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Article

Methods for Determining Economic Damage to The Environment

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Abstract: This article explores various methods for determining the economic damage caused to the environment, focusing on the quantitative and qualitative approaches used in environmental economics. The paper discusses the challenges associated with estimating the economic impact of environmental degradation, highlighting both direct and indirect effects on ecosystems, public health, and the economy as a whole. It presents several established techniques, including contingent valuation, cost-benefit analysis, and the damage function approach, as well as emerging methods that incorporate ecosystem services and sustainable development principles. The article aims to provide a comprehensive understanding of how economic damage assessments can guide policy-making and contribute to the implementation of environmental protection measures.

Keywords: Economic damage, environmental degradation, environmental economics, contingent valuation, cost-benefit analysis, ecosystem services, sustainable development, damage assessment.

1. Introduction

Unconventional measurement methods are becoming increasingly important due to the need for more concrete evidence that supports stakeholders at all levels in order to assess the impact of Tourism. There is due to the wide range of opportunities arising from digitization in the tourism sector, with the support of responsible management with the necessary information by filling in traditional data sources. As a result of the huge attention given to sustainable tourism, its importance is increasing day by day: the demand for consumers (tourists) is increasing, suppliers of tourist services are providing new projects, and government and international organizations are introducing new measures for sustainable development in the field of Tourism.

First of all, what standards should sustainable tourism meet, what characteristics should it demonstrate, both the confidence of consumers and the success of entrepreneurs and the benefit of the local population, while being able to resist inappropriate claims? the question is waiting for its solution. It is believed that tourism should contribute to sustainable development with integration with the natural, cultural and Human Environment and take into account its impact on cultural heritage and the traditional elements, activities and aspirations of the local community. Stability indicators (indicators) today cause interesting controversy in politics, that is, a strong interest in the imitation of previous and current changes is increasing the importance of applying more and more indicators. In addition to its basic function of quantification, indicators also evaluate opportunities and trends, provide information and have the

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characteristics of predicting future opportunities and trends, Early Citation Qodirov Abduvohid Abdumannof oʻgʻli Methods for Determining Economic Damage to The Environment American Journal of Economics and Business Management 2024, 7(12), 1398-1405. Received: 10th Nov2024 Revised: 11th Nov 2024 Accepted: 24th Nov 2024 Published: 5th Dec 2024 Copyright: © 2024 by the authors. Submitted for open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/lice nses/by/4.0/) 1399 Warning. Indicators of socio-economic development of the territory can be selected based on geographical location and several other factors. In particular, there are indicators of different categories: a decrease in the number of tourists who intend to return; measures pressure in the system, such as water shortages; measures biodiversity and socio economic impact, such as deforestation; there are indicators that give early warning signals, such as management work, which measures the cost of cleaning for coastal pollution and the impact of management intervention. There is an opportunity to choose between them, taking into account the peculiarities of the territory.

The presence of reliable, accurate and comparable indicators brings the following advantages: warning of risks or reducing costs, promoting a more perfect decision; preventive measures by identifying problems; flexible management, the possibility of measuring effects; measuring the implementation of plans, anticipating deviations and promoting constant improvement; reduced planning errors; high transparency (accountability), the process of informing the public about development. The International Tourism Organization argues that when choosing indicators, decision makers and stakeholders should work together and choose indicators that meet their goals for the impressive challenges of tourism to be considered. Most indicator data must be easily accessible to the sector of each industry member or accessible through other government bodies (e.g. at the national level). The purpose of collecting information should be the process of gathering different sources of information together to create a detailed map of the tourist industry of the area. Analysis of modern methods for assessing the sustainable development of regions shows that there are many approaches to assessing sustainability. These approaches differ mainly in the set of indicators, their grouping, methods of evaluating and generalizing the results. In the process of developing indicators of sustainable development of the territory, it is necessary to determine the approach in which the assessment of the stability of the territory is carried out. Currently, two methodological approaches are widely used:

- The first approach is characterized by the construction of a system of indicators that reflect one or another aspect of sustainable development.
- The second approach is characterized by the construction of a combined indicator, the use of which allows you to assess the level of stability of the development of the area under consideration.

In fact, to implement the second approach, it may be necessary to start with the first, that is, the integral indicator is calculated on the basis of separate indicators that characterize the main directions of sustainable development.

