



Ecological-economic assessment of environmental quality as a natural basis for territorial sustainable development: conceptual-categorical analysis

Yinan Dong

Southern Federal University, Rostov-on-Don, Russia,
yinan.2.dong@uconn.edu, <https://orcid.org/0000-0001-8658-7196>

Abstract. In the context of growing global problems of resource using and environmental protection the development of a sustainable environmental-economic development strategy, including at the territorial level is becoming increasingly actual. The *purpose* of the research is conceptual-categorical analysis of ecological-economic assessment of environmental quality as a natural basis for territorial systems of different levels sustainable development, elaboration and justification of the conceptual assessment model and methods of its implementation. *Methodological issues* focus on how to comprehensively assess the environmental quality of the territory and how this assessment can be taken into account in the formation of a strategy for environmentally sustainable development of spatial-economic systems. The *scientific novelty* of the research results lies in the consolidation of the theories of territorial development sustainability and environmental quality environmental-economic assessment in the conceptual model, as well as in the substantiation of tools for quantitative measurement of environmental quality, increasing the accuracy and reliability of the obtained environmental-economic assessments. The significance of the *research results* lies in providing decision-makers with comprehensive information on the long-term consequences of environmental-economic decisions and facilitating the transition to environmentally sustainable economic development of territories. This information can be obtained as a result of systematic application of multidimensional environmental-economic assessment tools that take into account not only the full socio-economic value of natural environmental resources, but also the spatial characteristics of territories.

Keywords: ecological-economic assessment, environmental quality, natural basis, territorial sustainable development, conceptual-categorical analysis

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Эколого-экономическая оценка качества окружающей среды как природного базиса устойчивого развития территорий: концептуально-категориальный анализ

Инань Дун

Южный федеральный университет, Ростов-на-Дону, Россия,
yinan.2.dong@uconn.edu, <https://orcid.org/0000-0001-8658-7196>

Аннотация. В контексте растущих глобальных проблем ресурсопользования и охраны окружающей среды выработка стратегии устойчивого эколого-экономического развития приобретает все большую актуальность, в том числе и на территориальном уровне. *Цель* исследования – концептуально-категориальный анализ эколого-экономической оценки качества окружающей среды как природного

базиса устойчивого развития территориальных систем различного уровня, разработка и обоснование концептуальной оценочной модели и методов ее реализации. *Методологические вопросы* фокусируются на том, как всесторонне оценить качество окружающей среды территории и как эта оценка может быть учтена при формировании стратегии экологически устойчивого развития пространственно-экономических систем. *Научная новизна* результатов исследования заключается в консолидации в концептуальной модели теорий устойчивости территориального развития и эколого-экономического оценивания качества окружающей среды, а также в обосновании инструментов количественного измерения экологического качества, повышающих точность и надежность полученных эколого-экономических оценок. *Значимость результатов* исследования заключается в предоставлении лицам, принимающим решения, всесторонней информации о долгосрочных последствиях эколого-экономических решений и содействии переходу к экологически устойчивому экономическому развитию территорий. Данная информация может быть получена в результате систематического применения многомерных эколого-экономических инструментов оценки, которые учитывают не только полную социально-экономическую ценность природных ресурсов окружающей среды, но и пространственные характеристики территорий.

Ключевые слова: эколого-экономическая оценка, качество окружающей среды, природный базис, устойчивое развитие территории, концептуально-категориальный анализ

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1. Quality of the environment and territorial sustainable development

In recent years, the rapid development of the global economy has brought about significant environmental challenges [1, 2]. The expansion of industrial activities, accelerated urbanization, and increased consumption have not only exacerbated pollution issues but also led to resource depletion [3]. The relationship between economic development and environmental sustainability is intricate, often necessitating trade-offs between economic interests and environmental well-being. Achieving sustainable development (SD) requires striking a balance between economic growth and environmental protection. Incorporating environmental quality (EQ) assessments into economic planning to ensure that development projects are sustainable and do not compromise the well-being of future generations can contribute to the attainment of SD goals.

