SVU-International Journal of Engineering Sciences and Applications (2025) 6(1): 106-122
Print ISSN 2785-9967 | Online ISSN 2735-4571
DOI 10.21608/svusrc.2025.331646.1246

Proposed sustainable coastal management framework to set urban development priorities (Al-Zafarana - Ras Gharib - Hurghada) sector

Donia Fakhri Abdel Monem Nahla[1,] , and Seham Mostafa Qutb [2]

Abstract

Coastal and Marine Spatial management is a methodical process of assigning the spatial and temporal distribution of human activities to fulfill social, financial, and environmental goals. This process involves enabling and disabling conditions, categorized into four groups: Plan Attributes; Legal Context; Plan Development and Social Context; Integration. The effectiveness of the plan depends on factors like plan type, planning phase, and institutional capacity, which includes planners' knowledge, legitimacy of the plan, and financial and human resources allocated for its implementation, monitoring, and enforcement.

Many tools have emerged for Coastal and Marine Spatial Planning (MSP) management, the most well-known and widely applied of which are Ecosystem-based management (EBM) and ecosystem services.

Ecosystem-Based Management (EBM) is a holistic management approach that takes into account the entire ecosystem, including human interactions. Its primary objective is to keep ecosystems healthy, productive, and resilient, ensuring they can deliver the essential services that humans require. Unlike traditional methods that typically concentrate on a single species, sector, or specific issue, EBM evaluates the cumulative effects of various sectors on the ecosystem.[1]

It is essential to integrate coastal zone management with appropriate tools tailored to the Egyptian context to achieve sustainable coastal management. Thus, it is urgent to propose a sustainable framework that prioritizes urban development. This research aims to outline a sustainable coastal management framework that establishes key priorities for urban development. The research will achieve this by identifying tools that contribute to sustainable coastal management, evaluating the importance and goals of each tool, and selecting the most suitable one to address the urgent ecological challenges in Egypt, while considering the most widely used global practices.

Ultimately, the research seeks to develop an application framework for implementing sustainable Coastal Management, based on the integrate of the methodology of integrated coastal zone management and the principles of Ecosystem-Based Adaptation, to promote sustainable development of these areas.

The proposed framework has been applied to the Al-Zafarana - Ras Gharib - Hurghada sector as a case study, addressing its specific coastal and marine challenges.

Using the EbA tool to develop a sustainable coastal management framework for Al-Zafarana, Ras Gharib, and Hurghada results in a balanced approach that protects the environment, enhances economic opportunities, and supports resilient urban development. This approach ensures that these coastal cities can thrive sustainably while mitigating risks associated with climate change and environmental degradation.

Keywords

sustainable coastal management framework, Eco system-based adaptation tool -Coastal zone management – Al Zafarana, Ras Gharib, Hurghada sector - urban development priorities

1 Introduction

Coastal environments are vital to ecological balance, economic prosperity, and societal well-being. As human activities continue to exert pressure on these regions, effective management becomes imperative. Integrated coastal offers a structured approach to manage the competing interests and complexities inherent in marine and coastal ecosystems. This framework utilizes various tools designed to analyze, organize, and allocate marine and coastal space effectively. From integrating ecological, economic, and social objectives to addressing governance challenges, these tools are essential for developing sustainable strategies that foster both environmental health and community resilience. By exploring the various tools available within the CMSP framework. [1][40]

Concept of the Coastal Spatial management is the overall

Received: 28 October 2024/ Accepted: 2 January 2025
Corresponding Author: Donia Fakhri Abdel Monem Nahla, doni7.fa5ri@yahoo.com.
Seham Mostafa Qutb, *seham.mostafa87@cu.edu.eg*.
1. Lecturer, Environmental Planning Department, Faculty of Urban Planning, Cairo University, Egypt.
2. Assistant professor, Environmental Planning Department, Faculty of Urban Planning, Cairo University, Egypt.

process of analyzing and allocating the spatial and temporal distribution of human activities to achieve ecological, economic, and social objectives typically determined through practical policy goals [2]. It is a systematic operational process aimed at organizing and distributing land uses and various activities in coastal and marine areas with the aim of achieving specific environmental, economic, and social objectives. [3]

Our review included theory and empirical data from which we developed the 19 conditions and gained a knowledge of the particular importance of every condition to MSP. Four main groups distinguished the conditions: Plan Attributes, Legal Context, Plan Development and Social Context, and Integration. Every condition could affect MSP's capacity to succeed either favorably or negatively. Though some of the illnesses overlap, each reflects unique elements deserving of inclusion and individual treatment. [5]