2. Materials and Methods

Environmental restructuring generally incurs higher costs compared to traditional economic activities. However, the essence of sustainable development lies in the idea that sometimes equilibrium criteria must include mechanisms for economic growth that account for the regenerative capacity of the environment, emphasizing the necessity of environmental restoration. Addressing this issue requires developing environmental management in production processes. As the relationship between humans and the environment becomes increasingly complex, philosophers, sociologists, and economists are paying greater attention to the diverse characteristics of the “society-nature” system. Humanity operates within the framework of the laws governing nature’s development while adhering to the principles of social development in its activities. This dual contradiction is evident and requires resolution. The challenges of economic relationships in environmental management systems have been studied by contemporary foreign scholars such as T. Anopchenko, M. Guzeev, B. Porfirev, S. Tuaglov, and A. Cheshov [2].

In the field of land resource utilization, significant contributions have been made by researchers like O. Botkin [3], I. Buzdalov [4], A. Uemeluanov [5], and Ch. Ionov [6], who have conducted fundamental research. At different stages of history, classifications of these contradictions and their solutions have varied. These circumstances necessitate a meticulous and objective analysis of conflicting relationships.

The production process involves a network of production relationships and the dynamics of their interactions. Forces derived from natural resources play a primary role in the system of production forces. As M. Lvovich aptly noted: “the principle of 'protection through utilization' for water resources and other natural components is inherently flawed. Environmental protection should not be viewed as something separate from production—it must be embedded within the very foundation of technology itself. In other words, environmental protection must become an integral part of the process of production and reproduction”.[7]

From these environmental principles, we must derive conclusions for the “human natural environment” system. Environmental laws generally belong to the type that impose restrictions—specifically, they limit human activities that alter nature.[8] The environment fulfills three primary functions: ensuring resources necessary for human activity; managing waste and pollution; offering services that provide recreational and aesthetic experiences for humans. These functions collectively form a single overarching role of the environment-the life-supporting function.[9] A wide range of methods has been employed to study the economic management of environmental issues. These include comparative analysis, statistical examination of data, economic comparison and evaluation, logical reasoning, scientific abstraction, as well as techniques such as analysis and synthesis, induction, and deduction.

3. Results and Discussions

Economic damage to the environment, economic damage to the environment is understood as the actual and potential economic loss caused by pollution or the additional expenses incurred to compensate for this damage. Currently, two main methods for calculating environmental pollution have been developed: direct calculation method; empirical aggregated (consolidated) calculation method.

The annual economic damage caused by pollution I (in currency units per year) is determined by the formula:

$$\boldsymbol{I = Iz \cdot w \cdot My} \quad (1)$$

Where:

- Iz: damage per unit of harmful substances emitted (currency units/ton);
- w: weight (mass) of harmful substances emitted per unit of product (tons/ton);
- My: annual production volume (tons/year).

The comprehensive economic damage Ic, encompassing emissions into air, water, and soil, is calculated as follows:

$$\boldsymbol{Ic = Iatm \cdot a + Iwater \cdot b + Isoil \cdot v + Imineral \cdot n} \quad (2)$$

Where:

- Ic: economic damage caused by emissions from specific sources or enterprises (currency units/year);
- $Iatm$: economic damage due to air pollution (currency units/year);
- $Iwater$: economic damage due to water pollution (currency units/year);
- $Isoil$: economic damage due to soil degradation and pollution (currency units/year);
- $Imineral$: economic damage due to the degradation and pollution of mineral resources (currency units/year);
- a, b, v, n: correction coefficients reflecting the reliability of the aggregated calculation method compared to direct calculation.

For any source, the economic damage caused by air pollution $Iatm$ can be calculated using the aggregated method with the formula:

$Iatm = K \cdot \chi \cdot f \cdot M$ (3)

Where:

- K: constant (its magnitude may vary depending on inflation, currency units/ton);
- χ: relative hazard coefficient based on the type of region (e.g., -10 for resorts, -8 for urban zones, 0.2 to 0.0025 for forests, -0.25 for arable land, -0.5 for gardens);
- f: dimensionless coefficient accounting for dispersion characteristics of pollutants in the atmosphere, influenced by sedimentation velocity, release height, and gas temperature (ranges from 0.08 to 1.0 depending on these parameters);
- M: adjusted annual mass of emissions (tons/year).