As economic and social development progresses, EQ has suffered severe degradation. Environmental deterioration, including air and water pollution, soil contamination, and biodiversity loss, has in turn adversely impacted socioeconomic processes [4, 5]. There is an urgent need for integrated approaches to assess EQ to ensure that economic development strategies do not compromise environmental sustainability. This involves evaluating various environmental parameters and their interactions with economic activities, prompting decision-makers to increasingly focus on the concept of territorial ecological sustainability and undertake comprehensive EQ assessments.

The key aim of the research is to analyze how EQ ecological-economic assessments can promote sustainable territorial development. To achieve this goal, three crucial concepts: environmental quality, ecological-economic assessment, and sustainable development are examined. Based on the relationships among these three concepts, a conceptual theoretical model is constructed. The study integrates theories of ecological-economic assessment and environmental sustainability, proposing an integrated assessment approach that elucidates the direct and indirect EQ impacts on economic activities and social development. The paper employs literature review, conceptual analysis, and theoretical analysis to develop a novel conceptual framework. By constructing a model that encompasses EQ, environmental economic assessment, and SD, the study aims to evaluate environmental quality more effectively, thereby driving territorial sustainable development.

The significance of this paper can be manifested in two aspects. Firstly, its theoretical research significance lies in the multidimensional ecological-economic assessment method, which unveils the interactions among economic, social, and ecological systems, providing a novel research perspective for theoretical researchers and contributing to innovation and systematization in this field. Secondly, the paper holds practical significance. The model proposed can provide actionable policy recommendations for governments to guide

the development and implementation of sustainable practices at regional and national levels. These recommendations will be based on integrated EQ assessments and economic evaluations. Such assessments provide scientific grounds for making prudent management decisions and advancing environmental sustainability strategies, enabling policymakers to comprehend the long-term environmental consequences of economic decisions and facilitating the transition towards an environmentally friendly economy.

2. Methodology for territorial EQ ecological-economic assessing in the sustainable development system

The methodology focuses on three main aspects, the first is relevant studies on ecological-economic assessment and the second aspect is the SD theories.

The literature on ecological-economic assessment can be broadly categorized into two types: the first employs non-monetary methods to evaluate EQ, while the second utilizes monetary methods from economic methodologies to assess it. Non-monetary methods primarily include Life Cycle Assessment, a systematic analytical tool used to evaluate the environmental impacts of a product, process, or activity throughout its entire life cycle, from raw material acquisition to final disposal [6]. Sustainability Indicator Approach measures the sustainability of a system through a series of environmental, economic, and social indicators [7]. Monetary methods mainly encompass: Hedonic Pricing Method, which infers the impact of EQ on prices by analyzing the price variations of goods in the market [8], Contingent Valuation Method, which evaluates the EQ value by surveying the amount the public is willing to pay [9]. Choice Experiment Method analyzes consumer preferences under different EQ scenarios by setting up simulated market situations [10].

However, most existing studies employ a single valuation method, lacking a comprehensive and integrated approach. There is a need for frameworks that combine multiple assessment methods to capture the full socio-economic value of environmental resources and account for spatial and temporal variations across regions.

The SD concept was first introduced in 1987 in the report "Our Common Future", which emphasized the balance between environmental protection and economic development. The initial definition stressed that development should meet present needs without compromising the ability of future generations to meet their own needs. Subsequently, the SD theory underwent several developmental stages, gradually becoming more refined and proposing a balance among environmental, economic, and social aspects. Over time, the theory was further improved. Later, in 2015, the United Nations put forth 17 Sustainable Development Goals, forming a more comprehensive theoretical framework and further specifying the implementation pathways for SD [8].

While SD literature highlights the EQ importance, it often lacks quantitative assessment tools. Existing sustainability assessments are primarily qualitative [11], failing to provide precise measurements and economic valuations of environmental impacts. There is a need for integrating rigorous economic valuation methods into SD frameworks.

The main contributions of this research to the methodology are reflected in two aspects. First, it integrates sustainability into ecologic-economic assessing procedure. Existing research on EQ assessment typically adopts a single method, lacking a comprehensive analysis and a sustainability development perspective. The conceptual model proposed in this study incorporates the SD perspective into ecological-economic assessment methods, providing a more comprehensive analytical framework. Second, it offers a more accurate assessment model for sustainability. Current research on sustainability assessment is primarily qualitative, lacking sufficient quantitative analysis. By leveraging monetary economic assessment methods, EQ can be effectively analyzed quantitatively. The conceptual theoretical model constructed in this study incorporates quantitative economic assessment methods, such as monetary value estimation, into sustainability development research, providing new perspectives and tools in the SD field.