Plan qualities the efficiency of an MSP is probably influenced by several fundamental factors. Planning type (e.g., information-based, strategic and vision based, or regulatory); planning phase (e.g., pre-planning, analysis for planning, plan development, plan completion, plan approval, plan implementation or plan revision); and the underlying motivation and intent of a plan provide vital background [6]. We found eight conditions falling under this category. Institutional capability Institutional capacity speaks to the entity creating a plan's capacity. It covers planners' awareness of the social and environmental systems, past performance with planning techniques, and leadership ability. This criterion also takes into account whether the intended beneficiaries of the plan have experience—positive or negative—with the entity creating the plan and/or with other pertinent participants engaged in execution. Collier, Enabling circumstances for community-based marine protected area management in the United States, 2020. [7] [8]

Here is relevant whether the plan and planners have legitimacy and the social license to operate—that is, the acceptance and approval of society to carry out and implement planning. [9] [10]

The idea of planning culture, the standards and behaviors by which people and institutions act to create a plan, also relates with institutional capacity. The decisions that planners make and, hence, the results of a plan can be much influenced by their planning culture. Lastly, this requirement covers the capacity of a plan for ongoing implementation, monitoring and enforcement, evaluation, and adaptive management. With regard to funding contingency and resilience, this covers the financial resources allocated for MSP as well as personnel, supplies and/or facilities, and the ratio of available resources to those projected as required for complete plan implementation. [11] [4]

It is essential to integrate coastal zone management with appropriate tools tailored to the Egyptian context to achieve sustainable coastal management. Thus, it is urgent to propose a sustainable framework that prioritizes urban development. This research aims to outline a sustainable coastal management framework that establishes key priorities for urban development. The research will achieve this by identifying tools that contribute to sustainable coastal and marine management, evaluating the importance and goals of each tool, and selecting the most suitable one to address the urgent ecological challenges in Egypt, while considering the most widely used global practices. [1] [39]

Conventional coastal management approaches represent traditional strategies for coastal protection, primarily relying on engineering interventions and localized solutions. While these methods offer immediate benefits, they often neglect broader ecological considerations. These limitations underscore the critical need for integrated management frameworks like Ecosystem-Based Adaptation, which harmonize human requirements with environmental sustainability and resilience. [38]

Ultimately, the research seeks to develop an application framework for sustainable Coastal Management, based on the integration of the methodology of Integrated Coastal Zone Management and the principles of Ecosystem-Based Adaptation, this approach aims to promote the sustainable development of coastal areas.

