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## THE CIRCULAR BLUE ECONOMY IN EGYPT: OPPORTUNITIES FOR REGIONAL COOPERATION AND INTEGRATION WITH MEDITERRANEAN COUNTRIES FOR SUSTAINABLE DEVELOPMENT

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**Abstract.** This study examines the possibility of the Circular Blue Economy in Egypt to support sustainable development and the usage of its renewable resources, focusing on possibilities for regional collaboration, particularly in the Mediterranean region. The study's methodology was an analysis of missing policies, identifying key actors, and an expert survey to identify future collaborations and opportunities, which included 20 experts from diverse sectors. Current policies in Egypt (e.g., Egypt Vision 2030) and the Mediterranean region were analyzed against the Sustainable Development Goals (SDG 14) and regional initiatives such as BLUEMED and SwitchMed, highlighting shortcomings in cooperation, investment, and environmental measures. The main parties, including the Egyptian government, the Union for the Mediterranean (UfM), the private sector, and local communities, were grouped according to their level of interest and influence. Findings indicate that Egypt's strategic location and extensive coastline are suited to drive regional efforts in maritime tourism, aquaculture, and maritime transport. Yet, problems, including marine litter and underfunding, continue. Experts also support the creation of regional cooperation platforms and joint pollution monitoring systems. The paper concludes with policy recommendations to integrate circular economy concepts into government strategies, strengthen collaboration across the region, and establish a collaborative and innovation-based ocean governance model. The paper presents new ideas to support regional integration and suggests additional studies on sustainable financing mechanisms.

**Keywords:** Circular Blue Economy; Egypt; Mediterranean; Sustainable Development; Regional Cooperation; Policy Gap Analysis

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**JEL Classifications:** O1, O55

### 1. Introduction

The Circular Blue Economy (BCE) combines ideas from both the Blue Economy (BE) and the Circular Economy (CE) to encourage long-term ecological balance and efficient use of resources in marine and coastal environments. The blue economy focuses on the responsible utilisation and management of ocean resources to

boost the economy, create jobs, and support communities while maintaining healthy and balanced marine environments. It covers several industries, including fisheries, aquaculture, maritime transport, coastal tourism, renewable ocean energy, marine biotechnology, seabed mining, and marine conservation (Graziano et al., 2022; Choudhary et al., 2021; Junceda-Mena et al., 2023; Shan et al., 2023). First introduced by Belgian economist Gunter Pauli in the mid-2000s, the concept of the blue economy points to the ocean's potential to support greener, more equitable development (Ahmed & Thompson, 2018). The Blue Economy has emerged from an increasing awareness of the role of the oceans in national economies, alongside the need to protect the oceans (Winder & Heron, 2017; Garland et al., 2019).

On the other hand, the circular economy focuses on reducing how much we rely on nonrenewable materials by encouraging reusing, recycling, and renewing materials across the life of products. It seeks to reduce waste, emissions, and energy consumption while fostering sustainable production and consumption models (Tolio et al., 2017; Junceda-Mena et al., 2023; Rezk et al., 2023). The circular economy in the marine context involves designing out pollution, keeping materials in use, and helping ecosystems recover. This approach plays a key role in sectors such as fisheries, aquaculture, maritime transport, offshore energy, and tourism (Barroso et al., 2022). The circular approach in marine sectors offers substantial potential to reduce the ecological footprint of blue economy activities by promoting innovative practices such as fisheries waste valorisation, repurposing plastic debris, and the design of biodegradable aquaculture gear. (Francis & Herat, 2020). This model matches broader global efforts for sustainability, particularly the United Nations Sustainable Development Goals (SDGs), including SDG 12, focused on using and producing responsibly, and SDG 14, which aims to protect and wisely use oceans. (Di Vaio et al., 2024)

The Circular Blue Economy (CBE) is an integrated approach that not only helps use marine resources responsibly but also significantly reduces environmental impact by bridging resource gaps, improving the reuse and recycling of materials, and supporting new, green, and climate-friendly ways of doing business (Tucci et al., 2021; Fernandez-Gonzalez et al., 2024). It encourages systemic changes across the marine value chain by embedding eco-design principles, life cycle thinking, and regenerative resource use into coastal and ocean-based industries. Furthermore, the CBE initiative supports creative reuse and turning marine materials into valuable products such as oyster shells, seaweed biomass, seagrass beach wrack, and fishery by-products, which are being incorporated into bio-based plastics, fertilisers, pharmaceuticals, and green building materials (Summa et al., 2022). The scope of the Circular Blue Economy thus extends well beyond conventional recycling practices; it includes the development of circular water markets, energy-efficient desalination systems, blue biorefineries, and closed-loop wastewater management solutions, which are increasingly recognized as integral components of building a sustainable and resilient blue economy while reducing the amount of waste produced by blue industries (Firoozi & Firoozi, 2022).

The blue economy includes old and new industries that are essential for boosting new ideas, eco-action, and development, particularly in the Mediterranean region, which has a vast 46,000 km coastline and sea-based assets worth around €4.7 trillion. It covers just 1.5% of Earth but holds remarkable natural life and marine diversity (Biuksane, 2022; Sardinha, 2024). Among the core sectors of the blue economy, fishing and aquaculture play a critical role in ensuring food security and providing livelihoods, especially within coastal communities (Sardinha, 2024). Coastal and maritime tourism significantly contributes to the economy by capitalising on the region's unique natural and cultural heritage to create jobs and generate income (Figueiredo et al., 2023). Maritime transport plays a central role in trade and logistics, enhancing economic integration and facilitating regional development (Olteanu & Stinga, 2019). Furthermore, the growth in clean marine energy like wind and wave power shows how key it is to go green and reduce pollution (Roberts & Ali, 2016). In 2022, EU blue industries created employment for nearly 4.82 million people, made €890.6 billion in revenue, and added €250.7 billion in value (Table 1). Projections for 2023 suggest continued growth, with these sectors contributing €263 billion to the

EU's gross value added (GVA) and employing approximately 4.88 million people, highlighting the increasing economic significance of the blue economy across the European Union (European Commission, 2025).

**Table 1.** European blue economy established sectors, main indicators, 2022

Indicator	EU Blue Economy 2022
Turnover	€890.6 billion
Gross value added	€250.7 billion
Gross surplus	€120.6 billion
Employment	€4.82 million
Net investment in tangible goods	€8.8 billion
Net investment ratio	3.5%
Average annual salary	€27 016

\* Turnover is calculated as the sum of turnover in each sector

Source: European Commission, 2025

Building upon the importance and variety of industries of the blue economy, recent strategies are now more connected to international green efforts, most notably the United Nations Sustainable Development Goals (SDGs). These evolving strategies highlight the rising in understanding of the seas' key role in advancing long-term innovation and ecological balance. SDG 14, which aims to protect and wisely use marine resources, has become a core part of ocean economy planning (Steven et al., 2019; Wang et al., 2022; Ha, 2024). In this context, the European Union has intensified its commitment to safeguarding marine biodiversity while promoting sustainable blue growth and employment. In line with broader environmental goals such as the European Green Deal and the Farm to Fork Strategy, the European Commission introduced strategic guidelines for the aquaculture sector (2021–2030) to foster resilience, competitiveness, and environmental sustainability. Central to these guidelines is promoting organic aquaculture through innovative feed practices, including reducing limiting use of ocean-caught ingredients and using other protein alternatives like seaweed, insects, and leftover materials from seafood processing factories (European Commission, 2021).

At the regional level, efforts to advance a sustainable and resilient blue economy have been reinforced through coordinated policy actions and innovative environmental initiatives, the Union for the Mediterranean (UfM) renewed its focus on ocean sustainability by issuing a major political declaration on February 2, 2021. Building on the foundation laid in 2015, this declaration emphasises post-pandemic recovery and long-term sustainability in sectors such as marine governance, scientific research, sustainable fisheries, climate-resilient maritime transport, and strategic investment (Union for the Mediterranean, 2021). Complementing this commitment, the BLUEMED Initiative serves as a key platform for promoting science-policy-industry collaboration across the Mediterranean. Its Strategic Research and Innovation Agenda (SRIA) supports circular economy practices, marine innovation, and joint actions that facilitate Egypt's participation in sustainable blue growth (Cappelletto et al., 2018). Similarly, the Barcelona Convention, under United Nations Environment Programme / Mediterranean Action Plan (UNEP/MAP), offers a binding framework for protecting the Mediterranean marine environment. Egypt engages with its protocols on pollution control, biodiversity, and coastal zone management, particularly through the Regional Plan for Marine Litter Management, which aligns with national efforts to advance circular marine waste strategies (Galgani, 2019).

