Article

Blue Accounting Approaches in the Emerging African Blue Economy Context

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ABSTRACT

The Blue Economy (BE) relates to the sustainable use and conservation of marine and freshwater environments. Accounting for the BE has not yet been undertaken in African countries due to disparities in data collection related to social, economic, and ecological components of the BE; it is a critical factor in decision and/or policymaking associated with BE objectives. This review provides a conceptual understanding of blue accounting and outlines some of the best practices, lessons learned, and key policy messages in blue accounting systems. The United Nations Economic Commission for Africa (UNECA) Blue Economy Valuation Toolkit (BEVTK) recently paved the way for the development of an African national BE accounting system. The aim of the BEVTK was to build a tool capable of capturing and recording various dimensions of human interaction with the 'blue environment'. It is organised around three easily comprehensible modules that address the above-mentioned dimensions. The toolkit has provided a meaningful overview of the BE in the Seychelles to better understand the economic importance of its industries and can capture changes in stocks of natural capital and ecosystem services. The main challenge is in collecting the necessary information needed to run the toolkit. The application of the BEVTK can therefore be seen as part of the preparatory phase for development of proper BE accounting which should be done in a unified way to ensure that all above-mentioned dimensions are taken into consideration within a customizable framework. Such a unified approach will allow comparisons between countries as data collection, analysis and presentation will be standardised.

KEYWORDS: blue economy; blue accounting; blue economy valuation toolkit; satellite accounts; environmental accounting

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INTRODUCTION

The Blue Economy (BE) encompasses both marine and freshwater environments. It relates to the sustainable use and conservation of oceans

and seas, coastlines and banks, lakes, rivers, and groundwater. In Africa, the BE is defined by the United Nations Economic Commission for Africa as "the sustainable use and conservation of aquatic resources in both marine and freshwater environments. This includes oceans and seas, coastlines and banks, lakes, rivers, and groundwater" [1]. This definition further guides the African Union Blue Economy Strategy. Driven by social sustainability, the BE consists firstly, of the human activities that organise the production and trade of goods and services resulting from the exploitation of marine and aquatic resources, and from maritime transport and coastal tourism that take place in marine and aquatic environments. Secondly, it consists of the human activities that contribute to improving the health status of marine and aquatic ecosystems by establishing protective and restorative measures [1]. As a result, the BE revolves around the valorisation of the social, economic, and ecological components [2]. Accounting for BE components at the national level has not yet been undertaken in African countries or performed according to standards that allow for consistent information across the countries. There have been some pilot accounting projects such as the Global Accounts Partnership and Cape Peninsula University of Technology collaboration, which piloted marine ecosystem accounting in Cape Town (South Africa), Bazaruto Archipelago (Mozambique), and Kilifi (Kenya) [3]. Also compiled [4], was a pilot monetary ecosystem service account for KwaZulu-Natal province in South Africa, but not specific to marine and freshwater ecosystems. South Africa has a system for national natural capital accounts and a ten-year strategy for advancing Natural Capital Accounting in South Africa [3] but this does not extend to all marine and freshwater elements of the BE. Beyond these, and some other local pilots across the continent however, ocean accounting at the national level is in its nascent stages. Overall, a critical barrier to presenting a comprehensive view of the BE (at the social, economic, and ecological level) is the lack of comparable data which must first be gathered from different sources [5]. Creating an appropriate national accounting framework which embraces social, economic, and ecological components should facilitate recording annual changes to identify the contributions of the BE.

Ecological components of the BE, such as the delivery of critical ecosystem services, are also inadequately incorporated [6]. The implementation of a process to track Nationally Determined Contributions (NDC) to facilitate 'green' and 'blue' accounting will benefit decision and policymakers by becoming the cornerstone for evidence-based actions, such as those related to climate change [7].

The need for accounting schemes specific to the BE have been identified as critical for achieving BE objectives [6]. The expansion of BE accounting was based on the unification of Blue Satellite accounts and Blue Ecosystem accounts which have been inscribed in strategies and working plans at various scales including the Africa Blue Economy Strategy at the continental scale; the Indian Ocean Commission (IOC) [8] and

Intergovernmental Agency for Development Strategies (IGAD) at the regional scale; and by the Seychelles, Mauritius and Kenya at the national scale [9]. Other countries beyond Africa which have also incorporated Blue Satellite Accounts or Ecosystem Accounts within their national Blue Economy strategies include Barbados, the Bahamas, and Jamaica.

This review provides a conceptual understanding of blue accounting by highlighting the connection between blue accounting and the sustainability of marine and aquatic ecosystems, and indicates the relevant information and data requirements for socio-economic assessment of blue resources, including the goods and services they generate. Furthermore, it emphasises the requirements for setting up a baseline for comprehensive BE socio-economic assessment. Lastly, it outlines the application of a newly developed toolkit for applying BE accounting in Africa, including the lessons learned, and key policy messages, using its application in the Seychelles as a case study on blue accounting systems.

THE NEED FOR A CONCEPTUAL FRAMEWORK AND ACCOUNTING

According to the estimates presented in the Africa Blue Economy Strategy (2020) [9], African BE sectors and components generated USD 296 billion with 49 million jobs in 2020. It is estimated that by 2030, these figures will be USD 405 billion and 57 million, respectively. Likewise, in 2063, these estimates would be USD 576 billion and 78 million, respectively (Figures 1 and 2). The number of jobs would correspond to about 5% of the active population in 2063.

