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Phoebe Koundouri[1*], George Halkos[2], Conrad Landis[3], Angelos Alamanos[4]

[1] School of Economics and ReSEES Research Laboratory, Athens University of Economics and Business; Department of Technology, Management and Economics, Denmark Technical University (DTU); Sustainable Development Unit, Athena RC; Academia Europea; pkoundouri@aueb.gr

[2] University of Thessaly, Department of Economics, halkos@uth.gr

[3] ReSEES Research Laboratory, Athens University of Economics and Business; Visiting Faculty, India Institute of Management Rohtak; conrad@aueb.gr

[4] Sustainable Development Unit, Athena RC, angalamanos@gmail.com

* Corresponding author: Phoebe Koundouri, pkoundouri@aueb.gr

Abstract: The significance of the SDGs lies in their holistic, global and interdisciplinary nature. But this nature at the same time poses significant challenges, as it is difficult to bridge the environmental with the socio-economic aspects of SDGs, in theory, practical application and policymaking. SDG14 on "life below water" consists of these aspects, as it refers to a natural/environmental system, supporting several economic activities and values, and associated with strong social and cultural characteristics. The main challenges for the achievement of a sustainable life below water are analyzed, and ways forward are discussed. Holistic and well-coordinated approaches based on systems thinking are necessary. Moreover, we argue on the role of environmental economics, as tools that can bridge environmental and socio-economic aspects, towards more accurate and insightful sustainability reporting. In particular, the potential of environmental valuation as a means to better inform SDG policies, is discussed, using the example of SDG14. The currently established frameworks for Country's Sustainability Reporting, lack metrics focusing on the economic impact of the environment and the ecosystem services' degradation or restoration rates, including ocean and marine ecosystems. Acknowledging and quantifying the costs and the benefits of ocean and marine ecosystems can lead to more effective interventions (ocean pollution prevention, climate change mitigation, fishing exploitation, biodiversity and coral reefs preservation), and to a better understanding of the human-environmental dynamics strengthening thus coordinated management and cooperation.

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Keywords: Sustainability; SDG14; Environmental Valuation; Ecosystem Services; Sustainability Reporting Frameworks.

Introduction

The need for sustainable ways of development is widely acknowledged in science and literature, as the world increasingly calls for resilience and integrity in various aspects, such as the economy, society, and the natural environment. These three aspects contextualize the term 'sustainable development' and take on the name of 'pillars' of sustainability (1). These pillars can be widely extended and deepened (e.g. to several diverse environmental systems, or economic processes), and simultaneously, affect the ways that such systems interact (i.e., intersections of economic, environmental, social, human and cultural spaces) at national and international scales (2). So, sustainable development can be seen as a phenomenon of our modern world that brings together various disciplines with their unique aspects. Thus, a broader system is materializing to overcome local or national capacities, to provide solid solutions to global problems, such as climate change, resource scarcity and depletion, inequalities, etc.

Sustainable development needs a balancing course of well-organized action to equilibrate its pillars and the disciplines involved, given its inclusive nature (3). The United Nations' (UN) 2030 Agenda with the 17 Sustainable Development Goals (SDGs) and the 169 associated targets serve currently as such a course of action, a pathway that can lead to a sustainable world. The significance of the SDGs lies in their global commitment by all UN member countries and their holistic, interdisciplinary approach to addressing pressing global challenges. However, the very attributes that make the SDGs powerful, their global and interdisciplinary nature, also pose significant and interconnected challenges to their achievement (mismanagement of any sustainability pillar will have negative effects to the others, too). Science and policies need to consider this and "bridge" the sustainability pillars.

In this paper we discuss such scientific instruments that can help overcome current SDG challenges. We argue that economic have the potential to do that and contribute towards overcoming such challenges, by integrating environmental valuation in the SDG-related policymaking. We use SDG14 "Life Below Water" as an example clearly combining the environmental component (oceans, seas, marine resources) and the interconnected socio-economic system with the associated activities and well-being. The paper is organized as follows: The necessary background information is provided regarding Environmental Economics and valuation; next SDG14 is described and its main challenges are analysed; A way forward is presented with our opinion for the need of more holistic approaches and the integration of economic instruments for overcoming the challenges for the achievement of SDG14.

The role of Environmental Economics and Valuation

Ecosystems provide essential services that enhance the quality of life for all entities. These services, including regulation, provisioning, cultural, and support functions, constitute the benefits derived from ecosystems (Ecosystem Services – ES). Most ES lack market prices, as it is challenging to assign them monetary values (4). Environmental valuation studies assign a monetary measure of the benefit or cost to the welfare status of individuals and social groups regarding improvement interventions or the impacts of environmental degradation (5; 6). These insights help policymakers in prioritizing and managing ES effectively, or allocating environmental and economic resources more efficiently to maximize economic, social, and environmental gains while preserving ecological integrity (7). Recognizing the economic and social impacts of human activities on well-functioning ecosystems is essential, particularly to mitigate market failures and negative externalities, ensuring the harmony between socioeconomic and natural systems (8).