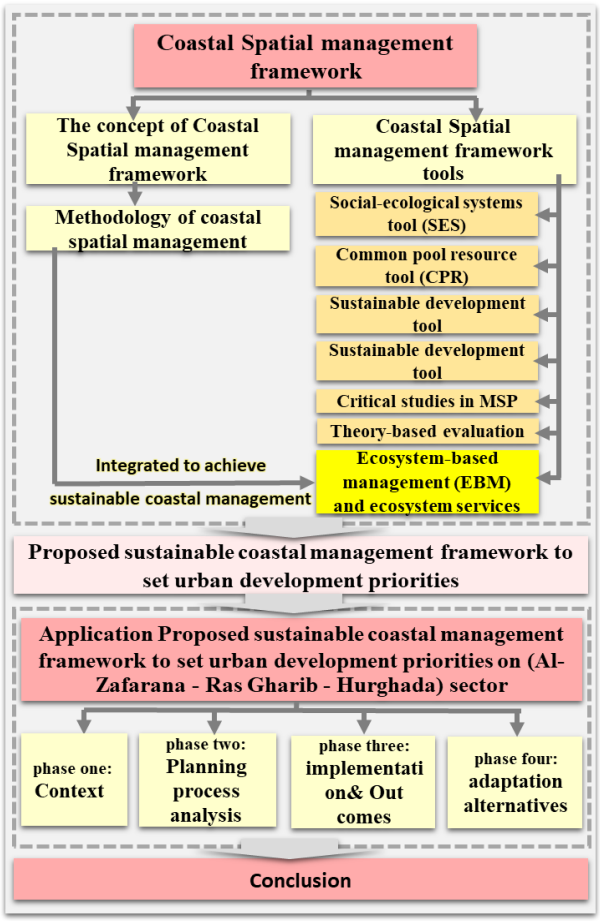

Fig. 1 research methodology
Source: Researchers

Proposed Sustainable coastal management framework is critical concept in addressing the challenges faced by coastal areas. This term encapsulates the need for integrated approaches that balance ecological health in coastal management methodology so it is essential for effective policy-making and implementation in coastal regions to set Urban development priorities in coastal areas focus on the need for continuous monitoring and adaptation in spatial planning processes. [1] The dynamic nature of coastal and marine ecosystems, combined with evolving human activities, demands a flexible, adaptive approach to management. Ensuring stakeholder involvement and cross-sector collaboration will be essential in refining the MSP framework, allowing for sustainable development that aligns with both ecological preservation and economic growth. [37]

2 Coastal Spatial management framework

2.1. The concept of Coastal Spatial management framework

Evaluating Multi-Stakeholder Partnership (MSP) under considering enabling conditions has many advantages. Good evaluation not only monitors development toward the objectives of a plan but also promotes learning and guides adaptation. This approach allows practitioners and assessors to evaluate factors that either supported or hampered plan effectiveness, therefore guiding data-informed decisions during plan modification. Examining every condition and how it relates to the goals of the plan helps one to find areas that need work and ways to use several conditions to support success. [5] [12]
Examining twelve plans, Jones et al. found many limiting factors including a focus on single sectoral objectives, tradeoff analyses motivated by sectoral interests, and minimal stakeholder influence.[12] These results point out chances to shape and enhance future MSP plans. Campaigns surrounding SDG 14 and initiatives such as the United Nations Decade of Ocean Science for Sustainable Development reveal the growing interest in coastal and ocean governance. [1] Still, questions about how well present governance systems meet intended social and environmental results abound. Adoption of a Blue Growth narrative for ocean development is received with mistrust, underlining the need of thorough review and adaptive tactics in MSPs to properly handle these difficulties. [5] [13]
Examining and characterizing enabling and hindering factors helps one to graphically represent the MSP process and how an outcome evaluation can clearly incorporate the social-environmental context of planning (1), parts of the planning process (2), and of plan implementation (3). The assessment ranks outcomes (4) within the framework of these criteria to guide adaptation (5), as shown in Fig. 2. [5]

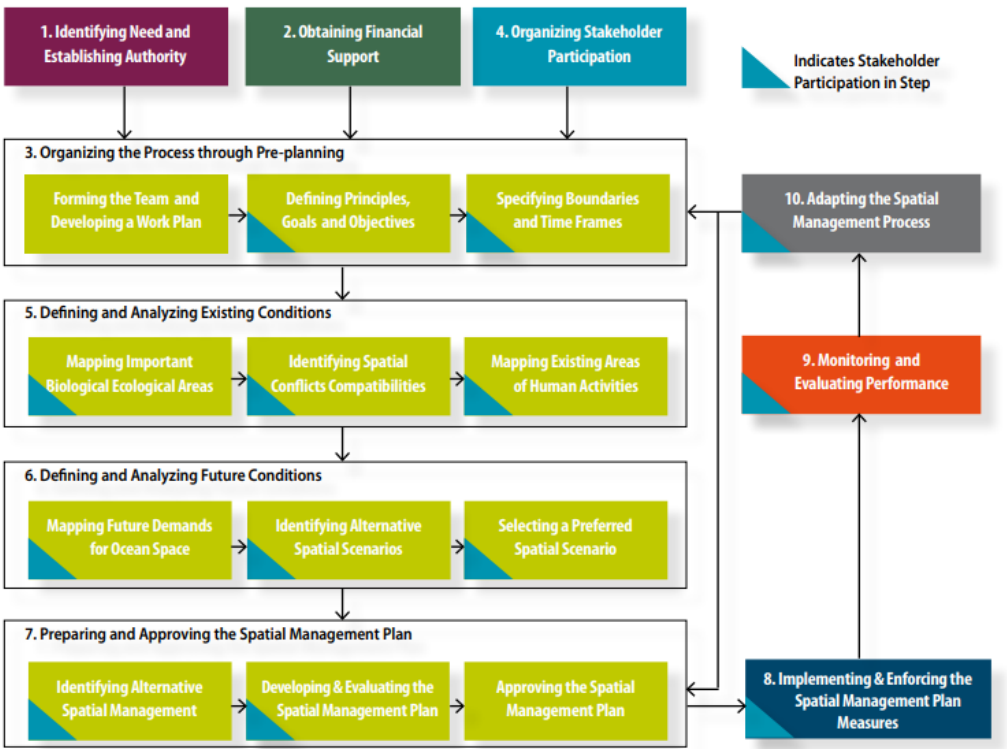

Fig. 2 A Step-by-step approach to coastal Spatial Planning
Source: [5] [2]