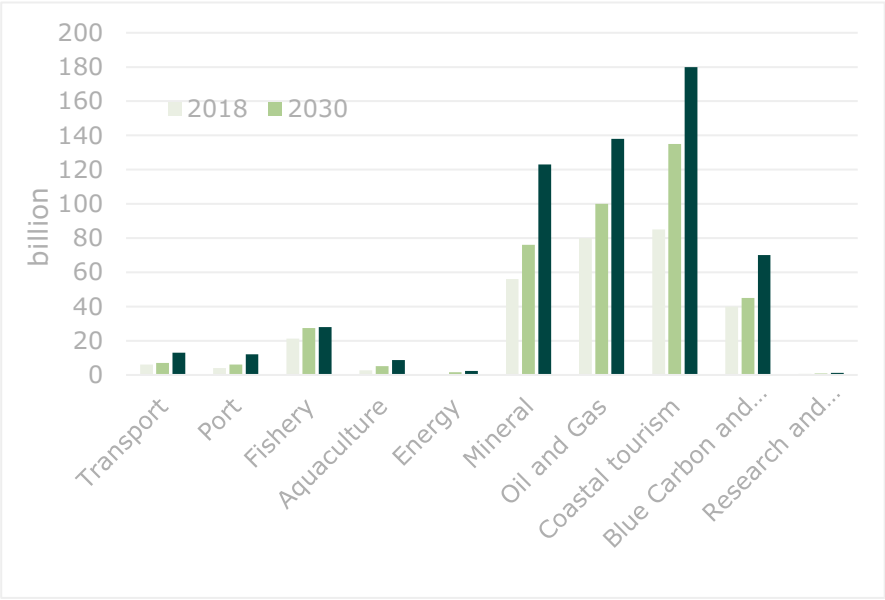

Figure 1. Value created by BE sectors (value added) and components (value of services). Source: Africa Blue Economy Strategy, 2020 [9].

The main driving sectors of the African BE are the tourism, mineral, and oil and gas sectors [9]. While the tourism sector contributes

substantially in terms of value added and job creation, the mineral and oil and gas sectors contribute strongly to value added, but minimally to job creation. In coming decades, the fishery sector is predicted to remain stable, with a consistently high level of employment, while the aquaculture sector will continue to grow in value and in providing job opportunities. Port and shipping sectors will grow at a constant rate [9]. The value of blue carbon and other ecosystem services generated by coastal, marine, and aquatic ecosystems is expected to progressively increase as conservation efforts expand [10]. Education and research will likely follow the same pattern due to a growing demand for knowledge, especially in deep-sea mining, offshore exploration, and climate change mitigation and adaptation.

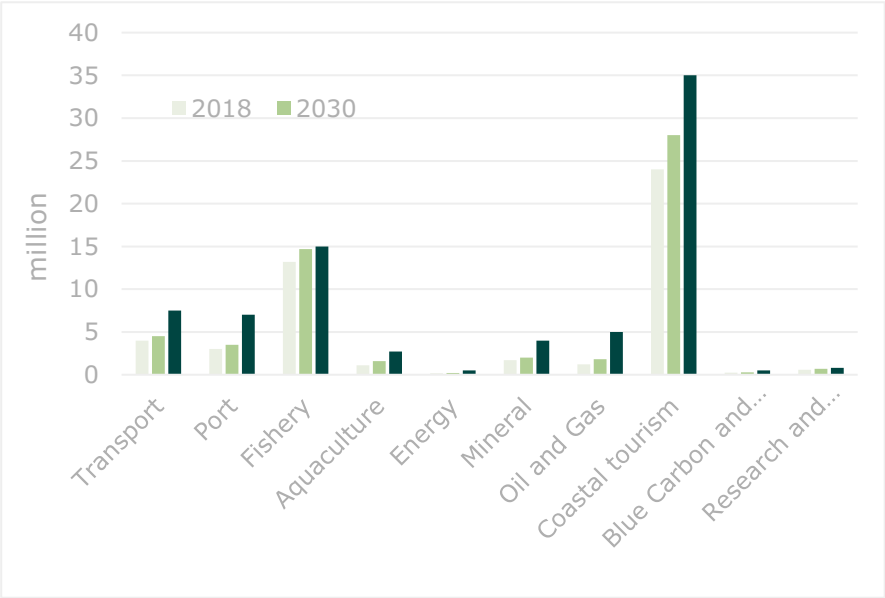

Figure 2. Employment generated by BE sectors and components. Source: Africa Blue Economy Strategy, 2020 [9].

Currently, accounting of BE activities and components is not done in a unified way [11]. Data needs to be collected from various sources to provide an overall picture of the BEs contributions to value addition and job creation. A proper national accounting system should be set up in order to record annual changes in BE sectors and ecological components. With the implementation of the NDC, green and blue accounting will become the cornerstone for assessment of actions against climate change.

Internationally, the Organisation for Economic Co-operation and Development's (OECD) Ocean Economy in 2030 report (2016) [12] put forward the potential development of the global ocean economy (i.e., BE) to a new level. It showed the significance of the global ocean economy as it made a contribution of approximately 2.5% of world gross value added (GVA) in 2010 (based on the OECD's Ocean Economy Database), which is around USD 1.5 trillion. Based on a 'business-as-usual' scenario from 2010 to 2030, this report estimated that the global ocean economy has the

potential to more than double its contribution to the GVA, reaching over USD 3 trillion. This scenario also estimates that around 40 million full-time equivalent jobs are likely to be offered in 2030.

To enhance the sustainable development of the ocean economy, the OECDs report recommended that future research "improve the statistical and methodological base at national and international level for measuring the scale and performance of ocean-based industries and their contribution to the overall economy" and further develop the OECD's Ocean Economy Database [12]. The World Bank & UN Department of Economic and Social Affairs (2017) [13] examined the Blue Economy's potential for Small Island Developing States (SIDS) and coastal Least Developed Countries (LDCs). It mentioned that the sustainable management of marine and aquatic resources requires cooperation between nation-states, public-private sectors, and private sectors, in which the scale has not yet been achieved. National investments aimed at predicting and adapting to the effects of climate change (part of the BE approach) must be complemented by regional and global cooperation to achieve common goals [14]. Also, in order to make the correct policy decisions (including those relating to trade-offs amongst different sectors of the BE), countries are required to apply an accurate valuation of the natural oceanic capital's contribution to welfare [6].

