The design and structure of the survey play a very important role in a CM study, as they bring data collected from the target population sample to use in estimating WTP / WTA. Badly designed survey can elicit information that is biased, inaccurate, useless, and at a greater cost. Therefore the researcher should try to prepare such a survey that is correctly and easily understood by respondents and that encourages them to answer its questions in a considered and truthful manner.

The aim of the CM survey is thus to elicit individual preferences for any change of non-market environmental good and display them in monetary terms. In order to make sure that the elicitation of these results emerging from a CM survey are valid, its design must satisfy three conditions (Pearce et al., 2002):

1. The non-market good and the change(s) to it are carefully defined;

2. The valuation scenario has a plausible means of payment (payment vehicle);

3. There is a credible trade-off mechanism between consumption of private goods and the target non-market good.

The way to satisfy these conditions is to have a well-presented and explained valuation scenario with options for respondents to choose from, each based on a specific payment vehicle, and additional questions to check how well the respondents understood the scenario and options and made the trade-offs. All this should be wrapped in a logical and respondent-friendly survey design and structure, which usually includes 5 key elements: introduction with purpose of the study, pre-valuation questions (about respondents' attitude and use of the good), valuation scenario with value elicitation questions, follow-up questions, and socio-demographic and economic characteristics (Figure 6).

Such structure is standard for any type of economic valuation survey. The differences are only in the valuation scenario section with its WTP / WTA elicitation questions, and they depend on the value elicitation technique chosen. For example, in the CE survey the valuation scenario is adapted to the format of choice sets with different options to be chosen by the respondents.

Introduction and Purpose

- Introduction of the researchers and the organization doing the study
- Explanation of the study and its purpose
- Statement about confidentiality of the respondents' answers

Pre-valuation Questions

- Questions about basic demographical characteristics of the respondents
- Questions about the respondents' attitude to the target good and issues concerning it
- Questions about the respondents' use of the target good to separate users from non-users

Valuation Scenario

- Presentation and explanation of the target good and the change(s) in its provision
- Definition of the payment vehicle chosen for the study
- Explanation of substitute goods, budget constraints, and money versus benefits trade-off
- Value elicitation questions, which depend on the chosen WTP/WTA elicitation method

Follow-up Questions

- Questions about the respondents' motives and reasoning behind their answers
- Questions about free-riding and protest bids to separate valid from non-valid answers
- Questions about the credibility of the valuation scenario and the respondents' interest in it

Socio-economic Characteristics

- Questions about the respondents' social background
- Questions about the respondents' and their households' income to check whether they can afford paying for the change(s) chosen and whether WTP/WTA varies with income

Figure 6. Standard structure of an economic valuation survey.
Source: Adapted from Pearce et al., 2002.

Before starting to formulate pilot survey questions, it is crucial for the researcher to have a clear idea of what policy change needs to be valued, which non-market good is planned to be changed, and what type of change(s) it is going to be (quantitative or qualitative). These should be briefly reflected in the introduction to the survey, which "sets the scene" for the respondents answering it and gives them the explanation of why the whole study is being done in the first place. The introduction of the researcher in this section should also give a "human face" to the survey, even if it is conducted without direct interaction with the interviewer (through post mail or on-line), as this can establish the relationship of trust and

commitment among respondents. Mentioning of an incentive reward for completing the entire survey in the introduction is also recommended.

> Example from the Codru Quest survey:
>
> We are researchers from the Moldovan Environmental Governance Academy (MEGA; www.megageneration.com). We are interested in nature conservation and its relation to people's well-being in Moldova.
>
> We are conducting this survey in order to understand people's attitudes to and valuation of benefits coming from the Codru Nature Reserve and the Codru forest when they are better protected, developed, and expanded through reforestation and biodiversity conservation activities.
>
> Your answers are going to be treated as confidential and will not be disclosed to anyone without your permission.

When the researcher has the vision of the target environmental good, the change(s) to it, and the introduction with the purpose of the study, he/she can start designing the pilot survey. According to Bateman (2002), there are three stages of designing a CM survey: defining the problem and drafting the valuation scenario, formulating and adding questions, and calculating and introducing choice sets.

Stage 1: Define the Problem and Draft the Valuation Scenario

Understanding the problem that the CM study addresses makes it easier for the researcher to formulate the questions for the survey. Topics that should be taken into account are the policy change that is being valued, the valuation scenario, and monetary values. The valuation scenario has a role to prepare respondents for the upcoming economic valuation questions / choice sets. It should include the description of the policy which will be altered by the project, the method of payment (payment vehicle), and the market. These should be clearly described in the survey, so that while reading the valuation scenario a respondent, can understand what it is all about, visualize the situation in his/her mind, and believe it to be realistic (Table 2). Only then the respondent will provide valid and credible answers to the questions of the survey. Poorly defined valuation scenario with unclear description of its key elements has the risk of bringing meaningless and useless answers from the respondents.

Table 2. Example of core elements and their description in the valuation scenario of the Codru Quest.

Core Elements of Valuation Scenario	Sections of the Codru Quest Valuation Scenario that Describe its Core Elements
Place	The Codru Nature Reserve, a nationally protected area that covers approximately 5175 ha of the Codru forest located in the Straseni, Hincesti, and Ialoveni regions. It consists of 720 ha of strictly protected zone that can be accessed only for official research and nature conservation activities and 4455 ha of buffer zone, where visitors are allowed under the permission of the Codru Nature Reserve's administration.
Status Quo	Access to the buffer zone and excursions in the Codru forest are free. Only visits to the Museum of Nature situated in the administration building near the forest have a cost of 20 MDL for adults, 10 MDL for students, and 100 MDL for a guided walk. The Codru Nature Reserve has about 1000 species of protected plants, representing half of Moldova's flora, and approximately 8000 species of insects and other invertebrates. Some of these species are symbolic to Moldova, such as the plant small-flowered black hawthorn (Crataegus pentagyna) and the insect stag beetle (Lucanus cervus).
Change	In the coming years, the Ministry of Environment of Moldova, Moldsilva, and the Codru Nature Reserve administration are going to work together to develop a new plan to further protect and develop the forest and its biodiversity, as well as the benefits they provide to local communities. The territory of the Codru Nature Reserve might be enlarged by annexing additional forest areas near the Capriana village, as well as through reforestation. The territory of the strictly protected area, where the natural forest is protected but no visitors are allowed, might also be enlarged.
Method of Payment	In order to cover the costs of implementing the new Plan, a visitor price to attend the buffer zone of the Codru Nature Reserve and enjoy the Codru forest will be introduced.
Market	You will have to pay a certain price every time you decide to visit this place. Remember to imagine that depending on your choice the accessible buffer zone in the Codru Nature Reserve, the Codru forest and nearby territories that you can visit and use will be affected. You can also choose the current state of the forest with no price (Scenario 0 in all questions), which means that the new Plan will not be introduced, and things remain the same as they are now.

In the Codru Quest case, the valuation scenario included the following components:

- Place, which introduced the study area and location, where changes to the target environmental good described further are taking place.

- Status quo, or baseline scenario, which described the current real situation at the place, when no change has been introduced. Here the attributes of the environmental good were introduced and the baseline levels for every attribute were set.

- Change that included the explanation of what changes in the supply and quality of attributes of the target environmental good are envisioned to be introduced. The "problem" of the Codru Nature Reserve and the Codru Forest was to improve the quality of ecosystem services and biodiversity through enlargement of the protected area of the Reserve, reforestation activities, and increased efforts in biodiversity conservation.

- Method of payment that allowed the researcher to estimate the value of the changes;

- Market: for good quality of the survey and the respondent's answers to its questions, it is important to provide additional information about the valuation scenario, such as the institution that is responsible for change, the technical and political feasibility, the time frame (when the project will take place), and who will have to pay for the change.

Stage 2: Formulate and Add Questions

At this stage the researcher should include additional introductory and follow-up questions, which are questions in order to understand the reasoning behind respondent's choices of scenarios and their WTP / WTA, as well as possible issues that might influence their preferences and magnitude of WTP / WTA. Moreover, these questions serve the role of gathering information not only about the monetary values but also about attitudes, opinions, and experience of respondents in relation to a particular good. Demographics and socio-economic conditions of the respondents is another topic that should be taken under consideration in formulating additional questions.

Thus, there are different types of questions that can be included in a CM survey in order to collect additional relevant data from the respondents (Table 3):

- Demographics;

- Attitudinal questions;

- Use of the good / behavioural questions;

- Choice follow-up questions;

- Socio-economic characteristics;

- Contact information.

Table 3. Types of additional questions that can be included in a CM survey and their examples from the Codru Quest survey.

Types of Additional Questions	Categories in the Codru Quest survey	Examples of Specific Types of Questions from the Codru Quest Survey
Demographics	Your Introduction	• What year were you born in? • Where do you live? • Are you involved in an environmental organization (as a member / activist / volunteer / supporter)?
Attitudinal questions	Your Attitude	• How would you characterize your own interest in nature and environment protection in general? • What is your attitude towards … ?
Use of the good	Your Experience	• How often have you visited a forest in the last 12 months? • What activities did you do the last time you visited the forest? • How far do you live from the Codru Nature Reserve and the Codru forest?
Choice follow-up questions	Your Reasoning	• Do you think your willingness to pay would have been different, if instead of paying a visitor price to the Codru Nature Reserve you had been asked to pay an increased local tax that would be directed to protecting biodiversity in the Codru forest and increasing the territory of the Codru Nature Reserve? • To what extent did the specific characteristics influence you choices between the alternative scenarios? • Did you choose the "Scenario 0" in all the questions? If yes, why?
Socio-economic characteristics	Your Background	• What is your personal gross income per month? • What is your household gross income per month?
Contact information	Your Contact Info	• Your name, surname, telephone number, e-mail? • Would you like to receive the results of "The Codru Quest" research when they are ready?

Order of these types of questions is optional. However, while designing the survey, the researcher needs to pay attention to cognitive workload on a respondent.

It is recommended to start the CM survey with relatively easy questions that the respondent can answer quickly and immediately get into the "flow" of completing the survey. These can be either demographical (date of birth, age, sex, etc.) or attitudinal (attitude towards environment in general and target environmental good in particular) questions. Then the researcher can shift to the questions about the respondent's use of the target good. This will allow the respondent to remember his/her experience with the good and prepare him/her for the valuation scenario and choice sets that follow.

The valuation scenario and the choice sets require the highest cognitive workload for the respondent while completing the CM survey. This is why the section with them is usually placed in the middle of the survey, where the respondent is already in the "flow" of completing it, but is not yet tired.

The follow-up, socio-economic, and contact information questions are added to the end of the survey. They should be relatively short and simple to answer, so that the respondent can rest after the challenging decision-making in the choice sets and quickly finalize the remaining part of the survey. Basically, the K.I.S.S. rule, recommending to "Keep It Short and Simple", is applicable to any question of the survey, if possible.

Demographics

Demographic questions are those related to the socio-demographic background of a respondent. They usually include questions about age, gender, marital status, residency, education, and employment. Other personal characteristics such as nationality and health state can also be included if they are relevant to the problem and valuation scenario of the survey. Researchers use these questions in order to examine the representativeness of the target population sample size among the survey respondents (Pearce et al., 2002).

> Example from the Codru Quest survey:
>
> **Have you visited the Codru Nature Reserve and the Codru forest in the last two years?**
>
> Yes …………………………………….. ❏
>
> No ………………………………………… ❏
>
> Don't know ……………………………. ❏

Socio-economic Characteristics

Often questions about socio-economic status of the respondent, specifically about his/her income (or its surrogate measure), are included in the section of Demographics. In other cases these questions can be separate, as demographical questions are easy to answer and can be put at the beginning of the CM survey, while questions about income are of a very personal nature and should be hidden at the end of the survey in order not to scare the respondent off.

The information gathered from socio-economic questions is used to verify whether the WTP answers conform to theoretical expectations (in other words, whether WTP varies with the respondents' income) (Pearce et al., 2002).

Example from the Codru Quest survey:

What is your personal gross income per month?

Less than 1000 MDL …………..❑   5000 – 6999 MDL ……………….....❑
1000 – 2999 MDL ……………...❑   7000 – 8999 MDL ……………….....❑
3000 – 4999 MDL ……………...❑   9000 MDL or more …………………❑
Don't know / Don't want to answer ………………………………………….❑

Attitudinal Questions

It is important to include some questions that gather data on the participant's attitudes, thoughts, or feelings about the problem of the CM study, general issues concerning the target environmental good, and then about the good in question (Pearce et al., 2002).

With this type of questions the researcher is able to collect and interpret the survey results better. In addition, they help the participant to gradually get involved into completing the survey, as well as to prompt him/her to consider personal preferences for the change. Last but not least, the importance of attitudinal questions lies in the fact that they offer valuable qualitative and quantitative information for the validation of further monetary valuations.

Example from the Codru Quest survey:

What is your attitude towards:

	Very positive	Positive	Neutral	Negative	Very negative	Don't know
Existing Nature Reserves with forests in Moldova?	❑	❑	❑	❑	❑	❑
Expansion of existing Nature Reserves and forests in Moldova?	❑	❑	❑	❑	❑	❑
Establishment of new Nature Reserves with forests in Moldova?	❑	❑	❑	❑	❑	❑

In the Codru Quest survey the attitudinal questions included the ones about the respondents' interest in nature and environment protection and their attitude towards the Nature Reserves in Moldova: their current states, possibility of expansion of existing ones, and possibility of establishing new ones.

Use of the Good

After the attitudinal questions a CM survey usually includes the questions asking the respondent about his/her current use of the target environmental good. The aim here is to determine what use the respondent makes of the environmental good with the purpose to test his/her familiarity with it and to distinguish users from non-users (Pearce et al., 2002).

In the Codru Quest survey these questions included inquiries about the frequency and duration of visits to a forest, activities done while being there the last time, distance of the respondents' place of residence from the Codru forest, as well as availability of another forest (substitute good) closer than the Codru forest.

> **Example from the Codru Quest survey:**
>
> **How much time did you spend on your last visit to the forest?**
>
> Less than 1 hour ………………❑   3 – 5 hours …………………………….. ❑
>
> 1 - 2 hours ………………………❑   More than 5 hours …………………..❑
>
> Don't know ……………………... ❑

Follow-up Questions

The follow-up questions are introduced after presenting the valuation scenario and offering the choice sets to the respondent. Their purpose is to validate the responses collected and identify possible protesters and strategic bidders. There are two types of follow-up questions that the researcher should include: the ones verifying the validity of the respondents' answers and the ones testing the credibility of the valuation scenario.

In the first case it is important to add questions which indicate why the respondent was or was not willing to pay for or to accept compensation the change. The reason behind it is for the researcher to be able to identify answers that are not related to the respondent's welfare change, basically invalid answers. These questions are most useful for the pilot testing phase of the study and for the cases where one can expect some form of protest or unwillingness to pay (or to accept compensation) for the target good. A protest may reveal itself as an unwillingness to give any answer to the questions at all. But zero valuations are not necessarily protests: individuals may genuinely not be willing to pay anything for the good. Nevertheless, certain zero bids may conceal protest motives (Pearce et al., 2002).

In the Codru Quest survey the follow-up questions included the questions on the reasons of both willingness to pay for the target environmental good (whether the respondent chose Scenario 1 or Scenario 2 in at least one of the choice sets and why) and unwillingness to pay for it (whether he/she chose Scenario 0 in all choice sets). These questions had lists of possible answers for the respondents to select, where certain answers indicated valid responses, while others suggested invalid ones (free-riding or protesting). This helped the researchers in selecting only the valid responses while doing the data analysis during both Phase I and II of the study (Table 4).

Table 4. Follow-up questions on the validity of the respondents' answers in the Codru Quest survey.

Attribute	Valid answer (V) or protest / bias (X)
Possible reasons for willingness to pay	
I am very interested in the Codru Nature Reserve and the Codru forest	V
I believe we should protect the Codru forest ecosystem for the plants and animals mentioned in the survey	V
I believe the improvements will be beneficial for me and my family	V
I am interested in the benefits the improvements might bring to other people and communities	V
I consider that nature in Moldova must be preserved for future generations	V
I generally want to contribute to nature conservation in Moldova	V
I am willing to support the improvements no matter the cost	X
I would like to preserve and improve all forests in Moldova, not just Codru	X
I feel happy and satisfied to support a good and noble cause	X
I believe that I will not really have to pay any extra price for the improvements	X
I feel like I was expected or morally obliged to do so in this survey	X
Possible reasons for unwillingness to pay	
The other scenarios were too expensive for such cause	V
I cannot afford to pay such large sums, as were given in other scenarios	V
I already pay enough when I visit the Codru Nature Reserve and forest	V
Nature and forests are not a priority for me	V
I am not interested in the Codru Nature Reserve and forest	V
I have another forest nearby that I visit	V
The Ministry of Environment / the Codru Nature Reserve administration / the Government should finance this development, not citizens	X
I do not believe that the improvements in the Codru Nature Reserve and the Codru forest can be achieved through the increase in visitor prices	X
The questions were too difficult for me to answer	X

Source: Adapted from Pearce et al., 2002.

The second type of follow-up questions is those which show respondent's point of view on the scenario description. They are used to test the credibility of the valuation scenario. Such questions might ask about the respondent's interest in the target good and about the

perceived credibility of the institution that is hypothetically responsible for providing the environmental good (Pearce et al., 2002).

Example from the Codru Quest survey:

To what extent were your choices between the alternative scenarios based on the following considerations?

	None	Little	Some	Very much	Don't know
Scenario's influence on plants and animals in the Codru forest	❑	❑	❑	❑	❑
Scenario's influence on the recreational opportunities in the Codru forest	❑	❑	❑	❑	❑
Scenario's influence on the well-being of communities living near the Codru forest	❑	❑	❑	❑	❑
Scenario's influence on my personal use of the Codru forest	❑	❑	❑	❑	❑

Sometimes questions asking for the respondent's name, telephone number, and/or e-mail may be included after the follow-up questions. These have the purpose to get the contact information about the respondents willing to share them to have the possibility of contacting them for a follow-up interview at a later point. They can also be used for organizing the incentive lottery among the respondents and sending the rewards to its lucky winner(s). This is what was done in the Codru Quest survey, where the final section was about participation in the lottery for a cash prize and points to exchange for a physical prize in a virtual shop.

Stage 3: Calculate and Introduce Choice Sets

The centerpoint of any CM survey is the valuation scenario and the related value elicitation questions (choice sets) that allow a respondent to express his/her willingness to exchange goods (or impacts) for money. Here it is very important to elicit either the maximum WTP or the minimum WTA from each respondent in order for the answers to be consistent with the underlying theory of economic valuation. Simple WTP / WTA values are not satisfactory enough for this requirement (Pearce et al., 2002). Also carefully and properly designed value

elicitation questions will lead to successful realization of the study, while the improperly prepared ones have the risks of bringing the researcher incorrect and useless data.

As it was mentioned earlier, the CM technique is able to estimate and interpret both use and non-use values of an environmental good. Due to this advantage the CE method, which is part of the CM technique, was used in the Codru Quest study. This method allows the researcher to apply the theory of welfare economics to the analysis of the WTP / WTA data, as well as to interpret these data according to the theory.

The CE method, like all the other ones related to the CM technique, is based on the understanding that an environmental good can be described as a whole that can be split into certain characteristics (attributes) and the levels that theses take (Pearce et al., 2002). For example, in the Codru Quest study the Codru Nature Reserve and the Codru forest where it is situated were split into such attributes as the total area under protection, number of species of plants and insects under protection, presence of symbolic endangered species, and the price to pay for enjoying these environmental goods. Changing levels of these attributes hypothetically produced different "goods", such as larger Codru forest with better biodiversity conservation and thus better recreational experience. It is on the value of such changes in attributes that the CE method focuses (Pearce et al., 2002).

In the CE method the choice sets include a baseline scenario equivalent to the status quo and several alternative scenarios in which there are certain quantitative changes in the specified attributes. The status quo represents the "no-change" of the good, and the respondent choosing this scenario basically supports the "do nothing" option. In the Codru Quest the Scenario 0 represented the status quo, which was compared to two other scenarios in every choice set (Figure 5).

The typical process of calculating and constructing choice sets for a CE survey has a series of steps the researcher should do:

1. Select the attributes of the target good, including the payment vehicle;

2. Assign levels to every attribute selected;

3. Choose and apply statistical design theory;

4. Combine scenarios calculated with the help of statistical design into choice sets;

5. Review the choice sets and do the first testing of them.

The researcher initiates the construction of choice sets by selecting the attributes, defining their levels, and determining the baseline scenario. The selection of attributes and their

levels is usually done through research on the target environmental good, literature reviews, focus group discussions, and/or direct questioning of the owners / beneficiaries of that good. This is needed to ensure that the selected attributes are relevant for people's preferences and decision-making purposes, provide realistic and adequate description of the target good, and are described in consistent, intelligible, and credible manner.

