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Short communication

Opportunities and risks of the blue economy for innovative companies in the sustainable aquaculture sector

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Abstract

The oceans play a crucial role in the global ecosystem and offer solutions to meet the growing demand for food, water, and energy. However, a new economic concept is needed to regulate and sustainably exploit the maritime resources offered by the marine ecosystem to ensure sustainable development. It is in this initiative that the concept of the blue economy has emerged, in response to the inadequacy of measures taken by States to meet their obligations and achieve their objectives in terms of marine biodiversity conservation. This is how the blue economy concept was born, in response to the inadequacy of state measures to conserve marine biodiversity. This concept proposes an innovative solution integrating aquatic and human resources into sustainable economic activities. The aim of this study is to understand the opportunities and threats that the blue economy represents for innovative companies. This short literature review, based on a SWOT (Strengths, Weaknesses, Opportunities, and Threats) diagnosis of innovative companies, identified a number of obstacles to the development of the blue economy, such as climate change, lack of financing and the lack of instruments for measuring the performance of the blue economy. Action strategies could be implemented to mitigate risks, threats and hazards, and consider an economic approach that reconciles marine and terrestrial ecosystems.

Keywords: Blue economy, biodiversity, oceans, marine ecosystems

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Introduction

With a growing human population and increasing demand for food, economic activities, particularly agriculture and fishing, are expanding around the world, leading to increased pressure on coastal and marine environments. Marine, coastal, and terrestrial activities, as well as the exploitation of water resources, particularly oceans, seas, lakes, and rivers, threaten marine biodiversity and associated ecosystems (Bennett et al., 2019). In addition to playing a crucial role in the terrestrial ecosystem, with a biological diversity that remains largely unexplored, the oceans represent an underestimated economic driver, thanks to the wealth of their marine products (Choudhary et al., 2021). Sustainable use of the oceans and cooperation between public institutions and the private sector offer an innovative solution for effective conservation of marine biodiversity (Pascale, 2021). The blue economy emerged at the end of the twentieth century as a model using natural aquatic and human resources in response to insufficient state action to conserve marine biodiversity and create marine protected areas (Pauli, 2010).

The blue economy is integrated into economic and commercial activities, responding to the need to incorporate conservation and sustainability into the management of maritime spaces. With the blue economy, sustainable efficiency is achieved by replacing what does not require the development of new industries, offering a significant number of new

jobs, valuable products, and social justice through innovation (Pauli, 2010). The blue economy, or ocean economy, which includes the sustainable management of maritime resources by innovative companies in existing and new sectors, such as marine biotechnology and renewable energies, has the potential to contribute to sustainable development (Choudhary et al., 2021).

To gain a better understanding of how this blue economy concept works, a literature review was carried out to enumerate the principles and importance of the blue economy. Next, we will look at the various players involved in this blue economy model, as well as the innovative companies that have adopted it. Next, we'll look at the opportunities and risks associated with adopting this concept, as well as the resulting impacts in terms of benefits and challenges. Finally, to highlight mitigation strategies for adopting the blue economy concept to ensure sustainable environmental, social and economic development.

Generalities and principles of the blue economy

The oceans cover almost 75% of the Earth's surface and are home to more than half of all life forms, often giving the illusion of an infinite resource (Brehmer and Ndiaye, 2021). The high seas represent the world's last global commons, and effective management of ocean resources is urgently needed to achieve sustainable development. It's time for competitive and innovative businesses to adopt an economic concept that originated at the United Nations Conference on Sustainable Development held in Rio de Janeiro in 2012 called the "blue economy" (Pauli, 2010). The United Nations Environment Programme introduced the concept of the blue economy, defined as an economy that improves human well-being and promotes social justice while reducing environmental risks and resource scarcity in island countries, particularly the Caribbean (Sakhuja and Narula, 2017).

The blue economy is based on various principles, the main one being the divergent use of raw materials and energy in ecological processes (Sverdan, 2021). Speaking of principles, the World Wide Fund for Nature has presented a set of principles for the blue economy (Judicaël, 2017), offers significant benefits to present and future generations by contributing to several crucial aspects of society. It strengthens food security by preserving the diversity, productivity, and value of marine ecosystems. At the same time, it fights poverty by raising incomes and creating secure jobs while improving general living standards. The management of this economy relies on both public and private systems, using sustainable, preventative, and responsible methods. To ensure its long-term sustainability, it is essential to maintain an open dialogue with all stakeholders and to strengthen government commitment. By effectively communicating its principles and benefits, the blue economy guides strategic decisions in both the public and private sectors, promoting balanced, environmentally-friendly economic growth.