OVERVIEW OF EXISTING TOOLS AND APPROACHES

Many international institutions and organisations have started developing approaches to consider both the economic and the environmental contributions of the Ocean Economy, or more broadly, the BE. Recently adapted from green economy principles by the Caribbean Development Bank (CBD), OECD, and the Food and Agriculture Organisation (FAO), blue accounting is yet to be implemented. These initiatives rely on the United Nations' (UN) System for Environmental Economic Accounting (SEEA) Central Framework [15]. SEEA is an international statistical standard for environmental measurement and its impact on the economy. The Central Framework covers three main areas:

- ***Environmental flows:*** this encompasses natural inputs, products, and residuals between the environment and the economy, (as well as within the economy) both in physical and monetary terms.
- ***Stocks of environmental assets***: environmental asset stocks refer to those individual asset stocks, such as water or energy assets, that change over an accounting period due to economic action and natural processes, both in physical and monetary terms.
- ***Economic activity related to the environment***: monetary flows associated with environmental-related economic activity, such as resource management and environmental protection expenditures, as well as the production of environmental goods and services.

There are a number of existing approaches which consider the economic and environmental contributions of the BE (United Nations Statistics Division, N/A) [16]. The first is ***Environmental Satellite Accounts (ESA)***, also called Integrated Economic and Environmental Accounts, which were developed in European countries in the early 1980s. They provide physical and economic information for integration of economic and environmental policies in a format consistent with the normal economic statistics and national accounts [15]. The high number of interactions between the economy and the natural environment raise analytical questions. The answers to these questions are often based on partial or inconsistent information. This highlights the need to identify and quantify these interactions within a systematic framework for more informed analysis and decision making. The ESAs are meant to help fill that need [17]. As an example, the application of ESA has been used at the national level in Portugal in the 'Satellite Accounts for the Sea' programme by Statistics Portugal and the Directorate-General for Maritime Policy (2016) [18]. The ESAs are a supplementary set of accounts structured to show the interactions of the economy and the environment more fully than the existing economic accounts. While the ESAs build on the existing economic accounts, they do not replace them; likewise, ESA measures do not replace measures such as gross domestic product (GDP) from the existing accounts (Integrated Economic and Environmental Satellite Accounts, 2022). Environmental satellite accounts are therefore best used as evidence for policy making.

Green accounting, developed in the 1990s following the Rio Conference on Sustainable Development, has been widely acknowledged by international institutions (yet received lukewarm attention at the national level). The aim of this accounting framework is to measure the sustainable income level that can be secured without decreasing the stock of natural assets [19]. The System of National Accounts (SNA) requires modification to reflect the changes in the stock of natural assets, particularly those that account for environmental deterioration, which in turn impairs the quality of life of present and future generations and therefore development sustainability. Greening the conventional national accounts introduces environmental impacts and costs into these accounts and balances. Green accounting is an ideal compass for steering the economy towards sustainability, which may change not only the main measures of economic performance but also the basic tenets of environmental and resource policies [19].

The UN System of Environmental-Economic Accounting (SEEA) is a framework that integrates economic and environmental data to provide a more comprehensive view of the relationships between the economy, environment, stocks, and changes in stocks of environmental assets as they bring benefits to humanity. SEEA provides the internationally recognised standard concepts, definitions, classifications, accounting rules, and tables that allow for the production internationally comparable

statistics and accounts. The SEEA framework follows a similar accounting structure as the SNA [20]. The framework facilitates the integration of environmental and economic statistics by using concepts, definitions, and classifications consistent with the SNA. The SEEA is a versatile system that produces a wide range of statistics, accounts, and indicators with numerous potential analytical applications. It is a flexible system that can be adapted to a country's priorities and policy needs while at the same time providing a common framework of concepts, terms, and definitions. The System of Environmental Economic Accounting Central Framework (SEEA CF) was accepted as the international statistical standard by the UN Statistical Commission in 2012 to evaluate the environment and its interrelation with the economy. The SEEA Experimental Ecosystem Accounting (SEEA EEA), currently under revision, complements the Central Framework and represents international efforts towards coherent ecosystem-based accounting [21]. The SEEA CF 2012 has been produced and is released under the auspices of the UN, the European Commission, the OECD, the FAO of the UN, the World Bank Group, and the International Monetary Fund. Australia has applied SEEA to the Great Barrier Reef under the SEEA–Experimental Ecosystem Accounting (SEEA–EEA) framework [22].

Natural Capital Accounting is a tool to measure the changes in the stock of natural capital at a variety of scales and to integrate the value of ecosystem services into accounting and reporting systems at Union and Member States' level [23]. It was developed under the 7th Environment Action Programme (EAP) and the EU Biodiversity Strategy, with a focus on ecosystems and their services (including food provision, air and water filtration, pollination, climate regulation, and protection against natural disasters such as flooding) [24]. This approach will result in better management of the country's natural capital. An integrated natural accounting system for ecosystems and their services and associated data sets is being developed by the EU, while Rwanda has already implemented a Water Account [25]. It aims to provide a multi-purpose tool that can be used for decision-making in a range of policies, and at different stages of the policy cycle, that national authorities and research centres can access. This approach is best suited for inking the economic, environmental, and ecological aspect of a country [25].

A shared project called the Knowledge Innovation Project for an Integrated system for Natural Capital and ecosystem services Accounting (KIP INCA) was set up in the EU to develop an integrated system for natural capital and ecosystem services accounting, aiming to value ecosystem services and integrate them into accounting and reporting systems by 2020 [26]. The project aimed to design and implement an integrated accounting system for ecosystems and their services in the EU by connecting relevant existing projects and data [23]. Previous studies provided overviews of the main issues surrounding valuation methodologies in the context of ecosystem and natural capital accounting and the possible approaches for

valuing crop pollination and recreation within the KIP INCA [27]. It also indicated how NCA can contribute to wider strategy and policy analysis. In 2019, a framework was proposed which involved consideration of different evaluation methods within the NCA framework and explored how to evaluate ecosystem services and the benefits they provide [28]. They also reviewed a series of case studies on NCA and illustrated a number of advantages that the systematic application of accounting practices can bring to the policy process. Following the reports mentioned above, the NCA report (2019) [29], published by the EU, provided a brief overview of NCA and ecosystem accounting. It highlighted that NCA can contribute to the better management of the EU's natural capital as it can help mainstream biodiversity and ecosystems in economic decision-making and ensure that natural capital continues delivering ecosystem services to our economy and society in the long-term [29].