The Mediterranean Sea is one of the world's most polluted seas with plastic pollution, particularly in areas near densely populated coastlines, river estuaries, and regions with limited water exchange (Cózar et al., 2015). Mediterranean nations collectively generate approximately 24 million tons of plastic waste annually, yet only 72% of this waste undergoes proper treatment through formal systems, with noticeable differences in effectiveness across countries. Around 20.4 million tons, roughly 85% of the total, is collected, while the remaining 3.6 million tons (15%) remain uncollected and likely to leak into the environment (Dalberg Advisors, 2019). As illustrated in Figure 1, all countries in the region contribute to some extent to improperly managed

plastic waste. However, due to factors such as consumption levels, economic scale, and the efficiency of waste infrastructure, Egypt (42.5%), Turkey (18.9%), and Italy (7.5%) are ranked as the top sources of poorly managed plastic trash in the region (Kaza et al., 2018).

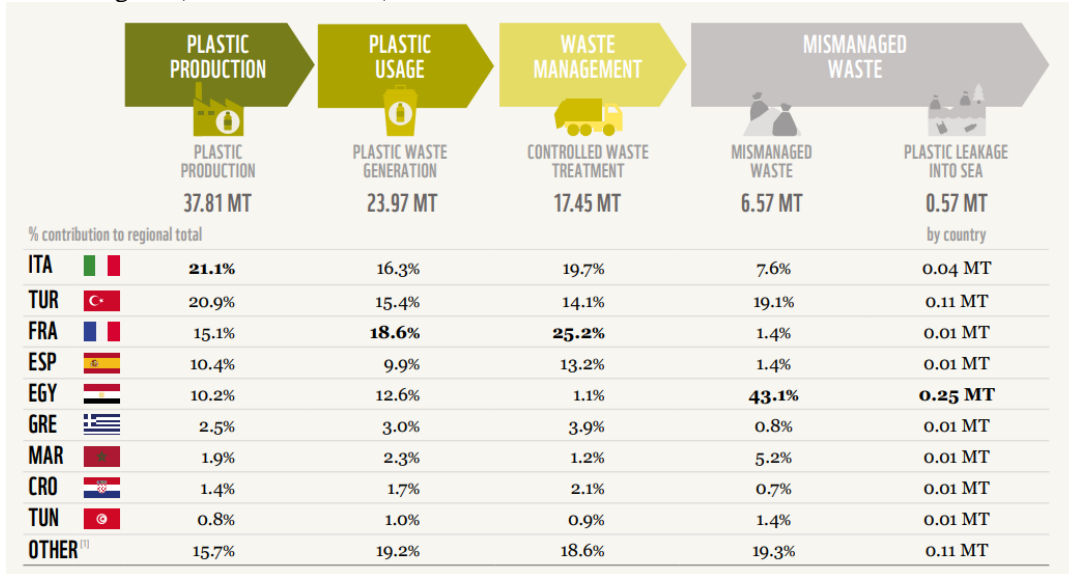


Figure 1. Overview of the Mediterranean Plastic Lifecycle and Its Contribution to Marine Pollution

Source: Kaza et al., 2018

Egypt plays a key role in how plastic is made and handled in the Mediterranean, producing 10.2% of all plastic and generating 12.6% of the overall waste in the region. However, the country is facing serious problems with plastic disposal. Even though it doesn't produce or use as much plastic as some countries, Egypt accounts for 43.1% of the region's mismanaged plastic waste, the highest among all countries, and about 250,000 tons end up in the sea, representing nearly 44% of the region's total plastic leakage. This highlights why it is pivotal to boost the circular blue economy.

A clear case showing how circular blue economy ideas are applied in the Mediterranean area is Italy's Life Muscles Project (2021–2025), which aims to reduce plastic waste caused by mussel farming by introducing sustainable practices such as recycling mussel nets and using bio-based materials like MATER-BI. This approach deals with the major problem associated with this industry of using 700 to 1,000 tons of nets used annually, a portion of which, approximately 8 to 9 tons, usually ends up polluting the sea (Pietrelli, 2022). Similarly, the Ocean Wise Project (2021) addresses problems caused by using EPS boxes in fishing by promoting biodegradable alternatives and setting up return-and-reuse systems. These projects exemplify actionable strategies for enhancing circularity and reducing ecological impact within the maritime supply chain (Savoca et al., 2022).

New developments in the region show how Egypt could lead the shift toward a more sustainable marine economy. Geographically situated at the crossroads of Africa, Asia, and Europe, Egypt possesses approximately 3,000 kilometres of coastline comprising 1,000 kilometres along the Mediterranean Sea, 2,000 kilometres along the Red Sea and the Gulf of Aqaba and a network of 55 seaports containing 197 terminals spanning 37.5 kilometres (Gaber, 2022; Attallah & Attia, 2024). These geographic and infrastructural assets offer a strong foundation for developing a resilient blue economy. Nevertheless, even with these strengths, marine activities still make up just 2.2% of Egypt's GDP, showing that these ocean resources aren't being used to their full potential (Gaber, 2022; Attallah & Attia, 2024). Egypt's blue economy framework focuses on responsibly using sea and coastal resources, particularly within key sectors such as fisheries, aquaculture, and coastal tourism, which are instrumental for

national food security and economic diversification (Nguyen, 2024). To fully benefit from this sector, Egypt needs major policy changes at home and closer teamwork with other countries around the Mediterranean. Better cooperation means exchanging skills, setting shared environmental rules, and launching cross-border initiatives, thereby contributing to a more integrated and sustainable blue economy model at the national and regional levels.

This paper investigates the many opportunities Egypt has for developing its circular marine economy, focusing on how Egypt can work with nearby countries to promote sustainability. It aims to find what's missing in current policies, understand who's involved, analyse the main issues, and suggest practical solutions. By combining different tools and approaches, this research informs policymakers, regional organisations, and private sector actors working toward a more stable and eco-friendlier ocean future benefiting all countries around the Mediterranean Sea.

## **2. Methodology**

This study used a research approach to investigate the Circular Blue Economy in Egypt to support sustainability and build stronger regional ties with Mediterranean nations. The methodology (included reviewing earlier research on the blue and circular economies, especially studies that connected the two, also involved identifying Egypt's strengths in the marine economy compared to other Mediterranean nations. a structured review was carried out to find what's missing in Egypt's key strategies, including Egypt Vision 2030 and the National Climate Change Strategy 2050 alongside regional initiatives such as BLUEMED, Plastic Busters, and programs under the Union for the Mediterranean related to the blue economy. This analysis looked at how well these strategies match the targets of SDG 14, (to find where improvements are needed in leadership, teamwork across borders, funding, and pollution management.

The study also identified and grouped the main players using their involvement and influence as a criterion. The classification included government institutions (e.g., Ministry of Environment, Ministry of Transport), regional organisations (e.g, Union for the Mediterranean), international partners (e.g., the World Bank, Global Environment Facility - GEF), along with the private sector, civil society organisations, and local communities. A diagram was created to show how these groups interact and where connections are missing. To explore how Egypt can work more closely with other Mediterranean nations in the future, a two-round Delphi questionnaire was sent to 20 experts in the blue and circular economy sectors. The questionnaire used Google Forms, exploring current policies, where investment could go, what environmental risks exist, and how countries might work together. The collected data was studied using basic statistics with SPSS software to spot shared views and differences in opinion. The study relied on direct responses from experts and existing sources like reports and academic studies.

## **3. Results and Discussions**

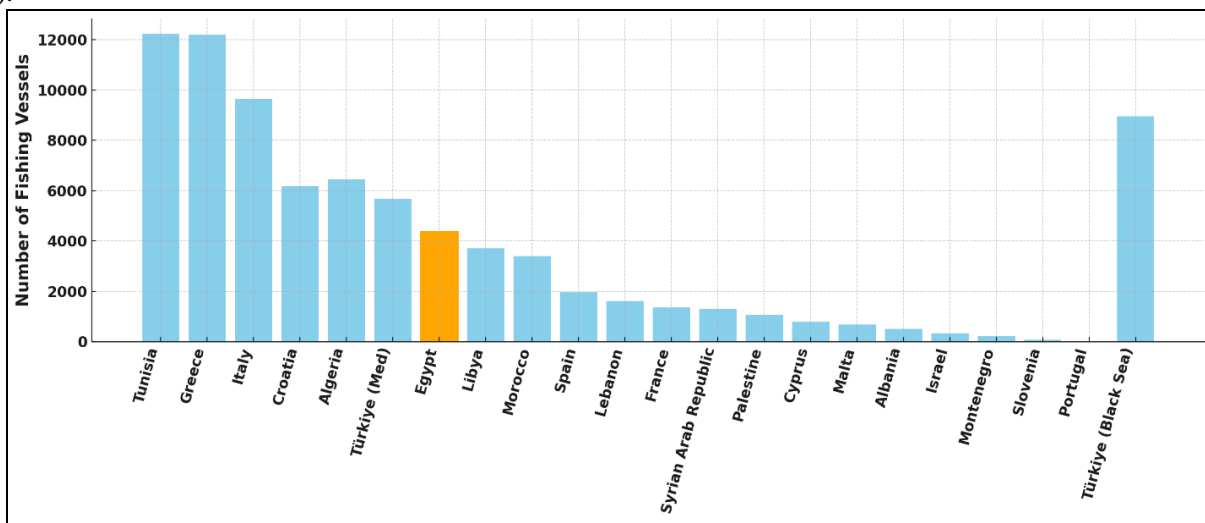
### **3.1 Mapping the Sectors and Key Stakeholders of Egypt's Circular Blue Economy**