For the implementation of the blue economy concept, many of the players involved have highlighted multinationals and shareholders, private sector companies partnering with state governments through public-private partnerships, development banks and also some international nature conservation NGOs. There are also coastal communities, fishermen and socially disadvantaged coastal dwellers. Finally, international agencies include multilateral state agencies (G8), the World Economic Forum, international financial institutions, and United Nations agencies (CCFD-Terre Solidaire, 2023). In addition, Enabel plays a crucial role in updating the National Strategy for Maritime Protection, Safety, and Security. In collaboration with key partners such as OPJEB, a pan-African organization dedicated to promoting the blue economy across the 54 member countries of the African Union, these initiatives aim to reinforce the continental commitment to sustainable management of maritime resources. In addition, entities such as ACDM, a Cameroonian association specializing in maritime law, provide valuable expertise by studying the essential legal aspects associated with maritime activities (Lopes, 2024).

Innovative companies in the blue economy

"Art Sunu Gueej", an innovation and incubation platform for the blue economy, harnesses scientific knowledge to foster the emergence of new development sectors in Senegal and the sub-region. The initiative focuses on key areas such as algaculture and macro-algae valorization. Significant progress has been made in the study of the nutritional quality of several macro-algae species, as well as in their cultivation, making algoculture a major innovation for Senegal. In addition, Art Sunu Gueej is providing crucial support to fish farming by promoting the acclimatization of a freshwater tilapia species, the *Sarotherodon melanotheron heudolotti*. Research is also being carried out to improve the feed formulas used in aquaculture. Finally, this platform is committed to mentoring young people and women, training them in fish farming and aquaponics techniques" (Waly et al., 2023). In addition, the Agence Nationale Chargée de l'Action de l'Etat en Mer (ANCAEM) is an entity in Benin that plays a crucial role in maritime protection, safety and security. Its aim is to share with participants Benin's efforts to combat maritime insecurity, and to take stock of the situation in order to better understand the phenomenon and update the national maritime safety strategy. Its mission is to ensure the exercise of State sovereignty at sea, and to coordinate the actions of the various administrative structures involved in maritime affairs. Recently, ANCAEM organized the multinational exercise Obangame Express 2023 in collaboration with the U.S. Africa Command (AFRICOM), to reinforce the intervention capabilities of the players involved in State action at sea. In order to gain a better understanding of how these companies are developing thanks to the blue economy, a SWOT (Strengths, Weaknesses, Opportunities, and Threats) diagnosis was drawn up, highlighting the points of similarity and dissimilarity that these companies face, and is presented in the Table 1 and Table 2.

Identification of opportunities and risks associated with the adoption of the blue economy model by businesses

It is difficult to compare the blue economy between different countries due to variations in the definition, classification, criteria and scope of this concept. Even the terminology used to designate the blue economy differs from region to region; some speak of ocean economy, ocean industry, ma-

Table 1. SWOT diagnosis (strengths, weaknesses, opportunities, and threats) of companies adopting the blue economy concept.

Strengths	Weakness
• Art Sunu Gueej has enabled the acclimatization of a freshwater tilapia species, *Sarotherodon melanotheron heudolotti*, which is crucial to the development of fish farming in Senegal • ANCAEM ensures that the State exercises its sovereignty at sea. This strengthens its position in protecting the country's maritime interests • Coordinates the actions of the various administrative structures involved in the maritime sector, promoting an integrated approach	• Lack of funding • African states' dependence on Westerners
Opportunities	**Threats**
• Improving feed composition to optimize the growth and health of fish raised in aquaculture for Art Sunu Gueej • Self-employment training for young people and women • ANCAEM can contribute to the fight against maritime insecurity in collaboration with other national and international player • Updates its strategy to better meet current and future challenges • Capital grants are needed for all blue-economy projects	• Competition with other innovative organizations • Climate change • Offences at sea • Managing maritime problems

Table 2. WAS classification in ascending order of priority.

P1	Lack of funding
P2	Climate change
P3	Capital grants needed for all blue-economy projects
P4	Combating maritime insecurity in collaboration with other national and international players
P5	Marine infringement management

Table 3. Some opportunities and risks linked to the adoption of the blue economy.