In the Codru Quest study the process of determining the necessary attributes of the Codru Nature Reserve and the Codru forest included the following activities (Photo 2):

- Several expeditions to the Codru Nature Reserve and the Codru forest;

- Research at the Museum of Nature in the Codru Nature Reserve;

- Workshops and discussions with the first project participants during and after the expeditions to the Codru forest;

- Consultations with the professional guide working at the Codru Nature Reserve.

Photo 2. Expedition to the Codru forest and consultation with Dragos Voda, the guide from the Codru Nature Reserve. Source: Alexandr Iscenco, 2016.

The inputs and data obtained from these steps were then evaluated and introduced into the valuation scenario and status quo. Initially there were 10 attributes identified:

1. Total territory of the Codru Nature Reserve;

2. Territory of strictly protected area of the Reserve with untouched nature;

3. Number of species of plants conserved;

4. Number of species of insects conserved;

5. Presence of symbolic endangered species: small-flowered black hawthorn (*Crataegus pentagyna*) and stag beetle (Lucanus cervus);

6. Share of research and recreation activities in total use of the Codru forest;

7. Expansion of the Museum of Nature at the Reserve;

8. Availability of guided tours through the Codru forest;

9. Presence and development of recreation infrastructure (trails, signs, etc.);

10. Price to visit the Codru Nature Reserve and the Codru forest.

The number of attributes was then limited to 5. Although there is no general rule on the number of attributes, the recommended range is from 3 to 8, while 5 or 6 is a "golden middle" number allowing respondents to handle them. More attributes are likely to result in complex survey design that imposes increased cognitive workload on the respondent, necessity for more complex decision-making, and more fatigue (Figure 7).
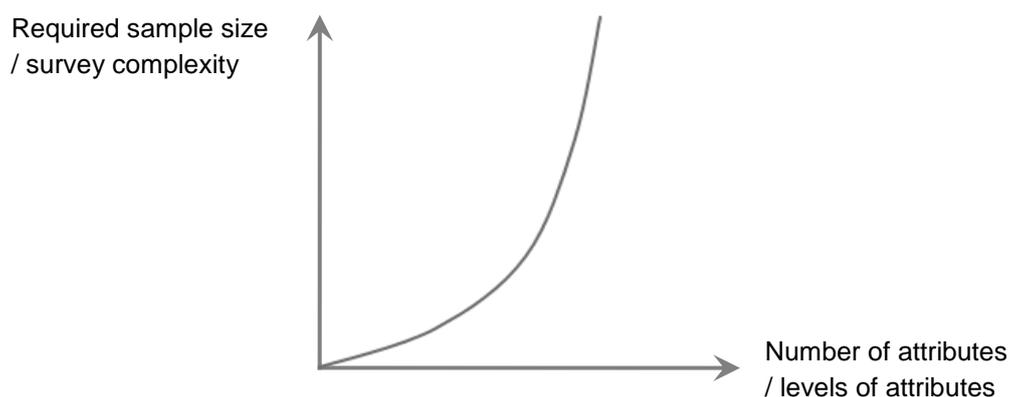
Figure 7. Relation between the number of attributes with their levels and complexity of a CM survey.

An attribute that must be included in choice sets is the payment vehicle. This is a monetary attribute that represents the cost of provisioning the target environmental good and allows estimation of WTP / WTA. It can be in the form of mandatory (income tax, specific local tax, visitor fee, price increase, etc.) or voluntary (donations) payment. In the Codru Quest survey the visitor fee for the Codru Nature Reserve and the Codru forest was chosen, as the most realistic, credible and familiar payment mechanism for the target respondents.

Ideally, the researcher should choose such a payment vehicle that meets all four fundamental characteristics at minimum (Fausto and de Kruiff, 2017):

- Bindiness – this is when the respondents are constrained to pay with having minimum possibility to free-ride;

- Familiarity – this is when the respondents are familiar with that specific method of payment and understand it easily;

- Credibility – this is when the respondents believe in the chosen method of payment and trust that it brings the changes described in the valuation scenario;

- Realism – this is when the respondents clearly see how the chosen payment vehicle can actually influence the changes and make their chosen scenarios come true.

Certainly, every choice of the payment vehicle has its advantages and drawbacks. It is therefore up to the researcher to choose the payment vehicle that is most suitable and appropriate to the aims of the CM study, the specifics of the country and region where it is being conducted, and the characteristics of the target population. Nevertheless, it is recommended to include in the follow-up section of the survey a question on the perception of the payment vehicle chosen. This is especially important at the pilot phase of the CM study, because the respondents' answers to this question can help the researcher decide on the most suitable, familiar, credible, and realistic payment vehicle.

For instance, in the Codru Quest survey there was a question whether the respondent's WTP would have been different, if instead of the visitor fee the choice sets had the payment vehicle in the form of an obligatory local tax. During the preliminary data analysis the respondents' answers to this question helped the researchers to dig out a number of issues related to choosing a proper payment vehicle in the setting of a developing country with high corruption level and low trust in governmental institutions, such as the Republic of Moldova.

Example from the Codru Quest survey:

Do you think your willingness to pay would have been different, if instead of paying a visitor price to the Codru Nature Reserve you had been asked to pay an increased local tax that would be directed to protecting biodiversity in the Codru forest and increasing the territory of the Codru Nature Reserve?

Yes, it would have been significantly higher ……………………………………… ❑

Yes, it would have been somewhat higher ……………………………………… ❑

Yes, it would have been somewhat lower ……………………………………… ❑

Yes, it would have been significantly lower …………………………………….. ❑

No, it would remain the same …………………………………………………….. ❑

Don't know …………………………………………………………………………….. ❑

The levels set for the payment vehicle should be comprehensive and include the entire relevant bid range: from zero or almost-zero to the choke price / cost. These levels should also be aligned with the levels of other attributes chosen.

After the researcher has decided upon the final set of attributes and their levels, the next step is to combine them into different choice sets that will be presented to the respondent and limit the number of these choice sets to a necessary minimum (usually 5 – 7). This can be done by applying the fractional factorial design approach, which is a statistical experimental design consisting of a carefully chosen subset (fraction) of a full factorial design or experiment. While full factorial design brings the entire set of possible alternatives together with all their interaction effects, fractional factorial design narrows it down to a certain subset and removes the redundancy of excess number of interactions.

In the Codru Quest study the choice of attributes was limited to 5 with 4 of them having 3 levels and one (payment vehicle) having 5 levels (Table 5).

If the researcher introduces all possible combinations of these 5 attributes and their levels, he/she ends up with 3x3x3x3x5 = 405 alternatives for choice sets. This represents the full factorial design, which is certainly unpractical for any kind of survey.

To make it easier and bearable for the respondent to select scenarios in the choice sets and complete the survey the researcher can use the fractional factorial design to narrow down the number of alternative choice sets. From one side, this helps him/her to deal with the

necessary amount of data. From the other side, a survey with 5 – 6 choice sets is more attractive and understandable to the respondent.

Table 5. Final attributes and their levels in the Codru Quest study.

#	Attribute	Number of Levels	Values of Levels
1	Total territory of the Codru Nature Reserve, ha	3	5175; 5300; 5425
2	Number of species of plants conserved	3	1000; 1050; 1100
3	Number of species of insects conserved	3	8000; 8500; 9000
4	Presence of symbolic species: small-flowered black hawthorn and stag beetle (representatives observed during a visit)	3	2; 4; 6
5	Price to visit the Codru Nature Reserve and the Codru forest, MDL	5	0; 30; 60; 90; 120

In order to apply the fractional factorial design, the researcher should compile a table with 9 alternatives, for example, and different variables, where each variable has zero correlation with any of the others. This condition is called orthogonality. The alternatives will thus become choice sets, and the variables in them – levels of different attributes (Table 6).

Table 6. Example of a fractional factorial design with the orthogonality condition satisfied.

Alternatives	Variable 1	Variable 2	Variable 3	Variable 4	Variable 5
1	1	1	1	1	1
2	1	2	2	3	2
3	1	3	3	2	3
4	2	1	2	2	1
5	2	2	3	1	2
6	2	3	1	3	3
7	3	1	3	3	1
8	3	2	1	2	2
9	3	3	2	1	3

After satisfying the orthogonality condition in all the alternatives, the most common method to continue further with designing the choice sets is to try to find differences between the alternatives. The researcher should minimize overlapping of alternatives and their variables while constructing the survey. At the same time he/she should verify whether specific alternatives are realistic and do not contain "always best" scenarios with the highest benefits

and lowest payment. Finally, the researcher should balance the necessary number of choice sets with the level of their complexity and familiarity of their contents to respondents. For instance, for simple and easily understandable target good with its attributes it is possible to leave 6 – 8 choice sets in the survey design. However, when the good in question and its attributes are rather complex and not quite familiar to respondents, then the amount of choice sets should be limited to 3 – 5 (Figure 8).
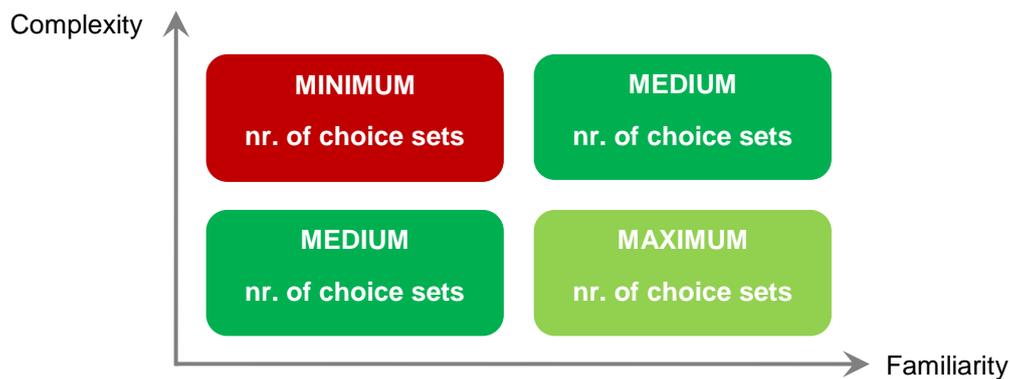
Figure 8. Relation between the number of choice sets and their complexity/familiarity in a CM survey.

To get the choice sets design right, it is recommended to use the efficient designs approach with minimization of the variance-covariance matrix elements. It allows minimization of the standard errors of parameter estimates while maximizing the *t*-ratios of the survey design model. To implement the efficient designs approach the researcher should review the latest scientific literature on how to design a CE survey, because it is always a challenge of trying to find the optimal way of doing this. He/she can then prepare the choice set design manually or use readily available software, such as SAS or the AlgDesign package in R.

In the Codru Quest study there were 8 choice sets, among which 2 were excluded as being not realistic. Thus, 6 final choice sets remained and were included in the survey (Table 7).

Table 7. All choice sets of the Codru Quest study, including the ones that were excluded from the survey design (indicated in red).

#	Attributes	Scenario 0	Scenario 1	Scenario 2
1	Total territory of the Codru Nature Reserve, ha	5175	5425	5300
	Number of species of plants conserved	1000	1100	1050
	Number of species of insects conserved	8000	8500	9000
	Presence of symbolic species	2	6	4

www.megageneration.com

	Visitor price, MDL	0	90	120
2	Total territory of the Codru Nature Reserve, ha	5175	5300	5300
	Number of species of plants conserved	1000	1050	1050
	Number of species of insects conserved	8000	9000	9000
	Presence of symbolic species	2	4	6
	Visitor price, MDL	0	60	30
3	Total territory of the Codru Nature Reserve, ha	5175	5425	5425
	Number of species of plants conserved	1000	1050	1100
	Number of species of insects conserved	8000	8500	9000
	Presence of symbolic species	2	6	6
	Visitor price, MDL	0	30	90
4	Total territory of the Codru Nature Reserve, ha	5175	5300	5425
	Number of species of plants conserved	1000	1100	1100
	Number of species of insects conserved	8000	8500	8500
	Presence of symbolic species	2	6	6
	Visitor price, MDL	0	90	120
5	Total territory of the Codru Nature Reserve, ha	5175	5300	5300
	Number of species of plants conserved	1000	1050	1100
	Number of species of insects conserved	8000	8500	8500
	Presence of symbolic species	2	6	6
	Visitor price, MDL	0	90	30
6	Total territory of the Codru Nature Reserve, ha	5175	5300	5300
	Number of species of plants conserved	1000	1100	1100
	Number of species of insects conserved	8000	9000	8500
	Presence of symbolic species	2	4	6
	Visitor price, MDL	0	30	60
7	Total territory of the Codru Nature Reserve, ha	5175	5425	5300
	Number of species of plants conserved	1000	1100	1100
	Number of species of insects conserved	8000	8500	9000
	Presence of symbolic species	2	4	6
	Visitor price, MDL	0	90	60
8	Total territory of the Codru Nature Reserve, ha	5175	5425	5300
	Number of species of plants conserved	1000	1050	1100
	Number of species of insects conserved	8000	9000	8500
	Presence of symbolic species	2	4	4
	Visitor price, MDL	0	60	120

In addition, it is a good practice to include a question on the respondent's confidence in his/her choice of a particular scenario after each choice set. In such way the researcher receives additional data on how understandable the choice sets were for the respondent and how confident he/she was in making decisions in each set. This is especially important in the pilot phase of the study, as high uncertainty levels of choice sets indicated by the first respondents may point to design issues that should be addressed before starting the next research phase.

> Example from the Codru Quest survey:
>
> **How certain are you in your choice of the scenario above?**
>
> Very uncertain …………………❑   Certain ………………………………. ❑
>
> Uncertain ……………………….. ❑   Very certain …………………………❑
>
> Neither certain nor uncertain … ❑   Don't know ……………………..   ❑

At the end of this stage, the overall structure of the survey and the way the questions are formulated and ordered should be reviewed, as these could have important impact on the quality of the obtained data. Moreover, the design of the choice sets and the entire survey should be closely connected to further testing of the survey, as ongoing iteration between the two actions may be needed.

1.5. Test Pilot Survey

It is very important for the researcher to be able to try the prepared survey design on small groups of respondents to check whether he/she gets the desired results, and then to be able to immediately use the feedback collected from these first respondents to improve the survey design (Pearce et al., 2002).

A good way to ensure that the survey design is efficient and brings the necessary data is to test it with a small group of respondents, who are open to doing it and sharing their feedback on the survey. This allows the researcher to identify and fix possible problems in the survey design, including potential biases that might affect the target respondents' WTP / WTA values. These biases, if not accounted for and corrected, can undermine the credibility of the main survey results. Identifying and correcting all problems and biases is exactly what the first phase of the study is all about (Table 8).

Table 8. Some possible biases in a CM study.

#	Type of bias	Nature of bias	Effect on WTP (tWTP = "true" WTP)
1	Hypothetical	Valuation scenario and changes described are not consistent with the reality.	WTP ≠ tWTP
2	Classic free-rider	Respondent believes that the payment of his/her WTP will be collected only from him/her.	WTP < tWTP
3	Strategic free-rider	Respondent believes that the payment will be collected only from other people.	WTP > tWTP
4	Starting point	Respondent's WTP is anchored on initial values in the first choice set	WTP = initial value ≠ tWTP
5	Framing effect	Respondent's WTP depends on how questions are framed.	WTP varies with question frame
6	Improper payment vehicle	Respondent's WTP depends on the way the payment vehicle was chosen and how the good will be financed with it.	WTP for the good should be invariant with the payment vehicle
7	Embedding	Respondent's WTP does not vary with the changes in the quantity of the good provided.	WTP reflects satisfaction of paying for the good (warm glow)
8	Yea-saying	Respondent tries to please the researcher or interviewer.	WTP > tWTP
9	Nay-saying	Respondent tries to counter the researcher or interviewer.	WTP < tWTP
10	Protesting	Respondent refuses to answer the questions or gives extremely high WTP or untrue zero WTP.	No WTP WTP ≠ tWTP

Source: Adapted from Pearce et al., 2002.

Survey design testing can be done in different ways: with focus groups, one-to-one interviews, verbal protocols, and pilot surveys. Depending on the budget and time availability the researcher can choose to apply one or several of these ways.

Focus groups is a very useful survey design testing method that should be used early in the design process, as they may bring rather unexpected findings and inputs. They usually consist of 6 – 12 participants and are organized as an unstructured discussion conducted by a moderator to bring qualitative inputs from all contributors. The discussion usually lasts for about an hour. Longer working time of focus groups can be tiring for the respondents and therefore less productive. Also, if more than 12 people are present, the discussion can be

split into smaller groups of participants working in parallel. These people should ideally represent the sub-samples of population relevant for the study, but it is not required for them to form the random sample of the population (Pearce et al., 2002). The outputs of every focus group should be carefully documented, revised by the researcher, and then implemented in the survey design.

In one-to-one interviews selected participants are asked to answer the questions of the test survey and then immediately give feedback on its design. In such way it is easier to pinpoint the problems and correct them at once on the basis of individual feedback. This also eliminates possible dominance of other people, which might be the case in focus group discussions.

Verbal protocols approach in the form of personal discussions is useful at the early stage of structuring the survey, because this method elicits early feedback, ideas, and thoughts of the respondents in relation to the survey design and its valuation scenario. A problem that might occur here is that participants could have many thoughts that they do not wish to pronounce, thus the researcher does not get all the necessary feedback.

Last but not least, pilot surveys are draft versions of the intended survey design that can be used to send to a small sample of target population, which will participate in the final survey. This sample varies from about 25 to 100 depending on the full population sample size, the complexity of the survey design, and the budget of the study. If possible, the pilot survey respondents should be debriefed beforehand and asked to provide comprehensive feedback on the survey design afterwards. This is like a final "rehearsal" before the main "performance"; pilot surveys give the researcher the final feedback and suggestions on improving the survey before releasing it to the target population. If necessary, several pilot surveys can be released, and several iterations to the survey design can be done on the basis of each pilot release.

Only when the survey has performed satisfactorily in focus groups, interviews, and/or pilot surveys should the researcher commit to the expense of the full survey (Pearce et al., 2002).

In the Codru Quest study, the key questions of the survey were firstly discussed in small focus groups that included the researchers and some representatives of the target population of different age, education level, residence, and other characteristics (Photo 3).

Photo 3. One of the focus group discussions during a training on ecosystem services within the Codru Quest project. Source: Alexandr Iscenco, 2016.

After the focus groups and several consultations with the guide from the Codru Nature Reserve administration, the pilot survey was prepared and released. It is available only in Romanian and can be accessed, viewed, and downloaded from the MEGA account on Issuu (https://issuu.com/megageneration/docs/mega_-_the_codru_quest_-_your_choic_9b17431923484b).

The pilot survey was then sent to a small sample of 100 respondents. These people were found by the researchers mainly through personal contacts, references of colleagues and friends, and partner organizations. The selection of the first respondents did not matter much, as the aim of doing the pilot survey was to gather feedback on improving its design, not on collecting WTP data. Nevertheless, the answers to the questions and the data obtained mattered, because they gave the insight on how each question had performed, how clear the valuation scenario and choice sets had been for the respondents, and what kind of results the researchers can expect from such a survey.

www.megageneration.com

To have the necessary response rate on the pilot survey and in this way to gather the necessary amount of feedback, the researchers introduced an incentive reward to the surveying process. It was in the form of a gamified lottery, where at the end of the process the two lucky respondents selected randomly (via Random.org, 2017, for instance) would receive a prize: one of them would get 300 MDL (approximately 15 EUR) and another one – 300 experience points to spend on tangible reward(-s) in the virtual shop of the organization MEGA (MEGA, 2016). The rewards in the virtual shop were obtained from partner non-profit organizations and private companies that supported the Codru Quest study.

This incentive tactic worked well in stimulating the respondents to complete the pilot survey and getting the desired response rate. Certainly, when all data were collected, the researchers randomly selected the two lucky winners and delivered the incentive reward promised in the survey to them. Relying on the success of the tactic in the pilot survey, the researchers introduced it in the final survey as well.

Example from the Codru Quest survey:

As a reward for completing the survey you will get the chance to win a gift voucher worth 300 MDL or 300 experience points that allow you to order the prizes of your choice available at our MEGA Shop: http://megashop.megageneration.com. The winners of both 300 MDL and 300 XP points are going to be chosen by random selection and contacted personally by e-mail.

The testing of the Codru Quest pilot survey had lasted for approximately 1.5 months. During that time the respondents were approached mainly with the on-line version of the survey through direct e-mail messages and Facebook chat. Only several interviews were done.

In order to allow the first respondents to express their feedback and share ideas on the pilot survey, it had a final question with the text field to write that feedback. Although it was not a required question, the researchers asked the respondents to answer it and give their feedback in an as detailed way as possible. It turned out to be a very good idea, as many respondents provided very valuable insights on their understanding of the survey and the valuation scenario, its complexity and familiarity to them, as well as gave the researchers suggestions on its improvement.