The adjusted mass of pollutants emitted into the atmosphere M is calculated using:

$$M = \sum i = 1c\Phi i \cdot mi \ (4)$$

Where:

- c: total number of pollutants;
- Φi: dimensionless factor representing the natural activity of the iii-th pollutant (e.g., 1 for carbon monoxide, 22 for sulfur dioxide, 54.8 for hydrogen sulfide, 980 for fluorine vapors);
- mi: annual mass of i-th pollutant emissions (tons/year).

The economic damage $Iwater$ caused by pollutants discharged into water bodies is calculated using:

$Iwater = K \cdot \chi k \cdot M$ (5)

Where:

- K: constant (currency units/ton);
- χk : coefficient varying across different water management regions;
- M: adjusted annual mass of wastewater discharges, calculated as:

$$M = \sum i = 1c\chi i1 \cdot mi1 \ (6)$$

Where:

- $\chi i1$: relative hazard indicator for the iii-th wastewater pollutant;
- $mi1$: annual mass of iii-th pollutant discharged (tons/year).

The hazard indicator $\chi i1$ is determined by:

$$\chi i1 = 1 \ g/m3REMb/\chi i \ (7)$$

Where:

- $REMb/\chi i$: permissible concentration of the iii-th pollutant in water bodies (g/m³).

Soil Resource Degradation:
The economic damage due to soil degradation $Isoil$ is evaluated as:

$$Isoil = (Iatm + Iwater + Io) \cdot Ber \ (8)$$

Where:

- $Iatm$: damage from atmospheric emissions due to soil degradation (currency units/ha/year);
- $Iwater$: damage from water pollution due to soil degradation (currency units/ha/year);
- Io: loss due to land withdrawal (currency units/ha/year);
- Ber : area of degraded land (ha).

The loss due to land withdrawal Io is:

$$Io = \sum m = 1nOm \cdot (Tm'' - Tm') \ (9)$$

Where:

- Om : annual reduction in agricultural production due to land degradation (tons/ha/year);
- Tm': cost per ton of production in control zones (currency units/ton);
- Tm'': cost per ton in degraded zones (currency units/ton).

Degradation of Mineral Resources:
Economic damage due to mineral resource degradation $Imineral$ is calculated as:

$$Imineral = Idamage + Ipollution \ (10)$$

Where:

- $Idamage$: economic loss from degradation of mineral resources (currency units/year);
- $Ipollution$: economic loss from pollution of mineral resources (currency units/year).

This methodology provides a comprehensive framework for estimating the economic impact of environmental degradation, supporting the development of effective policies for sustainable management.

Aggregated calculations indicate that approximately 60% of the total economic damage to the economy is attributed to air pollution, 30% to water body pollution, and 10% to solid waste contamination. Accurately determining economic damage using direct calculation methods requires extensive primary data, which can be obtained through engineering-economic investigations of enterprises and their impact zones.

The economic efficiency of environmental protection measures is expressed as the annual reduction in economic damage caused by environmental pollution or the amount of damage prevented as a result of such measures. This also includes the annual increase in revenue due to improved production outcomes. [12] The economic efficiency of environmental protection measures is evidenced when the economic outcomes exceed the expenditures incurred.

The overall (absolute) economic efficiency, Su, of annual comprehensive measures can be calculated using the ratio of the total benefit obtained to the comparative costs required to implement these measures, as follows:

$$Su = X + Hs \cdot KS \ (11)$$

Where:

- S: Annual benefit achieved,
- X: Current annual expenditures,

- Hs: Normative efficiency of annual capital investments,
- K: Effective capital investments.

For measures yielding long-term benefits spanning several years, where the expenditure recovery period exceeds the timeframe for benefits realization, the integral benefit $\sum S$ can be calculated for the period $t = Hs1$. Costs are then computed using the following formula:

$$Su = \sum(X + K)\sum S \ (12)$$

Primary Economic Effect

The primary effect, Sbs, derived from reducing environmental harm (e.g., mitigating pollution), is calculated as:

$$Su = X + Hs \cdot KY \ (13)$$

Where:

- Y: An indicator characterizing the improvement in the environmental condition at the specific location.