3. Results of conceptual- categorical analyses

The results of conceptual – categorical analysis allowed us to clarify the essence of the concepts and categories by examining how they are employed in various contexts and by identifying the necessary and sufficient conditions for their applications.

EQ is an indicator used to evaluate environmental conditions, but it encompasses many aspects. There are different ways to define EQ. Therefore, to better conduct EQ economic valuation, the first step is to clearly define it. After synthesizing the definitions by Xin Jiang [12] and Stratoulas & Nuthammachot [13], this research proposes a definition of EQ and further categorizes it into air, water, land and biodiversity quality. Effectively assessing these four aspects of EQ can provide its in-depth economic understanding.

Ecological-economic valuation is a crucial methodology to address EQ externalities, with a rich and multifaceted conceptual underpinning. Figure 1 presents a structured framework delineating the various components integral to the EQ economic assessment. This framework is divided into two primary categories: economic concepts and environmental concepts, which collectively contribute to the overarching aim of EQ evaluating.

Ecological-economic assessment can be analyzed from two distinct perspectives. Firstly, from an environmental economics lens, environmental economic valuation primarily encompasses three core conceptual domains: (1) the externality problem of EQ from an economic perspective; (2) economic instruments and tools to internalize EQ externalities; (3) methodologies for monetizing EQ as an economic good.

Secondly, from an economic perspective on the environment, it also incorporates three aspects: (1) conceptualizing EQ resources as a form of natural capital [4]; (2) recognizing that the environment provides goods and services to human society, collectively termed "ecosystem services" [14]; (3) considering EQ as an integral component of SD, interlinked with economic and social development.

The SD theory has undergone two significant phases.