> Example from the Codru Quest survey:
>
> **If you have any comments or feedback for us,
> please use the text field below to write them?**
>
> _____
>
> _____
>
> _____
>
> _____

1.6. Analyze Feedback

When testing of the pilot survey is done, the researcher should shift focus to analysis of the feedback received from the first respondents. There are several parts of the data received that is recommended to be analyzed here:

1. Completeness of data obtained: How much data has been gathered with the current survey design? Are there any gaps of data that the current questions could not obtain from the respondents? What should be added to the survey design, modified, or removed from it to have the complete necessary amount of relevant data for analysis?

2. Perception of valuation scenario and choice sets: How understandable is the description of the issue and changes in the valuation scenario for the respondents? How easy is it for them to express their WTP / WTA by choosing alternative scenarios in the choice sets? Are the respondents able to handle the cognitive workload of the multiple choice sets and complete the survey? What should be added to the valuation scenario and choice sets, modified, or removed from them in order to have complete and reliable WTP data from all the respondents?

3. Suitability of payment vehicle: How well was the payment vehicle chosen for the current survey design? Does it match the four fundamental characteristics (bendiness, familiarity, credibility, and realism) at least at minimum level? How well do the respondents understand and perceive it? Is it likely that the WTP / WTA answers of the respondents will change with the choice of another payment vehicle? If yes, what this other payment vehicle should be?

4. Users versus non-users: How well can the current survey design elicit who of the respondents is a user of the target good and who is a non-user? What should be added or modified in order to improve this ability of the survey design?

5. Valid versus non-valid answers: How well can the current survey design determine who of the respondents gives valid answers, and who of them expresses free-riding or protest behaviour? What should be added or modified in order to improve this ability of the survey design?

6. Overall structure and design of the survey: How well can the respondents deal with the longevity and complexity of the current survey design? Do all of them complete the survey, or are there any drop-outs? Does the respondents' fatigue with the survey influence the quality of answers provided? How can the structure and design be improved in order to gather the necessary information from the respondents without overwhelming them with complexity and duration of the survey?

7. Additional suggestions: What are the additional suggestions and ideas that the first respondents expressed? How do they recommend improving the survey design?

While analyzing feedback, the researcher is able to see possible gaps and flaws of the current survey design and already come up with concrete ways to improve it. There is little probability that one can come with the „ideal" survey design from the first try, so this feedback and several iterations on its basis are necessary. Still, the researcher should be careful in treating the respondents' feedback, as in most cases they do not have knowledge of economic valuation that he/she or other specialists in this domain have. So, when possible, expert advice on the feedback collected should be sought.

In the Codru Quest case there was a lot of useful feedback received from the first respondents. Particularly valuable were the entries in the last field of the pilot survey, where people could express their ideas freely. After analyzing all feedback, the researchers produced the following summary of suggestions and improvements to be used in preparing the main survey for Phase II:

•   Overall opinion of the pilot survey is that it was good, well-thought, and nicely elaborated.

•   The use of images in the questions, especially in choice sets, was well received and appreciated as being a very useful visual support.

- The survey was too long with too many questions. In such way it could become boring to fill it in till the end, and respondents might not take it seriously and provide qualitative responses. A suggestion here was to reformulate the questions differently, so that it would be more motivating and engaging for people to complete them.

- The text describing the case and valuation scenarios was especially too long. A suggestion here was to shorten it and/or replace / supply it with representative images.

- The choice sets and alternative scenarios within them were not understood by several respondents. This could cause the respondents to abandon the survey or provide random answers without thinking about them. A suggestion here was to customize the survey and make it more interactive in such way, that a respondent firstly selects the most important attributes for him / her, and then, on the basis of this selection, he/she receives only three options to choose from.

- There was certain doubt that the calibration of preferences / scenarios had worked, as well as the risk that most people could have contradictory answers due to forgetting to calculate their WTP as relative measure of income. A suggestion here was to consult a behavioural economist and design scenarios and choice sets under his / her guidance.

- The focus on certain species of plants and insects was too narrow. A suggestion here was to introduce the problem of reduced biodiversity and protection of more animal species.

- The choice of entrance fee as a payment vehicle might not have been the best one, as many Moldovan residents don't reach the Codru Nature Reserve and the Codru forest. So, they are unlikely to pay the fee, and their WTP could be not entirely realistic. However, using tax as a payment vehicle might not produce reliable WTP data as well, as people would doubt whether such a tax would be used according to its purpose and not end up in the corrupt officials' pockets. There was also belief that no matter what payment vehicle was used, it would not produce any positive change described in the scenarios, as the Codru forest management agency is corrupt as well. A suggestion here was to have a discussion / consultation with a number of current and potential respondents on the proper payment vehicle to be used in such a survey.

- The sums of entrance fee in scenarios were considered rather high for some respondents. There were also large gaps between the values of different scenario fees. A suggestion here was to adjust them according to the average wages in the country and people's feedback.

- The questions about personal and household income should not be set as required, as they request confidential information that a respondent might not be willing to disclose.

- The question about membership / activism / volunteering in an environmental organization could have been moved to the end of the survey, specifically to the part about respondent's profile and background.

- Certain questions did not offer the respondents to present arguments / express their opinion / share ideas, etc. A suggestion here was to add fields for respondent's comments for such questions.

- Another suggestion was that the survey can be also used to collect opinions and ideas of respondents on how the management and conservation activities in the nature reserves and/or forests can be improved. For this purpose the respective open-ended question(-s) could have been introduced.

- In addition, the survey might serve as a tool to collect people's opinions regarding equality and equity, social inclusion, and policy making within the topic of forest ecosystems and protected areas. Such information could then be used to prepare proposals for environmental projects. A suggestion here was to include additional questions asking respondents' opinions on such aspects of environment protection and management.

- The Romanian version of the survey should be reviewed, as it contained a number of grammar mistakes.

- A suggestion also for the Romanian version of the survey was to use the name of the protected area the Codru Nature Reserve as it is stated in the legislative acts (specifically, the Law #1538 of the Republic of Moldova about state protected areas): "Rezervaţia Ştiinţifică Codru".

- There was hope among the respondents that the hypothetical improvements described in the scenarios become real and that the Codru Quest study finalizes with valuable results that could also be transferred into practice.

The researchers discussed this feedback with a number of specialists in the domain of environmental economics to make sure what parts of feedback are relevant to be implemented in the final survey. But before actually improving the survey design they did an analysis of the preliminary data received from the pilot survey.

1.7. Analyze Preliminary Data

Besides evaluating the first respondents' feedback, it is a very good practice to do the analysis of their socio-demographic and valuation data as well. This helps the researcher answer all the questions related to how well the current survey design elicits the necessary data and additional information from the respondents and how can the design be improved to do this task better. It also allows the researcher to practice doing economic analysis and identify possible gaps in knowledge to be "closed" before doing the analysis of the final data in Phase II.

Generally, the data analysis in a CM study aims to achieve two main objectives:

1. Give estimates of the mean and median WTP / WTA of the respondents surveyed;

2. Give insights on the structure in the WTP / WTA responses to valuation questions in the survey. This helps the researcher explain how differences in the estimates depend on the differences in the socio-economic and attitudinal characteristics of the respondents.

However, before going into the data analysis and starting to estimate the mean and median WTP / WTA values, the information collected from the respondents should be prepared for it.

Prepare and Summarize the Data

If the pilot survey was done entirely on-line, the researcher should already have the respondents' answers documented and structured in an on-line database represented by a spreadsheet or other format. In case there were face-to-face interviews done or the interviewers used other off-line ways to obtain respondents' answers, these answers should be transferred to the database and ordered there according to the questions and respondents. Ideally this database should be made available openly, so that other researchers can verify it and possibly use for their own CM studies.

The respondents' answers in the database can be summarized and visualized in the graphical form. This gives the first insight on the socio-economic and attitudinal characteristics of the population sample surveyed, respondents' level of use of the target good, general preferences in relation to it, etc. With the use of on-line tools, such as Google Forms and Excel features, it is possible to do this quite fast and in a visually representative way. In the Codru Quest study the researchers summarized and visualized the Phase I data in the on-line publication "The Codru Quest: Phase I Results. Second edition" (MEGA, 2017a). However, the researcher should be careful in publishing and sharing the pilot study data, as they might be perceived as final results of the study and thus confuse stakeholders.

Another very important aspect of preparing data for analysis, especially from the valuation questions and choice sets, is formatting it in the right way and compiling a dataset. Each record in the dataset must contain attributes and their levels of each of the alternative scenarios presented to the respondents, as well as a dependent variable indicating which of the scenarios were selected. The particular form of the data in the dataset will depend on the econometric model and the software used for estimating the model (Pearce et al., 2002). For CE data, it is recommended to use the long data format, wherein each scenario represents one line of data. This means that every choice set is split into so many lines, as there are alternative scenarios. For example, in the Codru Quest survey any given respondent gave his/her answers to six choice sets each comprising of three alternative scenarios (Scenario 0 / status quo, Scenario 1, and Scenario 2). This should generate 18 lines of data for every individual respondent. All personal data pertaining to the respondent, including whether the interview was conducted in a village or city, were repeated for all 18 lines corresponding to every respondent (Table 9).

Table 9. Excerpt from the Codru Quest dataset for the first respondent.

Id	ObsID	Choice Set	Scenario	Choice	V_unc	Unc	Nei_nor	Cert	V_cert	?
1	1	1	1	0	1	0	0	0	0	0
1	2	1	2	1	1	0	0	0	0	0
1	3	1	3	0	1	0	0	0	0	0
1	4	2	1	0	1	0	0	0	0	0
1	5	2	2	0	1	0	0	0	0	0
1	6	2	3	1	1	0	0	0	0	0
1	7	3	1	0	1	0	0	0	0	0
1	8	3	2	0	1	0	0	0	0	0
1	9	3	3	1	1	0	0	0	0	0
1	10	4	1	0	1	0	0	0	0	0
1	11	4	2	0	1	0	0	0	0	0
1	12	4	3	1	1	0	0	0	0	0
1	13	5	1	0	1	0	0	0	0	0
1	14	5	2	0	1	0	0	0	0	0
1	15	5	3	1	1	0	0	0	0	0
1	16	6	1	0	1	0	0	0	0	0
1	17	6	2	1	1	0	0	0	0	0
1	18	6	3	0	1	0	0	0	0	0

In the long format dataset, each attribute level should be included as a new dummy variable that is equal to 1 if the attribute is present at that particular level in each alternative scenario and 0 otherwise. This means that an attribute X with three levels 1, 2 and 3 would yield three variables: X_1, X_2 and X_3. Variables should be added as columns. The choice made by each respondent should also be presented as a dummy variable, which means that, within a given choice set, this variable would be equal to 1 for the chosen scenario and 0 for the two others. Only the payment vehicle attribute levels should be left as continuous variables.

It is also important that there should be variables in the dataset identifying the respondent, the choice set, and the particular alternative scenario.

The variable identifying the respondent should start at 1 and increase by 1 with each new respondent. There should therefore be 18 lines with the value 1, 18 lines with the value 2 and so forth until the last respondent.

The variable identifying the choice set should range from 1 to 6 and be the same for each choice set, regardless of the respondent. There should therefore be 3 lines with each integer from 1 to 6 in each 18 lines corresponding to each individual respondent. For each new respondent, the exact same pattern should be repeated so that all identical choice sets are coded with the same number.

The variable identifying the scenarios should range from 1 to 3 and be repeated in ascending order within each choice set. This means that scenarios should be coded according to order and not content. Different scenarios should therefore be coded with the same number if they occupy the same position within the choice set, regardless of attribute levels.

Identify and Remove Non-valid Answers

One more step in preparing data for analysis is to differentiate valid respondents' answers from non-valid ones, and remove the latter from the dataset. Validity of an answer here means its conformity to the economic theory and principles that the study is based on. Generally, non-valid answers are the ones in which the respondents (Pearce et al., 2002):

- Refuse to answer the valuation questions of the survey for any possible reason;

- Act as protesters, who do not give their "true" WTP, but respond with a zero value instead;

- Act as free-riders, who do not give their "true" WTP, but respond with an unrealistically high value instead.

In the Codru Quest study the "protesters" were the respondents, who had chosen Scenario 0 in all choice sets, and this choice had been related to the belief that someone else (Ministry of Environment, Government, etc.) should pay for the good and/or that the respondent refused to understand the survey. The "free-riders" identified were mostly the respondents, who had chosen relatively expensive alternative scenarios that they could not afford and/or they believed that they would not be paying for.

The validity of the respondents' answers can be checked through different sections and questions of the survey. These include:

- Follow-up questions, where the respondents were asked why they had been willing or unwilling to pay for the change(s) in the provision of the target good. In the Codru Quest survey these were the questions asking whether the respondent had chosen Scenario 0 in all choice sets and why, and whether he/she had chosen Scenario 1 or 2 in at least one of the choice sets and why. The validity can then be determined by comparing each respondent's answers to these questions to the possibility of bias in them (Table 4).

- Debriefing questions in the choice sets regarding the respondents' confidence on their answers to the scenarios chosen. Low confidence of the respondent in his/her choices suggests low credibility in his/her "true" WTP values.

- Socio-economic characteristics that include questions about the respondents' and their households' income. If the relatively high WTP values expressed by the respondent in the choice sets exceed his/her ability to pay, this an indicator of a likely free-riding behaviour.

- In case of telephone or face-to-face interviews, notes and debriefing of the interviewers about signs of refusing / protesting / free-riding behaviour of their respondents.

Having these sections and questions in the survey and the answers obtained through them, the researcher can identify and argument non-valid answers. It is recommended to also document how many respondents' answers were marked as non-valid and for what reason to help other researchers in their work with the dataset. For example, in Phase I of the Codru Quest study there were 4 non-valid answers identified mostly on the basis of zero bid protesting behaviour.

The non-valid answers are then removed from the dataset that will be analyzed. This is done because the "true" WTP / WTA of these respondents is not known or biased, and this can influence the result of the study. However, when removing the respondents with non-valid

answers, the researcher should ensure that there is no significant difference in characteristics between the overall surveyed population sample and the reduced one. If this is unavoidable, it is recommended to use weighting procedures to compensate for the lack of representativeness of the reduced sample. Analytical weights are applied to the subsets of observations that are:

- Underrepresented in the population sample. These observations receive an above average weight, which makes their average influence on the data analysis greater.

- Overrepresented in the population sample. These observations receive a below average weight, which makes their average influence on the data analysis weaker.

The weighting procedure implies that the researcher calculates analytical weights by taking the proportion of the population falling into the group affected by the removal of non-valid answers and dividing it by the proportion of the sample falling into that group. If for some reason it is impossible to calculate analytical weights, the researcher should proceed to the data analysis without them and rely on his/her own interpretation and explanation of the study results.

Often a large number of non-valid respondents' answers might reflect certain flaws of the valuation scenario and objections of the respondents to specific aspects of it, such as the payment vehicle choice. A survey result with high share of non-valid answers should therefore be treated with a dose of skepticism. So, at the preliminary data analysis stage the researcher should identify such possible flaws and objections and then modify the survey design and valuation scenario in order to minimize the potential for non-valid answers in the main survey (Pearce et al., 2002).

In the Codru Quest pilot survey there was an insignificant number of non-valid responses identified and removed. However the researchers did change some of the attitudinal and follow-up questions. This was done for them to be able to identify non-valid answers more precisely and deal with them more effectively during the next phase of the study.

Estimate the Mean and Median WTP / WTA Values

The next step in data analysis is the estimation of the two key statistical values: the sample mean WTP / WTA and the sample median WTP / WTA. The mean WTP / WTA represents the average WTP / WTA estimate of the population sample. The median WTP / WTA is the value of WTP / WTA that divides the sample exactly in half, where exactly 50% of the sample have lower WTP / WTA and another 50% have higher WTP / WTA.

Each of these statistical values has different relevance for stakeholders of the study. The mean WTP / WTA estimate is relevant for CBA, where it is necessary to compare costs and benefits for a certain project in relation to the target good (for example, expansion of the territory of the Codru Nature Reserve). The median WTP / WTA estimate is useful in the case of policy making, where there is a need to see when the majority approval for a certain policy in relation to the target good can be achieved.

However, estimating just mean and median WTP / WTA is not enough, as these represent only the mean and median estimates of the entire population based on the specific information in the chosen population sample. A different sample would yield different WTP / WTA values and then result in different estimates of the population's WTP / WTA. Therefore the researcher should include an indication of how accurate are the obtained estimates in the data analysis and results. This is achieved with the construction of the 95% confidence interval (Pearce et al., 2002). The most robust method to do it is through bootstrapping, a technique for constructing confidence intervals for mean and median WTP / WTA that works with any type of data and applicable in practically any data analysis. It is quite difficult to compute, but modern statistical software packages, such as R, can handle its computational burden easily.

In the case of CE survey results, the estimation of mean and median WTP / WTA with confidence intervals is done with the help of an econometric model that describes discrete choice behaviour of the respondents. The model is based upon Random Utility Theory (RUT), which seeks to describe respondents' choices and utility gains behind them. It relies on the assumption that a rational respondent selects the scenario from each choice set, which offers him/her the maximum expected utility. This utility depends on the attributes and their levels of the target good provided by that particular scenario and the cost / price incurred by the respondent in order to receive it (Pearce et al., 2002). Such relationship can be represented by equation (5), which is assumed to be linear in parameters for convenience.

$$U_{ij} = \beta_1 \ (attribute\ 1) + \beta_2 \ (attribute\ 2) + \beta_3 \ (attribute\ 3) + \ldots + \beta_n \ (price) \qquad (5)$$

where U_{ij} – utility of individual i from alternative j and β – indicator of specific preferences of individual i.

The researcher formulates the econometric model by specifying an indirect utility function, which connects the attributes, their levels, and costs / prices to the level of expected utility

for each respondent. This is done to determine how the respondents had made their choices among alternative scenarios through the parameters of the indirect utility function.

Due to the fact that there can be other reasons for the respondent to choose a particular scenario besides attribute levels and costs, the researcher should include a random element (error) to the indirect utility function, thus transforming it into Random Utility Model (RUM). In such way he/she accounts for the difference between the true utility of the respondent from a scenario chosen and the utility that is modelled. The random / error element in RUM captures a series of elements, such as missing attributes, unobserved preference variations, measurement errors, and other. But now, with the random / error element included in RUM, the data analysis becomes probabilistic instead of deterministic. Here the probability that the respondent prefers a certain scenario to any other alternative scenario can be expressed as the probability that the utility associated with that scenario exceeds that associated with all other scenarios (Pearce et al., 2002).

RUM with the random / error element included can be represented by the equation (6).

$$U_{ij} = V(x_{ij}\,S_{ij}\,\beta) + \varepsilon(x_{ij}\,S_{ij}) = V_{ij} + \varepsilon_{ij} \tag{6}$$

where V – function of attributes of alternative j, x – set of attributes, S – socio-economic characteristics of individual i, β – set of unknown parameters, and ε – random / error term.

Based on (6) it is possible to describe the probability of observing the choice of alternative j in comparison to alternative k, This probability depends on differences in the attribute levels and error terms across alternatives, as it is seen in (7).

$$P(j\,|\,C_i) = Pr(V_{ij} + \varepsilon_{ij} \geq V_{ik} + \varepsilon_{ik}) = (\varepsilon_{ij} - \varepsilon_{ik} \geq V_{ik} - V_{ij}) = (\varepsilon_{ik} - \varepsilon_{ij} \leq V_{ij} - V_{ik}) \tag{7}$$

While formulating RUM, the researcher needs to decide upon its functional form and the probability distribution of the error terms (and consequently the distribution of the difference between them, $\varepsilon_{ik} - \varepsilon_{ij}$), as these elements are unobserved. In terms of the form, it is recommended to go for the simplest option, such as a simple linear combination of attributes and costs. In terms of the probability distribution of the error terms, the researcher needs to do a bit more thinking about it.

After doing previous steps of preparing the data and removing the non-valid answers, the researcher has a dataset with the valid respondents' answers and their WTP / WTA values

in the form of dummy variables, indicating that the respondents are choosing among "option A" (Scenario 1), "option B" (Scenario 2), or "no change" (Scenario 0). In such case estimation of mean and median WTP / WTA and inclusion of the error term through linear regression models cannot be done, because this type of data does not provide suitable dependent variable to regress against the independent variables. For this reason, logistic (Gumbel) distribution and logit (logistic probability unit) models are usually used for the analysis of CE data. They are often preferred for such kind of data analysis, because these models approximate normal distribution of the error term quite well and are quite convenient analytically mainly due to the fact that the integral for the probability has a closed form. For example, in the conditional logit model most suitable for CE study with more than two alternative scenarios the probability of choosing alternative j looks as in equation (8).

$$P (U_{ij} > U_{ik}) = \frac{exp (\mu \, V_{ij})}{\Sigma \, exp (\mu \, V_{ik})} \tag{8}$$

where μ – scale parameter, which is generally assumed to be 1 for convenience.