#### ***3.1.1. Fisheries and Aquaculture***

The fisheries and aquaculture sector in the Mediterranean plays a major role in the region's marine economy, generating more than 1.5 million tons of fish annually. Of this output, approximately 55% is caught directly from the sea and 45% is produced from aquaculture. The sector generates an estimated EUR 18 billion in revenues, with aquaculture accounting for roughly 60% and fisheries making up the other 40%. Furthermore, it provides jobs for over 700,000 people across the sector, with over 60% of jobs concentrated on fisheries and less than 40% in aquaculture-related activities. About 75,000 fishing boats operate in the region, with more than 750,000 tons in total vessel size (FAO, 2023). Jobs, both directly and indirectly linked to the sector in the region. Majority of the workers are based in border nations (Tunisia, Turkey, Egypt, Italy, Greece and Morocco) and with a strong prominence of workers in Small Scale Fisheries (about 62% of total employment in the sector although only

representing 26% of total revenue), usually run as small businesses, with little investment, and often owned and operated by families (FAO, 2022).

When evaluating the entire region, Egypt is central to developing the blue economy in the Mediterranean through its substantial fish production and expanding aquaculture industry. Fish production is a significant component of Egypt's national economy, helping to ensure food supply, jobs, and national income. The country produces approximately 1.9 million tons of fish annually, of which 1.6 million tons are sourced from aquaculture and 0.3 million tons from natural resources wild stocks (Mehanna, 2021). Egypt operates a fleet of 4,379 fishing vessels, making it one of the eight biggest fleets in the region. As illustrated in Figure 2, which shows the number of fishing vessels operating across Mediterranean countries, Egypt's fleet size is smaller than top countries like such as Tunisia (12,220), Greece (12,197), and Italy (9,651), yet it still ranks among the five main nations alongside Italy, Türkiye, Tunisia, and Algeria who together make up about 66% of the region's fishing power fleet (FAO, 2023).



**Figure 2.** Number of fishing vessels operating across Mediterranean countries  
Source: FAO, 2023

Egypt is going through a significant shift in managing its lakes and fisheries by setting up the new Lakes and Fish Resources Development Agency (LFRDA), taking over from the previous fisheries authority General Authority for Fish Resources Development (GAFRD). Operating under the Prime Minister's supervision, LFRDA plans to gather funding to support the long-term development of lakes and coastal areas to contribute to national development. In parallel, the Ministry of Agriculture and Land Reclamation (MOALR) introduced a long-term plan to improve eco-friendly fish production and support jobs, which was in line with new national laws and recent regulations. These efforts encourage teamwork between government and business, with a focus on helping small fishers through loans and fair policy tools.

### 3.1.2. Maritime Transport

Maritime transport continues to be a core part of ocean-based economics, comprising 90% of goods traded worldwide and helping to connect markets and create jobs (Randone et al., 2019). The Mediterranean Sea plays a unique geographic and trade role, connecting three continents Africa, Asia, and Europe and accommodating roughly 30% of global maritime trade and up to 25% of oil shipments. The corridor between the Suez Canal and the Strait of Gibraltar is one of the world's most heavily used and critical maritime passages. However, the high traffic density creates major environmental challenges, increasing risks of pollution and damage to sea life. In recognition of these challenges, the Mediterranean will soon become a special zone to limit ship emissions under

implementing MARPOL Annex VI starting May 2025, requiring cleaner fuel and pushing ships to adopt green technologies (Brewer, 2020; Alomar et al., 2025).

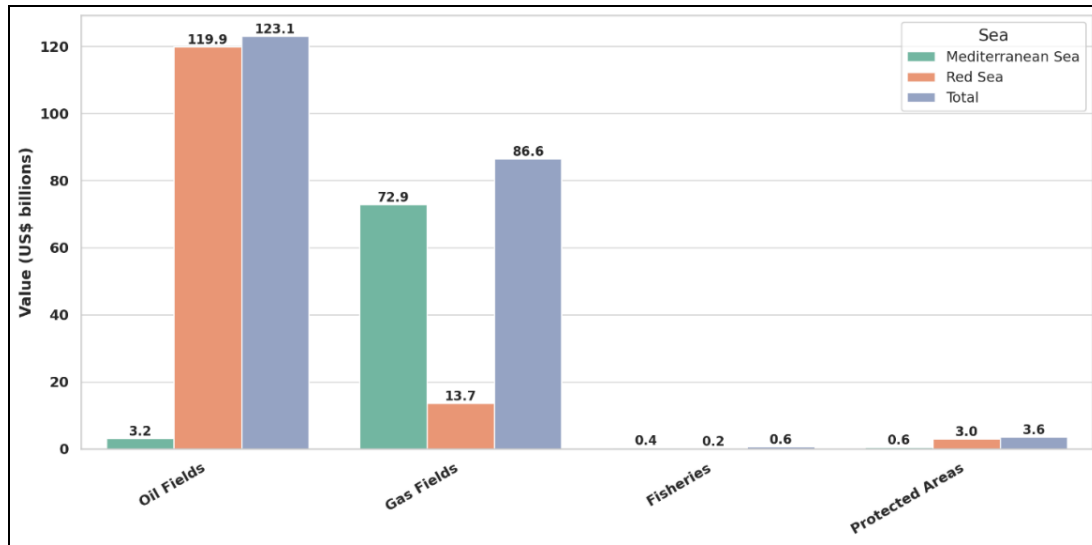
Egypt's position makes it a major player in maritime transport, primarily due to its stewardship of the Suez Canal, which handles one-tenth of world trade and over one-fifth of the global container movement (Guangqiang, 2022). Key ports such as Port Said, Alexandria, and Damietta function as a vital part in regional shipping, supported by national initiatives aimed at enhancing infrastructure and transport efficiency. Nonetheless, the country still faces problems like outdated ports, climate-related risks, and heavy use of oil-based energy. In response, Egypt has begun investing in smart port technologies, greener practices, and better connections with inland transport. Its engagement in regional frameworks such as the Mediterranean Maritime Strategy 2022–2031 and EU-supported decarbonization programs signals a strong commitment to align maritime growth with sustainable development goals. By promoting cleaner shipping practices, Egypt not only reduces its environmental footprint but also contributes to the long-term health of marine ecosystems and the sustainability of coastal economic activities (Dewan & Godina, 2024).

### ***3.1.3. Coastal Resources***

The 2021 Ministerial Declaration on the Sustainable Blue Economy (SBE) (Union for the Mediterranean, 2021) highlights how important maritime tourism near the sea is for the region's economy especially for those countries bordering the Mediterranean. This prominence comes from how easy it is to reach the coast and how busy coastal towns are. Nevertheless, the declaration also points out this industry's environmental and social downsides on coastal communities. The tourism sector contributes approximately 13% of total exports and 23% of the service sector in Mediterranean economies. On a global scale, the region accounts for nearly 35% of international tourist arrivals and 30% of tourism revenues, while accommodating 20% of the world's hotel capacity, comprising over 10,000 destinations, 600 ports, 100,000 hotels, and more than one million restaurants (ASCAME, 2022).

In Egypt, the areas where land meets the sea host rich and varied ecosystems that support a wide range of environmental and economic functions. The Mediterranean coast is distinguished by sandy beaches, coastal dunes, lagoons, mudflats, and seagrass beds, while the Red Sea coast hosts mangrove forests and coral reef systems, which are ecologically significant and contribute to the provisioning of ecosystem services. By the end of 2022, Egypt's 2,800 km coastline was home to approximately 22% of the country's total population of 104.4 million (CAPMAS, 2025), showing how important coastal areas are to for the economy and the society. These areas support a variety of strategic sectors, including maritime transport and ports, oil and gas exploration, industrial and energy production, aquaculture, and fisheries, in addition to infrastructure for desalination, wastewater treatment, and tourism-related services (Yoshijima et al., 2024). The presence of protected areas and ecotourism lodges further underscores the multifaceted value of these coastal and marine spaces.