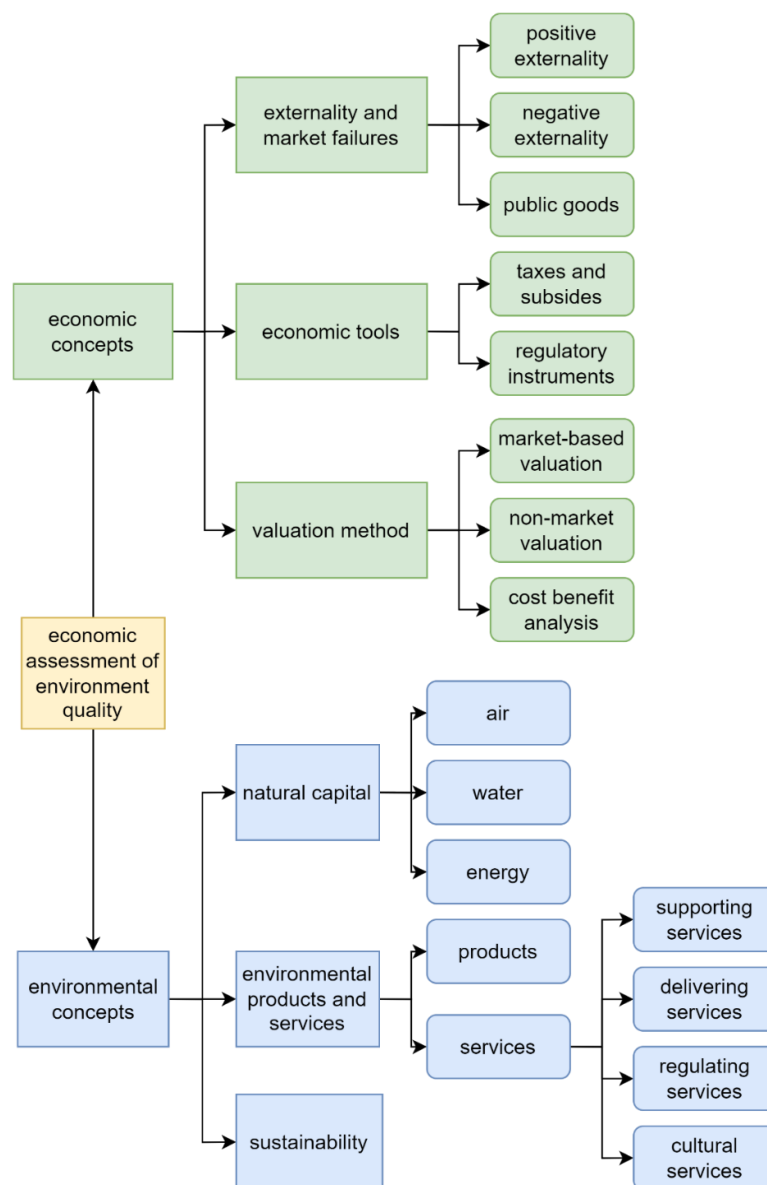


Fig. 1. Concept of ecological-economic assessment¹

Рис. 1. Концепция эколого-экономической оценки

¹ Compiled by the author / Составлен автором.

Problems of Economics

Yinan Dong. Ecological-economic assessment of environmental quality as a natural basis for territorial sustainable development

The first phase began with the introduction of the SD concept, emphasizing the need to meet the requirements of future generations. This phase also saw theoretical advancements, including the articulation of SD three dimensions: environmental, economic, and social [15]. SD research initially focused on environmental and economic aspects but gradually incorporated social factors, such as emphasizing equitable social distribution when discussing environmental resources and economic development. Public participation also emerged as a critical element in environmental sustainability.

The second phase involved further concretizing these three dimensions by introducing 17 operational Sustainable Development Goals. These goals provide a comprehensive blueprint for addressing global challenges. They cover a wide range of issues, including poverty eradication, quality education, gender equality, clean water and sanitation, affordable and clean energy, and climate action [16]. The SDGs represent an integrated approach, acknowledging the interconnectedness of social equity, economic growth, and environmental protection.

Conceptual-categorical analysis revealed interrelationships between different conceptual approaches and allowed synthesizing a model of integrated ecological-economic assessment of the territory's environmental quality. Specific methods employed included systems thinking, causal loop diagrams, and scenario analysis to understand the complex interactions and feedback loops between SD economic, social, and ecological dimensions. The framework aims to provide a comprehensive approach to assessing EQ, quantifying its economic impacts, and aligning these assessments with SD objectives (fig. 2). The core idea is to leverage economic valuation methods to quantify the impacts of various environmental aspects on SD trajectory. Under the objective of environmental sustainability, various aspects are encompassed, including renewable energy, water quality, and biodiversity. For each of these aspects, different indicators can be identified. By conducting detailed analyses of these specific indicators and the factors influencing them, it is possible not only to improve specific aspects of EQ but also to advance the overall SD process from an environmental, economic, and social perspective.

Therefore, within the SD context, EQ receives more effective attention, focusing on its improvement from a holistic perspective encompassing environmental, economic, and social dimensions.