However, logit models come with some limitations. One of them is that the standard conditional logit model with more than two alternatives depends upon the hypothesis of independence of irrelevant alternatives (IIA), also known as binary independence or the independence axiom. IIA indicates that the relative probabilities of two alternatives are independent of the introduction or removal of other alternatives, and therefore their choice will not be affected by these changes. This can be represented by the equation (9), which shows that the relative probability of alternatives j and k depends only on the utility of j and k.

$$\frac{P_{ij}}{P_{ik}} = \frac{e^{Vij} / \Sigma \, e^{Vij}}{e^{Vik} / \Sigma \, e^{Vij}} = \frac{e^{Vij}}{e^{Vik}} = e^{Vij - Vik} \tag{9}$$

In most cases the IIA hypothesis is easily violated since the introduction or removal of other alternatives will nearly always alter the relative probabilities of choosing the first two ones. Another limitation of is that the traditional logit model assumes no serial correlation in the error terms. In other words, it assumes that all respondents have the same preferences or that their preferences depend on observable characteristics. This is often violated by the CE setting and therefore produces misleading predictions.

In case the researcher decides to go forward with the traditional logit model, he/she should do the IIA test, such as the Hausman-McFadden test for IIA violation. If the test fails, the researcher should choose another econometric model. For example, the nested logit model is not strictly dependent on the IIA hypothesis, while the multinomial probit model makes no IIA hypothesis at all (Pearce et al., 2002). Mixed logit model, heteroscedastic extreme value model, Bayesian (non-parametric) model, and Latent Class model are also ways to go around the restrictive IIA hypothesis.

So, unless there is a strong reason favouring the use of the traditional logit model, it is recommended to use a more robust mixed logit model, which also does not strictly depend on the IIA hypothesis. It is also flexible to include socio-economic background of respondents, which might be of interest for the researcher. The mixed logit model assumes that within the sample the respondents' attitudes towards each attribute vary. This means the result of the model is a distribution of WTP estimates, usually assumed to be normal. Therefore, the mixed logit model presents the advantage of taking into account the fact that people with different socio-economic background view the same environmental goods and services differently.

For the Codru Quest study the researchers experimented with the conditional logit model, but then opted for the mixed logit model (Figure 9).

The main reason for choosing mixed logit model was that the attribute levels present in the baseline scenario were not incorporated into any of the alternative scenarios, making it impossible to include more than one level for each attribute in the regression. In such a case the researchers could not do IIA testing, which is crucial for the conditional logit estimates to be valid, thus going for the IIA-free mixed logit model.

The simple logit and probit models (nested logit, mixed logit, multinomial logit, and binary probit) are estimated by maximum likelihood procedures. For instance, estimation of the conditional logit model is represented by the equation (10).

$$log\ L = \sum_{i}^{N} \sum_{j}^{J} y_{it}\ log\ \left[\ \frac{exp\ (V_{ij})}{\Sigma\ exp\ (\mu\ V_{ij})}\ \right] \tag{10}$$

where y_{it} – indicator variable taking value of 1 if the alternative is chosen.

Conditional Logit

	Dependent variable: Choice
2:(intercept)	1.6110*** (0.3743)
3:(intercept)	1.3415** (0.5347)
`Area 250`	0.0694 (0.1315)
`Plants 100`	0.5306*** (0.1826)
`Insects 80`	0.2624* (0.1352)
`Abundant symbolic`	0.1105 (0.2002)
Price	−0.0114** (0.0046)
Observations	570
R2	0.0283
Log Likelihood	−536.8410
LR Test	31.3199*** (df = 7)

Note: *p<0.1; **p<0.05; ***p<0.01

Mixed Logit

	Dependent variable: Choice
2:(intercept)	1.9290** (0.7746)
3:(intercept)	1.5841** (0.7842)
`Area 250`	0.0896 (0.1649)
`Plants 100`	0.6234** (0.2785)
`Insects 80`	0.2934 (0.1980)
`Abundant symbolic`	0.2063 (0.3582)
Price	−0.0137* (0.0075)
sd.`Area 250`	0.6366 (1.8333)
sd.`Plants 100`	1.1017 (1.0751)
sd.`Insects 80`	−0.1142 (4.2865)
sd.`Abundant symbolic`	0.6773 (0.8214)
Observations	570
R2	0.0292
Log Likelihood	−536.3498
LR Test	32.3024*** (df = 11)

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 9. Comparison of the preliminary results of the Codru Quest data analysis from Phase I done by using conditional logit and mixed logit models.

The WTP / WTA value can then be estimated by (11).

$$WTP = b_y^{-1} \, ln \left[\frac{\Sigma \, exp \, (V^1 i)}{\Sigma \, exp \, (V^0 i)} \right] \qquad (11)$$

where V^0 – utility of status quo / baseline scenario, V^1 – utility from changes that alternative scenario brings, and b_y^{-1} – marginal utility of income, which is practically the coefficient of the cost / price attribute.

WTP for specific attributes can also be estimated through simple equation (12).

$$WTP = - \frac{\beta \ (attribute)}{\beta \ (price)} \tag{12}$$

More complex multinomial probit model requires the use of simulated maximum likelihood procedures, which are much more difficult to work with (Pearce et al., 2002).

All this analysis of the CE data with estimation by maximum likelihood procedures can be carried out with the use of different statistical software packages. Usually R is recommended, as this is very powerful software, which is also open-source. R is a language and environment for statistical computing and graphics. Besides statistical computations, this tool can help the researcher construct well-designed plots and statistical diagrams (The R Foundation, 2017). A helpful guide for the use of R for analyzing CE data is "Discrete-Choice Logit Models with R" by Philip A. Viton, available online for free (Viton, 2015).

The output from the estimations by statistical software packages represents the monetary estimates of the respondents' utility change in the case when the attributes of the target good are changed from their current level (status quo) to some different level (the levels of the alternative scenarios). The output also includes the 95% confidence intervals on these estimates of utility change.

In Phase I of the Codru Quest the researchers presented the results of the analysis from both models that they had experimented with: conditional logit and mixed logit. They did it in the table form (Table 10) and as a diagram (Figure 10), where both mean WTP estimates and confidence intervals could be visually compared. This was useful for the researchers to see how well these types of models performed relative to each other and which model should be used in data analysis during Phase II of the study. However, when reporting on the results of the final data analysis, it is not relevant, if not adversary, to present them from different econometric models at once. Instead the researcher should choose the best performing model and supply the reporting of results with arguments for choosing this specific model. In the Codru Quest study the researchers did just that, and the preliminary data analysis helped them choose the "right" model.

Table 10. Preliminary results of the Codru Quest data analysis from Phase I done by using conditional logit and mixed logit models and represented in a table form.

Attributes	Parameters	Conditional Logit	Mixed Logit
Territory / area*	Mean WTP	6.010	4.022
Territory / area*	95% Confidence Interval (+- on mean value)	21.551	16.455
Species of plants	Mean WTP	46.614	39.496
Species of plants	95% Confidence Interval (+- on mean value)	30.415	24.567
Species of insects*	Mean WTP	23.055	14.667
Species of insects*	95% Confidence Interval (+- on mean value)	36.821	27.526
Symbolic species*	Mean WTP	9.709	6.575
Symbolic species*	95% Confidence Interval (+- on mean value)	40.365	34.663

*Note: Original attribute coefficients were not statistically significant.
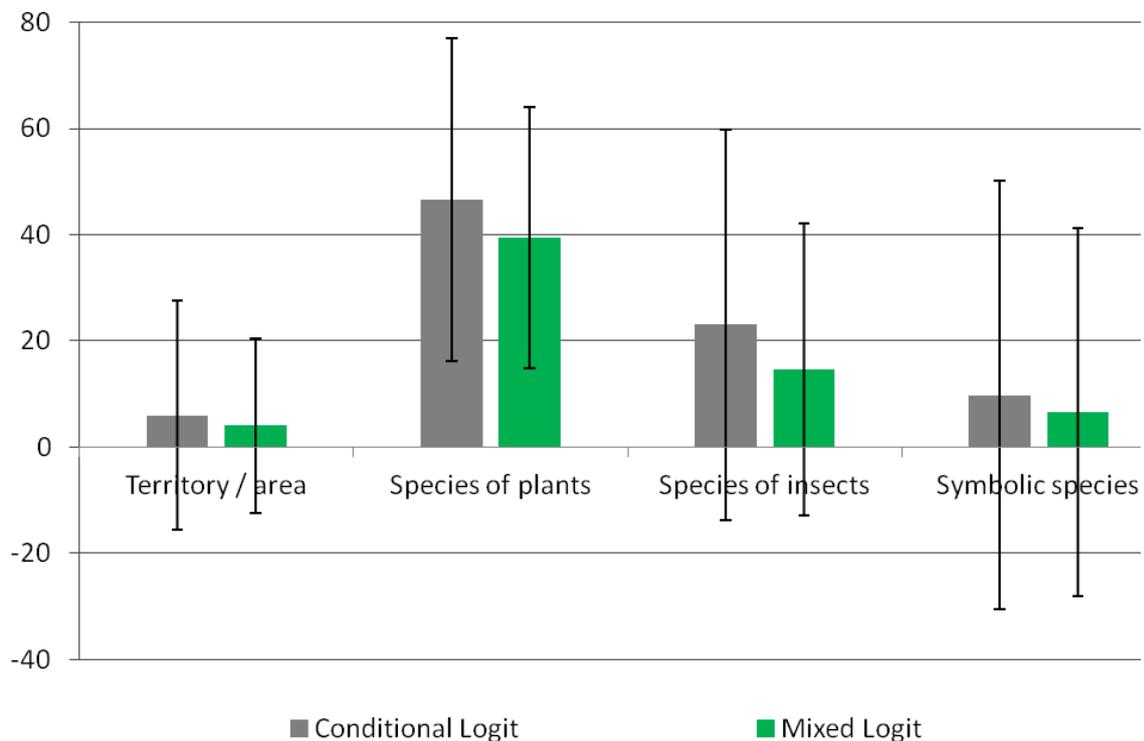
Figure 10. Preliminary results of the Codru Quest data analysis from Phase I represented as a diagram.

Test for Structure in WTP / WTA Values

In data analysis it is not sufficient to estimate sample mean and median WTP / WTA values. The researcher should also test their validity, which means testing whether these values follow certain distinguishable patterns and whether these patterns are in accordance with the economic theory. This is basically checking for signs of the estimated parameters, magnitudes of WTP / WTA values, and ordering of preferences. Structure and validity testing is done by using variables from socio-economic, attitudinal, and follow-up questions of the survey. The aim here is to see how they "explain" the respondents' WTP / WTA.

Structure and validity testing takes the form of a bid function, an equation that describes how each additional variable affects the respondents' WTP / WTA values. In the bid function each variable gets a specific parameter and once the function is estimated, the sign of the parameter indicates whether increasing values of that variable have a positive or negative influence on the respondent's WTP / WTA, while the significance of the estimated parameter determines whether it is possible to attribute any statistical significance to this influence. The bid function can be estimated quite easily with the help of the R statistical software.

When the bid function is ready, the researcher should verify that its parameters have signs that are aligned with prior expectations. For instance, such variables, as the respondent's income that are expected to increase the values, should have positive signs whilst such variables, as distance to the site of provision of the target good, which are expected to reduce the values, should have negative signs.

The statistical significance of the estimated parameters can be verified using t-test procedure and then included in the documentation of results. The explanatory power of the entire model is measured by the pseudo R^2 statistic. It takes values between 0 and 1, where zero indicates that the included covariates do nothing to explain the distribution of WTP / WTA in the sample. It means that the larger the value of the pseudo R^2 statistic, the greater the explanatory power of the model is. There is no specific threshold value for it, so the conclusion depends on the researcher's own thoughts. Certainly, he/she should be concerned if the pseudo R^2 statistic points to very low explanatory power (less than 0.1). This suggests that the WTP / WTA values from the CE survey show very little in the way of distinguishable patterns (Pearce et al., 2002).

1.8. Draw Preliminary Conclusions

Much can be learnt about the performance of a pilot CM survey and the validity and reliability of the data it brings by looking at the results of the preliminary data analysis. An important aspect of the validity has to do with the sign and significance of the price attribute. If the survey was well designed, and respondents found the valuation scenario and the payment vehicle credible and realistic, then there should be a negative and significant effect of price attribute on the choice of alternative scenarios. This means that the participants were considering the opportunity cost of spending money on the proposed changes versus spending them on other things. In other words, they understood that the money they had pledged to pay could not be spent on other things such as food, clothes and other kinds of leisure. If the researcher does not observe this negative and significant effect of the price attribute, it is a very important warning sign, a "red flag". In such case he/she should revisit the design of the survey and change it in a way to make sure the respondents understand and believe the valuation scenario and the payment vehicle described there.

In the Codru Quest preliminary data analysis the estimated price parameter was negative and significant in both conditional logit and mixed logit models, even if just marginally so in the mixed logit one. This result suggested that the respondents had taken the cost of changes in the provision of the target environmental good into account, which in turn points to at least some credibility of the valuation scenario and the payment vehicle.

The researchers expected the price attribute to be negative and significant in the Codru Quest study results no matter of the choice of the payment vehicle. Their explanation about such an expectation and preliminary results that met it was that Moldova is a comparatively poor country, where people are very price-and-cost-sensitive. At the same time, from the preliminary data analysis the researchers got an impression that the visitor price as a payment vehicle chosen had been perceived as more credible than tax. The reason here could be that with the visitor price the respondents saw the relation between what they pay for and what changes they get much better than in the case of an obligatory tax. In other words, with visitor price people pay for the use of the target environmental good, so they can regulate how much they pay by determining their frequency of using the good. With tax, which is assumed to be paid no matter whether one uses the good or not, is another story: in the situation of high corruption level in state agencies of Moldova its citizens are not sure whether the money collected through taxes will be used for financing development of the target environmental good or for filling in corrupt politicians' pockets. Such lack of trust in

taxes and governmental institutions administering them was confirmed by feedback and inputs during the focus group discussions.

If there is no problem regarding the price attribute, the researcher can shift his/her attention to estimates on other attributes. The main concern to be checked here lies in their significance levels. If an attribute is not statistically significant, it should be interpreted as not factoring into respondents' choices of alternative scenarios in any relevant way. Still, although this can be a sign that the respondents did not really value this attribute, the researcher should not discard any insignificant attribute just yet. Since a pilot survey was conducted with a very small and usually non-representative sample, such a vital decision as changing the attributes included in the survey should not rely on evidence from the preliminary data analysis alone. The researcher should think about possible justification for insignificance of attributes and, if possible, seek expert advice on that.

In the preliminary data analysis of the Codru Quest study the estimates for covariates on the territory of the Codru Nature Reserve and the number of species of insects conserved were statically insignificant in the mixed logit model. The territory attribute was insignificant in both models. This might be due to small sample size combined with high correlation with other variables (especially the number of plants conserved) that might have diminished the significance levels. Such high correlation was likely to be the consequence of the choice set construction. Still, the insignificance of these attributes, especially of the territory of the Codru Nature Reserve, could also be a valid result. The researchers assumed that reason for such insignificance was likely to be related to the specifics of the sample size. The pilot survey was done only with residents of the capital city Chisinau, who are not influenced by the enlargement of the protected area and therefore might not care for its size. The researchers also assumed that the case should be different for Phase II if the study, where they planned to interview residents of 9 villages around the Codru Nature Reserve and the Codru forest. They expected that with larger territory of the protected area the villagers might fear that their access to the forest for timber, non-timber forest products, etc. in the PA might become restricted, thus influencing their livelihood in a negative way. This assumption was proven by the respondents' answers in the second phase of the study.

Another aspect that the researcher can explore in the preliminary data analysis and its results is which attributes are valued the most by the respondents. This can be done by comparing the size of the estimated parameters. The researcher just need to keep in mind that while the relative impact of two attributes is given by their ratio, their marginal effects on

the probability of choosing a given scenario are not linear and depend on the value of all attributes.

In the Codru Quest study the first respondents expressed significance of value of the number of plants conserved. The researchers proposed an explanation that the respondents might believe the Codru forest land coverage to be sufficient, but not dense enough, and they were willing to pay for reforestation and better conservation of plant species. The significance of this attribute could also be related to general perception of a good natural environment as the one having many trees and dense forests. This might be influenced by the traditional practice of environmental non-governmental organizations (NGOs) in Moldova to do either waste cleanups or tree planting campaigns. As the test sample of respondents in Phase I of the study included members and volunteers from environmental NGOs, the researchers assumed that the main environmental activity the respondents did had been tree planting. This is why they might have preference for conservation of flora as a symbol / proxy of protected natural environment.

While reflecting on the preliminary results of the data analysis and trying to explain them, the researcher should not forget that these were obtained from a pilot survey covering a very small non-representative sample of respondents. Therefore he/she should not pay much attention to their validity and reliability, as most likely these criteria will not be met. However, the researcher should draw some conclusions on what data the survey had brought, how their analysis had been done, and what the preliminary results had shown. These conclusions along with the first respondents' feedback and the researchers' own lessons learnt from pilot survey phase can help him/her improve the survey design and release it during the next phase of the CM study.

Phase II: Full-scale Survey and Complete Data Analysis

The second phase of the CM study is where the researcher improves the survey design, determines the full and final population sample, releases the main CM survey to the target respondents, collects economic valuation data and socio-economic characteristics from them, performs the analysis of these data, and estimates the final WTP / WTA values. This phase can be considered as the "main performance" of the entire study. Therefore the researcher should use the inputs and lessons learnt from the previous phase to carefully implement each step of the current one and thoroughly document his/her actions and results. They will be the ones the researcher will enter in the final report during Phase III.

2.1. Improve the Survey

Once the analysis of the first respondents' feedback and their preliminary WTP / WTA data in Phase I is complete, the researcher can introduce this feedback, lessons learnt, and other inputs into the CM survey design; correct all issues identified; and prepare to release the main survey. There is no concrete rule or guideline how to do it; it is up to the researcher to decide what feedback and inputs to take into consideration, where to introduce modifications, and how to deal with problems and biases in WTP / WTA elicitation questions. Nevertheless, while working on the main survey, he/she is encouraged to consult with specialized literature and seek professional advice from other researchers and experienced specialists in CM studies. This should reduce the risk of ending up with long and complex survey that brings confusing and misleading results.

In the Codru Quest study after completing the pilot testing and preliminary data analysis the researchers introduced the following changes into the survey design:

- The first section of the survey included attitudinal questions in Phase I. It was replaced with demographical questions, shifting the attitudinal ones to the second section. This was done to put familiar and easy-to-answer questions first for the respondent to be able to start the survey in a quick, easy, and neutral way. It also lowered the cognitive burden for the respondents, as they were not immediately asked to reflect on their preferences at the beginning of the survey. In addition, such modification was also expected to help extract data on some essential characteristics of the respondents

needed in order to estimate a regression of WTP on the relevant explanatory variables and test for consequentiality of the payment vehicle.

- The question whether a respondent had visited the Codru Nature Reserve and the Codru forest in the last two years was added to the first section. It had the role to indicate, who of the respondents is a user of the target environmental good and who is not. This piece of information was important in determining what share of the population sample would be affected by the increase in costs of provisioning the target environmental good.

- The first attitudinal question about the respondents' interest in nature and environment protection in general received a new option "None" and a disclaimer clarifying that lack of interest does not compromise the validity of the answers. This was done to eliminate possible bias towards yea-saying for conservation of the Codru forest ecosystem and biodiversity.

- The other attitudinal question about agreeing or disagreeing with statements regarding nature conservation in Moldova was removed, as there was a risk of it unduly influencing the respondents' stated WTP in the choice sets by stimulating yea-saying and feelings of moral obligation or responsibility. However, answers to this question were important in identifying strategic behaviour, as long as they are given after the choices of alternative scenarios had been made. In order not to lose such valuable information on possible strategic behaviour, the options of the question were added to the follow-up question on whether the respondents had chosen alternative scenarios besides status quo in any of the choice sets and why.

- The use-of-the-good question about the importance of different forest elements and amenities was also removed, as the same information is extracted from the choices of alternative scenarios made by the respondent. Plus, this question included the possibility for extra amenities provided in the Codru forest, which were not mentioned in the valuation scenario and choice sets and therefore could be confusing for the respondents.