Ecosystem Services Accounting, which emerged from the Millennium Ecosystem Assessment in the mid-2000s, is another accounting mechanism that received increasing attention in recent years but the interest in implementation by countries remains low [30]. For instance, the IPBES assessment for Africa reported a very weak accountability of natural assets [10]. Its objective is to value the amount of services provided by ecosystems in terms of natural flow units and monetary units (including food provisioning, carbon sequestration, water purification, coastal protection, cultural services, etc.). Thus, it can enable accounting for the range of ecosystems and their services and demonstrate, in monetary terms, the benefits of investing in nature and the sustainable management of resources. As the NDC is implemented, its dissemination should be strengthened in the coming years [6]. This approach is best suited for analysing and adapting to changes in the ecosystem service requirements of a country. Suggested by European Commission (2015) [31], "It should be seen as a useful tool, as part of a wider toolbox to mainstream biodiversity in economic decision-making and to ensure that natural capital continues to deliver ecosystem services to the economy and society in the long term" [31].

BLUE ECONOMIC, SOCIAL AND ENVIRONMENTAL ACCOUNTING

BE Economic Accounting

Thus far, very few studies have provided an evaluation of the economics of the BE activities using the SNA. The first one, commissioned by the EU in 2016, was done for the EU outermost regions, the second one, initiated by the World Bank was carried out in Bangladesh while the third was conducted in Jamaica for the CBD [32]. It is now used as a starting point for the current UNECA/CDB initiative on blue accounting in the Seychelles and in the Bahamas. While the first two studies collected data from the SNA (value added and jobs), the third proposed to test the adaptability of the current national accounting systems to respond to

changes in the outputs from the industries associated with the BE. The authors estimated the direct and indirect growth impact of BE activities in the Caribbean by using the data from Jamaica's SNA. A Leontief matrix was applied to measure the intermediate and final demand of productive industries and the link between them. This provided an inter-industry analysis used to inform policymakers of potential demand increases in other industries following increases in demand within the BE [32]. Through this research, it is possible to quantify and compare the contributions of industries associated with the BE to total domestic output and the supply of BE products into other industries. Therefore, it is important to increase the exploitation of aquatic and marine resources generating economic benefits, while improving statistical systems to monitor the resulting impact on national output and supply of other sectors. This evidence-based analysis can be helpful for economies to prepare and develop activities related to investing in the BE.

Other studies, such as the ones carried out in the IGAD countries in 2019 for the preparation of the regional BE strategy and that of the African Union in 2020 for the Continental Strategy, have used various sources of information to define the value added and number of jobs in the BE sectors. For example, fishery data on value added and available jobs were sourced from the FAO Fishstat, deep sea mining from the International Deep Sea Mining Authority database, tourism from the World Tourism Organisation database and reports, etc. In other words, data related to the BE is not yet available in a distinct location.

BE Social Accounting

No social accounting has been developed so far for the BE [33]. The social dimension solely lies with the principles of the BE implementation, namely social sustainability, and empowerment and inclusive decision-making.

In terms of social sustainability, the reduction of communities' vulnerability while facing climate change within the framework of BE is imperative to guarantee food security and livelihoods [34]. Furthermore, mining, oil, gas and energy production in deep water should be developed within the NDC process following the strict precautionary and compensation principles (avoid, reduce, compensate) and ensuring civil society approval, since healthy ecosystems are of vital importance for the survival of living aquatic resources (both inland and oceanic). Thus, collective reflection and decision-making should precede the exploitation of deep water resources. Furthermore, countries must comply to national, regional, and international pollution control standards and practices, including those relating to chemicals and plastics. The existing landscape for international pollution control is however, complex and operates with varying degrees of development, particularly regarding land-based sources of aquatic and marine pollution and ocean plastics. In social terms, many communities lack adequate education and entrepreneurial skills.

They only have access to few proprietary rights to their livelihood, and are often excluded from the decision-making processes. African countries must therefore address the efforts needed to implement BE policies to fight poverty, especially in remote locations, and include these communities in the process of BE development. This would give communities greater access to the economic sector, and would positively impact their well-being [35].

With regards to empowerment and inclusive decision-making, in terms of awareness, beneficiaries and human rights, international discussions on the BE should raise the question of how to better involve the largest group of ocean users—the women and men who service, fish and trade from small-scale fisheries (SSF)—in the dialogue about BE projects and strategies. To ensure that the rights, interests and voices of SSF are respected in this dialogue, the FAO facilitated the production of the Voluntary Guidelines for Securing SSF in the Context of Food Security and Poverty Eradication [36]. This incorporated the input of around 4000 fisheries, government, and community representatives from more than 120 countries in more than 20 civil-society organisation-led national consultative meetings. These guidelines propose principles which are sensitive to food security and human rights, while fostering empowerment and inclusive decision-making. They have global reach and concentrate on the needs of developing countries [36,37]. As such, this initiative will be guided by the FAO to ensure active, free, effective, meaningful, and informed participation of SSF communities, including indigenous communities, in decision-making processes related to any project affecting fishery resources and/or areas where SSF operate. This would include adjacent land areas, and take into consideration the existing power imbalances between involved parties. In that regard, the program will engage with the African Network of Fisher Folk Organisations and Civil Society Consultation groups in each country. The policy framework and reform strategy for fisheries and aquaculture in Africa, which identified sustainable small-scale development as a key policy arena with strategic policy action on co-management and inclusive governance, are also in alignment with this. The African BE strategy also stresses the welfare and participation of communities in BE development [9].

BE Environmental Accounting

The first marine and coastal economic evaluation was conducted in 1926, when a fisheries biologist, Percy Viosca, estimated the conservation value of Louisiana's coastal wetlands. Recently, accidental marine pollution incidents have increased the need for such valuation: following the 1989 Exxon Valdez oil tanker spill in Alaska in 2008, the American Supreme Court fined Exxon over $1 billion in its final court judgement for ecological losses and compensatory damages. Ecosystem valuations are currently being used to estimate how the 2010 Deepwater Horizon oil spill impacted coastal ecosystems on the Gulf of Mexico.