Environmental valuation studies have their roots in the concept of Total Economic Values (TEV). TEV is divided into two major sub-categories: use values (direct, indirect, and option values) and nonuse values (existence and bequest values). In this context, environmental valuation offers various techniques for assigning monetary values to environmental impacts/changes, such as stated preference methods and revealed preference methods (9): Stated preference methods involve hypothetical scenarios and questions to gauge individuals' preferences, while revealed preference methods observe real behavior. Often, these methods are used together to compare and analyze how they measure environmental values under different theoretical frameworks. Stated preference methods encompass choice experiments and contingent valuation methods. Choice experiments involve presenting alternatives and attributes related to an environmental good or service (10). Contingent valuation studies focus on estimating people's willingness to pay (WTP) or willingness to accept (WTA) for environmental quality changes (11; 12; 13). Revealed preference methods, such as the Travel Cost Method and Hedonic Pricing Method, analyze actual behavior to estimate the value of ecosystem benefits or the impact of environmental attributes on housing prices. These methods help assess the costs and benefits associated with pollution, noise, aesthetics, and proximity to recreational sites.

SDG14 and challenges to its achievement

SDG14 focuses on protecting marine ecosystems, reducing marine pollution, addressing overfishing, and promoting the sustainable management of coastal and marine areas to ensure the well-being of both marine life and human communities that depend on them, socially and economically. Its key performance indicators (KPIs) refer to the protected areas for biodiversity conservation; the “ocean health” (clean waters, not contaminated by chemicals, nutrients, human pathogens, and trash); marine-biodiversity-threats; fishing exploitation; and the application of regulatory frameworks. The UN’s Department of Economic and Social Affairs and the relevant Statistics Division consider 10 indicators representing relevant metrics to these KPIs to measure progress for SDG14.

From the economic point of view, most KPIs could be informed and significantly enhanced by translating them into monetary terms, as oceans and marine ecosystems are full of ES. They provide food through fisheries, regulate climate by absorbing carbon dioxide, and generate oxygen. They also support cultural and recreational activities, such as tourism and spiritual practices, while serving as transportation routes and habitats for diverse marine life. Additionally, oceans contribute to scientific knowledge, offering valuable insights into climate dynamics and biodiversity. Their role in coastal protection, by buffering against storms and erosion, further underscores their significance. These indicative ES, clearly have use and nonuse values, as defined in the previous section. However, this contribution is not well-recognized, and is often neglected when management interventions are designed. The achievement of SDG14 globally has been characterized as "a round and inclusive failure", for a plethora of reasons (14). Table 1 summarizes the main threats for a sustainable "life below water".

Table 1. The main challenges for the achievement of SDG14.

Challenge	Description
Ocean Pollution	Pollution from various sources, including plastic waste, industrial discharges, and agricultural runoff, poses a significant threat to marine ecosystems, harming marine life, disrupting ecosystems, and affecting human health (15).
Climate Change Impacts	Climate change is leading to rising sea levels, ocean acidification, and altered oceanic currents. These changes affect marine ecosystems and the communities that rely on them (16).
Global Cooperation	There are insufficient global governance frameworks and cooperation to address transboundary issues. Conflicts over maritime boundaries and resources, or unequal rights, hinder progress.
Lack of coordinated management	Effective and coordinated management of marine resources across different sectors (e.g., fisheries, shipping, tourism) is often lacking, and there is often a competition of users to generate benefits from marine ecosystems.
Overfishing and Depleting Fish Stocks	Many regions are experiencing unsustainable fishing practices, which threaten fish stocks' viability, marine ecosystems, and the livelihoods of coastal communities.
Illegal, Unreported, and Unregulated (IUU) Fishing	IUU fishing remains a major problem, as it undermines efforts to conserve marine resources and enforce regulations. It leads to unfair competition, environmental degradation, and economic losses (17).
Coral Reef Decline	Coral reefs, which are critical for marine biodiversity, are under threat from rising sea temperatures, ocean acidification, and physical damage from human activities. Protecting and restoring coral reefs is a pressing challenge.
Biodiversity Collapse	The loss of marine biodiversity due to habitat destruction, pollution, and climate change is a grave concern (18).
Inadequate Data and Monitoring	Gathering comprehensive data on the state of the oceans and the impact of policies and actions is challenging, and there is very limited progress on this along several environmental SDGs, making accurate progress-tracking challenging (19).
Resource Constraints	Many coastal and developing countries lack the financial and technical resources to implement sustainable ocean management practices effectively (20).

Community-management understanding	There is limited understanding of community-based marine management approaches, as they are under-studied. Successful examples are difficult to generalize, as they are subject to local-specific and cultural factors (21).

The multidisciplinary character of scientific efforts to simulate and improve the natural-human marine systems is also a challenge. SDG14 is threatened by multiple and diverse threats, which are not always comparable or subject to the same metrics, so they cannot be tackled with the same measures. Moreover, each one of these challenges can be highly case-specific. Haas (22) indicate that despite its importance, SDG14 is one of the least studied and most under-implemented SDGs, given its highly case- and region-specific character across different countries and income groups.