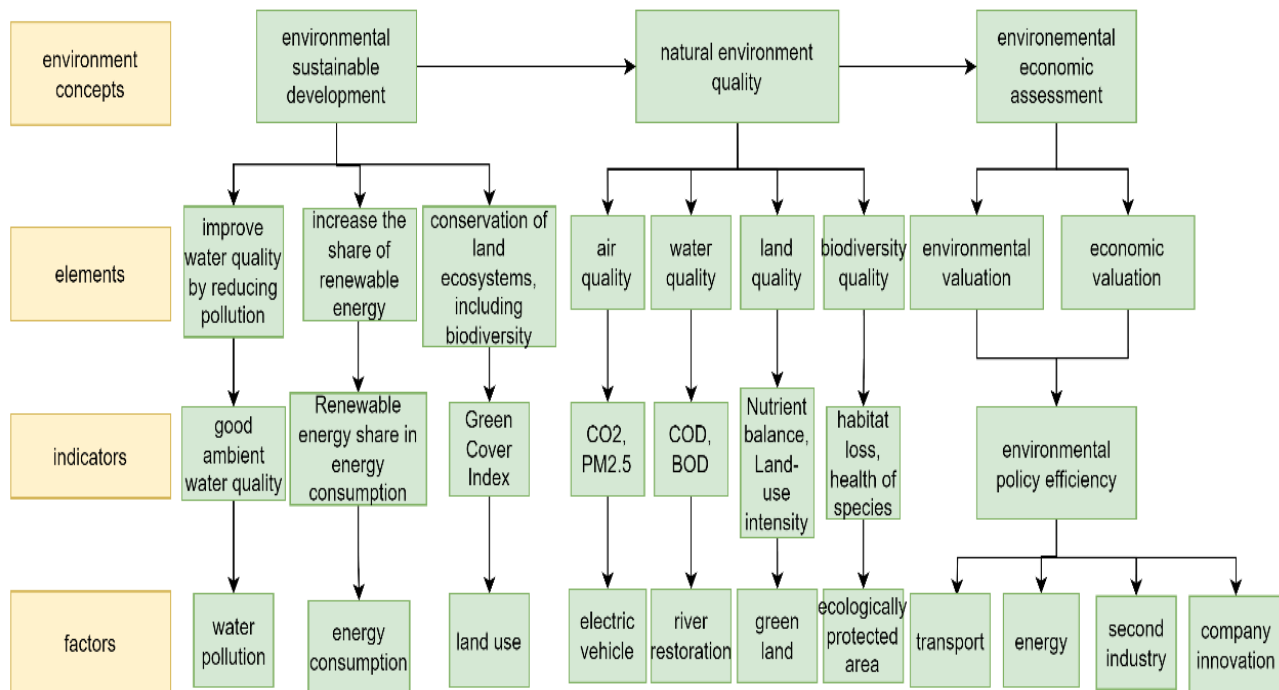


Fig. 2. Triple framework of environmental quality' ecological-economic assessment and SD¹
Рис. 2. Тройная структура эколого-экономической оценки качества окружающей среды и УР

¹ Author's development / Авторская разработка.

Achieving improvements in EQ necessitates government economic actions, such as promoting environmentally friendly electric vehicles, restoring and managing rivers, and establishing ecological reserves to protect biodiversity.

The economic actions taken by the government to enhance EQ must consider cost-benefit analyses to ensure economic efficiency. Ecological-economic assessment employs quantitative economic methods to evaluate these actions, thereby facilitating more efficient improvements in EQ and better promoting the process of SD.

4. Discussion

The proposed conceptual model of EQ environmental-economic assessment in the context of ensuring sustainable development of territorial systems is an important analytical tool and can be used to support environmental-economic decision-making both in public administration and in the management of territories and organizations developing.

The application of the assessment model will contribute to the development of adequate environmental-economic policy and the solution of specific environmental problems. For example, the results of the assessment of air quality parameters can be used in the development of emission trading mechanisms, as well as incentives for the introduction of environmentally friendly technologies. Similarly, assessments of water quality parameters can inform the development of water using regulations, wastewater discharge charges or subsidies for wastewater treatment plants. Environmental-economic assessments can justify the potential benefits of policy implementation for public health and long-term sustainability.

In addition to direct policy implications, the application of an assessment model can also indirectly influence people's behavior and public attitudes towards environmental sustainability. By quantifying the economic costs and benefits of EQ changes, public awareness of the importance of sustainable practices can be raised. For example, estimating the monetary value of ecosystem services provided by biodiversity conservation areas can encourage public support for such initiatives. In addition, the results of ecological-economic valuation can be used in educational campaigns promoting environmentally conscious consumption patterns and lifestyle choices.

5. Conclusion

The results of the research show the importance of an integrated, multidimensional approach to the EQ ecological-economic assessment, taking into account its socio-economic value and spatial characteristics of territories. It is proved that taking into account socio-ecological-economic interactions in the assessment initiates positive economic effects and serves as a basis for the development of adequate measures for environmental protection.

The author's assessment model is designed to improve the accuracy and efficiency of policy decisions, thereby contributing to the achievement of the SDGs. The formation of a balanced strategy for sustainable development of the territory is based on ecological and economic indicators (share of renewable energy sources, nutrient balance and habitat health), which guarantees compliance with the requirements of its ecological validity and economic viability.

The incorporation of the EQ environmental-economic assessment procedure into the strategic planning system will make it possible to ensure the sustainability of development projects without compromising the well-being of future generations.

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Информация об авторе

Инань Дун – соискатель кафедры «Инновационный и международный менеджмент» факультета управления ЮФУ.

Information about the author

Yinan Dong – Applicant, Department "Innovative and International Management" of the Faculty of Management, Southern Federal University.

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