During the 1990s, such valuations aimed for a larger scale when a team of researchers, led by Robert Costanza, estimated the economic value of the entire world's ecosystem services. The majority of these services (60%) are concentrated along coastlines, which account for only 9% of the world's surface area, and they were estimated to contribute $21 trillion annually to human well-being [38]. These coastal and marine areas, including coastal wetlands and mangroves, represent 77% of the global value of ecosystem services [39].

Internationally, studies of aquatic, marine and coastal ecosystem services valuation are increasing: all underscore the importance of aquatic and marine areas in providing goods and services. In the Mediterranean, these services are estimated at nearly €26 billion annually, with cultural and leisure services accounting for two-thirds of that total [40]. In the United Kingdom, provisioning services are valued at €713 million, cultural services at €15 billion, regulating services range between €840 million and €10 billion, and supporting services exceed €1 trillion [41]. In these valuations, the estimated worth of 'commercial' goods and services proves to be relatively less than that of cultural, supporting and regulating services.

Assigning value to biodiversity undeniably contributes to any efforts towards aquatic and marine resources conservation and sustainable exploitation. Ecosystem services valuation provides a powerful, integrated, multi-sector management tool combining knowledge from different disciplines—ecology, biology, economics, and social sciences—expressed in monetary form for ease of understanding and consideration. It provides two crucial policy tools: a means to represent the costs of marine ecosystems' degradation and destruction, and to define the 'good' environmental status that the EU's 2008 Marine Strategy Framework Directive requires by 2020 [42].

However, there are those who question the ecosystem services valuation's ability to provide accurate data as well as the application of such data. Values on large scales are frequently astronomically high, making it difficult to compare them to economic reality or to incorporate them into a national accounting system. Practitioners debate methodological questions, notably issues surrounding benefit transfer [43] and the aggregation and use of the results. Even the core principle of valuation is questioned, since studies tend to show that the more humans exploit an ecosystem, the more its economic value increases, boosted by direct use values [44]. Such results run counter to aquatic and marine biodiversity management policies that tend to limit some ecosystem uses.

Recently, the value of the services provided by Large Marine Ecosystems in Africa was assessed [6]. The analysis revealed a set of key challenges and monetary losses due to the degradation of coastal habitats or the poor health status of certain coastal areas (Table 1).

Table 1. Economic value of marine ecosystem services per African Large Marine Ecosystem, expressed in million USD/year, adjusted by the habitat functionality index for each LME (estimated values), and comparison with reference values [6].

LME and the additional region of Africa	Mangroves	Seagrass beds	Coral reefs	Kelp forests	Total
African Islands of the Indian Ocean	31	279	57,352	-	57,662
Agulhas Current LME	32,491	30,345	242,573	-	305,408
Arabian Sea LME	41	-	10,245	-	10,286
Benguela Current LME	3459	1876	-	445	5780
Canary Current LME	18,017	19,351	-	-	37,368
Guinea Current LME	30,282	45,379	-	-	75,661
Mediterranean Sea LME	-	15,822	-	-	15,822
Red Sea LME	426	21,752	206,411	-	228,589
Somali Coastal Current LME	5813	334	71,388	-	77,535
Total (reference values)	205,422	301,602	876,615	593	1,384,233
Total (estimated values)	90,561	135,137	587,967	445	814,111
%	44%	45%	67%	75%	59%

Note: LME, Large Marine Ecosystems.

Such an evaluation exercise should be a starting point for some regions that do not have ecosystem services valuations in place. Simply transferring the value of ecosystem services from unit monetary reference values is at best an approximation and should be interpreted with great care. This method does however have the advantage of being easily implemented in data-poor regions. The unit reference values of ecosystems can be used locally, with little adjustments, considering the GDP and the socio-economic and environmental contexts [6].

Valuation estimates can support arguments for establishing Marine Protected Areas (MPA) when the benefits of such designations outweigh its costs and, more generally, can inform the 'preservation versus development' debate in coastal areas. In return, the creation of MPAs contributes to achieving the Aichi target 11 and SDG 14—target 14.5, which is to effectively conserve 10% of coastal and marine areas by 2020 [45,46]. These outcomes may also support market solutions such as Payment for Ecosystem Services schemes [47]. PES programs, such as 'Reducing Emissions from Deforestation and Degradation' (REDD+), encourage conservation by rewarding 'avoided deforestation', in which a service buyer pays a service provider to store carbon that would otherwise be released due to a change in land use. In the marine environment, payments for avoiding deforestation are quickly gaining traction, primarily through mangrove research and policymaking under the term 'blue carbon' [48,49]. In fact, many countries are including Blue Carbon in

their revised NDCs [50] with carbon market makers such as Verra (formerly Verified Carbon Standard; VCS) creating methodologies and standards for seagrass carbon sequestration as well as regional bodies such as IORA (Indian Ocean Rim Association) initiating regional Blue Carbon Think Tanks, among other efforts.

Ecosystem services valuation challenges lie in overcoming this services-based approach and developing an approach based directly on ecosystem functions and their interactions. This requires an inventory of knowledge of the many disciplines involved in ecosystem assessments, an inventory that establishes linkages across domains. Beyond questions of method however, further work must be done on how to integrate valuations into practical decision-making, making them more relevant and useful for policymakers [6]. In that regard, assessing the value of ecosystem services is essential to facilitate the dialogue with and between decision-makers in making choices related to public investment. Ultimately ecosystem services valuations help to formulate sound policies for both economic development and nature conservation [6].

BE ACCOUNTING IN PRACTICE

In spite of the efforts made over the last decade, integrated accounting is still in its early stages of development. The main reason for the slow progress at the international level is the lack of interest by states who are still mainly looking at economic growth without fully considering the environmental and social dimensions. The BE in Africa is suffering from the same sustainability trap which consists of ignoring or failing to give as much attention to environmental and social dimensions as they do to economic ones.