- The structure and content of the valuation scenario and choice sets experienced the most changes to them, which included:

  o Better and clearer description of the target environmental good and the baseline scenario was prepared and introduced to ensure content validity. It included a separate sub-section on specifically the Codru Nature Reserve and the Codru forest

and the current level of each of the attributes chosen for them based on the available data from preliminary research and expeditions. This change theoretically avoided the risk of the respondents not understanding the valuation scenario and status quo and thus forming their own beliefs about the current situation.

o Description of the valuation scenario and status quo were supplied with images showing the current state of each of the attributes. These images were then used in the choice sets in Scenario 0. Such change was aimed to help the respondents visualize and understand the baseline situation before it is laid out with attribute levels within the following choice sets.

o Phrasing of the institutional setting and the background of changes in the alternative scenario were altered to avoid the impression that the plans for the expansion of the Codru Nature Reserve had already been decided upon and "set in stone". This might have affected the consequentiality and incentive compatibility of the survey, as the respondents might doubt that their answers would have any effect on future plans and policy regarding the provision of the target environmental good.

o For the symbolic endangered species attribute the levels were changed from "a few", "medium", and "abundant" to "2 representatives", "4 representatives", and "6 representatives", indicating the number of representatives of these species that once can observe during a visit to the Codru forest. This was a proxy for the population of the symbolic species, as this information was not known. Such a modification allowed the respondents to understand and visualize the changes in this attribute and to express their WTP more accurately and realistically.

o Representation of the payment vehicle attribute was changed. In the pilot survey it was shown as a price ranges. The reason for such representation was that there had been insufficient information on the exact visitor pricing for the Codru Nature Reserve. The researchers assumed that inside the protected area there was an area, where visitors need to pay to enter, and another one, where people could enter freely. However, from a statistical point of view, this would require assuming a distribution of the individuals along the indicated price range. In such case there would be high uncertainty as to which the respondents' true WTP was and how they ranked different attributes. As a result the researchers would get significantly less information about underlying preferences of the respondents, as they would not know how the price ranges had been interpreted. To prevent all this from happening, the

price ranges were replaced by single price levels on the basis of additional research, and this change was introduced in all choice sets.

- The follow-up question, which inquired the respondents about possible changes in their WTP in case an increased local tax would have been used as a payment vehicle, was altered in its formulation and options. In the pilot survey this question assumed that the use of local tax would lower stated WTP. In such way it excluded the possibility of having respondents, who wanted to pay more through tax than through the current payment vehicle. Considering this, the question was changed through the introduction of options that allowed the respondents to indicate the increase in their WTP in the case of local tax selected as the payment vehicle.

- In the other follow-up question, which asked the respondents whether they had chosen baseline scenario in all choice sets, and if yes, why, the option "*I do not believe that the improvements in the Codru Nature Reserve and the Codru forest can be achieved through the increase in visitor prices*" was added. Its purpose was to reveal possible protest votes against the chosen payment vehicle, as well as test the credibility of the valuation scenario.

After introducing all the changes, the final survey design was reviewed by both the researchers and external specialists, and all the mistakes identified were corrected. The main survey was then released in its on-line (https://goo.gl/forms/v41GFRG37YBrsYTH3) and to-be-printed (https://issuu.com/megageneration/docs/mega_-_the_codru_quest_-_your_choic_c693af527b6995) versions and published on the Codru Quest web page (MEGA Impact Championship, 2017) ready to be used for gathering valuation data.

2.2. Determine the Full Population Sample

Before launching the main surveying process, the researcher still needs to determine the full and final representative population sample. This will guide him/her to the choice(-s) of surveying methods to be implemented, the efforts and costs to be invested in conducting the final surveying process, and the amount of data expected to be obtained. Typical full population sample sizes range from 250 – 500 respondents to 500 – 1000 people to be surveyed depending on a number of factors: target population size, aims of the study, budget, and time constraints. If there are certain important differences in valuation scenarios or population groups that need to be considered in the study, the full sample size should be increased (Pearce et al., 2002).

As it was mentioned earlier, the Codru Quest study targeted a full population sample of 200 Moldovan citizens aged 18+. This sample was divided into two groups: 100 respondents from the capital city Chisinau, and another 100 from 9 villages near the Codru forest: Lozova, Stejareni, Capriana, Micleuseni, Huzun (Straseni region); Horodca, Bursuc, Dragusenii Noi (Hincesti region), and Condrita (Chisinau region).

The selection of the respondents from the city was straightforward, as only 100 people (0.02% of the total population of 492 894 residents) could be surveyed within the budget and time constraints of the study. The selection of the respondents from the target rural area was done through proportional calculations. Firstly, the information on the population in each of the 9 target villages was obtained from the National Bureau of Statistics of Moldova (2017). The population of each village was then compared to the total population of all 9 villages. The percentage share of the population of that village in the total population of the target rural area represented the number of respondents to be interviewed in that village (Magenta Consulting, 2017). For example, the population of Lozova represented 38% in the total population of 9 target villages. Therefore 38 people were interviewed in Lozova. Huzun and Horodca represented only 2% each of the total population of the area. So, only 2 respondents in each of these villages were approached by interviewers (Table 11).

Table 11. Sampling of target population from 9 villages in the Codru Quest study.

Village	Region	Number of population, pers.	Percentage share of population, %	Number of target respondents, pers.
Lozova	Strășeni	5 934	38	38
Căpriana	Strășeni	2 362	15	15
Micleușeni	Strășeni	2 038	13	13
Drăgușenii Noi	Hîncești	1 913	12	12
Bursuc	Nisporeni	1 306	8	8
Condrița	Mun. Chișinău	658	4	4
Stejăreni	Strășeni	647	4	4
Horodca	Hîncești	346	2	2
Huzun	Strășeni	296	2	2
TOTAL		**15 500**	**100**	**100**

Source: Adapted from Magenta Consulting, 2017.

2.3. Release the Improved Survey

When the full and final representative population sample is decided upon, it is time to deliver the main CM survey to its target respondents. Here the researcher should consider the choice of surveying method again. While for Phase I it was sufficient to use the cheapest available option (on-line surveying) to gather feedback from the first respondents, for Phase II he/she should consider the balance between the quality and cost of the final surveying method.

For SP studies it is recommended to use face-to-face interviews or computer-assisted personal interviews (CAPI). They offer the researcher greater flexibility in approaching the respondents, greater potential in controlling the population sample during the study, and thus higher response rate to the survey (Pearce et al., 2002). However, these methods are quite time-and-cost consuming. So, the researcher should check the study budget to see whether he/she can afford them.

With restricted budget and tough deadlines it is also acceptable to use other methods of surveying, such as on-line / e-mail surveys, post mail surveys, and telephone interviews. However, the researcher should be aware that these methods come with probability of losing important information, accuracy, and quality of the WTP / WTA data collected through them. Generally, every surveying method has its advantages and disadvantages, which the researcher should assess and make decision on before releasing the main survey (Table 12).

In the Codru Quest study the researchers combined two surveying methods in order to balance quality of data from the respondents with the budget and time constraints. They used on-line / e-mail survey for the sample of 100 Chisinau residents and CAPI for the sample of 101 respondents from the 9 selected villages near the Codru forest.

The reason to do on-line survey with the city residents was that they are more tech savvy and are used to on-line surveys. Therefore they would manage answering the Codru Quest survey on their own via internet. It was relatively easy to find these respondents and motivate them to fill in the survey. This surveying method was implemented by the researchers themselves by using the network of contacts from Phase I, friends, relatives, and partner organizations. The incentive of a lottery reward (300 MDL or 300 experience points to "buy" prizes from a virtual shop) helped achieve the necessary response rate.

Table 12. Advantages and disadvantages of different surveying methods.

Methods	Advantages	Disadvantages
E-mail survey	• Cheapest option • Use of visual support • Lack of interviewer bias • Easy to answer sensitive questions • Respondent can answer at his/her own pace • Easy to monitor and use data • Subsequent analysis is quicker	• Can have low response rates • Self-selection bias • Little control over who gives the answers • Fixed structure of questions • No clarification on difficult questions possible • Missing respondents without access to computer and internet and those rejecting PC technology
Post mail survey	• Relatively inexpensive • Lack of interviewer bias • Easy to answer sensitive questions • Respondent can answer at his/her own pace	• Usually low response rates • Self-selection bias • Time-consuming to prepare • Little control over who gives the answers • Fixed structure of questions • Restricts the use of visual aids • No clarification on difficult questions possible • Can be dependent on post service
Telephone interviews	• Relatively inexpensive • Can have complex structure • Allows clarification of difficult questions • Relatively quick to administer • Easy to monitor • High response rates	• No possibility to use visual aids • Restricts use of complex questions • Respondents may get tired • Respondents may refuse answering sensitive questions • Missing respondents without telephone number listed
Face-to-face interviews	• Can have complex structure and questions • Use of visual support • Allows clarification of difficult questions • Larger quantity of data can be collected • Greatest sample control	• Can be very expensive and time-consuming to do • Self-selection bias • Possible interviewer bias • Respondents may get tired • Respondents may refuse answering sensitive questions

	• Highest response rate	
Computer-assisted personal interviews (CAPI)	• Can have complex structure • Greatest use of visual support • Allows clarification of difficult questions • Larger quantity of data can be collected • Greatest sample control • Highest response rate • Easy to monitor and use data • Subsequent analysis is quicker	• Can be very expensive and time-consuming • Time-consuming to prepare • Self-selection bias • Possible interviewer bias • Respondents may get tired • Respondents may refuse answering sensitive questions
Mixed methods: drop off survey	• Gives personalized approach to the survey • Shares the advantages of e-mail / mail and face-to-face interviews	• Can be very expensive and time-consuming • Survey form may be lost in e-mails / mails before the visit of an interviewer
Mixed methods: e-mail / mail + telephone survey	• Gives personalized approach to the survey • Shares the advantages of e-mail / mail and telephone interviews • Respondent can answer at his/her own pace	• Can be relatively expensive and time-consuming • Survey form may be lost in e-mails / mails before the telephone call of an interviewer

Source: Adapted from Pearce et al., 2002.

The reality was different for village residents. The dominant majority of them do not have access to internet, or even to a computer, so on-line surveys would not work in their situation. Telephone interviews were also not considered, as the Codru Quest survey had important visual support in valuation scenario and choice sets. Post mail service in Moldova was not reliable enough to be selected for distributing the survey by ordinary mail. So, the best surveying option for this group of the population sample remained to be CAPI, as it combines face-to-face interaction and dialogue with the possibility to show visual support to the respondents and record their data into the on-line database immediately. To do CAPI with village residents, the researchers hired marketing research company. It did all the interviews in the villages by using their interviewers and access to the survey via tablet computers connected to internet.

In order to coordinate the implementation of CAPI in the target rural area, the research plan between the researchers and the hired marketing research company was agreed upon. According to the plan, the interviewers of the company had a determined path to visit the respondents' households, which had been based on the previously established number of respondents for each village (Table 11). For instance, in Condrita there were 4 respondents targeted. It meant that the interviewers had gone to every fourth household in that village.

When entering a household, the interviewers chose the person to talk with on the basis of the "last birthday" criterion. In other words, the actual respondent from a household was the person, who had been the last one to celebrate his/her birthday. If that person was not present at that moment, the interviewers tried to reach him/her by coming back to the household some other time or on another day. This approach ensured that there was no dominance of the category of respondents, who stay in a household longer than other members of it, such as unemployed, retired people, mothers with children, etc. (Magenta Consulting, 2017).

At the end of the surveying period, which lasted for 2.5 weeks, the researchers obtained complete answers from 201 respondents, among which 100 were from city residents and 101 from village residents. This division into two groups with different socio-economic characteristics helped them greatly in further analysis to see the influence of these characteristics, distance to the target good, perception of the good, etc. on the WTP values.

2.4. Analyze Final Data

The analysis of the final data and estimation of the final WTP / WTA values is a very important step in the CM study. During it the data so carefully collected in the main survey are transformed into useable and valuable output.

The stages of the final data analysis are generally the same, as in the preliminary one described in Phase I. However, in comparison to Phase I, here the researcher processes the respondents' information not for having general understanding and feedback to the survey design, but for preparing the results of the entire study and conclusions for the report, which is likely to be used by stakeholders in further research, CBS, land use planning, and/or environmental policy making. Another researcher or policy maker can have equally little confidence in the results of a high quality survey with poor data analysis, as in the results of a weak survey but where the data were carefully and thoroughly processed. Therefore it is very important that the researcher pays equivalent attention to the final data analysis, as he had done to preparations of the main high quality survey (Pearce et al., 2002).

In Phase II of the Codru Quest study the researchers reviewed the lessons learnt from the preliminary data analysis practiced in Phase I. This allowed them to process the data and estimate WTP / WTA values much faster by using the methods and models already decided upon. Nevertheless, several changes in the process were necessary due to certain specifics of the final data.

Prepare and Summarize the Data

In order to analyze the final data, the researcher once again needs to prepare the dataset. The process of doing this is the same as described in Phase I. The spreadsheet containing the data from the pilot survey can even be used as a reference. However, in doing so the researcher should keep in mind that the main survey has probably been redesigned between the first and the second phase of the study. So, there are likely to be differences in both question order and content that need to be taken into account while preparing Phase II dataset.

The final data in the Codru Quest study came to the researchers in the form of two datasets, one from city residents surveyed by the researchers themselves and another one from residents of the target villages interviewed by the marketing research company. The data in the datasets was already documented and arranged according to the answers of every respondent in the on-line Google Table and SPSS table. The researchers just reviewed them and transformed the datasets into the format that can be processed by the R statistical software.

Identify and Remove Non-valid Answers

The procedure of identifying and removing non-valid answers from the dataset is also similar to the one done in Phase I. However, here extra care should be taken in separating valid answers from non-valid ones, as this will directly influence the final results of the study. The researcher should remember that removing answers, which he/she considers to be non-valid, will decrease the sample size and in such way can undermine the credibility of the results. However, keeping non-valid answers for the sake of larger sample size can have the same negative effect on the credibility of the study. There is no definite and easy way around this issue. It is only up to the quality of the main survey design and the researcher's own judgment to effectively balance the elimination of non-valid answers and the maintaining of the relevant sample size.

In the Codru Quest study among 201 responses collected 24 (12%) were considered non-valid mainly on the basis of free-riding (the respondent believed that he/she will not be

paying for the good) or protesting (the respondent believed that someone else should pay for the good) behaviour. Among them the majority of non-valid answers were from village residents, 14 out of 101, while among the city residents there were 10 non-valid ones out of 100. After the removal of non-valid answers the researchers remained with two datasets comprising a total of 177 respondents and their answers, among which 87 were from villages around the Codru forest, and 90 – from the city Chisinau.

However, later in the data analysis the researchers had to remove additional respondents' answers and reduce the sample size even more. The reason for doing that was certain inconsistencies identified in the datasets, especially the one on city residents. The researchers investigated these inconsistencies by connecting socio-economic information to the respondents' preferences and in such way establish that there had been severe issue with consequentiality of the payment vehicle and resulting strategic behaviour of the respondents. The issue was that the city residents, who are not using the Codru Nature Reserve and the Codru forest, exhibited strong strategic behaviour by having positive responses to a visitor price increase. Such preferences were clearly conflicting with the underlying economic theory. In contrast, the respondents from the villages dataset, who were users of the target environmental good, exhibited behaviour far more in line with the economic theory. After careful consideration, the researchers concluded that in order to preserve the validity of the Codru Quest study only the respondents, who had used the Codru Nature Reserve and the Codru forest in the last two years, should be included. The removal of other respondents, non-users of the target good, drastically reduced the sample size to only 107 entries.

In spite of getting such a small sample size (only 53% from the entire number of respondents surveyed), the researchers believed that they did the necessary thing, because what they got is a population sample with all valid data that is consistent with the economic theory. The share of city / village residents in the final sample was also good, 62% to 38% respectively, as it was close to the overall distribution of urban / rural residents in Moldova: 57.47% to 42.7% respectively (National Bureau of Statistics of the Republic of Moldova, 2017). This allowed the researchers to avoid using weights in the data analysis. The final valid sample size also offered them the possibility to consolidate both city and villages datasets into one, and carry out a single data analysis.

Estimate the Mean and Median WTP / WTA Values

Once again this step of the data analysis is very similar to the one done by the researcher in Phase I. However, now the process should go much faster, as the researcher has already

experimented with different economic models in the preliminary data analysis and has chosen the most suitable one. If the model was chosen wisely and appropriately, it should perform well in estimating the sample mean WTP / WTA and sample median WTP / WTA values from the main survey results.

Nevertheless, the researcher should always double-check the chosen economic model and make sure it fits to the specific of the new data. For example, the level of heterogeneity in respondents' preferences obtained through the pilot survey and the main one can differ significantly. The pilot data could have far less heterogeneity in preferences than the main survey data and, therefore, pass the IIA test. Therefore, the researcher should verify the specifics of the final data he/she has and only then make the decision on what economic model to use for them.

During the preliminary data analysis of the Codru Quest study the researchers preferred the mixed logit model as the one performing the best for the kind of data collected and the one that does not strictly depend on the IIA hypothesis. So, in Phase II they also chose it for analyzing the main survey results.

While using the mixed logit model the researchers assumed that the random parameters associated with the attributes are normally distributed, and that the price attribute follows a censored (or truncated) normal distribution to account for the fact that it should only take negative values. There were certain inconsistencies with the mixed logit estimates observed, so the researchers also connected socio-economic characteristics of the respondents to the WTP estimates in order to see their influence on the respondents' preferences and valuations. It turned out that there were significant differences in preferences between the residents of urban and rural areas. To deal with this heterogeneity, the researchers used the method described in Kragt and Bennet, 2011. In this method they included interaction terms on the choice variables and the censored normal distribution on price to capture systematic heterogeneity between city and village residents. After doing this the researchers observed that the significance levels of the interaction terms had changed. Specifically, the interaction terms of all attributes except visitor price became significant and positive, which translated into consistently lower WTP estimates for village residents compared to city residents. The attributes for the territory of the Codru Nature Reserve and the number of species of plants conserved had negative average WTP for the respondents from the rural area, whereas the respondents from the urban area expressed only slightly negative but insignificant WTP for the plant species attribute. In terms of the insignificance of the visitor price interaction term, it was assumed to be caused by the model already capturing this difference.

The respondents from urban and rural areas had more or less common preferences in the two attributes of the target environmental good: the number of insect species conserved and the presence of symbolic endangered species: small-flowered black hawthorn and stag beetle. For both groups they were quite significant and positive (Table 13).

Table 13. Final results of the Codru Quest data analysis from Phase II done by using mixed logit model and represented in a table form, in MDL.

Attributes	Parameters	City Residents	Village Residents	Sample Average
Territory / area	Mean WTP	8.93	-11.94	-3.94
Territory / area	95% Confidence Interval (+- on mean value)	9	- 10.99	5.83
Territory / area	Extended CI boundaries*	17.71	17.71	17.71
Species of plants	Mean WTP	-4.53	-16.01	-11.65
Species of plants	95% Confidence Interval (+- on mean value)	9.02	14.28	10.22
Species of plants	Extended CI boundaries*	5.35	5.35	5.35
Species of insects	Mean WTP	22.42	12.54	16.3
Species of insects	95% Confidence Interval (+- on mean value)	16.14	11.803	12.54
Species of insects	Extended CI boundaries*	15.88	15.88	15.88
Symbolic species	Mean WTP	26.57	13.33	18.36
Symbolic species	95% Confidence Interval (+- on mean value)	19.86	12.71	14.37
Symbolic species	Extended CI boundaries*	24.56	24.56	24.56

*Note: "Extended CI boundaries" refer to the extension of the confidence interval boundaries to account for the different preferences across the sample.

This was a very obvious change from the preliminary data analysis, where the number of plant species conserved had been the main factor for the respondents' preferences (Figure 10). Such difference in results confirms that it might be unwise for the researcher to present the results of preliminary data analysis before doing the main one, as these results might differ significantly from the final ones, but could be understood as the final ones by the stakeholders.

With the final WTP values and their confidence intervals estimated, the researchers doing the Codru Quest study could present them in visual form. This form included once again a table (Table 13) and a diagram (Figure 11), where it was possible to compare WTP values from city residents with the ones from village residents and then with the sample average of WTP estimates. This table and diagram were designed to be included in the final report of the entire study in the next phase.
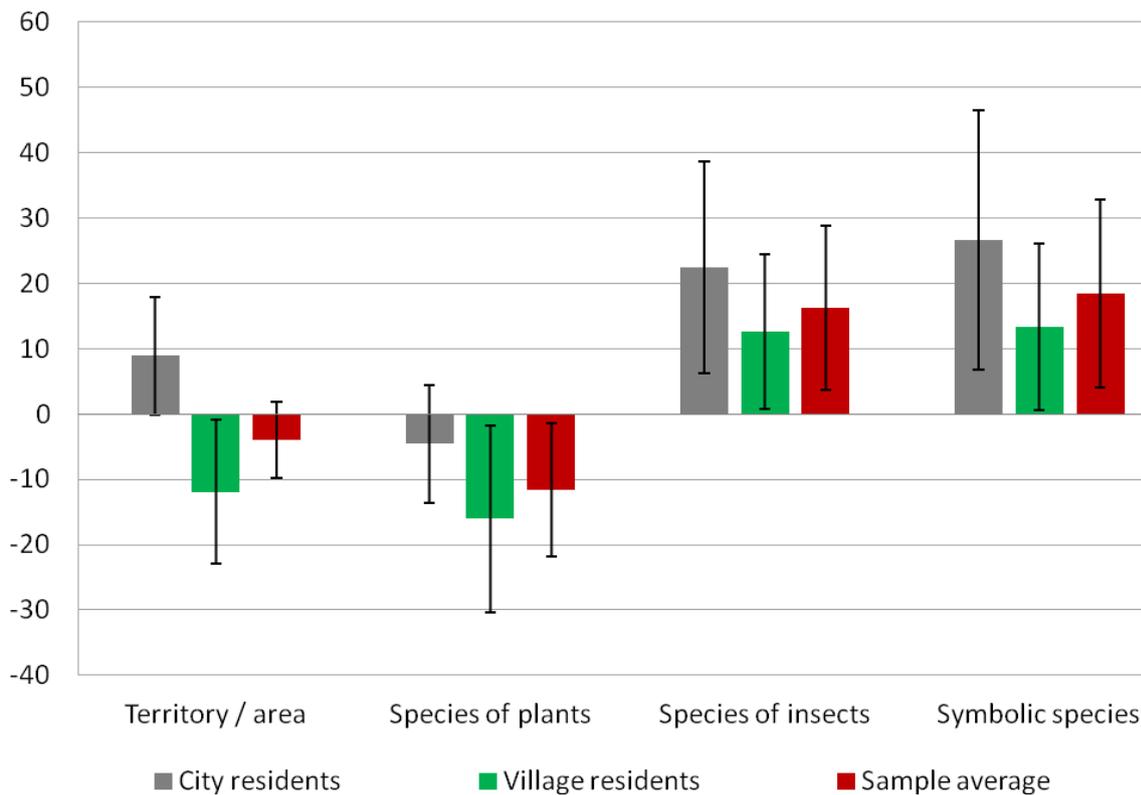
Figure 11. Final results of the Codru Quest data analysis from Phase II represented as a diagram.