In terms of economic valuation, Egypt's coastal and marine natural capital stock was estimated at approximately USD 233.4 billion in 2021, encompassing both the Mediterranean and Red Sea regions. This figure is calculated using a 25-year forecast of key resources, including active oil and gas reserves, fisheries, coral reefs, mangroves, and seagrass beds, adjusted for future value using a 3% rate (Figure 3). Although additional extractive resources such as salt, pearls, and black sand exist, they were excluded from the assessment due to insufficient data availability. Importantly, the valuation shows that fossil fuels far outweigh renewable resources in value: nonrenewable fossil fuels are valued at USD 209.7 billion, which is nearly nine times the value of renewable natural resources (USD 23.7 billion). The Red Sea is shown to have more wealth, contributing USD 133.6 billion in nonrenewables and USD 21.9 billion in renewables, largely due to its active oil and gas fields and extensive coral reef ecosystems, which together account for most of the country's valuable marine assets (Yoshijima et al., 2024).



**Figure 3.** Egypt Marine Natural Resource Capital Stock, (in 2021 Prices US\$ billions)

Source: Yoshijima et al., 2024

#### 3.1.4. Stakeholders in Egypt's Circular Blue Economy

The approach of involving stakeholders follows top global standards that have helped make circular blue economy efforts work well around the world. Countries such as Portugal, Norway, and Canada have demonstrated the effectiveness of integrated governance systems that combine efforts from government, science, business, and society in shaping practical and green solutions for the sea (OECD, 2021). In Egypt, a similarly comprehensive stakeholder framework is critical to advancing the circular blue economy, especially with a view of building stronger ties with other Mediterranean countries.

The key stakeholders (Table 2) encompass government entities, academic and research institutions, private sector actors, international organisations, civil society, and local communities. At the national level, ministries such as the Ministry of Environment, the Ministry of Transport, the Ministry of Tourism, the Ministry of Industry and the Ministry of Higher Education play critical roles in shaping regulatory frameworks, aligning policies with Egypt Vision 2030, and promoting blue innovation. Research centres like the National Institute of Oceanography and Fisheries (NIOF) and leading universities contribute to knowledge production and capacity-building in marine science and circular practices. Regional platforms such as the Union for the Mediterranean (UfM) and initiatives like BLUEMED act as facilitators of cross-border collaboration, policy harmonisation, and shared project development.

Meanwhile, NGOs and community-based organisations help bridge the gap between national policies and local implementation, particularly in areas related to marine conservation and sustainable coastal tourism. Private sector actors, including fisheries, aquaculture enterprises, and maritime transport companies, are essential for adopting circular practices, investing in eco-innovation, and creating job opportunities. Moreover, international partners such as the EU, UNDP, and FAO offer support, money, and tools to track progress aligned with the Sustainable Development Goals.

**Table 2.** Stakeholder Typology for the Blue Economy in Egypt and Regional Mediterranean Integration

Category	Stakeholders	Role
Government Entities	Ministry of Environment, Ministry of Transport, Ministry of Tourism, Ministry of Industry, Ministry of Agriculture (Fisheries), Suez Canal Authority, Lakes and Fish Resources Development Agency (LFRDA)	Policymaking, regulation, enforcement, financing, regional coordination
Regional Bodies	Union for the Mediterranean (UfM), BLUEMED Initiative, Barcelona Convention	Promote regional cooperation, joint projects, harmonise regulations across Mediterranean countries
International Partners	UNDP, FAO, UNEP-MAP, European Union (ENI CBC Med Program)	Funding, capacity-building, technical support, SDG 14 implementation assistance
Private Sector	Maritime tourism companies, port and transport companies, aquaculture businesses, offshore energy companies, tourism operators	Business operations, infrastructure investments, innovation in sustainable marine resource use
Research & Academia	Universities and research centres (e.g., Arab Academy for Science and Technology, National Institute of Oceanography and Fisheries (NIOF))	Research, innovation, scientific data production, marine biodiversity conservation
Civil Society & NGOs	Environmental NGOs, local fisherfolk associations, Nature Conservation Egypt, Youth-led environmental groups	Community engagement, awareness, local conservation, watchdog roles
Local Communities	Coastal communities in Alexandria, Port Said, Matrouh, Red Sea Governorates	Resource users, traditional knowledge holders, impacted stakeholders
Science & Innovation Bodies	Ministry of Higher Education and Scientific Research, Academy of Scientific Research and Technology, Science, Technology & Innovation Funding Authority	Research funding, innovation policy, linking academia with the blue economy needs
Financial Institutions	National banks, Global Environment Facility (GEF), World Bank, European Investment Bank	Funding sustainable projects, public-private partnerships, impact finance

Source: Authors

### 3.2. Gap Analysis of Egypt's Circular Blue Economy Policies: Alignment with SDG 14 and Mediterranean Initiatives

The Circular Blue Economy provides a new way to combine sustainable ocean use with circular practices like reuse and recycling, including waste minimisation, recycling, and the extension of product life cycles. While one or more countries are adopting this approach, positioning it as a pivotal pathway for sustainable marine development, its practical implementation in Egypt remains limited. This is primarily mentioned at a minimal level across different policies. This section analyses the policy and institutional gaps in Egypt related to the Circular Blue Economy, with a particular emphasis on their alignment with the Sustainable Development Goals (SDGs), notably Goal 14: Life Below Water. It explores how Egypt's plans align with important regional efforts, such as BLUEMED, SwitchMed, and Plastic Busters, which are widely seen as successful examples of marine protection and circular resource management.

#### 3.2.1. Policy Gaps in Egypt's Vision and Climate Strategies for the Circular Blue Economy

Egypt Vision 2030 and the National Climate Change Strategy 2050 serve as the main guides for sustainable development and climate resilience. Both documents highlight key ideas such as environmental protection, innovation, and cross-sectoral coordination. However, neither clearly includes the circular blue economy as a standalone strategic priority, which results in several policy gaps. In Egypt Vision 2030, while climate action and resource efficiency are key themes, the circular blue economy is not treated as a defined area with its own frameworks or measurable objectives. Although the vision references sectors like coastal tourism, maritime transport, and fisheries, it lacks specific targets or policies for reuse, recycling, or waste reduction within marine value chains. Additionally, there are no systems to measure progress toward SDG 14 (Life Below Water) or clear ways to coordinate among ministries responsible for maritime affairs.

Similarly, the National Climate Change Strategy 2050 supports sustainable coastal management and nature-based solutions, but does not include circular economy practices in its climate mitigation or adaptation strategies. The strategy connects protecting marine life with the circular use of resources and does not offer funding support for innovation and infrastructure in marine circularity. Key circular solutions, such as wastewater reuse in aquaculture or recycling marine litter, are not included in Egypt's climate or waste plans, representing missed opportunities for cross-sectoral synergy. In advancing a circular blue economy in Egypt, it is essential to see how current national plans match the Sustainable Development Goals, particularly SDG 14: Life Below Water, which directly addresses marine conservation, sustainable resource use, and the ecosystem. The circular blue economy brings together eco-friendly use of oceans resources with circular practices such as waste reduction, reuse, and regeneration. To assess how supportive the current system is for such an approach, this review compares the extent to which key SDG 14 sub-targets are reflected in three major national strategies: Egypt Vision 2030, the National Climate Change Strategy 2050. Table 3 shows what is included or missing of SDG 14 components across these strategies and identifies areas with potential for further development to support a circular blue economy model.

**Table 3.** Alignment of Key SDG 14 Sub-Targets with Egypt’s National Strategies

SDG 14 Sub-Target	Egypt Vision 2030	National Climate Change Strategy 2050	Alignment Notes for Circular Blue Economy
<b>14.1</b> Reduce marine pollution	General reference to environmental protection	Indirectly addressed through water pollution control strategies	Further integration needed for marine-specific pollution (plastics, nutrients, wastewater)
<b>14.2</b> Protect and restore marine/coastal ecosystems	Ecosystem resilience and biodiversity objectives included	Biodiversity conservation addressed under the adaptation goals	Supports coastal ecosystem preservation; can be expanded with targeted restoration programs
<b>14.3</b> Address Ocean acidification	Not addressed	Not addressed	Requires inclusion of ocean pH monitoring and related scientific research
<b>14.4</b> Regulate harvesting, end overfishing	Reference to sustainable resource use	Covered under ecosystem and biodiversity goals	Legal framework exists (Law No. 124/1983 and Law No. 146/2021) regulating fishing seasons, gear, and licensing across marine and inland fisheries. Where more specific policies could be developed to support sustainable fisheries management.
<b>14.5</b> Conserve coastal and marine areas (10%+ MPA target)	Protected areas established under Law 102/1983	Aligned with biodiversity protection but no direct MPA targets	National MPAs cover ~10% of marine/coastal zones; continued development supports international commitments
<b>14.6</b> Prohibit harmful fisheries subsidies	Not addressed	Not addressed	Alignment with global trade and sustainability frameworks (e.g. WTO) presents future opportunity
<b>14.7</b> Economic benefits from sustainable marine use	General goals on innovation and value chains	Included under sustainable economic development	Potential to enhance blue economy sectors: aquaculture, marine tourism, biotechnology
<b>14.a</b> Support marine research and tech transfer	Promote innovation and scientific research	Science, research, and awareness included in Goal 5	Could be strengthened by supporting marine-specific data systems and research infrastructure
<b>14.b</b> Access for small-scale fishers	Not addressed explicitly	Not addressed	Opportunity to integrate artisanal fisher rights into legal frameworks and development plans
<b>14.c</b> Implement international law (UNCLOS, ocean governance)	Egypt is a party to UNCLOS and regional conventions	Not explicitly referenced	Could benefit from stronger incorporation of international marine law into national strategy