2.1.1. Phase One: Pre-planning Stage

A. Understanding the Need for Spatial Planning and Determining the Planning Level

the first step is to understand the need for spatial planning and determine the appropriate planning level. This involves collecting relevant data, identifying the study area, monitoring problem details, and envisioning higher-level perspectives to set a strategic foundation for the planning process.

This stage should produce outputs from which A first list of particular issues you wish to address with marine spatial planning and a choice on the type of authority required for its development.

B. Identifying Available Physical Resources

the second step involves identifying available physical resources. This includes assessing the natural and man-made assets within the study area to determine their distribution, availability, and potential for use, which is crucial for informed decision-making and effective resource management.

This stage should produce outputs from which A financial strategy that: projects the expenses of your MSP operations; and points up other ways to get funding for those MSP projects.

C. Identifying and Organizing Participating Entities

the third step involves identifying and organizing participating entities. This step focuses on recognizing all relevant stakeholders and coordinating their involvement to ensure that diverse perspectives and expertise are integrated into the planning process for comprehensive and effective outcomes.

This stage should produce outputs from which arrangement of a maritime spatial planning team with the intended competencies; a work schedule including important tasks and resources needed to timely finish the outputs of planning; Specified limits and time horizon for management and research; a collection of ideas to direct the creation of the marine spatial management strategy; and a set of aims and objectives for the management region.

D. Organizing the Preparatory Process

the fourth step is organizing the preparatory process. This involves structuring and coordinating the initial activities, resources, and timelines needed to ensure a smooth and efficient transition into the main phases of planning and implementation.

From this stage, deliverables should be produced are a strategy specifying who, when, and how to include stakeholders all through the process of marine spatial planning.

2.1.2. Phase Two: Ecological Systems Identification Stage

A. Identifying and Analyzing Current Conditions

the fifth step involves identifying and analyzing the current conditions of ecological systems. This step includes assessing the existing state of marine environments, habitats, and species to understand their health, functionality, and interactions, which is essential for developing effective management strategies.

Delivered from this stage should be outputs. Maps of significant biological and ecological areas within the maritime management area; maps of present human activity (and pressures) in the marine management area; An evaluation of possible conflicts and compatibilities among present human uses; and an evaluation of possible conflicts and compatibilities between present human uses and the surroundings.

B. Identifying and Analyzing Future Conditions

the sixth step involves identifying and analyzing future conditions of ecological systems. This includes forecasting potential changes and impacts on marine environments based on trends, scenarios, and emerging threats to ensure that planning strategies are adaptive and resilient to future challenges.

This stage should produce outputs from which Alternative spatial sea use scenarios showing how the management area might look when human activities are relocated depending on new goals and objectives; trend scenario showing how the MSP area would look if existing conditions persist without new management interventions; A desired scenario that offers the foundation for spotting and choosing management strategies for the spatial management plan (Step 7).

C. Preparation and Approval of Spatial Management Plan

the seventh step is the preparation and approval of the spatial management plan. This involves developing a comprehensive plan that integrates findings from previous analyses and stakeholder inputs, followed by a formal approval process to ensure it is ready for implementation and enforcement.

outcomes from this stage should be an identification of criteria for choosing alternative management measures; an identification and evaluation of alterative management measures for the spatial management plan; and a thorough management plan comprising, if necessary, a zoning plan.

2.1.3. Phase Three: Monitoring Activity Conflicts and Uses

A. Implementing the Management Plan

the eighth step is implementing the management plan. This involves executing the strategies and actions outlined in the plan, coordinating with relevant stakeholders, and ensuring that all regulatory and operational measures are effectively put into practice.

This stage should produce outputs that guarantee compliance with, ensure implementation of, and enforce the spatial management plan by means of clear description of actions needed.

B. Monitoring and Evaluating Performance

the ninth step is monitoring and evaluating performance. This involves systematically tracking the outcomes of the implemented management plan, assessing its effectiveness, and identifying any areas for improvement to ensure that objectives are being met and adjustments are made as needed.