UNECA Blue Economy Valuation Toolkit

The UNECA Blue Economy Valuation Toolkit (BEVTK) recently led the way for the development of an African national BE accounting system. The BEVTK was designed as an evaluation toolkit to guide in-depth sub-regional and national socio-economic assessments that will support informed decision-making [51]. It supplements the multisectoral approach and step-by-step methodology for policy development as outlined in the BE Policy Handbook for Africa [1]. As such, BEVTK can be used for socio-economic assessments aimed at providing an accurate snapshot of the potential of the BE of African countries. The quality of any country's assessment using BEVTK depends on the amount of data available and as such it is crucial that such data be collected as completely and timeously as possible. The more relevant the data inputted into the BEVTK, the better the tool will be in drawing an accurate picture of the country's contribution to the BE. The aim of the BEVTK was to build a tool capable of capturing and recording various dimensions of human interaction with the 'blue environment' (ocean, rivers, lakes, etc.) including utilitarian, hedonistic and/or monetary gains.

The toolkit is flexible and comprehensive enough to represent any country within the UNECA scope (coastal, insular, or landlocked). The flexibility of the toolkit was achieved through use of internationally accepted classifications and systems such as the SNA, NCA, SEEA, etc. The BEVTK is organised around three easily comprehensible modules that address the above-mentioned dimensions of human interactions with the 'blue environment': Economics Activities associated with the BE; Social Dimension associated with the BE; and Ecosystem Services associated with the BE.

The flows of information within the BEVTK Toolkit are as follows:

1. Data collection for each module from multiple sources (e.g., SNA, NCA, LME organisations, UNDP, UNEP, AU-IBAR, World Bank, etc.).
2. Data entry in the tool using predefined tabular templates and a customised nested list of categories following specific nomenclatures for each module.
3. Automatically producing summary tables and charts for each module dynamically related to the corresponding tabular data.
4. Consolidation of the summary tables and charts from the three modules into a 'snapshot' summarising the country's contribution to the Blue Economy with some sensitivity analysis capabilities such as:

a. Simulating a change in the state of the economy through changes in inflation and exchange rates.
b. Simulate change in the state of the country's environment by modifying the quality of the ecosystem.
c. Simulating a change in the country's social dimension through changes in, for example, unemployment level, level of poverty, gender inequality or fair trade.

To facilitate the consolidation and comparison of the collected data in each of the three modules, the BEVTK utilises an additional reference tool detailing each country's exchange rates going back 10 years, as well as a table of deflators covering the same period. The reference tool also stores basic information on each country's geographic characteristics, flags, national currency, GDP, etc. To control how data is entered into the BEVTK, templates are used which incorporate systems of standards used by experts across the globe in each relevant dimension. For economic activity, the toolkit uses the International Standard Industrial Classification or ISIC Nomenclature (revision 4). For the social dimension, the toolkit uses Social Indexes from UNDP (Human Development Indexes such as Gini, MPI, GII, etc.), the World Bank, and from other internationally recognised organisations. For ecosystem services the toolkit uses IUCN Habitats Classification Scheme (version 3.1) to describe each relevant Ecosystem and Common International Classification of Ecosystem Services or CICES Nomenclature (version 5.1). Figure 3 shows various stages in the BEVTK from data collection to data transcription, standardisation, calibration, summary and finally presentation.

Despite the potential of this tool, there are recognised limitations. Firstly, there is a risk that ocean accounting, particularly when uniform and top-down, may lead to further limitations to public debate and exclusion of voices and knowledge systems as opposed to only being hampered by current limitations in public participation and civil society engagement. Secondly, there is a severe lack of knowledge regarding the functioning of deep-sea ecosystems in comparison to other marine ecosystem services which have been well studied and evaluated. This is partially due to the difficulties, risks, and high costs associated with conducting deep-sea research [52]. This generates complexity and uncertainty that forces either the exclusion of information in blue accounting processes, or that decisions are made informed only with partial knowledge.

Information on the level of uncertainty can be addressed for each value in the comment field provided in each of the three modules. There is no quantitative measure of the potential uncertainty associated with a particular value's estimate as most data, when available, should be collected from verifiable, official, or reputable sources. The toolkit requires specification of the quality of the data input into the model for each data entry. However, when not enough data is available to build a picture of the Blue Economy in a country, it might be necessary to temporarily estimate some of the value and provide an indication/feedback of the source of the estimate used and the reason for not being able to come up with a verified or official value: this could be the case when the data comes from a preliminary assessment, is provisional, and needs to be finalised and peer reviewed.

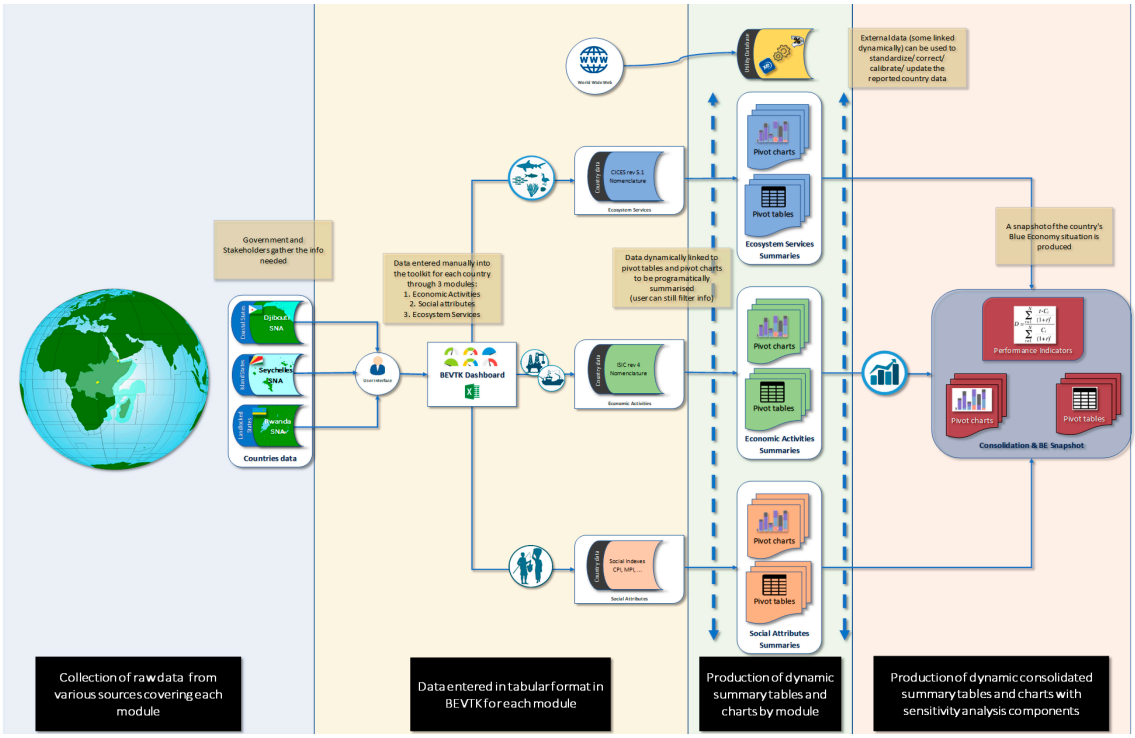

Figure 3. Diagram showing the final module-based structure of the Blue Economy Valuation Toolkit [51].