Source: Authors

### 3.2.2. Policy Gaps in the Egyptian Context and Alignment with Mediterranean Blue Economy Initiatives

Despite Egypt's clear efforts toward green development and adapting to climate change, several policy gaps hinder the full integration of circular blue economy principles within national strategies and their connection to major regional efforts. The Union for the Mediterranean (UfM) has launched initiatives supporting regional cooperation in key blue economy areas such as maritime transport, tourism, renewable energy, and fisheries. Egypt is strongly involved in these regional efforts, highlighting its regional commitment. There is room to better match Egypt's plans with UfM goals by developing national funding mechanisms, increasing SME and startup participation, expanding technical and administrative capacities, and creating clear systems to track progress and monitor funding access and program implementation.

The **BLUEMED** is an EU-led program focused on research and innovation, with the objective of promoting long-term development and employment in the blue economy across the Mediterranean region. It encourages a cooperative approach between EU and non-EU Mediterranean countries to address shared marine and maritime challenges, emphasising knowledge generation, technological progress, and environmental protection. In the Egyptian context, several national priorities match the goals of the BLUEMED Initiative, particularly in environmental sustainability and coastal development. Better aligning Egypt's efforts with BLUEMED's results can further enhance regional collaboration and knowledge exchange. The initiative also presents valuable opportunities for academic and research institutions to engage in collaborative innovation. Establishing a national coordination mechanism could support the integration of BLUEMED outcomes into Egypt's blue economy and circularity frameworks, facilitating the translation of shared outputs into actionable programs

**SwitchMed** is a European Union-funded program that supports the shift toward sustainable consumption and production patterns across Southern Mediterranean countries. Its blue economy component focuses on green innovation, building circular systems, and sharing knowledge across the region in key sectors such as fisheries, maritime transport, and coastal industries.

In Egypt, there is notable potential to enhance engagement with the SwitchMed program by developing a national action plan for the circular blue economy aligned with its objectives. Giving small businesses better access to funding and expertise, increasing participation in pilot projects, and adapting program toolkits to the local context would further advance this engagement. Improved institutional coordination across key ministries, such as environment, transport, and agriculture, would also support more effective application of SwitchMed's cross-cutting strategy.

**Table 4.** Policy Gaps and Alignment with Mediterranean Blue Economy Initiatives in Egypt

Mediterranean Initiative	Egypt's Current Engagement	Policy Gaps	Opportunities for Alignment
<b>Union for the Mediterranean (UfM)</b>	Active participation in UfM dialogues and platforms	<ul style="list-style-type: none"> <li>- National funding for circular blue economy initiatives is yet to be designated.</li> <li>- Strategic alignment with UfM priorities remains limited.</li> <li>- Private sector participation, especially SMEs, is still emerging.</li> <li>- Technical and institutional capacities require further development.</li> <li>- No evaluation mechanism currently tracks funding uptake.</li> </ul>	<ul style="list-style-type: none"> <li>- Develop national funding lines for circular blue economy</li> <li>- Align national strategies with UfM priorities</li> <li>- Encourage SME/startup participation</li> <li>- Build institutional capacity and introduce evaluation mechanisms</li> </ul>
<b>BLUEMED Initiative</b>	Partial alignment with environmental and coastal priorities	<ul style="list-style-type: none"> <li>- Structural alignment with BLUEMED outputs can be further strengthened.</li> <li>- Participation from universities and research institutions remains limited.</li> <li>- A national coordination and follow-up mechanism has not yet been established.</li> <li>- Circular economic practices in the marine sectors are in the early stages of adoption</li> </ul>	<ul style="list-style-type: none"> <li>- Establish a national platform to coordinate BLUEMED integration</li> <li>- Promote academic and research involvement in blue innovation</li> <li>- Align circular economy efforts with BLUEMED focus areas</li> </ul>

Mediterranean Initiative	Egypt's Current Engagement	Policy Gaps	Opportunities for Alignment
SwitchMed Initiative	Some involvement in initiatives, but lacks visibility and strategic coordination	<ul style="list-style-type: none"> <li>- A national action plan aligned with SwitchMed objectives is yet to be developed.</li> <li>- Financial and technical support for SMEs in circular models remains limited.</li> <li>- Program materials require adaptation to local contexts.</li> <li>- Cross-ministerial coordination is currently limited.</li> <li>- A monitoring and evaluation system has not yet been established.</li> </ul>	<ul style="list-style-type: none"> <li>- Create a national circular blue economy action plan</li> <li>- Develop SME support aligned with blue circularity</li> <li>- Adapt SwitchMed models to Egypt's context</li> <li>- Enhance cross-sector coordination and tracking</li> </ul>

### 3.3. Results of the Delphi

To identify the main focus areas and tools for policymaking to advance Egypt's circular blue economy, a Delphi study was conducted involving 20 experts from varied fields and areas of expertise. Participants were selected through purposive sampling to ensure representation across key domains, including marine policy, environmental economics, coastal and spatial planning, circular economy, and regional cooperation within the Mediterranean. The Delphi method was employed in two stages of repeated consultation, enabling the gradual refinement of expert consensus.

#### 3.3.1 Perceived Challenges and Barriers to Egypt's Circular Blue Economy

As illustrated in Figure 4, experts identified a clear set of barriers limiting Egypt's ability to transition toward a circular blue economy. The most critical challenge cited was the lack of funding and investment mechanisms (83%), followed closely by a weak regulatory framework (77%) and poor inter-agency coordination (63%). These structural and institutional obstacles reflect a fragmented policy environment, where practical implementation remains constrained despite national ambitions for green development. Experts noted that without reliable and accessible financing tools, such as blue bonds or marine investment facilities, projects aimed at circular marine practices are unlikely to scale. Furthermore, the absence of a cohesive regulatory framework and the siloed nature of government institutions hinder synergies across coastal, environmental, and economic sectors. Additional barriers identified include limited stakeholder engagement (57%) and gaps in public awareness (43%), pointing to stronger community involvement, inclusive policy dialogues, and public education on the benefits of circular blue practices. A minority of experts (17%) also emphasised the lack of a long-term strategy, highlighting the importance of institutional foresight and continuity in marine policy planning. These findings suggest that while Egypt has committed to sustainability through initiatives like the National Climate Change Strategy 2050, a dedicated circular blue economy roadmap remains underdeveloped.

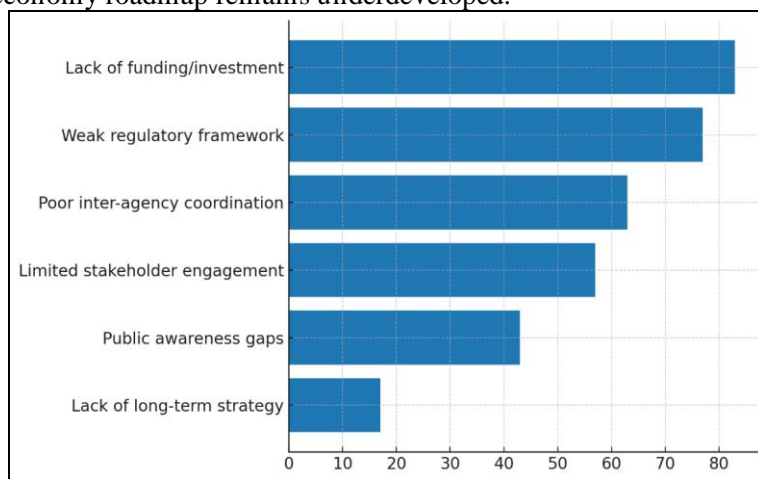


Figure 4. Perceived Barriers to Circular Blue Economy Development in Egypt According to Expert Responses (Delphi Survey, n = 20)

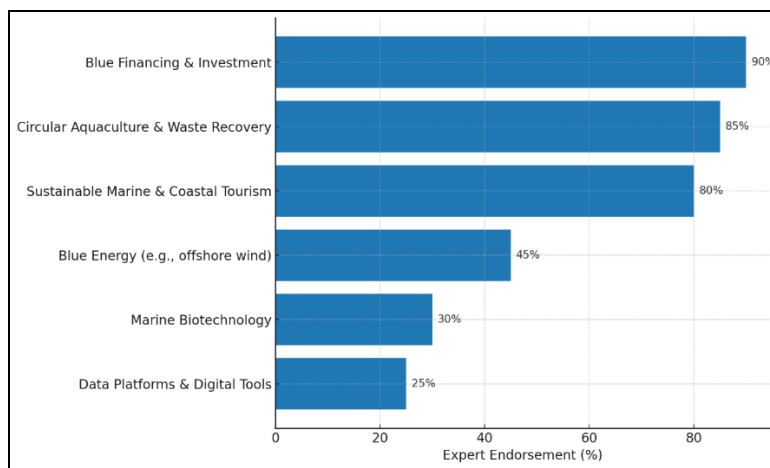
Source: Authors

Experts recommend establishing a unified governance structure, promoting cross-sectoral collaboration, and leveraging regional programs such as BLUEMED and the Blue Mediterranean Partnership to unlock innovation and funding. Together, these steps could help Egypt overcome systemic barriers and realise its full potential as a regional leader in sustainable blue growth.