Conclusion - The way forward

We believe that the reasons for these challenges are complementing the factors that hinder the progress for SDG14, which can be attributed, in general, to the lack of integrated management across different actors and uses, which is reflected by the limited studies on SDG14, and the poor understanding of its context.

SDG14 and other SDGs are profoundly correlated concerning sub-goals and indicators (23; 24). Trade-offs regarding SDG14 and other SDGs are the subject of research in the relevant literature (25; 26). One issue that needs further consideration is the trade-offs between SDG14 and other SDGs concerning the lens of distributive and procedural justice (27). At a managerial level, Ntona and Morgera (28) note the contribution of effective marine spatial planning to interrelate SDG14 with other SDGs and collectively move toward an “environment for well-being” approach under the Convention on Biological Diversity (CBD). The concerted action of SDGs provides a holistic management challenge and a system's demanding potential for optimizing methods and processes to become effective. This requires systems thinking, holistic, and scientifically-supported interventions.

From the Economics point of view, we believe that environmental valuation should be used to inform SDG-related policies. Policy measures are evaluated based on their expected costs and benefits, so the insights of environmental valuation studies can be used as inputs at the stage of the cost-benefit analysis (CBA) of the interventions under consideration. Matching environmental valuation studies with SDGs creates many research opportunities. Indicatively, for any environmental-related SDG (e.g. inclusive growth, climate action, clean water, life below water, life on land, etc.) environmental valuation methods can be employed, assessing different development efforts, implementation steps (e.g., use of resources), and monitor progress achieved (e.g., environmental indicators and benchmarking targets) when managing or exploiting natural resources (e.g., preserve, conserve, restore, enjoy). For the example of SDG14, the ES of marine and coastal ecosystems should be embedded in the decision-making process and the assessment of any centralized measures. These ES cover most aspects of SDG14, as they include provisioning services (fisheries and raw materials); supporting services (life-cycle maintenance for both fauna and local, element and nutrient cycling); regulating services (climate, carbon sequestration and

storage, erosion prevention, waste-water treatment, moderation of extreme events); and cultural services (tourism, recreational, aesthetic, and spiritual benefits).

Acknowledging and quantifying the costs and the benefits of each one of the challenges outlined in Table 1 will lead to more effective interventions (e.g. on ocean pollution prevention, climate change mitigation, fishing exploitation, biodiversity and coral reefs preservation). Better understanding of the human-environmental dynamics as reflected from valuation studies can serve to strengthen coordinated management and cooperation, along with the data and monitoring efforts, which are necessary to perform such studies.

The integration of environmental valuation into the CBAs of interventions also reflect the relationships between social welfare and the environment, which are not static. They evolve as new challenges occur (e.g., climate change and climate crisis), new consumptive and spending patterns appear, and change as core determinants of demand and supply differentiate and alter according to natural resource depletion patterns. According to Koundouri et al. (29), societies attributing greater value to ES mark greater progress toward the implementation of SDGs and SDG 14 in particular, as high WTP indicates behavioral changes that leads to higher implementation of SDGs. These issues highlight the significance of valuation studies not only as a subject of economic theory but also as a means of recognizing interdependencies among social and environmental factors within the economic system. After all, this is the critical idea of ecosystem valuation: to unravel the complexities of socio-ecological relationships, make clear how human decisions affect ecosystem service values, and direct these value changes in monetary units to facilitate their inclusion in public decision-making processes. Based on the above considerations, the ecosystem valuation estimates could be integrated in the decision-making tools such as the UN SDG Indicators (30).

These efforts should concern interregional, national, and international research attempts aligned to SDGs. In other words, all econometric models should consider all pillars of sustainability to reap benefits in terms of theoretical and practical implications. Researchers should employ various determinants and proxies of environmental quality, social and human well-being, and high-leverage market segments to accomplish this task. Additionally, comparative studies will offer a lot to understand relevant interdependencies and interrelations under different econometric schemes and approaches. Last but not least, since all these concepts and notions described above synthesize a dynamic and complex system, scientists ought to disseminate relevant research findings, empirical results, opinions, and expert judgments regularly. This is an advantageous and dependable way to move forward faster and safer towards a better world.

Declarations

Ethics approval and consent to participate

Not Applicable

Consent for publication

Not Applicable

Availability of data and material

UN, United Nations - Department of Economic and Social Affairs (2023). Sustainable Development, https://sdgs.un.org/goals

Competing interests

Not Applicable

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Authors' contributions

All authors have been equally contributed in writing the manuscript. All authors read and approved the final manuscript.

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Abbreviations

SDGs – Sustainable Development Goals

TEV- Total Economic Value

ES – Ecosystem Services

WTP – Willingness to Pay

KPIs – Key Performance Indicators

CBA – Cost Benefit Analysis

CBD - Convention on Biological Diversity

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