Test for Structure in WTP / WTA Values

After estimating the mean and median WTP / WTA values, the researcher should also test them for validity, just like in the preliminary data analysis. This will show him/her whether the estimates follow certain distinguishable patterns, which are in accordance with the underlying economic theory. To do this there researcher should once again review the respondents' answers to socio-economic, attitudinal, and follow-up questions of the survey, already the main one, connect them to the WTP / WTA values obtained, and see how they can "explain" these values.

In the Codru Quest the researchers connected socio-economic characteristics with the intercept to test whether there had been a possible source of above-mentioned heterogeneity towards alternative scenarios with improvements in the provision of the target environmental good over the no-cost baseline scenario. This test showed that gender had been the most influential characteristic in determining the probability of choosing an alternative non-baseline scenario. The share of women in the final sample was approximately 60% compared to 40% share of men. From analyzing their data the researchers found out that women had been more likely than men to select a non-baseline scenario, meaning that they had been more willing to bear the cost of these improvements. This observation did not directly translate into higher WTP values, but helped the researchers explain individual choices and get more accurate estimation parameters.

The other socio-economic characteristics, such as occupation, marital status, and distance to the Codru forest were somewhat important in explaining the respondents' preferences. Surprisingly, personal / household income characteristic did not seem to have important effect on the choices of alternative scenarios.

In terms of statistical significance, the results of the final data analysis and validity testing of its results suggested that the most significant attributes of the target environmental good were the territory of the Codru Nature Reserve, the number of plant species conserved, and somewhat the visitor price.

2.5. Draw Immediate Conclusions

There are still a number of steps for the researcher to do in the next phase of the CM study before introducing the final results and conclusions into the final report of the entire study. However, he/she can already come up with some immediate thoughts on the basis of the estimates obtained from the final data analysis. They can help the researcher see whether the estimates can be explained in the final report by using the information available to him/her, economic theory, expectations of human behaviour, and general logical explanations.

For example, in the Codru Quest study the researchers tried to explain the large differences between urban and rural residents in relation to the attributes of the territory of the Codru Nature Reserve and the number of plants conserved. They believed this heterogeneity could be expected for a developing country like Moldova. Practically, it reflects the socio-economic polarities and related preferences of the two prevalent societal groups, which are strong in a developing country.

One group, city residents, is represented by people of middle or upper middle class living in a large city (in the Codru Quest it is the capital city Chisinau). They have more or less stable daily job and source of income. However, besides urban parks, they have very limited interaction with outside green spaces and are mostly non-users of forest ecosystems and protected areas. City residents can still have some non-use values (existence and bequest values) attached to a forest or nature reserve situated not far away from their city of residence. Therefore they might be expressing positive WTP for preservation and even expansion of forests outside the city and conservation of biodiversity in them even if these people are not using them. Some city residents are visiting outside forests once or several times per year for recreation, as the Codru Quest study results showed, so they are likely to be supporting improvements in their favourite recreational sites, as well as their expansion. The negative WTP of city residents for the attribute of the number of plant species conserved might be also related to the recreational value. People want to have space while spending recreation time in a forest. The respondents from the city might have associated the attribute of plant species with additional tree planting and allocation of conservation zones, where their recreational possibilities would be low. This might have been the reason of their negative WTP for the plant species attribute. Additional research is needed to confirm or reject this assumption.

The other group, village residents, is comprised of mainly aged citizens, who prefer to stay in rural areas or have no other way but to stay there. They are usually independent farmers, unemployed, and retired people, whose only source of income are remittances from their children and some small sales of fruits and vegetables from their gardens and farms. In the Codru Quest study these were the residents of 9 villages situated very close to the Codru Nature Reserve and the Codru forest. They are direct users of natural resources and ecosystem services of the forest, especially timber and non-timber products, and largely depend on them. The village residents also have their land with gardens and farms situated close to the Codru Nature Reserve. Therefore they might feel fear of losing this land in case the territory of the protected area is enlarged. If there were precedents of this actually happening or threats for it to happen, then the villagers' fears could be justified. This is likely to be the reason for their negative WTP in relation to the protected area territory attribute. For the rest of the attributes, with the exception of number of plant species conserved, village residents expressed positive WTP, which can be explained that they depend on the healthy ecosystem services of the nearby forest and understand the connection between

them and their wellbeing. Just like with the city residents, additional research is necessary to verify all this.

In sum, these large socio-economic differences between the two groups of respondents in the Codru Quest study were mirrored in the differences in the WTP estimates and could be explained knowing the socio-economic situation in Moldova. However, these could not be considered final output of the Codru Quest study, as the researchers still needed to discuss them, aggregate them to the target population, and already on the basis of evaluated and aggregated results prepare the final conclusions. This is what was done in the third and final phase of the study.

Phase III: Presentation of Results to Stakeholders

The third and final phase of the CM study is focused on preparing its results for reporting, elaborating the final report, and presenting it to stakeholders of the study. Here the researcher needs to test the results obtained from the second phase on reliability and validity, aggregate them to the target population, estimate benefit transfer equation (an equation allowing the results of the current study to be used in other CM studies), elaborate final conclusions, introduce all this into the final report on the entire study, and then publish and present the report. The results and conclusions of the report might then be used by the study stakeholders for other studies, environmental management strategies, and/or environmental policy proposals. Therefore, the researcher should be attentive to how he/she is doing each step of this phase and how thoroughly, clearly, and understandably he/she presents the outputs of the entire study.

3.1. Test the Entire Study and the Final Results on Reliability and Validity

The task of the CM study is to elicit the respondents' WTP / WTA for the change(s) in the provision of an environmental non-market good. Ideally these stated WTP / WTA estimates should be equal to the respondents' true WTP / WTA if the change(-s) actually took place, or at least as close to them as possible. Unfortunately, this is very difficult to achieve, as the respondents might have some level of strategic behaviour when they see a certain advantage of mis-reporting their WTP / WTA. The differences might also arise due to greater cognitive effort of the respondents', when they reflect upon their stated WTP / WTA in a hypothetical valuation scenario compared to actually experiencing the situation of the scenario. All this implies that the CM study results and the performance of the main CM survey need to be verified through the tests on reliability and validity (Pearce et al., 2002).

Reliability refers to the degree of replicability of the study results. In other words, one should be able to rely on them in giving the same WTP / WTA estimates in repeated experiments under controlled conditions. Reliability is tested by repeating the study at different points in time and checking whether the results obtained from each test are the same. This testing process requires additional time and budget resources. Therefore it is not considered a

reasonable requirement for every CM study. In the Codru Quest project it was not possible to test the results for reliability, at least during the writing of the present guidebook.

Validity indicates how successful the survey has dealt with possible biases and how close its results reflect the true WTP / WTA values of the respondents. As there are no true WTP / WTA values for a non-market good to compare the results with, the validity testing is done through indirect means, namely:

- Content / face validity testing that verifies whether the respondents were asked the right questions in a clear, understandable, and appropriate to the goal of the study manner;

- Construct validity testing that indicates whether the results obtained follow the logical patterns one can expect and are consistent with economic theory, prior studies, past experience, and pure logic.

In the content validity testing the researcher needs to assess the entire CM study, from its goals and the way it was realized to the clarity and interpretability of the survey questions and the information collected from them. He/she should go through a series of verification questions and see how the study design, process, and its results answer them (Table 14).

The idea with content validity testing is to see whether all the components and methods used in the study were sufficient and used properly to induce the respondents in stating their WTP / WTA as close to the true values as possible. To verify this the researcher needs to use his/her own subjective judgment. However, it is recommended to bring in one or several specialists to review the study with its results and give their feedback on it as well (Pearce et al., 2002).

If the researcher and the specialist(-s) are able to assess the study and give positive answers to the verification questions, then the study and its results can be considered valid. Failure to pass the content validity test is an indication that the study results should be treated with certain skepticism.

The indicators of such results with low content validity can include:

- Description of the valuation scenario, change(-s) in the provision of the target good, and payment vehicle were poorly perceived and inadequately understood by the respondents;

- Institutions responsible for the provision of the target good described in the valuation scenario were not trusted or were considered to have low competence or efficiency by the respondents;

- Poor choice of the target population and/or inadequate sample size with biased representativeness of the population;

- High non-response rates of the survey or its individual questions;

- High number of protesters and free-riders among the respondents of the survey;

- Dubious responsiveness to the provision of the target good (WTP / WTA does not vary with change(-s) in the quantity of the good);

- Significant amount of signs in the respondents' answers, which indicate possible strategic behaviour affecting the study results.

Table 14. Questions for the content validity testing of a CM study.

#	Study components	Questions for testing
1	Design of valuation scenario	• Was the target good described and then understood clearly? • Did the valuation scenario contain enough information on the target good and change(s) in its provision? • Were the respondents likely to feel that their choices matter in the decision-making process on the provision of the good? • Did the valuation scenario create trust that the good will be provided by the institutions mentioned in it?
2	Choice of payment vehicle	• Was the chosen payment vehicle acceptable and relevant? • Was trade-off between money and the good plausible? • Were the respondents likely to feel that they were expected to pay for the good according to its provision scenario? • Were consequences of non-payment described sufficiently?
3	Choice of method	• Was the method of the study chosen appropriately? • Was the measure of wellbeing (WTP / WTA) chosen appropriately?
4	Sampling of population	• Was the target population identified appropriately? • Was the sampling of the target population done correctly?
5	Administration of surveying and data analysis	• Was the survey administered thoroughly and to a high standard? • Were the data prepared and analyzed correctly and in accordance with the underlying economic theory? • Did the study collect sufficient and adequate data on variables that are likely to explain WTP / WTA, so as to permit the researcher to construct validity testing?

Source: Adapted from Pearce et al., 2002.

In the case of the Codru Quest study there were different issues with different groups of respondents. In the group of city residents the researchers discovered a number of responses with strategic behaviour. These had been dealt with during the final data analysis by removing such responses from the sample. In the group of village residents there appeared a different type of issue. The respondents from the rural area had a relatively high number of comments about lack of trust in the institutions responsible for the provision of the target good, namely the Ministry of Environment, the Codru Nature Reserve administration, and the Moldovan Government. The respondents' explanations on this lack of trust were related to the issue of high level of corruption present in the country and specifically in state agencies. People did not believe that their payments would truly go to the chosen changes in the provision of the target good and not to state officials' pockets. An input to future studies on this aspect might be to experiment with other institutions, such as non-government organizations (NGOs), as providers of the good included in the valuation scenario. However, until the issue of high level corruption is present in the country, there will be a problem with the respondents trusting any institution at all.

Construct validity testing is done by comparing the results of the CM study with the ones obtained through other economic valuation methods, different CM studies, and/or actual or surrogate (proxy) markets. However, this testing is not always possible and can give wrong outputs if the other method or a different study chosen to compare the results of the current one is inappropriate or invalid. Still, where possible such comparisons should be made and reported, as they might indicate that one of the studies has flaws, which should be accounted for (Pearce et al., 2002).

In the Codru Quest study the researchers could not do proper construct validity testing due to constraints in time and budget, as well as due to the fact that such a study was done for the first time on such environmental non-market good as ecosystem services in the Codru Nature Reserve and the Codru forest and in such a developing country as Moldova. Therefore the assessment on whether the study and its results are aligned with prior expectations, past experience, and pure logic was done by the researchers on the basis of their own judgment. The study components assessed and discussed among the researchers included:

- Attitude towards the valuation scenario: whether the valuation scenario was perceived trustful, fair, and ethical by the respondents;

- Attitude towards the good: how the respondents perceived the target environmental good and payment for it;

- Use of the good: whether the relationship between the use of the target good and stated WTP values was positive, as expected;

- Distance to the good: whether the relationship between the distance to the target good and stated WTP values was negative, as expected;

- Quantity of the good: whether the stated WTP values were related to the quantity of the target good provided;

- Perception of the payment vehicle: whether the respondents perceived the payment vehicle chosen as binding, familiar, credible, and realistic;

- Price of the good: whether the respondents indicated reduction in the desire to consume the target good with the increase of its price, as expected;

- Respondents' income: whether the respondents' WTP values increased with the higher personal / household income, as expected;

- Survey method: whether there were certain effects of the survey mode on the values obtained, which should not be substantial, as expected;

- Rationality of the choices: whether the respondents made "rational" choices by seeing if alternative scenarios which are clearly inferior (e.g. have the lowest attribute levels) are chosen over superior ones;

- Consistency of the choices: whether the respondents were consistent in comparing their choices over different choice sets throughout the survey;

- Information effects: whether the respondents' answers and value were affected or unaffected by the information known by them.

The researchers verified their testing conclusions with the comments and feedback expressed by the respondents in the CE survey, which generally confirmed them. Overall, practically all aspects and components of the Codru Quest study were considered satisfactory in terms of aligning with prior expectations, economic theory, and logic. As in the content validity testing, there was an issue with the perception of the payment vehicle among village residents, but after careful consideration the choice of visitor price was still considered to be the most appropriate option for the situation of high corruption in Moldova.

The researchers did not test the choice of the wellbeing measure (WTP or WTA) in the study. The reason was mainly that the Codru Nature Reserve and the Codru forest are the unique goods, which are also historically and culturally symbolic to the country. In such case the choice of WTA would likely give unrealistically high values that could have been useless as outputs of the study. In addition, the dominating public opinion in Moldova that the corrupt state takes much from citizens' wellbeing, which is grounded in numerous facts and cases, would also likely to have strong influence on extremely high WTA results.

3.2. Aggregate the Final Results to the Target Population

After the researcher has estimated the mean and median WTP / WTA values from the main survey data and tested them for reliability and validity, he/she can proceed to the aggregation of the final results to the target population. This is done because the mean and median WTP / WTA estimates the researcher has are for only a sample of population, while the stakeholders of the CM study are interested in the mean and median WTP / WTA of the entire relevant population (Pearce et al., 2002).

If the target population sample was chosen carefully and was estimated by simple random sampling properly during Phase I of the study, as well as all respondents from the sample provided complete answers to all questions of the survey, then the aggregation of the study results to the whole population is quite easy and straightforward to do. The aggregate WTP / WTA are calculated by multiplying the sample mean or median WTP / WTA by the total number of people in the target population, as shown in the equations (13) and (14):

$$Aggregate\ WTP = N * \overline{WTP} \tag{13}$$

$$Aggregate\ WTA = N * \overline{WTA} \tag{14}$$

where N – the number of people in the population and $\overline{WTP}$ / $\overline{WTA}$ – the statistic of interest (sample mean or median WTP / WTA).

Unfortunately, in most cases there will be certain flaws and biases in previous phases of the study related to the choice of the target population, calculation of its sample, and ensuring that it represents the population well. These flaws and biases may affect the results of the aggregation. For this reason the researcher should adjust his/her calculations of the aggregate WTP / WTA by considering possibilities of an unrepresentative sample and inability to define the relevant aggregating population.

The situation with unrepresentative sample of population happens when the sample is probabilistic, but not perfectly random. In other words, each unit of the sample has positive but not equal probability of being chosen for the sample. In this situation the researcher can somewhat correct the flaw by adding analytical weights for each observation in the sample. If these weights were not used before while analyzing the WTP / WTA data from the sample, they can still be included in the aggregation equations (15) and (16):

Aggregate WTP = N * Σ w_i WTP$_i$ (15)

Aggregate WTA = N * Σ w_i WTA$_i$ (16)

where *N* – the number of people in the population, w_i – analytical weight for the observation *i*, and *WTP / WTA* – the statistic of interest (sample mean or median WTP / WTA).

In case the population sample is not probabilistic and/or it is biased due to the flaw of non-response, it is difficult to determine the specific probability of a unit to be in the sample. In such case the analytical weights can be defined by comparing the characteristics of the units represented in the sample with those of the entire population. The researcher then divides the proportion of the population falling into a particular characteristic group by the proportion of the sample falling into that same group and then uses the obtained weights in the aggregation equation (Pearce et al., 2002).

There might also be a case when the population sample is representative, but the researcher has an issue defining the relevant population. An example can be the sample of visitors to a protected area, which is random but the total population of users of the good is not known. Ideally, in such case the researcher should carry on with the study further until he/she finds and estimate of the total relevant population. If this is not feasible, the researcher can try to either guess the total population or arbitrarily define the population as belonging to some administrative area. The latter approach is simple to do when the target environmental good has a spatial dimension, such as the Codru forest situated at certain distances from the capital city Chisinau and the surrounding villages. The survey question on how far the respondent lives from the site of provision of the target good is very helpful here. On its basis the researcher can split the population into zones differing in distance from the site and then take WTP / WTA of each respondent in that zone as the mean WTP / WTA of individuals sampled in that zone. There can also be certain threshold distance over which WTP / WTA is assumed to be zero. Such threshold distance, as well as the variation of WTP / WTA in correlation with distance to the site of provision of the target good, can be

established by estimating a distance-decay function that has distance from the site as a covariate. The WTP / WTA of all respondents before the threshold limit can then be calculated from this function.

However, WTP / WTA can also be invariant with distance, for example, when there are strong existence and bequest values attached to the target environmental good, and these values are being assessed in the study. If this is true, then the researcher should aggregate the WTP / WTA estimates across the entire national population (Pearce et al., 2002).

In the Codru Quest study the researchers aggregated the estimated mean and median WTP values only to the direct users of the Codru Nature Reserve and the Codru forest. These were assumed to be Moldovan citizens, who actually visited the Reserve and the forest at least once in the last two years. The approximate number of these users was obtained from the background research on the yearly number of visitors to the Codru Nature Reserve, which is about 3500 people.

Unfortunately, such aggregation had its flaws. Firstly, by focusing only on the direct users of the target environmental good, the researchers excluded non-users among Moldovan citizens, who might still have existence, bequest, and altruistic values attached to them. In addition, the exact information on the number of visitors to the Codru Nature Reserve was not available at the time of conducting the Codru Quest study. The PA administration started monitoring and registering the number of its visitors only in 2016, and the data were not available in the first half of 2017 to be used in the study. Therefore, the researchers had to use the approximate number of 3500 people from the background research for aggregation.

3.3. Estimate the Benefit Transfer Equation

In any economic valuation study it is a very good practice to estimate the benefit transfer equation, which allows the results of this primary study to be used in other similar studies without the burden of significant time and costs related to conducting the entire study from the start. This is exactly what benefit transfer represents: a process of taking information about economic values of a good from one context and applying it to the other with similar good, objectives, etc. (Pearce et al., 2002). Thus, by estimating and presenting the benefit transfer equation, the researcher greatly helps other researchers in their studies of the same or similar environmental goods.

The benefit transfer equation is estimated by modifying the estimate of average WTP / WTA to account for differences in the population characteristics, such as demographics and socio-economic situation, as well as distance to the site of the provision of the environmental good.

The last characteristic is essential for establishing the rate of distance decay of WTP / WTA values.

The result of the estimated benefit transfer equation is recommended to be included in the final report of the study. This allows other researchers to find and easily use the equation for their own studies.

Unfortunately, it might not always be possible to estimate a reliable and useful benefit transfer equation. Reasons can be very different here. In the Codru Quest, for instance, the researchers chose not to estimate the equation due to a very small population sample size, small variation of income in this sample, and unconditional distribution at the sample level. Before deciding this, they tried several approaches to work around these issues.

One approach was about estimating conditional parameters, also called individual-specific parameters. However, their reliability is positively correlated with the number of choices offered to respondents. So, there was a concern in that with only three choices available per respondent in the Codru Quest survey conditional estimates would have been unreliable.