### 3.3.2. Strategic Pillars for Egypt's Circular Blue Economy

In the Egyptian context, expert consensus prioritised three strategic pillars seen as both effective and achievable, given the country's governmental and financial situation: blue financing and investment (90%), circular aquaculture and waste recovery (85%), and sustainable marine and coastal tourism (80%) (Figure 5). These priorities fit well with Egypt's current advantages in aquaculture production, its expanding coastal tourism sector, and its urgent need for varied and climate-friendly funding. The clear expert support for marine-related funding underscores the demand for new ways to finance projects such as sovereign blue bonds and blended finance to solve the ongoing problem of limited funding in marine sustainability and enable major development efforts. Circular aquaculture was viewed as a promising field capable of turning ecological problems into business opportunities, especially in the Nile Delta and Red Sea regions. Meanwhile, coastal tourism, already a key pillar of Egypt's economy, was identified as a practical entry point for applying circular practices through plastic-free zones, eco-certification, and nature-based tourism initiatives.

Conversely, less support for blue energy (45%), marine biotechnology (30%), and digital platforms (25%) reflects Egypt's current challenges in technological readiness, regulatory frameworks, and innovation ecosystems. These sectors, while critical for staying competitive in the future, were perceived as requiring a lot of government help, research funding, and teamwork between agencies before they could grow successfully.



**Figure 5.** Expert Endorsement of Strategic Pillars for Egypt's Circular Blue Economy (Delphi Survey, n = 20)

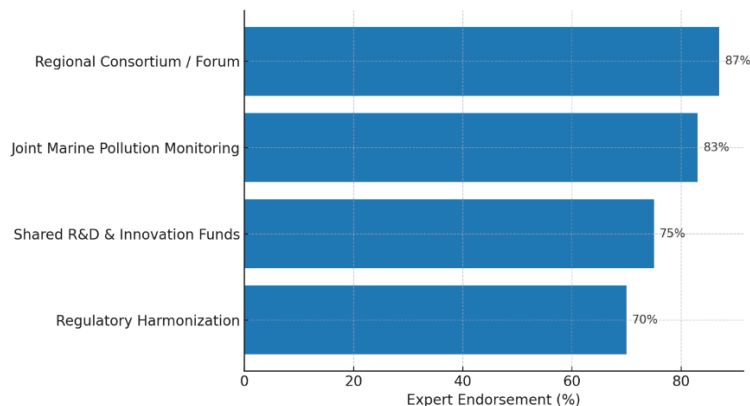
*Source:* Authors

The expert responses suggest a step-by-step plan that fits Egypt's current situation, focusing first on sectors with immediate economic and ecological returns, while preparing the path for future expansion into more advanced blue economy domains. This approach matches the goals in Egypt's national plans, emphasising flexible planning, smart funding, and working with neighbours, particularly within Mediterranean frameworks such as BLUEMED and SwitchMed, to support a just and sustainable transition to a circular blue economy.

### 3.3.3. Regional Cooperation Mechanisms for Advancing Egypt's Circular Blue Economy

Experts were asked to evaluate the effectiveness of various proposed regional mechanisms to support Egypt's integration into a Mediterranean-wide circular blue economy framework. The most strongly endorsed options were the establishment of a regional consortium or forum (rated highly by 87% of participants) and the development of a joint marine pollution monitoring system (83%). These were followed by shared R&D and innovation funding mechanisms (75%) and regulatory harmonisation across Mediterranean countries (70%) (Figure 6). The findings show that experts clearly prefer institutionalised regional cooperation, particularly through multi-stakeholder platforms and cross-border monitoring systems. The high endorsement of a regional consortium suggests confidence in structured dialogue formats to advance shared goals and streamline initiatives across national boundaries. Similarly, support for a unified pollution monitoring system reflects growing awareness of the transboundary nature of marine degradation and the need for collective environmental stewardship.

These findings show the importance of systems for managing cooperation between countries to enable Egypt to move effectively toward a sustainable marine economy. Experts acknowledge that while national reforms are important, regional consensus offers a multiplier effect, enabling joint funding opportunities, harmonised standards, and coordinated innovation. Strong support for collaborative systems for research and innovation indicates a strong desire for collaborative scientific research and technology development capable of addressing shared challenges, such as marine litter, sustainable fisheries, and blue biotechnology. Meanwhile, agreement on laws and rules, albeit slightly lower, is viewed as a key enabler of applying policies across countries and policy coherence.



**Figure 6.** Expert Endorsement of Regional Cooperation Mechanisms for Advancing Egypt's Circular Blue Economy (Delphi Survey, n = 20) *Source:* Authors

Leveraging platforms such as BlueMed, the Union for the Mediterranean, and the Blue Mediterranean Partnership could therefore provide Egypt with strategic avenues to drive and benefit from regional blue growth, enhancing the protection of nature long-term and economic resilience in the Mediterranean Basin.

### 3.3.4. Proposed Future Policy Directions for Egypt's Circular Blue Economy

Expert responses identified five connected strategic areas deemed essential for developing a circular blue economy in Egypt. Foremost among these was the development of a comprehensive national strategy that integrates reuse and sustainability concepts across marine and coastal sectors. Such a strategy should promote the use of materials wisely, ecosystem regeneration, and waste minimisation while aligning with Egypt Vision 2030, Sustainable Development Goal 14 (Life Below Water), and key regional frameworks like BLUEMED and Plastic Busters. Experts stressed that this strategy must be supported by an integrated policy framework capable of connecting local and regional plans, fostering synergies across environmental, economic, and different blue economy sectors.

Equally prioritised was the mobilisation of blue finance to fund circular economic infrastructure. Experts advocated for innovative mechanisms such as government-issued green investments and establishing a national blue finance platform to attract investments in areas like marine waste recovery, circular aquaculture, and green ports. Tapping into Mediterranean funding instruments, particularly through the Blue Mediterranean Partnership, was considered very important to unlocking external capital and ensuring project scalability. Strengthening regional cooperation emerged as a key recommendation, emphasising cross-border initiatives for pollution control, plastic reuse, and shared marine resource flows. Experts further proposed the creation of local centres for testing new eco-friendly ideas, especially in cities like Alexandria and Port Said, to pilot circular technologies and promote entrepreneurship in blue sectors. Finally, training institutions and educating the public were seen as essential, encompassing adding these topics to education, giving more responsibility and tools to local governments, and initiatives to inform and engage the public, campaigns to foster behavioural shifts toward sustainable consumption and marine conservation.

### **Conclusions**

The Circular Blue Economy (CBE) represents a paradigm shift in how marine and coastal resources are valued, governed, and utilised. One that is urgently needed to address the environmental, economic, and socio-political challenges facing Egypt and the wider Mediterranean region. By merging the sustainability objectives of the Blue Economy with the resource efficiency and regenerative practices of the Circular Economy, this model offers an integrated framework for achieving inclusive, resilient, and low-carbon development in ocean-based sectors. This shift is beneficial for Egypt, given its extensive coastline, rich biodiversity, and critical role as a regional maritime hub. Despite this potential, the study reveals that Egypt's current engagement with the Circular Blue Economy remains early. Although the country has made notable progress in aquaculture development, port modernisation, and participation in regional initiatives like BLUEMED and the Union for the Mediterranean, its marine economy contributes only marginally (2.2%) to national GDP. This discrepancy highlights a critical disconnect between resource endowment and policy execution. The findings of this research, based on stakeholder mapping, policy gap analysis, and expert insights via a Delphi survey, identify systemic barriers including fragmented institutional frameworks, underdeveloped financing instruments, limited policy coherence, and weak cross-sectoral coordination. Moreover, there is a noticeable absence of an overarching national strategy that formally integrates circularity into marine sectors, impeding both innovation and investment.