The economic benefits of environmental protection measures can be assessed as follows [13]:

- **Overall benefit**: Based on the growth of net product value, in line with the economic valuation of natural resources,
- **Operational efficiency**: Reflected in the increase in enterprise revenue or the reduction in production costs.

The benefit obtained from reducing damage, ΔZ, and the increase in enterprise revenue, ΔD, can be expressed as:

$$S = \Delta Z + \Delta D(X + Hs \cdot K) \ (14)$$

The absolute efficiency of additional capital investments in environmental protection measures for enterprises (Sm) is calculated as:

$$Sm = \Delta DK (15)$$

The absolute efficiency of environmental protection measures is determined using the formula [14]:

$$Cmn = X + Hs \cdot K\sum i = 1n\sum j = 1mSij \ (16)$$

Where:

- Sij: Economic benefit of type iii for object j,
- Hs: Normative coefficient for capital investment efficiency, equal to 0.16.

The comparative efficiency of allocated capital investments for environmental protection is determined based on comparative costs.

Social efficiency is reflected through indicators such as:

1. The benefit derived from preventing losses of net products (Ssm) due to pollution-related illnesses:

$$Ssm = Ikas \cdot Mk(B2 - B1) \ (17)$$

Where:

- $Ikas$: Adjusted number of workers affected by illnesses or providing care for the sick,
- Mk: Net product generated per workday,
- $B1$ and $B2$: Productivity of a worker before and after the measures, respectively.

2. Reduction in payments from the social insurance fund due to fewer illness-related claims:

$$Stq = Iif \cdot Nm(B2 - B1) \ (18)$$

Where:

- Iif: Number of workers receiving benefits due to pollution-related illnesses,
- Nm: Average amount of the benefit.

3. Savings from reduced societal expenditures on treatment of workers affected by pollution-related illnesses:

$$Smx = Ka \cdot Da \cdot Xa + Ks \cdot Ds \cdot Xs \ (19)$$

Where:

- Ka and Ks: Number of patients treated in polyclinics and hospitals, respectively,
- Da and Ds : Average time required to treat one patient,
- Xa and Xs : Average daily treatment costs per patient.

The overall economic benefit from increased labor productivity is calculated based on the growth of net product, while in the non-production sector, it is determined by the reduction of expenditures.

The overall economic benefit derived from reduced consumption of raw materials, fuel, and other materials, as well as reductions in waste, wastewater, gas, and dust, is calculated based on the growth of net product. The economic benefit to enterprises is evaluated based on increased revenues.

The overall benefit resulting from better utilization of equipment, due to improved environmental conditions, is calculated by considering the reduction in idle time of equipment under repair, decreased costs for maintenance and servicing, and increased labor productivity of workers.

The economic benefit to enterprises, Sxx, is calculated as follows:

$$Sxx = (X1 - X2) + J \cdot Kaf \cdot (D2 - D1) \ (20)$$

Where:

- $X1$ and $X2$: Repair costs before and after environmental protection measures,
- J: Average annual value of equipment,
- Kaf: Coefficient of annual profitability of fixed assets,
- $D1$ and $D2$: Equipment service life before and after the implementation of environmental protection measures. [14]

The economic and operational efficiency of improving the quality of industrial and agricultural products, reducing costs of air and water purification, and preventing deforestation while ensuring reforestation, is calculated using the methods described above.

When choosing the optimal option for implementing environmental protection measures, an economic comparison method is used. The preferred option is the one with the lowest comparative costs, determined by comparing the sum of operational and comparative costs based on the normative efficiency of capital investments:

$$C + Hs \cdot K \rightarrow min \ (21)$$

"Externalities" represent one of the most critical concepts in environmental management. The process of managing ecological-economic activities involves continuous impacts on nature and the population by various objects. Externalities arise from such impacts.

An externality is the external effect (or consequence) of economic activity, which has either a positive or, more commonly, negative impact on a third party not directly involved in the activity.

The issue of externalities is closely tied to property rights, the scarcity of natural resources, and the ownership of nature's assimilative capacity. Economic interests differ between two primary property holders: society and entrepreneurs. Society benefits from reducing pollution damage, while entrepreneurs are interested in minimizing environmental protection costs that affect the key economic indicators of production.