Case Study: Seychelles BE Accounting

Seychelles began to adopt the UN SNA in 2007, just prior to defaulting on interest payments on a $230 million Eurobond due to its foreign exchange reserves having been exhausted. By 2013, the Seychelles had made the transition from a market-based economy, with the assistance of the International Monetary Fund. Subsequently, the Seychelles National Bureau of Statistics has acquired accounts of most economic sectors, codifying them with the International Standard of Industry Classification (ISIC Revision 4).

Seychelles was an early adopter of the BE concept, being an advocate since the Rio + 20 Conference on Sustainable Development in 2012. The government established a BE Department in 2015, which forms part of the Ministry of Finance, Trade, and the BE, with the department being under the portfolio of the Vice-President [53].

The capturing of, and accounting for BE activities is in its infancy in Seychelles. Like other countries, Seychelles' current SNA does not account for stocks and flows of natural capital, nor does it account for activities that are solely applicable to the BE. This requires urgent consideration because the country's economy, in particular its two primary industries, namely, tourism and fisheries, are highly dependent on the health and quality of its marine natural capital [54]. Traditionally, the management of coastal and marine ecosystems has been compromised by "insufficient financing, capacity, and legal and institutional frameworks" [54].

Yet, the Seychelles has, and is conducting several projects to better understand the economic importance of its industries; some of the projects are in line with progress toward BE accounting. A fisheries satellite account [55] has been piloted and currently a tourism satellite account is being developed. The UN Development Program's Biodiversity Finance Initiative (BIOFIN) conducted a series of investigations in Seychelles with a view to assist with implementing biodiversity financing, however, Seychelles' graduation to high income status saw them lose the development assistance of this program, as well as many others. Nonetheless, BIOFIN has identified a range of opportunities to finance the protection and management of biodiversity [56]. The Seychelles Fishing Authority has strategic management initiatives aimed at improving reporting of fisheries. One such initiative is the Fisheries Economics Intelligence Unit which has been under development since 2015, the Fisheries Economic and Information Division [57], as well as Seychelles being party to the Fisheries Transparency Initiative and the Extractive Industries Transparency Initiative. Under the UNECA BEVTK project in Seychelles, BE activities have been captured alongside environmental and social dimensions. Outcomes of the BEVTK are presented in Figure 4.