However, from this study also surfaces important chances for improvement. Expert consensus underscores high-impact entry points such as circular aquaculture systems, sustainable and regenerative coastal tourism, and the deployment of innovative blue financing tools, including sovereign blue bonds and blended finance models. These areas align not only with Egypt's comparative advantages but also with regional and global sustainability priorities. Equally important is the recognition of regional cooperation as a catalyst for national progress. Experts strongly advocate for Egypt's leadership in establishing transboundary platforms for knowledge exchange, marine pollution monitoring, and harmonised regulatory frameworks, particularly in the face of shared environmental threats such as plastic leakage, biodiversity loss, and climate-induced coastal vulnerabilities. Several strategic imperatives emerge to translate the circular blue economy from a conceptual model into a functioning system. Firstly, Egypt must develop a dedicated National Circular Blue Economy Strategy that includes measurable targets, cross-ministerial implementation plans, and integration with SDG 14 indicators. Secondly, investment in marine innovation hubs, particularly in Alexandria, Port Said, and Red Sea coastal cities, should be prioritised to serve as incubators for eco-entrepreneurship, digitalisation, and community-driven innovation. Third, enabling conditions must be strengthened through capacity building, particularly for local authorities, SMEs, and youth-led initiatives, to democratise access to opportunities in the CBE space.

This transition's success hinges on aligning Egypt's domestic policy architecture with Mediterranean-wide initiatives. Engaging more effectively with programs like SwitchMed and ensuring the full implementation of international legal frameworks (e.g., UNCLOS), will enhance Egypt's visibility and credibility as a regional leader in marine circularity. By doing so, Egypt has the potential to address pressing domestic development challenges such as food security, employment generation, and climate adaptation and shape the future of Mediterranean cooperation based on shared sustainability objectives. Finally, the Circular Blue Economy is not merely a theoretical construct but a strategic development imperative for Egypt. It offers a multi-dimensional opportunity to build ecological resilience, drive inclusive economic growth, and reposition the country as a frontrunner in regional marine governance. However, achieving this vision requires bold policy action, strategic investment, and unwavering commitment to collaboration within Egypt and across the Mediterranean.

## References

- Ahmed, N., & Thompson, S. (2018). The blue dimensions of aquaculture: A global synthesis. *The Science of the Total Environment*, 652, 851-861. <https://doi.org/10.1016/j.scitotenv.2018.10.163>
- Alomar, C., Capó, X., Rios-Fuster, B., Bernárdez, P., Echeandía, J. S., & Deudero, S. (2025). Are mussels accumulating trace metals and microplastics in port facilities? *Marine Environmental Research*, 210, 107263. <https://doi.org/10.1016/j.marenvres.2025.107263>
- ASCAME. (2022). The new normal for Mediterranean tourism. Retrieved August 5, 2025, from <https://www.ascame.org/new/the-new-normal-for-mediterranean-tourism/>
- Attallah, N., & Attia, A. (2024). Applying the approach of greening the blue economy to the marine surfaces in Egypt. *Revista Internacional De Turismo Empresa Y Territorio*, 7(2), 147-158. <https://doi.org/10.21071/riturem.v7i2.16179>
- Barroso, S., Pinto, F. R., Silva, A., Silva, F. G., Duarte, A. M., & Gil, M. M. (2022). The Circular Economy solution to ocean sustainability. In IGI Global eBooks (pp. 875-901). <https://doi.org/10.4018/978-1-6684-5678-1.ch044>
- Biuksane, I. (2022). Blue economy in the EU-27. *The Journal of Economics Studies and Research*, 1-9. <https://doi.org/10.5171/2022.943474>
- Bocci, M., Mancini, R., SwitchMed, Blue Growth Community, CPMR Intermediterranean Commission, MedWaves, & UNEP/MAP Regional Activity Centre for SCP. (2022). A Circular Blue Economy for the Mediterranean: Current practices and opportunities (By M. Outters, A. Alonso, E. Maniscalco, C. Dubreuil, UNIDO, B. Wuatlet, Union for the Mediterranean, A. Sensi, A. Salazar, National Technical University of Athens, V. Bougiouri, Generalitat Valenciana, & F. D. Rojas Parets). <https://switchmed.eu/wp-content/uploads/2022/06/A-Circular-Blue-Economy-for-the-Mediterranean-SwitchMed.pdf>
- Brewer, T. (2020). A maritime emission control area for the Mediterranean Sea? Technological solutions and policy options for a 'Med ECA.' *Euro-Mediterranean Journal for Environmental Integration*, 5(1). <https://doi.org/10.1007/s41207-020-00155-1>
- CAPMAS. (2025). Statistical Yearbook 2024: Population and housing data. Central Agency for Public Mobilization and Statistics, Arab Republic of Egypt. Retrieved from <https://www.capmas.gov.eg>
- Cappelletto, M., Fava, F., Villanova, L. M., Trincardi, F., Barbanti, A., Bonanno, A., Nardelli, B. B., Ciappi, E., Palama, D., D'Alcala, M. R., Sarretta, A., & Sprovieri, M. (2018). Codevelop research and innovation for blue jobs and growth in the mediterranean - the bluemed initiative. *Environmental Engineering and Management Journal*, 17(10), 2313-2327. <https://doi.org/10.30638/eemj.2018.230>
- Choudhary, P., G. V. S., Khade, M., Savant, S., Musale, A., G. R. K. K., Chelliah, M. S., & Dasgupta, S. (2021). Empowering blue economy: From underrated ecosystem to sustainable industry. *Journal of Environmental Management*, 291, 112697. <https://doi.org/10.1016/j.jenvman.2021.112697>
- Cózar, A., Sanz-Martín, M., Martí, E., González-Gordillo, J. I., Ubeda, B., Gálvez, J. Á., Irigoien, X., & Duarte, C. M. (2015). Plastic accumulation in the Mediterranean Sea. *PLoS ONE*, 10(4), e0121762. <https://doi.org/10.1371/journal.pone.0121762>
- Dalberg Advisors. (2019). Stop the flood of plastic: How Mediterranean countries can save their sea. WWF Mediterranean Marine Initiative. [https://awsassets.panda.org/downloads/a4\\_plastics\\_reg\\_low.pdf](https://awsassets.panda.org/downloads/a4_plastics_reg_low.pdf)

