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ECONOMIC VALUATION OF ENVIRONMENTAL GOODS AND SERVICES IN UKRAINE

The paper analyzes the economic approaches to evaluation of environmental goods and services. It discusses both positive and negative sides of using such methods as: market price method, factor income/productivity, travel cost, hedonic property value. Also specific attention is paid to the non-market methods such as imputed and expressed willingness to pay. The paper provides the results of two surveys in Ukrainian regions on consumer readiness to pay additional money for the goods and services which are not harmful to environment.

Keywords: *economic valuation; environmental goods and services; regions of Ukraine; ecological economics.*

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ЕКОНОМІЧНЕ ОЦІНЮВАННЯ ЕКОЛОГІЧНИХ ТОВАРІВ ТА ПОСЛУГ В УКРАЇНІ*

У статті проаналізовано економічні підходи до оцінювання екологічних товарів та послуг. Значну увагу приділено аналізу переваг та недоліків окремих методів оцінювання екологічних товарів та послуг, зокрема – методу ринкової ціни, методу продуктивності ресурсів, методу гедоністичної ціни та інших. Також досліджено неринкові методи, що базуються на готовності споживачів платити додаткові кошти за екологічно чисті товари та послуги. Приведено результати опитування споживачів щодо оцінювання ними готовності платити додаткові кошти за екологічність продукції.

Ключові слова: *економічний аналіз, екологічні товари та послуги, регіони України, екологічна економіка.*
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ЭКОНОМИЧЕСКАЯ ОЦЕНКА ЭКОЛОГИЧЕСКИХ ТОВАРОВ И УСЛУГ В УКРАИНЕ

В статье проанализированы экономические подходы к оценке экологических товаров и услуг. Значительное внимание уделено анализу преимуществ и недостатков отдельных методов оценки экологических товаров и услуг, в частности – метода рыночной цены, метода производительности ресурсов, метода гедонистической цены и других. Также исследованы нерыночные методы, основанные на готовности потребителей платить дополнительные средства за экологически чистые товары и услуги. Приведены результаты опроса потребителей по оценке ими готовности платить дополнительные средства за экологичность продукции.

Ключевые слова: *экономический анализ, экологические товары и услуги, регионы Украины, экологическая экономика.*

Introduction. People's wellbeing and health greatly depend on the quality of environment, and quality of the food consumed. During the last decades environ-

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mental problems became so complicated in Ukraine that these issues attract serious attention of researchers. Today the situation is not unlike the recent past. Ukraine annually produces almost 50 times more waste per $1 of GDP than the US or EU do. Annual amount of industrial waste formation per 1 km^2 in Ukraine is more than 6.5 times bigger than in developed countries.

History of domestic research on ecological economics and valuation of anthropogenic impact on the environment started in 1969. At that time a group of scientists, from Sumy branch of Kharkiv Polytechnic University, started researches on estimation the economic losses from metallurgical pollution. By the end of the 1980s there were established national methodological principles of economic evaluation of natural resources (including water, land, forest) and evaluation of environmental impacts losses in Ukraine. During the 1990s little research was done on economic evaluation of environmental impact; however, the interest to ecological and economic researches nowadays increases perpetually.

The ecological and economic issues were researched by many Ukrainian and foreign scientists, among them O. Balatskyi (1979), L. Melnyk (2010), R.S. De Groot (1992), O. Veklych (2003), H. Daly (2007), T. Panayotou (2000), G. Grossman (1995) etc.

The aim of the study is to analyze the basic approaches to evaluation of ecological goods and services and to provide real-life examples of their application in Ukraine.

The structure of the paper is as follows. First we analyze the most important environmental functions as a base to perform proper economic valuation. Second we address methodological approaches to environmental goods and services estimation. Third we provide real life examples of contingent valuation approach usage to evaluate ecological goods and services in Ukrainian regions.

1. Description of the functions performed by environment. The evaluation of ecological goods and services can be done produced through the functions that they perform. Thus, according to (Melnyk, 2010; Ianni, 2008) there could be 4 groups of functions considering environment: 1) regulation functions; 2) habitat functions; 3) production functions; 4) information functions. Let us take a closer look to each group of functions.

Regulation functions: this group of functions relates to the capacity of natural environment to regulate essential biological processes and cycles. In addition to maintaining ecosystem health, these regulation functions provide many services such as clean air, water and soil etc.

Habitat functions: natural ecosystems provide "home" and reproduction habitat to wild plants and animals. Thus they promote conservation of biological and genetic diversity of all species.

Production functions: photosynthesis and nutrient uptake by autotrophs convert energy, carbon dioxide, water and nutrients into a wide variety of carbohydrate structures which are then used by secondary producers to create a variety of living biomass.

Information functions: natural ecosystems provide the base to green tourism and contribute to the maintenance of human health by providing opportunities for reflection, recreation etc.