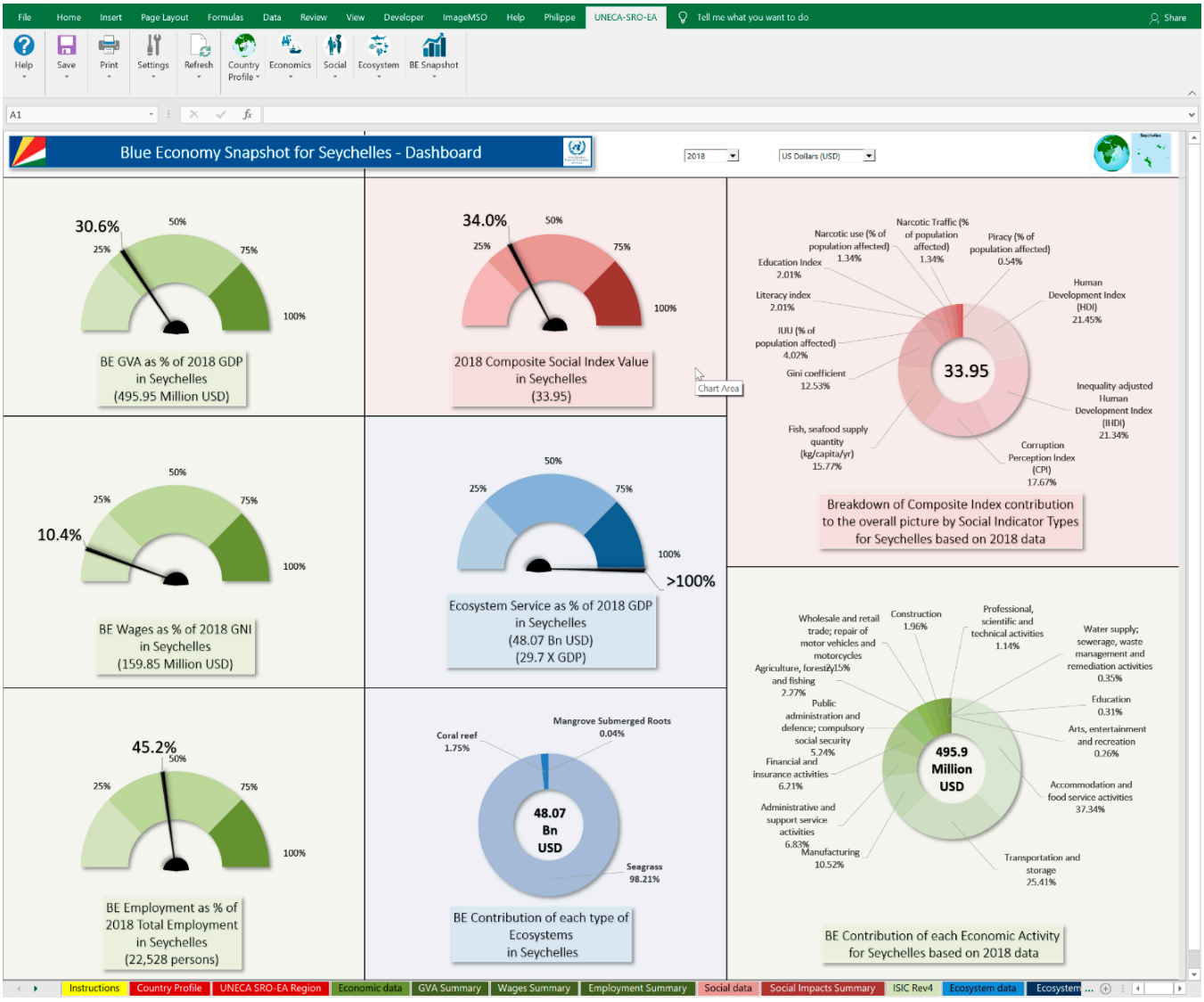

Figure 4. UNECA BEVTK outcomes for Seychelles.

The BEVTK has provided a meaningful overview of the BE in Seychelles from the three different dimensions. UNECA plans to develop a more advanced BE satellite account, enabling accurate reporting of this portion of the economy on an annual basis. The project is currently under development as a pilot project with Jamaica and the CDB.

Despite the lack of BE accounting systems in place, the small island developing state has been highly successful in attracting funding for its transition to a sustainable BE mainly because of its ability to show and monitor economic and environmental achievements. Investment in the BE has come through the Seychelles Debt for Nature Swap which resulted in the protection of 30% of Seychelles EEZ and grant funds for BE innovation, disbursed by the Seychelles Conservation and Climate Adaptation Trust (SeyCCAT) [58]; Seychelles innovative and first of its kind Blue Bond with proceeds to be used specifically for improvements in priority fisheries governance, expanding the current MPAs and the development of the BE [59]; development funding through the World Bank Group's Third South

West Indian Ocean Fisheries Governance and Shared Growth Project (SWIOFish3) with funding and guarantees from the Global Environment Facility, the International Bank for Reconstruction and Development and Seychelles Blue [54]; an independent public-private trust fund, SeyCCAT, which disburses the grant money received from the Debt for Nature Swap and Blue Bond, as well as attracting philanthropic funds and additional grant funding and capital.

Seychelles is investigating the feasibility of including its Blue Carbon (BC) resources, comprising seagrass meadows and mangrove forests, in its revised NDC. Additionally, Seychelles is looking into the likelihood of trading BC credits in the future alongside discussions surrounding prospective investment into marine biotechnology [53]. Despite the positive progress Seychelles has made, many of these projects are yet to be realised. Additionally, aside from the BEVTK and formal economic accounts, many gaps still exist in capturing the impact of the BE, and little progress has been made toward establishing a sound natural capital accounting system. This system should capture changes in stocks of natural capital and ecosystem services, as well as monitoring the underlying health of the habitats that support the natural capital.

CONCLUSIONS

The main challenge for implementing BE accounting in countries lies within the set-up of a national framework that should precede any BE development process. Without recording progress in economic, environment, and social aspects, there is significant hindrance in guiding policy and providing recommendations on the measures to be taken to improve the current situation [33]. The data coverage and collection should be led by the national statistical office that should coordinate the departments in charge of the implementation and monitoring of policies and key data.

For the UNECA BEVTK, which is ready to be used, the main challenge is in collecting the necessary information needed to run it. Some missing information sees the need to conduct surveys. The toolkit was designed as a dynamic decision-making tool and as such is flexible enough to accommodate user-defined categories in each of the three modules (economic, social and ecosystem). Users are also able to add items to the predefined list which are easily accessible within the BEVTK. The application of the toolkit can therefore be seen as part of the preparatory phase for development of proper BE accounting. From its application in Djibouti and Rwanda, alongside Seychelles, the key challenges identified were the lack of governance structure and understanding of blue potential, especially biodiversity and how much it can contribute to the BE development. From a socio-economic standpoint, the valuation faced some difficulties in numerous areas. Firstly, a lack of socio-economic data made it difficult to populate the toolkit. Secondly, data from national accounts are not properly harmonised; a lack of data relating to the contributions

to formal and informal sectors led to their exclusion from the BE. As such, this approach may fail to account for cultural or gender dimensions which are already identified as significant shortcomings of existing Blue Economy policies [60], and should therefore prioritise further development of data and application in this area. At present there is no specific framework dedicated to data collection on demographics and social elements (security, education, health, access, justice, equity etc.) for the BE sectors, especially as these are difficult to assign monetary values. From the environmental angle, the lack of knowledge of blue ecosystems is a key issue: no proper indications of their coverage, their ecosystem services or their ecological conditions have been recorded.

Further priority research in this space is needed to operationalise the relationship between the three components of the toolkit, i.e., economics, environment, and social dimensions. This would provide valuable information on the interrelationship between the dimensions, and more precisely, provide some quantitative measures on how the improvements or degradation of the aquatic, marine or coastal ecosystems impact the economics and social components of the BE. As such it will provide some clear indication on the benefit of protecting and restoring ecosystems and their services.

Blue accounting poses the opportunity for nations to improve their reporting abilities, particularly in line with international targets associated with the Paris Agreement's Enhanced Transparency Framework [7]. More detailed knowledge and understanding of the existing status of sectors of the Blue Economy (including environmental, social and economic components) promotes compliance and global stock take, which should encourage greater ambition and action. This increased drive should apply not only to climate related targets under the Paris agreement such as the NDCs, but also wider environmental and social goals such as those under the Convention on Biological Diversity and the SDGs.

DATA AVAILABILITY STATEMENT

A guide for the toolkit was developed for UNECA and is available on their website. The model itself is available through UNECA upon request. The authors are working towards an online version which will be readily available when finished. All specific data requests can be made directly to the authors (https://www.uneca.org/sites/default/files/SROs/BEVTK%202.0%20Operational%20Manual.pdf).

AUTHOR CONTRIBUTIONS

PF: Conception, data analysis, supervision. JL: Investigation, writing—first draft. PL: Conception, investigation, data analysis, writing—first draft. AM: Investigation, writing—first draft, writing—review and editing.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

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