For entrepreneurs, damage caused to "third parties" is inherently an external cost of their production activities. Given the conflict between societal and entrepreneurial interests—where society aims to reduce pollution damage and entrepreneurs seek to minimize environmental protection expenditure there arises a necessity to develop mechanisms for regulating impacts on the environment.

The essence of regulation lies in the internalization of external costs, meaning that external costs imposed on society must be transformed into internal costs borne by entrepreneurs. Entrepreneurs must be compelled to bear the expenses associated with their activities.

4. Conclusion

The diverse impacts of externalities can be categorized into the following types: temporal, global, intersectoral, interregional, and local. Temporal externalities are closely tied to the concept of sustainable development. They require the current generation to meet its needs while considering the interests of future generations. Global Externalities: These are associated with the transboundary spread of pollution and necessitate the development of international conventions and treaties to address such issues. Intersectoral Externalities:

These externalities arise when certain sectors of the economy, particularly those exploiting natural resources, cause ecological damage to other sectors. This drives the search for alternative solutions to environmental issues and fosters structural reforms in the economy. Interregional Externalities: These are scaled-down versions of global externalities and involve the consequences of externalities within specific countries or regions. Efforts are made to eliminate these impacts on a regional scale. Local Externalities: Local externalities pertain to the analysis of external costs caused by polluting enterprises within confined areas. These analyses focus on their impacts on recipients (e.g., other businesses or facilities) and provide conclusions and recommendations.

The **assimilation capacity of the environment (AMA)** refers to the ability of natural components (such as the atmosphere, water sources, and soil) to absorb anthropogenic impacts without altering their fundamental properties over an extended period. AMA is a distinct natural resource and is considered finite or scarce.

The economic significance of AMA lies in its potential to reduce environmental protection costs. This savings reflects the **social utility** or value of AMA. The economic assessment of AMA is based on two primary methods: **Rent-Based Valuation**; **Quasi-Rent Valuation.**

These methods rely on the feasibility of artificially reproducing AMA by reducing emissions or impacts to meet environmental standards. Valuation is based on the difference between the socially necessary costs for achieving ecological standards within specific regions and the individual costs for the same. This approach aligns AMA's value with the objective value of natural resources and its practical application.

In practical applications, the economic valuation of AMA can use the extent to which environmental standards are exceeded in a region (e.g., expressed as multiples of allowable limits). Using these metrics, coefficients are calculated to determine the economic value of AMA based on a reference region's predetermined AMA value. This approach can also be applied to specific pollutants, allowing for the aggregation of valuations to derive the overall economic value of AMA.

REFERENCES

1. Address of the President of the Republic of Uzbekistan Shavkat Mirziyoyev to the Oliy Majlis. http://uza.uz
2. Anopchenko T. “The Role and Place of Managing Ecological-Economic Risks in Developing National and Regional Economies.” // Regional Economy: Theory and Practice, 2007, No. 16.
3. Botkin O. I. “Institutional Transformations of Agricultural Enterprises in a Market System.” – Izhevsk, 2002.
4. Buzdalov I. “Land Ownership and Its Use in Economic Structures.” // Economics and Management of Agro-Industrial Complex, 1996, No. 2.
5. Emelyanov A. “Regulated Market Circulation of Land and Private Ownership of Land.” // Issues of Economics, 2001, No. 8.
6. Kuznetsov V. V. “Why State Regulation of Agro-Industrial Complex Development is Necessary.” 1995, No. 5.
7. M. Lvovich. “On Economics and the State, the People, and Justice.” Moscow: Nedra, 1995, p. 112.
8. Razumov V. "Ecology. Textbook." Infra, 2012. http://dlib.ru/rsl/01005000
9. Weizsäcker E. "Factor Four: Halve the Costs, Double the Returns." http://yandex.ru.
10. “Economics of Environmental Management,” 2nd Edition, Revised and Supplemented. Textbook for Bachelor’s Students.
11. http://dlib.rsl.ru/rsl/01005000000
12. http://dlib.rsl.ru/rsl/01005000000
13. http://dlib.rsl.ru/rsl/01005000000
14. http://dlib.rsl.ru/rsl/01005000000