According to the functions performed all natural resources have to be either efficiently allocated or used at sustainable rate. The best way to understand the difference between: (a) an efficient allocation of resources, and (b) a sustainable rate of resource use, is to first recognize that the economy is a subsystem of the natural environment. Overall, to ensure sustainability, the rate at which resources are harvested from the natural environment must not exceed the carrying capacity of the natural environment. Similarly, the rate at which wastes are generated must not exceed the natural environment's waste assimilative capacity. Also according to the founder of ecological economics prof. Herman Daly: "we should deplete the nonrenewable resources at rates that, as far as possible, do not exceed the rate of development of renewable substitutes".

If the allocation of the resource flows is efficient, nothing more and nothing less than the correct amount of the resources will be allocated to produce different goods and services demanded by society.

2. Market valuation of economic goods and services. Two forms of buying and selling processes can be found according to the essence of natural factors involved.

1. *Processes of direct realization of market relations* happen when buying and selling object is a natural factor, such as mineral resources, forest producer, natural resources for ornament art etc. In that case the price for ecological goods and services can be achieved as interaction of market supply and demand.

2. *Process of indirect realization of market relations* happen when the object of buying and selling is not the natural factor itself, but its functions, which are realized in the selling process of other goods and services.

Theoretically, indirect monetary value of any natural service can be measured through additional volume of selling and/or high price level for a definite good comparing to economic indicators in those places and in that time, where and when there is no high demand for these services. Schematically it can be expressed by the following equation:

$$E_{in} = \sum_{i=1}^{n} \left(V_i^{\text{hd}} \times P_i^{hd} - V_i \times P_i \right), \quad (1)$$

where E_{in} – indirect monetary value of natural service; V_i^{hd}, V_i – volume of selling of i good in high demand (due to the need for a natural resource) and in the absence of high demand; P_i^{hd}, P_i – price of i good in high demand and in its absence; n – number of goods (subjects and services) due to which the demand of this natural service can be realized.

As is showed in the formula (1) in order to properly estimate ecological goods and services there are certain restrictions, such as market demand and competitive conditions. However, it is not always possible to use market mechanisms to evaluate ecological goods and services. Some goods are not traded at the market, for other goods there are no consumers to pay the money. Actually, the basic methods of market valuation of economic goods and services are shown in Table 1.

There are also specific methods that demand estimations of the so-called willingness to pay: 1) valuation on the imputed willingness to pay; 2) valuation of the expressed willingness to pay.

Table 1. **Basic methods of market valuation of economic goods and services**

Technique	General Applications	Measurement Basis	Strengths/Limits
The Market Price Method	This method estimates consumers and producer's surplus of goods and services traded at the market. Technique is applied to estimate use benefits of ecosystem goods that are sold directly at markets.	The functional relationships may be linear or non-linear. The list of determinant variables (such as income, prices of substitutes, prices of other goods etc.) may not be an easy task to make.	This method has several limitations. First, since only a few environmental goods are traded at the markets, its coverage is limited. Secondly, market distortions and imperfections.
Factor Income/ Productivity	This method is applicable in cases where environmental goods/ services are the inputs to produce a marketed good. An appropriately specified production function may indicate the contribution of these inputs.	Relies on estimating and using production relationships for the marketed good to estimate how changes in the ecosystem factor of production will affect the costs or profits of producers.	Major strength is that it avoids the need to model the demand side of the market. However, major problem is incorporations of environmental good into production function. Also not all goods are traded at the market.
Travel Cost	The method is based on the assumption that the cost that people incur to visit a site is the payment or the "price" of access to the site and its environmental services.	Peoples' willingness to pay to visit a site may be estimated based on the number of trips that are done with different kinds of transportation.	Major strength is that values are based on the actual choices of people. Major limitation is that region-wide modeling would generally be needed to estimate the welfare impacts of changes in site.
Hedonic Property Value	Consider a (marketed) good/service as a bundle of characteristics. A producer enriches his product with the characteristics in demand. Technique can be applied to estimate the benefits of locational ecosystem amenities, and certain ecological services.	This method is applicable only to valuation of those environmental goods/services that are tied to a marketed goods/services and the prices of the latter respond to changes in the quality/quantity and attributes of the former.	Major limitation is that the method demands a rich data/base and reliable estimation method. It is also susceptible to the choice of model specification used to estimation at hand.

* based on the works of (Melnyk, 2010; De Groot (1992); Ianni, 2008; van der Straaten).

Valuation of the Imputed Willingness to Pay: The value of some environmental services can be measured by estimating people's willingness to pay. That is costs that consumers are ready to pay in order not to discontinue the provision of certain ecological goods and services.

The cost approach is based mainly on accounting costs incurred by a community to economic development of natural resources. Thus, the resulting application of this economic assessment of natural resources is the consideration of social costs of labor required to reproduce the quantitative and/or qualitative parameters of natural wealth and their preparation for inclusion in economic activity.