Another approach tried was an attempt to introduce demographic and socio-economic variables in the choice likelihood function and interact them with the price parameter. The idea was to transfer this estimated choice function in order to predict how people would make their choices at the Codru Nature Reserve and the Codru forest and subsequently calculate the associated welfare measures of the change considered at the study site. Unfortunately, the interaction terms introduced had either proven to be non-significant or produced unreliable results.

Certainly, it would have been possible to estimate and present the benefit transfer equation even with such limitations. But in this case it would not have been reliable or even valid. For this reason the researchers decided that it would not be advisable to do it.

3.4. Elaborate Final Conclusions

With the final results aggregated to the target population and the benefit transfer equation estimated, the researcher can now analyze them, reflect on the lessons learnt from the entire study, and summarize these results and lessons into the final conclusions. In doing so, he/she should consider the socio-economic reality of the country where the study had been done, the current and projected situation in relation to the provisioning of the target environmental good, possible gainers and losers of the change(-s) that had been envisioned in the valuation scenario, and the consequences that the results of the study might have on

the target good and socio-economic relations around it. It is advised that after coming up with final conclusions the researcher tries to arrange their professional review and collect valuable feedback from other environmental economists. This feedback should then be integrated into the conclusions and mentioned in the final report.

When discussing the final results and preparing the final conclusions the researcher should consider several interconnected elements, namely:

- Profile of respondents: The researcher should analyze the socio-demographic and economic profile of the survey respondents, discuss how close it represents the actual target population, and present how different characteristics (age, gender, marital status, education level, current occupation, income level, etc.) influence the resulting WTP / WTA values;

- Respondents' relation and attitude towards the target environmental good: Here the researcher should evaluate the ways the respondents use the good, how accessible is the good to them, whether there are any substitute goods that they can use, what is their attitude towards different aspects of nature conservation related to the good, and how all this can explain the respondents' WTP / WTA;

- WTP / WTA estimates and their aggregated values: This is where the researcher actually presents the monetary values of the target environmental goods and its attributes represented by WTP / WTA for change(-s) in their quality and provisioning. He/she also shows these estimates aggregated to the target population, including what population was selected for aggregation.

- Discussion and conclusions: Last but not least, the researcher discusses the reasoning behind WTP / WTA presented earlier and tries to explain them by using inputs from the survey follow-up questions. He/she also formulates conclusions on what the results of the entire study mean for the target environmental good and its users.

- Recommendations to stakeholders: An optional element, where the researcher suggests how different stakeholders can benefit from the study results, as well as presents recommendations regarding the management of the target environmental good on the basis of these results, earlier discussion, and conclusions.

In the Codru Quest study the researchers discovered a number of interesting and valuable outputs regarding the situation in the Codru Nature Reserve and the Codru forest. While the negative attitude of village residents towards the expansion of the PA territory was rather

expected, as the researchers knew about their fear of the state taking their land, the negative valuation of plant species conservation by both city and village residents was a surprising result. Several possible explanations were suggested. For residents of urban areas protection of more plant species could mean limitation of available recreation space in the forest, and allocation of conservation zones, which would be restricted for people's access. Additionally, with more species of flora under protection visitors of the Codru forest would be limited with the variety of flowers, berries, mushrooms, etc. they are allowed to collect. For residents of rural areas conservation of more plant species is likely to limit their possibilities for collect fuel wood in the forest, as well as picking up and commercialization of endangered plant species, which turned out to be a typical (yet illegal) practice of earning additional income among village residents.

In terms of positive WTP for conservation of species of insects and symbolic endangered species, the researchers associated them with strong existence and bequest values among city residents and indirect use values for village residents. When it comes to symbolic endangered species, significantly positive WTP for their conservation of both urban and rural area residents is likely to be influenced by the factor of scarcity and fear of losing something that is rare and symbolic to the country. However, the researchers also assumed that visual representation of different attributes in the survey, where images of insects (colourful beetles and butterflies) and noticeable and charismatic stag beetle might have appeared as more visually interesting and attractive than plain forest and plants, could have influenced the valuation results.

While such discussions of an economic valuation study results are very good, it is also useful to present them in a way that is visually appealing and understandable to stakeholders, who might have never heard of economic valuation of ecosystem services and who do not have time to analyze complex tables and diagrams. Such visualization can include transformation of final data and key outputs of the study into images, infographics, and "smart" diagrams. Each of these should ideally communicate maximum 3 key messages.

In the Codru Quest the researchers visualized the results in the form of "bubble" diagrams. Basically, they combined Figure 11 and Table 13 into 4 diagrams: one only for WTP of city residents, another one for WTP of village residents, the third one for sample average WTP, and the final diagram for the aggregated WTP. In these diagrams the size of the bubbles represented magnitude of WTP for each attribute, colour – sign of the estimates (green – positive, red – negative), and transparency – the significance level (Figure 12 and 13).

![MEGA]

Attributes of the target environmental good

| Total territory of the Codru Nature Reserve | Number of species of plants conserved | Number of species of insects conserved | Presence of symbolic / endangered species |
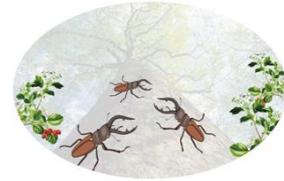
Mean willingness-to-pay, city residents

Territory (8.93)

Species of plants (-4.53)

Species of insects (22.42)

Symbolic / endangered species (26.57)
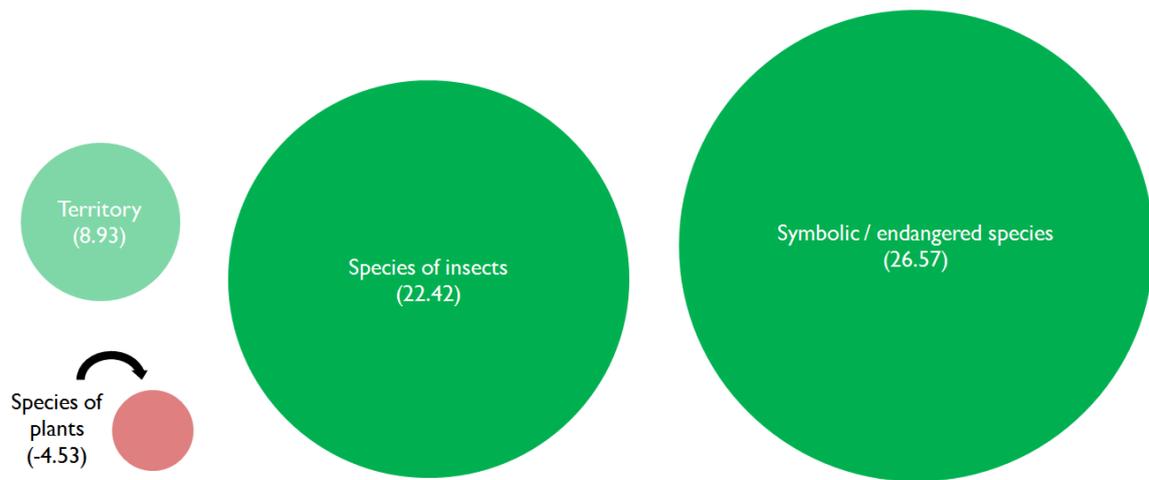
Mean willingness-to-pay, village residents

Territory (-11.94)

Species of plants (-16.01)

Species of insects (12.54)

Symbolic / endangered species (13.33)
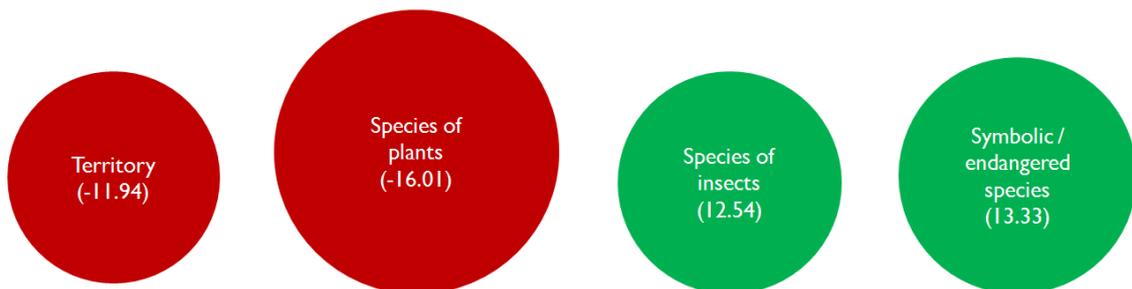
Figure 12. Visualization of WTP of city and village residents in the Codru Quest project, in MDL.

Note: Size – WTP magnitude, colour – sign (**positive** and **negative**), transparency – significance.

www.megageneration.com

MEGA

Attributes of the target environmental good

| Total territory of the Codru Nature Reserve | Number of species of plants conserved | Number of species of insects conserved | Presence of symbolic / endangered species |
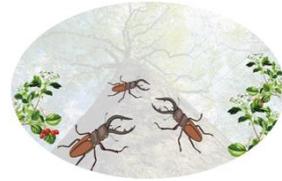
Mean willingness-to-pay, sample average

Territory (-3.94)

Species of plants (-11.65)

Species of insects (16.30)

Symbolic / endangered species (18.36)
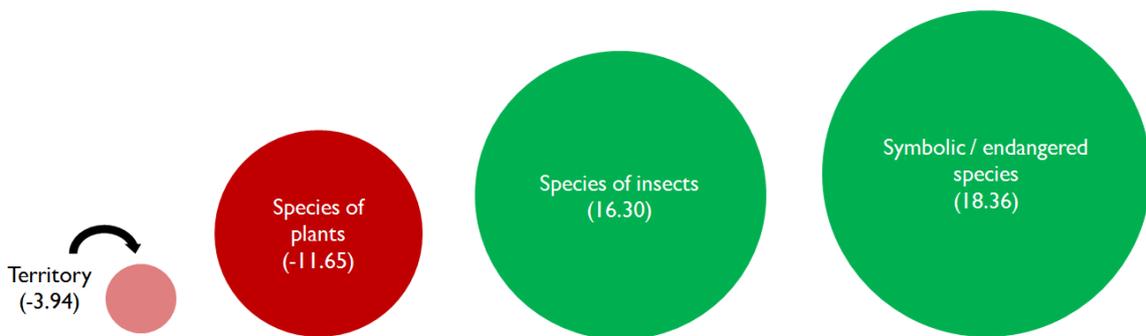
Mean willingness-to-pay, aggregated sample average*

Territory (-13.798)

Species of plants (-40.775)

Species of insects (57.050)

Symbolic / endangered species (64.260)
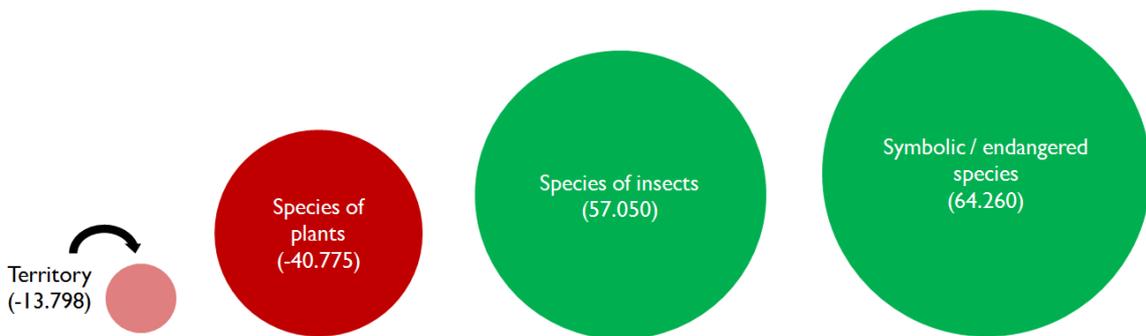
Figure 13. Visualization of population sample average WTP in the Codru Quest project, in MDL.

Note: Size – WTP magnitude, colour – sign (**positive** and **negative**), transparency – significance.

*Aggregation is based on the approximate number of visitors to the Codru Nature Reserve per year.

www.megageneration.com

3.5. Prepare the Final Report on the Entire Study

When all the results, including the aggregated WTP / WTA values, benefit transfer equation, discussions, conclusions, and recommendations, are ready, the researcher can organize them into the final report of the entire CM study. This report will be the primary means of communicating the achieved results to the stakeholders of the study and other researchers, who might use them in future economic valuation studies. Also the report can become the basis for future research articles on different aspects of the study.

The final report should be written in a comprehensive, understandable, and transparent manner, so that readers can get maximum value out of it and understand what was researched, how it was done, why, and what the outcome of the researcher's work is. Complete and transparent information in the report will also make it easier for readers to verify the data and methodology and use them to continue the study on the target environmental good further or apply them in other contexts (Pearce et al., 2002).

The structure of the final report can vary depending on its purpose and profile of possible readers. Nevertheless, there are certain elements (sections) that should be included in it:

1. Executive summary: presents a brief overview of the context of the report and the main study findings preferably in non-technical language for easy read;

2. Introduction: usually includes the description of the purpose, goal, and objectives of the study; its expected results; brief review of any previous relevant valuation studies; and how the present study complements them with additional methods, results, and discoveries;

3. Object of the study, study area, and problem addressed: describes the target environmental good that had been valued, the target population for it, and the problem that the researcher had addressed and intended to solve with the study;

4. Key assumptions: briefly explains the underlying assumptions related to the problem addressed and the target environmental good that the researcher had before commencing the study;

5. Methodology: presents and briefly explains the economic valuation methodology and concrete techniques used in the study. Specifically, this section should cover the reasons of choosing a particular method, the way population sampling was done and attributes of the target environmental good were chosen, the arguments for the choice of

a specific payment vehicle, the discussion about WTP versus WTA as the chosen measure of wellbeing, and other methodological aspects of the study;

6. Surveying process: lists the main steps of the surveying process, including how the survey was designed and tested, what alterations were made to its design after pilot tests, what method of approaching respondents was used for the main survey, what were the main problems with the survey administration, and how they were approached and possibly corrected by interviewers and the researcher;

7. Data analysis: explains how the data from the survey were processed, how and why the non-valid answers were identified and how many were removed from the sample, what economic models were used to estimate mean and median WTP / WTA and confidence intervals, what were the standard errors and statistical significance of the estimates, as well as discusses how the final data obtained conform to the underlying economic theory and prior expectations;

8. Validity testing: presents how the results obtained from the data analysis were tested for validity and what were the outputs of these tests;

9. Limitations: describes the limitations of the study, how they influenced its results, and what was done to deal with these limitations;

10. Final results: displays the mean and median WTP / WTA estimates from the population sample, the final values aggregated to the target population, along with the profile of the respondents, their relation to the target environmental good and attitude towards it, and influence of the respondents' socio-demographic and economic characteristics on the final WTP / WTA estimates;

11. Discussion and conclusions: contains the researcher's reflection on the final results obtained during the entire study; the implications they might or will have on the target environmental good and population; whether they solve the problem addressed by the study, and, if yes, how do they do it; conclusions in relation to the achievement of the study's purpose and goals; and finally recommendations for stakeholders and other researchers, who might use the study, its data, and final results;

12. References: lists the literary sources used in the text of the report according to certain referencing standard;

13. Terminology: explains the key scientific terms used throughout the report preferably in non-technical language;

14. Indexes: represents the list of important terms and concepts with links to them in the test of the report for readers to easily find the ones they are most interested in;

15. Annex: includes a copy of the main survey design or link to it, datasets used or links to them, and any diagrams and photos relevant to the content of the report with proper referencing to them in the text.

The researcher should plan sufficient time for preparing the final report. Writing it in comprehensive, understandable, and transparent manner takes significant time and effort, and these should be taken into consideration in the action plan of the study. Also the review of the report by specialists in the domain of CM studies is highly recommended before releasing it and presenting it to stakeholders.

In the Codru Quest study it took the researchers about one month to prepare, proof-read, improve, and publish the final report. It is now available for reading and downloading under the title "The Codru Quest: Final Report" at the MEGA account on Issuu (MEGA, 2017c).

3.6. Present the Final Report to Stakeholders

It is not enough just to prepare the study report. The researcher needs to publish it and present it to the stakeholders of the study. Only then the researcher's work will be visible and could be used in a practical way for CBA, environmental management strategies, environmental policy documents, and other economic valuation studies.

Stakeholders of the study can include a variety of people and institutions. These can be:

- Survey respondents, who expressed their willingness to be informed of the study results and conclusions;

- Administration of the protected area or land owners of the territory, where the target environmental good is located;

- Citizens and local communities, whose wellbeing is likely to change due to possible change(-s) in the quality and provisioning of the target environmental good;

- Environmental organizations, both local and international, that are concerned about the current state of the study area and quality and provisioning of the target good;

- Ministry of environment and policy makers, who are responsible for elaborating and monitoring environmental policies related to the target good;

- Other environmental researchers and research institutions that might use the study datasets, results and benefit transfer equation for conducting their own economic valuation studies.

The researcher should assess, who of these stakeholders should be most concerned about the state of the study area and the target environmental good, who should be most interested in the final report of the study, as well as who of them has the highest influence to transform its results and conclusions into realistic outcomes and positive impact on the target good. These stakeholders should be the first people and institutions the researcher should approach with the report. To identify them he/she can use the stakeholder mapping approach (Thompson, 2017). This approach includes allocating the stakeholders mentioned above into different sections on the basis of each one's level of interest and influence and then focusing on the ones with the highest interest and influence, while not forgetting to keep other stakeholders informed (Figure 12).
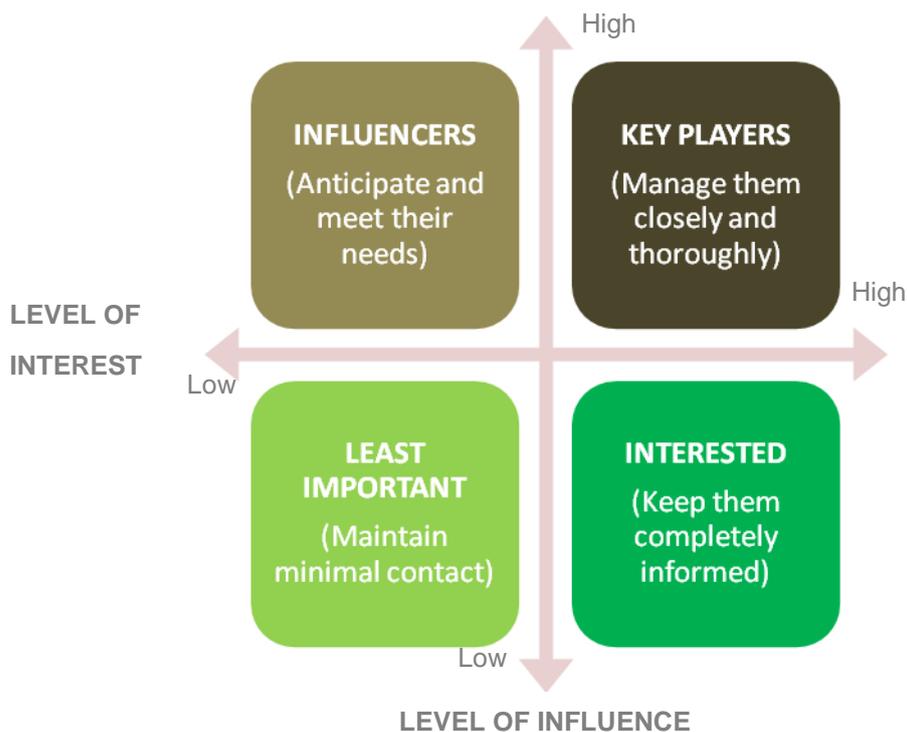
Figure 12. Interest / Influence Stakeholder Map. Source: Adapted from Thompson, 2017.

In the Codru Quest study the researchers addressed the report mainly to the Codru Nature Reserve administration and environmental organizations, as the ones having both sufficient interest in the target environmental good and influence to make positive change(-s) in its regard. Ministry of Environment, the state agency Moldsilva governing the Reserve, and

policy makers were considered as influencers with high level of power, but insufficient interest to make any change(-s) from the current situation. Survey respondents, local communities living near the Codru forest, frequent visitors to that forest, and environmental researchers were assembled into a group of highly interested people, but without sufficient influence on the target good. Finally, other Moldovan citizens, who might have certain existence and bequest values attached to the Codru Nature Reserve and the Codru forest, but who were non-users of their ecosystem services, were left to be simply informed about the study results from the on-line resources of the Codru Quest project.

When the stakeholders for the final report have been chosen, it is time for the researcher to think how to deliver them the report. There are different ways to do it:

- Publish the report on-line on the website of the study, of the organization, or any other relevant on-line resource. This works for the Interested and Least important groups of stakeholders, but is not sufficient to engage Influencers and Key players.

- Write research article(-s) on the basis of the report, refer to the report in them, and publish the article(-s) in scientific journals. This is also good for the Interested group, but again is not sufficient for the Influencers and Key players.

- Present the report at a scientific conference or a stakeholder consultation meeting. Here it is possible to get in contact with all the groups and show them the results of the study, but it is not guaranteed that all the relevant stakeholders will be present there.