Delivered from this stage should be outputs. a monitoring system intended to track indicators of maritime spatial management strategies; Details on the effectiveness of marine spatial management strategies meant for evaluation; therefore, periodically reports on the effectiveness of the marine spatial management plan to public, stakeholder, and decision-makers.

C. Adapting Management Processes to Subsequent Planning Cycles

the tenth step involves adapting management processes to subsequent planning cycles. This includes revising goals and decisions based on performance evaluations and emerging trends to ensure they remain aligned with the overall vision and address any new challenges or opportunities effectively.

This stage should produce outputs from which Suggestions for adjusting management goals, objectives, results, and tactics for the following planning cycle; Identification of required applied research projects.

2.2. Coastal Spatial management framework tools

2.2.1 Importance of Coastal Spatial management tools

The type of plan, the planning stage, and the underlying motive and goal all have bearing on how effective Marine Spatial Planning (MSP) is. These elements have been classified into eight conditions and offer necessary background. [14] [15]

- In planning, institutional capacity refers to entity's competency, planners' knowledge, experience, legitimacy, social acceptance, and planning culture. It guarantees efficient application, control, and modification of strategies for reaching objectives. [14] [4]
- SMART goals are absolutely vital for the conception, execution, and evaluation of a plan. Early definition of quantifiable objectives, defined outcomes, precise targets, stakeholder involvement is evaluated in this condition. Vagueness might impede assessment and support bad habits. [14]
- In planning, critical analysis of evidence includes review of ethical principles, data quality, and relevancy. Focusing on causes rather than knowledge gaps, MSP depends on integration of thorough social data to properly address social and environmental challenges. [4][38]
- Future-oriented: This criteria assesses whether a plan considers existing and historical developments in tandem with future social, environmental, and ocean use situations. It aligns planning timeframes with ocean space licensing periods, therefore addressing tensions between established and growing ocean users, climate change consequences, and varied community adaptive capacity. [5]
- Multi-sector planning comes with natural trade-offs. Open study of trade-offs balances several ocean user needs, so improving plan equity. Evaluation should cover data and methodologies utilized for quantification, consideration of unrepresented values, marginalized populations, and biodiversity. Inclusive decision-making depends on knowing trade-off conversation venues. [14] [38]
- Learning, monitoring, and evaluation: Successful management depends on constant observation, assessment, and knowledge sharing. This criterion evaluates the strategy of monitoring and evaluating a plan including handling ambiguity. It assesses alignment with plan goals, feasibility, social dynamics monitoring, stakeholder perceptions of alignment, cost, benefit, and unintended impact monitoring. MSP's participatory learning improves adaptive management performance. [16]
- Management of dynamic maritime ecosystems depends on plan adaptation, particularly in view of climate change. This criterion evaluates if a strategy reflects new knowledge and stakeholder needs and shows whether an adaptive procedure for changes is described. For industry and ocean users, it assesses legal authority and stakeholder involvement in adaptation, therefore balancing flexibility with governance predictability [16] as shown in Fig. 3.

Fig. 3 factors can influence the effectiveness of Marine Spatial Planning (MSP)
Source: The researcher based on [16] [14] [5] [4]

2.2.2 AIMS of Coastal Spatial management tools

The Coastal and Marine Spatial Planning management tools aims to achieve comprehensive goals across

economic, environmental, social, and administrative dimensions [17]. Economically, it seeks to promote sustainable growth and enhance planning for economic activities. Environmentally, it focuses on protecting biodiversity, improving ecosystem health, and establishing marine protected areas. Socially, it aims to boost job opportunities, preserve cultural values, and assess the impact of decisions on local communities. Administratively, it strives to enhance decision-making quality, reduce regulatory costs, and ensure effective management of information and regulatory consistency [18], The goals can be categorized as follows:

Economic AIMS:

- Achieving sustainable economic growth.
- Accessing desirable investment areas.
- Identifying and solving incompatible land uses through planning.
- Improving planning capacity for economic activities, including associated technologies and impacts. [19]

Environmental AIMS:

- Protecting rare species and biodiversity.
- Prioritizing environmental protection, conservation, and restoration of ecosystem health.
- Identifying harmful and non-harmful environmental areas and protecting them.
- Identifying and reducing the cumulative impacts of human activities on marine ecosystems.
- Establishing a framework for planning a network of marine protected areas.
- Improving environmental performance and services. [18]

Social AIMS:

- Improving job opportunities for local community involvement in planning.
- Identifying and preserving social and cultural values related to marine areas' use.
- Identifying the impacts of marine spatial allocation decisions on surrounding communities. [18] [20]

Administrative AIMS:

- Improving the quality and transparency of decision-making and reducing regulatory costs.
- Improving information collection, storage, retrieval, and accessibility at any time.
- Improving the consistency and compatibility of regulatory decisions. [19]

2.2.3. Coastal Spatial management tools

Globally, several instruments are applied to reach sustainable management of coastal and marine environments. Social-ecological systems tool (SES), Common pool resource tool (CPR), Sustainable development tool, Critical studies in MSP (from environmental justice and political ecology), Theory-based evaluation, Conservation evaluation and Ecosystem-based management (EBM) and ecosystem services are the most often adopted tools. These instruments are briefly discussed below together with their importance for coastal and marine sustainability.

A. Social-ecological systems tool (SES)

Marine spatial plans exist within complex coupled human and natural systems, and can be best understood by applying social-ecological systems theory. For every one of the four subsystems noted in SES theory—resource system, resource units, users, governance system—we found enabling conditions pertinent to each [21] as shown in Fig. 4.

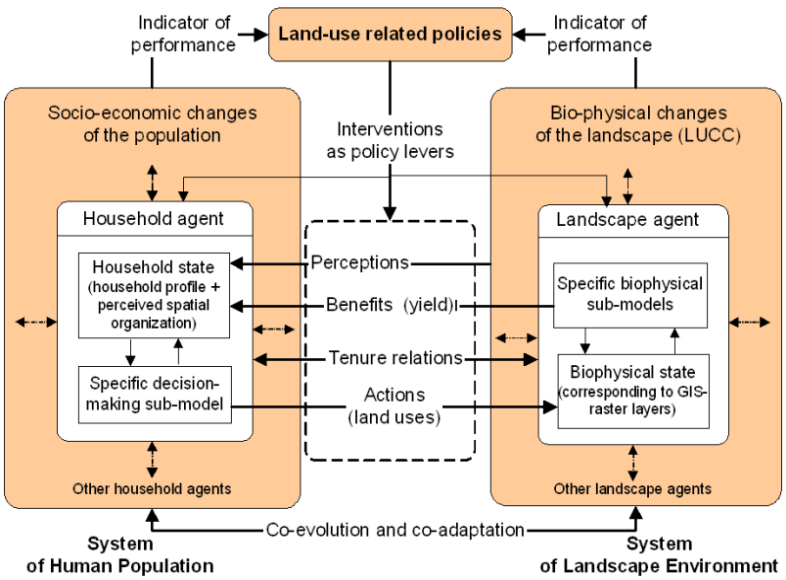

Fig. 4 Social-ecological systems (SES)
Source: [21]

B. Common pool resource tool (CPR)

Although they are varied and context-specific, marine spatial plans usually address the management of CPRs and are likely to have a set of common prerequisites accompanying their management. The institutional design ideas for CPRs' sustainable governance guided the conditions shown here. [22]

Each of two domains significantly impacted by CPR theory—marine protected area (MPA) governance [23]) and community-based conservation—also informed many of the requirements discussed here. [24]

C. Sustainable development tool

The evolution of this framework was shaped by the larger sustainability debate and literature on sustainable development, particularly with regard to the apparent conflict between a Blue Growth approach vs. a conservation-first approach (loosely aligning with "soft," "hard," conceptualizations of sustainability). [25]

D. Critical studies in MSP (drawing from political ecology and environmental justice)

Growing critical literature on MSP based on theories in political ecology and environmental justice studies greatly affected the framework. These criticisms offered particularly insightful analysis of the significant ways in which a lack of enabling conditions may disadvantage people and communities MSP seeks to help. [26] [27] [2]

E. Theory-based evaluation

Different methods of theory-based evaluation—including realism evaluation—offer means to operationalize this paradigm. Especially, the theory-of- change approach offers evaluation methods fit for complicated systems and interventions with uncertain results. [28]

F. Conservation evaluation

The literature on conservation evaluation stresses the need of knowing how mechanisms affect social-ecological outcomes and the acceptance of system complexity as is required for thorough MSP evaluation. Although MPA assessment has received much of the attention thus far, this research shows great chances to guide MSP evaluation. [29] [2]

G. Ecosystem-based management (EBM) and ecosystem services

An integrated approach to management, EBM takes the whole ecosystem—including people—into account. Maintaining an ecosystem in a healthy, productive and resilient state is the aim of EBM so that it may supply the services people need and need. EBM takes into account the combined effects of several sectors, unlike present methods that typically center on a particular species, sector, or activity or concern. [30] [31]

MSP has evolved under great influence from EBM principles, which also apply generally for evaluation of MSP. Often seen through the prism of ecosystem services, embedded in the EBM literature are ideas and methods for assessing trade-offs.