Valuation of the Expressed Willingness to Pay: Many environmental goods and services are not directly traded at markets, nor are they closely related to or tied with any marketed goods. Therefore, people cannot "reveal" their willingness to pay for

them. In that case the contingent valuation methods are used. The name "contingent" valuation is based on the characteristic feature of this method, as it works on asking people to state their willingness to pay, depending on a specific scenario of situation development. As any method, contingent valuation has its own positive and negative sides. Positive sides of the method is the methodology based on the theory of economic valuation and can give reliable estimates and confidence intervals. Most errors can be eliminated if the researcher carefully build structure of the questionnaire. The typical questions could be:

1) Do you agree on a program of financing saving forest, if it will reduce your monthly income by 120 UAH?

2) If horal will cease to exist tomorrow as a species, what the maximum amount of money you are willing to pay today to prevent its disappearance: a) 0–25 UAH; b) 25–100 UAH; c) 100–300 UAH.

3) How much you pay for environmental safety?

Up to day it is the only method that can be applied to natural resources which do not have established ownership. Also expressed willingness to pay can be applied to estimate use benefits for any or all ecosystem services, as well as non-use benefits.

The main disadvantage of the method is about the questions indicated in the form of money estimates and may exceed the actual propensity to consume. The results may be inconsistent with the requirements of rational choice. Respondents in a hypothetical situation would not feel hard budget constraints and questions may not reflect what people would actually pay for the resource in a real economic or policy choice setting (Mishra).

3. Results of surveys on using contingent valuation approaches in Ukraine. In this section we describe the assessment of ecological goods and services in terms of the expressed willingness to pay. We address 2 recent surveys that were independently performed in Sumy and Donetsk regions. The surveys mainly addressed consumer's attitude to additional payments for certain ecological goods and services.

In Donetsk region 80% of the people who participated in a survey were concerned with healthy food. More than 70% of the respondents indicated that they are ready to pay more for ecologically clean products (ECP). To answer the question "*What is the proof of ecological cleanness of the products you like to buy?*" the majority of population of different age categories and social status said that they would give preference to: reputation of a product or TM – 29%; opinions of friend, relatives, colleagues, i.e. purchasing verified products – 19%; expert's recommendations – 16%; outcome of the state control bodies and special marking – 9%; trust the data on packaging – 3%. The important issue of the survey was to figure out what additional amount of money people are ready to spend on ecological pureness of certain goods and services. The price increases in ECP up 30% above usual goods are ready to pay almost 60% of the population. The price increase from 31 to 50% are ready to pay 25% of the population and at last price increase for more than 50% are ready to pay only 7% of the respondents (Sadekov, 2008).

According to the survey in Donetsk, the most significant part of the people are ready to purchase ECPs provided that the price would be only 10–50% higher than those of the products produced using traditional technologies.

Similar results were received from the study conducted in Sumy, the largest proportion of consumers are not ready to invest in reducing negative ecological impact of the production process (Fig. 1).

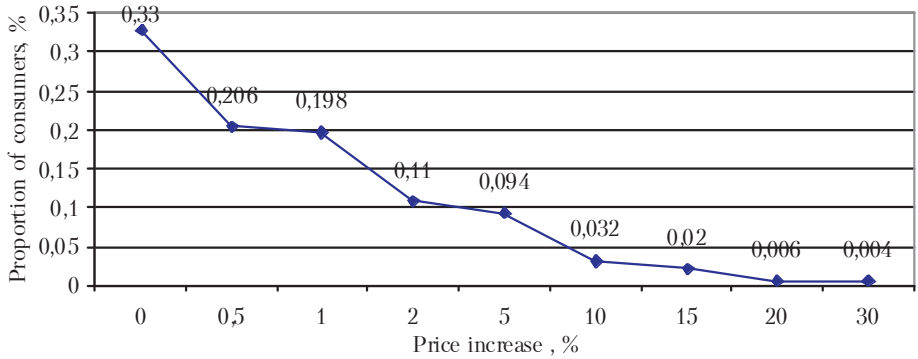

Figure 1. **Consumer readiness to pay additional money for the goods and services which are not harmful to environment (500 respondents),** *build on the data by Prokopenko (2006)*

The situation depicted on Figure 1 is explained by the low puchasing power of consumers and the fact that there are many different issues for consumers and the environment is not among the most urgent. Generally it is known that high population care about the environment is observed in developed countries, and this, in our opinion, is due to relatively high economic levels of their life. Moreover, negative ecological impact will reveal its negative influence only with time, and people always actively counteract negative phenomena which appearance is expected soon, and show certain indifference to the negative phenomena that are expected in distant future.

Conclusions. Economic valuation of environmental goods and services is performed when there are proper economic conditions and consumers well-being. When citizens are not rich enough they first negotiate about vital needs and then about quality of environment. It could be even a situation that economic goals are achieved through ecological losses but later on the quality of environment should go up together with income growth.

First of all, in order to improve ecological situation the consumer's preferences should be changed from homothetic to *nonhomothetic*. Under the homothetic individual preferences, an increase in income leads to higher consumption, which causes higher pollution. Individuals with nonhomothetic preferences along with rising income may desire less consumption and pollution, depending upon relative risk aversion between consumption and environmental safety.

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