- Organize own conference or meeting and invite relevant stakeholders to it. This way promises high possibility to engage Influencers and Key players, as the researcher is the one choosing and inviting participants to the event.

- Set up individual meetings with relevant stakeholders. Here the researcher has the highest chances of engaging Key players into considering and using the study results, as the presentation of the report will be done in a personal approach adapted to each stakeholder.

Certainly, the researcher can use several ways of presenting the report to the stakeholders, or even all of them. However, most likely he/she will be constrained by time and budget limitations in his/her choice. Therefore the researcher should reflect on each of the ways and decide upon the ones which engage the most relevant stakeholders, generate highest value for them, while still staying within time and budget limitations.

In the Codru Quest study the researchers started informing the stakeholders about the study results, conclusions, and recommendations through the most realistic and inexpensive ways. They published the final report with its visual summary in the form of a presentation on the Codru Quest webpage (MEGA Impact Championship, 2017) and sent the link to it firstly to partners and sponsors of the project. Based on results and recommendations from the report the researchers then prepared a brief public policy proposal. It contained their suggestion on establishing collaborative governance and sustainable management of ecosystem services of the Codru forest with participation of key stakeholders and next steps on how to begin implementing such suggestion. The public policy proposal was also published on the Codru Quest webpage.

In long-term perspective the researchers envisioned publishing several research articles on different aspects of the Codru Quest research process and results, such as perception of the payment vehicle choice in an economic valuation study conducted in a developing country, use of gamification in SP studies, and economic valuation of indirect use and non-use values of ecosystem services and biodiversity conservation in the Codru forest. There is also a public meeting with presentation of the Codru Quest results and individual meetings with Key players included in the plan beyond the study timeframe. This plan also mentions educational initiatives and training course on economic valuation of ecosystem services on the example of the Codru Quest results to be organized in the future.

All in all, the researchers aim to use all possible ways of informing and engaging stakeholders into nature conservation in the Codru Nature Reserve and the Codru forest in a step-by-step manner. This should ensure that their efforts not only theoretically but also practically contribute to resolving the problem addressed and improve management and governance of such symbolic, valuable, and irreplaceable natural asset of the Republic of Moldova as the Codru forest.

Conclusions

Economic valuation with choice modelling technique is a complex but very useful way for translating non-use values of environmental goods and impacts, which do not have observable "prices" and therefore are usually undervalued in decision-making, into a clearly understandable "language" of money. Money is the "language" that is "spoken" and understood by organizations, protected area managers, land use planners, policy makers, governmental officials, and other stakeholders, who can transform the results of the choice modelling study into real strategies, plans, and policies with the possibility of improving the quality and provisioning of these environmental goods and their individual characteristics (attributes). This is one of the strongest advantages of economic valuation methodology in general and choice modelling technique in particular, which makes possible such things as cost-benefit analysis of environmental policies and projects that concern non-market goods and ecosystem services.

Certainly, the technique is still in process of constant development, refinement, and improvement. There are still many discussions and debates around different aspects of it, and it is definitely not one-size-fits-all approach for considering environmental non-market goods in projects and policies. But each study that uses the technique adds a new piece to the "puzzle" of how economic valuation with choice modelling should be done properly to bring the desired value. We hope that our own study, the Codru Quest, is one of these important pieces of "puzzle".

Economic valuation with choice modelling technique plays a very important role in delivering valuation data on environmental non-market goods for environmental project management and policy making. But in order for it to provide valid and reliable results, it needs to be applied with specific methodological accuracy and adequate resources and support. The methodology of using the technique implies that the researcher needs to complete three phases of research work.

In the first phase the researcher should determine the target population for the study and calculate representative sample to approach. Then he/she should design the pilot survey with valuation scenario and choice sets according to the environmental economic theory. The pilot survey is then tested, and feedback from the first respondents is collected. The

researcher should analyze it along with the preliminary WTP / WTA data to see how the survey design elicits the necessary information and economic values.

In the second phase of the study the researcher should focus on improving the survey design on the basis of the first respondents' feedback and his/her preliminary data analysis. When the main survey is ready, the researcher should calculate the full population sample and release the survey to the target respondents. After the surveying period, he/she returns to the data analysis and estimates the final WTP / WTA values from the information received through the main survey.

In the third and final phase the researcher should test the results of the last data analysis on validity and reliability, if possible, and aggregate them from the representative sample to the target population. Ideally, he/she should also estimate the benefit transfer equation for other researchers to be able to "plug" it into their economic valuation studies. Finally, the researcher should prepare the report of the entire study with its results, conclusions, and recommendations, publish it, and present it to the relevant stakeholders, who have the most interest and influence on transforming them into real strategies, policies, and projects.

All in all, the process of conducting economic valuation study by using choice modelling technique is logical and coherent. But it can be very difficult for a beginner researcher in environmental economics to conduct it, if he/she had not had previous experience in using economic valuation techniques. For us, the researchers from the Moldovan Environmental Governance Academy (MEGA), the Codru Quest study marked our first practical experience and bold experiment in using choice modelling technique for valuing ecosystem services and biodiversity conservation in a developing country with such complex socio-economic and political situation as in the Republic of Moldova. It was indeed a challenge, but the one that we think we successfully overcame with the support of our partners, sponsors, peer researchers, mentors, and additional literature sources on this topic. So, we hope this methodological guidebook written on the basis of our literature review, practical experience, and lessons learnt from it has already helped you or will help you in the future to prepare and conduct your own economic valuation study with choice modelling technique.

Acknowledgements

We, the researchers from the Moldovan Environmental Governance Academy (MEGA) and the team members of the Codru Quest project, acknowledge the great support of the partners and sponsors of this project, including:

- The Rufford Foundation (www.rufford.org) for financing the Codru Quest project through its Small Grant programme;

- The Austrian Federal Ministry for Science, Research and Economy (BMWFW; www.bmwfw.gv.at) and the Institute for the Danube Region and Central Europe (IDM; www.idm.at) for offering their Danubius Young Scientist Award 2016;

- The German Federal Agency for Nature Conservation (BfN; www.bfn.de) for providing consultative and mentoring support through its Klaus Toepfer Fellowship programme;

- Spark Research Labs (www.sparklabs.md) for offering additional financial support and feedback for certain steps of the Codru Quest project;

- The Codru Nature Reserve administration for hosting our expeditions and events to the protected area and the Codru forest, as well as providing valuable information for the research work.

Additionally we express our gratitude to Tim de Kruiff, Felipe Fausto, and Evdokia Roidou for joining the team of the Codru Quest project and significantly contributing to its success; and to Gebeyehu Manie and Søren Bøye Olsen for providing valuable feedback and ideas for the project.

References

- Andersen, L.E. and Gomes, G.M. (1997). *A Cost-Benefit Analysis of Deforestation in the Brazilian Amazon*. [online] Available at: http://repositorio.ipea.gov.br/bitstream/11058/2137/1/td_0455.pdf [Accessed 30 June 2017].

- Bateman, I. (2002). *Economic valuation with stated preference techniques*, [online] Edward Elgar Pub. Available at: http://www.amazon.com/Economic-Valuation-Preference-Techniques-Association/dp/1840649194 [Accessed 17 July 2017].

- Bräuer, I. (2003). Money as an indicator: to make use of economic evaluation for biodiversity conservation. *Agriculture, Ecosystems & Environment*, [online] 98(1-3), pp. 483-491. Available at: http://www.sciencedirect.com/science/article/pii/S0167880903001075 [Accessed 30 June 2017].

- Carson, R.T. (2000). Contingent Valuation: A User's Guide. *Environmental Science & Technology*, 34(8), pp. 1413-1418.

- Creative Research Systems (2012). *Sample Size Calculator*. [online] Available at: https://www.surveysystem.com/sscalc.htm [Accessed 1 July 2017].

- Fausto, F. and de Kruiff, T. (2017). Conducting Stated Preference Surveys in Developing Countries: The Choice of an Appropriate Payment Vehicle. University of Copenhagen, June 2017.

- Kragt, M.E. and Bennet, J.W. (2011). Using choice experiments to value catchment and estuary health in Tasmania with individual preference heterogeneity. *The Australian Journal of Agricultural and Resource Economics*, [online] Volume 55, Issue 2, April 2011, pp. 159-179. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1467-8489.2011.00533.x/full [Accessed 27 July 2017].

- Lancaster, K.J. (1966). A New Approach to Consumer Theory. *Journal of Political Economy*, [online] Volume 74, Issue 274, April 1966, pp. 132-157. Available at: https://www.jstor.org/stable/1828835?seq=1#page_scan_tab_contents [Accessed 5 September 2017].

- Magenta Consulting (2017). *THE CODRU QUEST: Alegerea voastră*. June 2017.

- MEGA (2016). MEGA Shop. [online] Available at: http://megashop.megageneration.com [Accessed 17 August 2017].

- MEGA (2017a). *The Codru Quest: Phase I Results*. Second edition. [online] Available at: https://issuu.com/megageneration/docs/mega_-_the_codru_quest_-_phase_i_re_7d8864fd8d80bd [Accessed 1 June 2017].

- MEGA (2017b). *The Codru Quest: Your Choice. Survey on the value of benefits from the Codru Nature Reserve, forest, and biodiversity there in relation to their protection and expansion.* [online] Available at: https://issuu.com/megageneration/docs/mega_-_the_codru_quest_-_your_choic_c693af527b6995 [Accessed 20 July 2017].

- MEGA (2017c). *The Codru Quest: Final Report*. [online] Available at: https://issuu.com/megageneration/docs/mega_-_the_codru_quest_-_final_repo [Accessed 11 September 2017].

- MEGA Impact Championship (2017). *The Codru Quest*. [online] Available at: http://megaimpact.md/the-codru-quest [Accessed 9 September 2017].

- National Bureau of Statistics of the Republic of Moldova (2017). *Statistical databank "Statbank"*. [online] Available at: http://www.statistica.md/pageview.php?l=en&idc=407 [Accessed 25 July 2017].

- Pearce, D. et al. (2002). *Economic Valuation with Stated Preference Techniques. Summary Guide*, [online] Department for Transport, Local Government and the Regions: London, March 2002. Available at: http://webarchive.nationalarchives.gov.uk/20120919162306/http://www.communities.gov.uk/documents/corporate/pdf/146871.pdf [Accessed 17 July 2017].

- Pearce, D. et al. (2006). *Cost-Benefit Analysis and the Environment: Recent Developments*, [online] OECD: February 2006. Available at: http://www.oecd.org/env/tools-evaluation/cost-benefitanalysisandtheenvironmentrecentdevelopments.htm [Accessed 7 August 2017].

- Random.org (2017). *True Random Number Generator*. [online] Available at: https://www.random.org [Accessed 9 September 2017].

- The R Foundation (2017). *What is R?* [online] Available at: https://www.r-project.org/about.html [Accessed 21 August 2017].

- Thompson, P. (2017). *Stakeholder Analysis: Winning Support for Your Projects*, [online] MindTools. Available at: https://www.mindtools.com/pages/article/newPPM_07.htm [Accessed 6 August 2017].

- Viton, P. (2015). *Discrete-Choice Logit Models with R*, [online] July 2015. Available at: http://facweb.knowlton.ohio-state.edu/pviton/courses2/crp5700/5700-mlogit.pdf [Accessed 31 July 2017].

- UN (2014). *The Value of Forests: Payments for Ecosystem Services in a Green Economy*, [online] Geneva Timber and Forest Study Paper 34, March 2014. Available at: https://www.unece.org/fileadmin/DAM/timber/publications/SP-34Xsmall.pdf [Accessed 31 July 2017].

- University of Florida (2017). Z-table [online]. Available at: http://www.stat.ufl.edu/~athienit/Tables/Ztable.pdf [Accessed 8 September 2017].

- Z Score Table (2017). Z Table [online]. Available at: http://www.z-table.com [Accessed 8 September 2017].

Terminology

Altruistic value

One of non-use values. Altruism is the opposite of egoism and refers to the desire to assure an improvement in the wellbeing of others. So, altruistic economic value is when individual A is willing to pay its part in order to make sure that individual B will be better off in his/her wellbeing.

Attribute

Distinctive characteristic of a good or service. For example, attributes of a forest can include size of its territory, species of flora and fauna, recreational possibilities, etc.

Averting behaviour (AB)

Economic valuation approach from the family of the revealed preference technique. Also known as defensive expenditures. It is based on people's choices and purchases of market goods in order to avoid negative intangible impacts due to decreasing physical quality of environmental good or service.

Benefit transfer

Method, where values of a good are estimated in one site (study site) and then applied, with some adjustments, to another site (policy site). An example is the application of values from one research project concerning a river at a particular location to another project with similar river ecosystem at another location.

Bequest value

One of non-use values. It measures individuals' willingness to pay for ensuring that future generations are able to access and use environmental good or service in the future.

Cost of illness (COI)

Economic valuation approach from the family of the revealed preference technique. It is based on consumers' expenditures on health services and medical products made in response to morbidity and other health effects of non-market impacts.

Choice experiment (CE)   Method from the family of choice modelling approaches, where respondents receive a variety of alternative scenarios regarding environmental good or service and asked to choose the most preferred one, thus expressing their willingness to pay or willingness to accept compensation.

Choice modelling (CM)   Economic valuation approach from the family of the stated preference technique. Also known as conjoint analysis or conjoint choice analysis. It is based on respondents' preferences for environmental goods, where goods are described in terms of their characteristics and the levels that these take. Choice modelling is able to measure non-use values of environmental goods or services. It includes such methods as choice experiment, contingent ranking, contingent rating, and paired comparisons.

Content validity testing   Form of valuation of study results. It helps evaluate whether the study had its survey questions formed in a clear, understandable, and appropriate way in order to obtain valid estimates, for example, to assess the maximum willingness to pay for a specific environmental good.

Contingent valuation (CV)   Method from the family of choice modelling approaches, where respondents are directly asked for their willingness to pay or willingness to accept compensation for a change in the quality and/or provisioning of environmental good or service.

Cost-benefit analysis (CBA)   Procedure to value and compare benefits (gains) and costs (losses) of changes in environmental good expressed in monetary terms based on individuals' preferences in order to enhance their utility, welfare, or wellbeing.

Dichotomous choice   Approach to describe human preferences (choices), where the set of alternatives to choose from is divided into two subsets: "good" or "bad".

Direct use value

One of the components of the total economic value of environmental good or service. It measures people's direct use of a natural resource or ecosystem services, who receive benefits from it. Direct use values can be for consumptive use or for recreational purposes.

Economic value

Monetary measure of people's wellbeing related to the change(-s) in quality or provisioning of environmental good or service. It is related to the willingness to pay or willingness to accept compensation for this change(-s). It should not be confused with monetary value or financial value.

Ecosystem services

Gains from natural ecosystems that mankind uses and benefits from. Ecosystem services include four broad categories: provisioning, regulating, supporting, and cultural services.

Existence value

One of non-use values. It measures the value that people put on the existence of environmental good or service, for instance, the Amazonian forest, even if they might never actually use this good or service.

Fractional factorial design

Statistical experimental design, which is applied to narrow down the number of choice sets that will be used in the stated preference survey.

Free-rider

Individual, who takes advantage of the benefits of a good (usually public good) without paying for it.

Gamification

Concept of applying game design, mechanics, and features to a non-game context, such as environmental research. It is aimed mostly at attracting, engaging, and motivating participants to a certain project or cause.

Hedonic pricing (HP)

Economic valuation approach from the family of the revealed preference technique. It is based on the fact that environmental

good or service is part of the characteristics bundle of some market goods or bads, where price is clearly observable. Most common uses of hedonic pricing rely upon prices on property and labour markets.

Heterogeneity

Scientific term for the word *diversity*. It is an opposite of homogeneity. Heterogeneity is used in statistics to explain the lack of uniformity in population sample, experimental design, dataset, etc.

Independence of irrelevant alternatives (IIA)

Axiom in decision theory and social sciences. It indicates that the relative probabilities of two alternatives are independent of the introduction or removal of other alternatives, and therefore their choice will not be affected by these changes. Also known as binary independence or the independence axiom.

Indirect use value

One of the components of the total economic value of environmental good or service. It measures the benefits that individuals receive from environmental good or service by not using it directly. Examples are water purification, carbon sequestration, pollination, etc.

Logit model

Statistical regression, where the dependent variable is categorical: it takes on one of a limited, and usually fixed, number of possible values. Also known as logistic probability unit or logistic regression.

Maximum likelihood procedures

Method of estimating parameters of observations in a statistical model, by finding the parameter values that maximize the likelihood of making the observations given the parameters.

Non-use value

One of the components of the total economic value of environmental good or service. It measures the value that people put on the environmental good or service, which they do

not intend to use themselves. Components of non-use values are altruistic, bequest, and existence values.

Non-market good

Category of goods, characterized by the fact that their economic value is not revealed in market prices. For this reason their economic valuation relies on non-market techniques, such as stated preference technique. Examples of non-market goods are clean air, clean water, wildlife habitat, biodiversity, etc.

Paired comparisons (PC)

Method from the family of choice modelling approaches, where respondents are asked to choose one of the two scenarios, which are presented at the same time, according to some specific criteria.

Payment vehicle

Representation of monetary value of environmental good or service. This is a specific type of payment mechanism that is decided in exchange for benefits of the good or service. Payment vehicle can be a market price, entrance fee, tax levy, voluntary donation, etc.

Pilot survey

Early version of a survey used to test its design and structure among a small sample of population prior to preparing and releasing the main survey.

Protester

Individual, who expresses the value of willingness to pay or willingness to accept compensation that is either zero or unrealistically high. In such way he/she protests against different aspects of the valuation scenario, survey design, and/or underlying economic theory.

R software

On-line software with language and environment for statistical computing and graphics. Similar to R are such software packages as Stata, SAS, and SPSS.

Random utility theory (RUT)

Theory, which seeks to describe respondents' choices and utility gains behind them. It is based on the assumption that individuals select such preferences, which maximize their expected wellbeing, welfare, or utility. So, if among the two scenarios, A and B, the respondent's utility is higher in scenario A than in B, then he/she prefers A to B.

Regression

Set of statistical procedures aimed to estimate the relationships among different variables. More specifically, regression helps to understand how the typical value of the dependent variable changes when one of the independent variables is varied, while the other independent variables are held fixed.

Reliability testing

Form of valuation of study results. Along with validity testing, it ensures that the economic valuation method used has produced reliable estimates of willingness to pay or willingness to accept compensation. Reliability refers to the degree of replicability of these results. In other words, one should be able to rely on them in giving the same estimates in repeated experiments under controlled conditions. However, it is possible to have a highly reliable study results, but it does not imply that they are valid as well. To verify that validity testing should be used.

Revealed preference (RP)

Economic valuation technique, which is based on real-life observations of purchasing behaviour and choices of individuals in existing markets related to environmental good or service.

Stated preference (SP)

Economic valuation technique, which is based on interviews and surveys eliciting respondents' willingness to pay or willingness to accept compensation for environmental good or service. This is the only economic valuation technique able to elicit non-use values of a good. It includes such approaches as contingent valuation and choice modelling.

Status quo Baseline / no-change scenario in an economic valuation survey, which represents the current situation of environmental good or service. By choosing status quo, an individual shows preference for the "do-nothing" policy.

Substitute good Certain good that can be used instead of another good. This is a product or service that an individual perceives as similar or comparable, so that having more of one product or service makes him/her desire less of another one.

Total economic value (TEV) Aggregated measure of the economic value of environmental good or service. It includes use and non-use values of that good or service.

Travel cost (TC) Economic valuation approach from the family of the revealed preference technique. It is based on estimating the value for environmental good or service from the complementary market goods and costs, specifically from the fact that people need to spend money on travelling and accessing a specific site in order to benefit from the environmental good or service. This approach is used mostly for recreational and touristic sites.

Use value One of the components of the total economic value of environmental good or service. It measures the value that users of the environmental good or service put on it. Components of use values are direct and indirect use values.

Validity testing Form of valuation of study results. It indicates how successful the survey has dealt with possible biases and how close its results reflect the true willingness to pay or willingness to accept compensation of the respondents.

Willingness to accept compensation Monetary measure of the value of what an individual is willing to receive as compensation in order to allow negative changes to environmental good or service or to stop benefitting from it.

Willingness to pay   Monetary measure of the value of what an individual is willing to pay / to give up in order to benefit from environmental good or service or to avoid the loss of it.

Indexes

www.megageneration.com

MEGA

Dear Friend,

We, the researchers from MEGA, hope you have found the methodological guidebook "The Codru Quest: Methodology" relevant and useful for your economic valuation study with application of choice modelling technique.

We welcome your comments and feedback on both the description of the technique in the guidebook and how it was illustrated by the methodological examples from the Codru Quest project. To share them with us,

please visit our website www.megageneration.com,

or send us a message to hello@megageneration.com.

We wish you MEGA great success in your environmental projects and economic valuation studies!

Yours Truly,
The MEGA Team

Playing

for Impact