Opportunities	Risks
• Sustainable economic growth from maritime resources • Capital grants for all blue-economy projects. • Managing new jobs with improved livelihoods for coastal communities	• Increasing economic activities in the marine environment have a negative impact on the marine ecosystem • Ownership of maritime sites and resources leading to privatization and exclusion of local communities • Lack of clarity on sustainability and performance measures for the blue economy

rine economy, marine industry, coastal economy, and so on. In the USA and Ireland, the term "oceanic" predominates, while "marine" is preferred in the UK, France, Australia, Canada, New Zealand and the European Union (Bari, 2017). In Spain, the term "maritime" is the most common. In addition, the classification of the ocean economy varies, being divided into 6 main sectors in the US versus 16 in the UK. The UK does not include seafood processing in the ocean economy, while France includes electricity generation, such as thermal and nuclear power (Brehmer & Ndiaye, 2021).

The adoption of the blue economy model offers multiple opportunities throughout the world and across all actors and partners involved in an innovation system for sustainable economic development. A workshop to launch the project to update the strategy and provide information on the blue economy concept was held in Cotonou, Benin, on July 16, 2021. Take the case of the Agence Nationale Chargée de l'Action de l'Etat en Mer (ANCAEM), which, with Enabel's support, has been confronted with certain risks associated with the blue economy. According to the Cabinet Director of the Ministry of Economy and Finance in Cotonou, "a growing number of security problems persist in maritime areas, such as drug trafficking, piracy, illegal fishing and armed robbery. Illegal actors freely exploit Africa's maritime space due to its vastness and

the lack of effective surveillance systems". According to Aomar (2023), the possible opportunities and risks are diverse (Table 3).

Impacts of adopting the blue economy and risk mitigation strategy

The blue economy, based on the sustainable use of marine resources, offers opportunities for economic growth and job creation. On the one hand, sustainable aquaculture represents a major opportunity. Farming fish, crustaceans, and molluscs in the marine environment can contribute to food security and economic growth. In addition, coastal and marine tourism can stimulate the local economy by developing coastal areas. On the other hand, risks should not be overlooked. Overexploitation of marine resources can lead to their depletion, while marine pollution (from plastics, hydrocarbons, etc.) damages the ecosystem and the economy. In addition, climate change, such as sea-level rise and ocean acidification, represent major challenges. Finally, conflicts of use between different activities (fishing, tourism, energy) can create tensions (Waly et al., 2023).

The adoption of the blue economy by innovative companies entails a number of risks requiring special attention. It is crucial to minimize negative impacts on marine ecosystems, such as biodiversity, water quality, and coastal habitats. Investing in sustainable technologies is essential to reduce pressure on ecosystems while supporting economic development. Projects must respect local rights and traditions, including coastal and indigenous communities for a fair distribution of benefits. Responsible ocean management must balance human needs with the preservation of fragile ecosystems. Finally, policies and regulations are needed to encourage sustainable practices and limit harmful activities, supported by increased awareness of marine conservation (Aomar, 2023).

Conclusions

The blue economy is a crucial concept for all innovative companies wishing to ensure sustainable development. Indeed, its adoption by various public and private institutions, as well as by states, organizations, and companies in the economic sector, particularly in agriculture and fishing, has demonstrated its effectiveness. It has enabled many companies to acquire stable financial autonomy, while ensuring the preservation of marine ecosystems worldwide.

However, despite the many opportunities offered, such as subsidies for blue-economy projects and support for self-employment among young people and women, the adoption of this concept can represent a risk for some companies. Indeed, those without sufficient capital to implement the concept and ensure the sustainable management of marine resources may find themselves in difficulty. Consequently, these companies need to develop strategies or action plans to mitigate the potential risks and dangers that could hinder the sustainable development of the maritime economy.

Faced with the challenges posed by the adoption of the blue economy, it would be wise to consider an economic approach that reconciles marine and terrestrial ecosystems. This will require greater involvement of private and public investors, who are concerned with environmental preservation and the sustainable management of natural resources such as solar radiation, air, water in all its forms, soils, and plant and animal biomass. This approach would be beneficial not only for present generations, but also for future generations .

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Authorship contribution

Yann Emmanuel Miassi: Writing - original draft preparation, conceptualization, resources, data curation, writing - review and editing. **Kossivi Fabrice Dossa**: Writing – review and editing, methodology, formal analysis, visualization, supervision. All authors gave final approval for publication and agreed to be held accountable for the work performed therein.

Data availability

Datasets generated during and/or analysed throughout the present study are available from the corresponding author upon reasonable request.

Conflict of interest

On behalf of all authors, the corresponding author states that there are no conflicts of interest.

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