- Dewan, M. H., & Godina, R. (2024). Sailing Towards Sustainability: How seafarers embrace new work cultures for energy efficient ship operations in maritime industry. *Procedia Computer Science*, 232, 1930-1943. <https://doi.org/10.1016/j.procs.2024.02.015>
- Di Vaio, A., Dell'Amura, G., Chhabra, M., & Garofalo, A. (2024). Circular economy and waste production models for sustainable development goals 12 and 14: Evidence from cruise sustainability reporting. *Sustainable Development*, 32(6), 6686-6702. <https://doi.org/10.1002/sd.3051>
- European Commission. (2021, May 12). Strategic guidelines for a more sustainable and competitive EU aquaculture for the period 2021–2030 (COM(2021) 236 final). Publications Office of the European Union. [https://eur-lex.europa.eu/resource.html?uri=cellar:bab1f9a7-b30b-11eb-8aca-01aa75ed71a1.0022.02/DOC\\_1&format=PDF](https://eur-lex.europa.eu/resource.html?uri=cellar:bab1f9a7-b30b-11eb-8aca-01aa75ed71a1.0022.02/DOC_1&format=PDF)
- European Commission. (2025). The EU Blue Economy Report 2025. Directorate-General for Maritime Affairs and Fisheries. Retrieved from [https://oceans-and-fisheries.ec.europa.eu/news/commission-publishes-2025-report-eu-blue-economy-2025-05-22\\_en](https://oceans-and-fisheries.ec.europa.eu/news/commission-publishes-2025-report-eu-blue-economy-2025-05-22_en)
- FAO. (2022). The State of Mediterranean and Black Sea Fisheries 2022. General Fisheries Commission for the Mediterranean. Rome. <https://doi.org/10.4060/cc3370en>
- FAO. (2023). The State of Mediterranean and Black Sea Fisheries 2023 – Special edition. General Fisheries Commission for the Mediterranean. Rome. <https://doi.org/10.4060/cc8888en>
- Fernández-González, R., Pereira, Z. G. T., & Ricoy-Casas, R. M. (2024). Governance of the circular economy in the canned fish industry: A case study from Spain. *Environmental Technology & Innovation*, 34, 103618. <https://doi.org/10.1016/j.eti.2024.103618>
- Figueiredo, R., Soliman, M., & Al-Alawi, A. N. (2023). Deep Blue Entrepreneurship: ocean venturing and infinite opportunity. In *Contemporary issues in entrepreneurship research* (pp. 5-17). <https://doi.org/10.1108/s2040-724620230000016002>
- Firoozi, A. A., & Firoozi, A. A. (2022). Circular economy for sustainable construction material management. *Journal of Civil Engineering and Urbanism*, 12(4), 70-81. <https://doi.org/10.54203/jceu.2022.10>
- Francis, A. E., & Herat, S. (2020). Tackling marine plastic pollution through Source-To-Sea approach and circular economy. *Nature Environment and Pollution Technology*, 19(5(Supp)), 1775-1787. <https://doi.org/10.46488/nept.2020.v19i05.001>
- Gaber, M. (2022). Opportunities facing the Egyptian Blue economy. *The International Maritime Transport and Logistic Journal*, 11(0), 1. <https://doi.org/10.21622/marlog.2022.11.001>
- Galgani, F. (2019). Litter in the Mediterranean Sea. In Springer eBooks (pp. 55–67). [https://doi.org/10.1007/978-3-030-00138-4\\_6](https://doi.org/10.1007/978-3-030-00138-4_6)
- Garland, M., Axon, S., Graziano, M., Morrissey, J., & Heidkamp, C. P. (2019). The blue economy: Identifying geographic concepts and sensitivities. *Geography Compass*, 13(7). <https://doi.org/10.1111/gec3.12445>
- Graziano, M., Alexander, K. A., McGrane, S. J., Allan, G. J., & Lema, E. (2022). The many sizes and characters of the Blue Economy. *Ecological Economics*, 196, 107419. <https://doi.org/10.1016/j.ecolecon.2022.107419>
- Guangqiang, T. (2022). Suez Canal Economic Corridor (Egypt). In Routledge eBooks (pp. 602–606). <https://doi.org/10.4324/9781003286202-132>
- Ha, L. T. (2024). Achieving a blue economy through the circular initiatives: a path towards sustainable marine living resources. *Environmental Science and Pollution Research*, 31(9), 13656-13672. <https://doi.org/10.1007/s11356-024-31951-9>
- Junceda-Mena, I., García-Junceda, E., & Revuelta, J. (2023). From the problem to the solution: Chitosan valorisation cycle. *Carbohydrate Polymers*, 309, 120674. <https://doi.org/10.1016/j.carbpol.2023.120674>
- Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). What a waste 2.0: A global snapshot of solid waste management to 2050. World Bank. <https://doi.org/10.1596/978-1-4648-1329-0>
- Martina Bocci & Raffaele Mancini. (2022). A circular blue economy for the Mediterranean: Current practices and opportunities. CPMR Intermediterranean Commission & MedWaves, the UNEP/MAP Regional Activity Centre for Sustainable Consumption and Production. <https://doi.org/10.1016/j.biombioe.2025.107835>

- Masi, M., Adinolfi, F., Vecchio, Y., Agnusdei, G. P., & Coluccia, B. (2024). Toward the circular economy in the aquaculture sector: Bibliometric, network and content analyses. *Sustainability*, 16(13), 5405. <https://doi.org/10.3390/su16135405>
- Mehanna, S. F. (2021). Egyptian marine fisheries and its sustainability. In Elsevier eBooks (pp. 111 -140). <https://doi.org/10.1016/b978-0-12-824296-4.00010-4>
- Nguyen, N. B. (2024). How does a sustainable ocean economy affect national GDP? *Cogent Economics & Finance*, 12(1). <https://doi.org/10.1080/23322039.2024.2435926>
- OECD. (2021). Sustainable Ocean for All: Harnessing the Benefits of Sustainable Ocean Economies for Developing Countries. <https://doi.org/10.1787/bede6513-en>
- Olteanu, A., & Stinga, V. (2019). The economic impact of the blue economy. *Lumen Proceedings*. <https://doi.org/10.18662/lumproc.111>
- Pietrelli, L. (2022). Polypropylene Recovery and Recycling from Mussel Nets. *Polymers*, 14(17), 3469. <https://doi.org/10.3390/polym14173469>
- Randone, M., Bocci, M., Castellani, C., Laurent, C., & Piante, C. (2019). Safeguarding marine protected areas in the growing mediterranean blue economy—recommendations for the maritime transport sector. *International Journal of Design & Nature and Ecodynamics*, 14(4), 264-274. <https://doi.org/10.2495/dne-v14-n4-264-274>
- Roberts, J., & Ali, A. (2016). The blue economy in small states. *Small States Digest*. <https://doi.org/10.14217/5jlskg9818q8-en>
- Rezk, M. R., Kapiel, T. Y. S., Piccinetti, L., Salem, N., Khasawneh, A., Santoro, D., Montagnino, F. M., El-Bary, A. A., & Sakr, M. M. (2023). Circular economy in Egypt: An overview of the current landscape and potential for growth. *Insights into Regional Development*, 5(3), 45-57. [https://doi.org/10.9770/ird.2023.5.3\(3\)](https://doi.org/10.9770/ird.2023.5.3(3))
- Sardinha, Á. (2024). Apresentação do Centro de Competência e Desenvolvimento da Economia Azul. *Revista Internacional Em Língua Portuguesa*, 45, 135-138. <https://doi.org/10.31492/2184-2043.rilp2024.45/pp.135-138>
- Savoca, S., Battocchio, F., Scalici, M., & Borgogni, F. (2022). First insights on the behavior of foamed polystyrenes in the marine environment and on the ways to reduce this pollution. <https://doi.org/10.13140/RG.2.2.10590.92488>
- Shan, S., Mirza, N., Umar, M., & Hasnaoui, A. (2023). The nexus of sustainable development, blue financing, digitalisation, and financial intermediation. *Technological Forecasting and Social Change*, 195, 122772. <https://doi.org/10.1016/j.techfore.2023.122772>
- Steven, A. D. L., Vanderklift, M. A., & Bohler-Muller, N. (2019). A new narrative for the Blue Economy and Blue Carbon. *Journal of the Indian Ocean Region*, 15(2), 123-128. <https://doi.org/10.1080/19480881.2019.1625215>
- Summa, D., Lanzoni, M., Castaldelli, G., Fano, E., & Tamburini, E. (2022). Trends and opportunities of Bivalve shells' waste valorisation in a prospect of Circular blue Bioeconomy. *Resources*, 11(5), 48. <https://doi.org/10.3390/resources11050048>
- Tolio, T., Bernard, A., Colledani, M., Kara, S., Seliger, G., Duflou, J., Battaia, O., & Takata, S. (2017). Design, management and control of demanufacturing and remanufacturing systems. *CIRP Annals*, 66(2), 585-609. <https://doi.org/10.1016/j.cirp.2017.05.001>
- Tsangaris, C., Pantì, C., Compa, M., Pedà, C., Digka, N., Bains, M., D'Alessandro, M., Alomar, C., Patsiou, D., Giani, D., Romeo, T., Deudero, S., & Fossi, M. C. (2021). Interlaboratory comparison of microplastic extraction methods from marine biota tissues: A harmonisation exercise of the Plastic Busters MPAs project. *Marine Pollution Bulletin*, 164, 111992. <https://doi.org/10.1016/j.marpolbul.2021.111992>
- Tucci, H. N. P., De Oliveira Neto, G. C., Rodrigues, F. L., Giannetti, B. F., & De Almeida, C. M. V. B. (2021). Six sigma with the blue economy fundamentals to assess the economic and environmental performance in the aircraft refueling process. *Renewable and Sustainable Energy Reviews*, 150, 111424. <https://doi.org/10.1016/j.rser.2021.111424>
- Union for the Mediterranean. (2021, February 2). UfM Ministerial Declaration on Sustainable Blue Economy (2nd UfM Ministerial Declaration). UfM Secretariat. <https://ufmsecretariat.org/wp-content/uploads/2021/02/Declaration-UfM-Blue-Economy-EN-1.pdf>
- Wang, S., Li, W., & Xing, L. (2022). A review on Marine Economics and Management: How to Exploit the Ocean Well. *Water*, 14(17), 2626. <https://doi.org/10.3390/w14172626>

Winder, G. M., & Heron, R. L. (2017). Assembling a Blue Economy moment? Geographic engagement with globalising biological-economic relations in multi-use marine environments. *Dialogues in Human Geography*, 7(1), 3-26. <https://doi.org/10.1177/2043820617691643>

Yoshijima, S., Elhadary, H., Doumani, F. M., Arif, S., Sakr, D., Aparicio, P. A., & Temraz, T. (2024). Egypt - Country environmental analysis: Promoting circular economy and blue economy for environmental sustainability – Executive summary. World Bank Group. <https://documents.worldbank.org/curated/en/099060724102510054>

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