Ecosystem-Based Adaptation is a tool of coastal spatial management that utilizes biodiversity and ecosystem services to help communities adapt to climate change. Key aspects include:

- Ecological system
- Social system

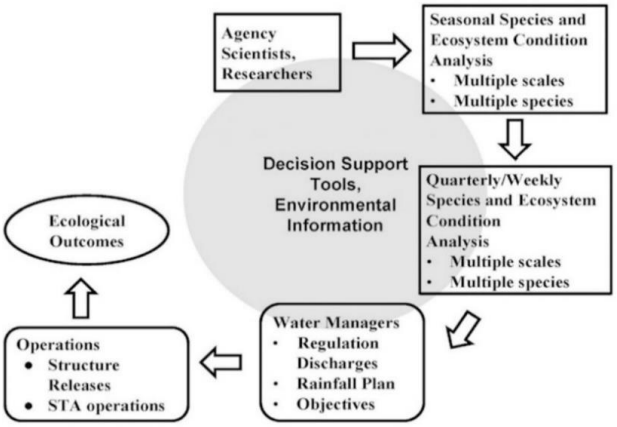

Fig. 5 Framework for Ecosystem-Based Management
Source: [32]

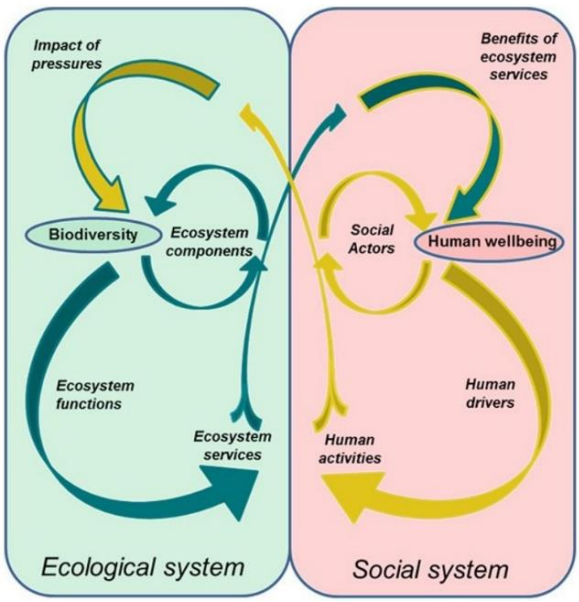

Fig. 6 a key concept of ecosystem-based management, how components of ecological (green box) and social (pink box) systems are linked
Source: [31]

We leverage general ecosystem service theory and the more focused research on cultural ecosystem services to offer a means of including socio-cultural aspects of MSP and integrative approaches into the framework. [33] and the four ideas follow:

A. The environment should be kept in a desired condition such that - both consumptive and non-consumptive values could be maximized constantly, Present and future choices are guaranteed; so, use minimizes the chance of long-term negative impacts or permanent change.

B. Management decisions should incorporate a safety element to let for the reality that institutions are flawed and information is limited

Strategies for preserving a wild living resource should be developed and implemented such as to prevent the needless consumption of other resources.

Planned use of wild living resources should come first in surveys or monitoring, analysis, and assessment accompanying actual use of these resources. [33] [34]

Using the **Ecosystem-Based Adaptation (EbA)** tool to propose a sustainable coastal management framework for setting urban development priorities in **Al-Zafarana, Ras Gharib, and Hurghada** is ideal due to the following reasons: Enhancing Resilience to Climate Change, Supporting Urban Sustainability, Promoting Socioeconomic Benefits, Reducing Development Costs and Aligning with Regional and Global Goals.

Implementing an EbA tool for sustainable coastal management in Al-Zafarana, Ras Gharib, and Hurghada ensures a balanced approach that prioritizes urban development while safeguarding environmental and socioeconomic sustainability. This nature-based strategy creates a resilient and adaptive framework suited to the region's unique ecological and economic contexts.

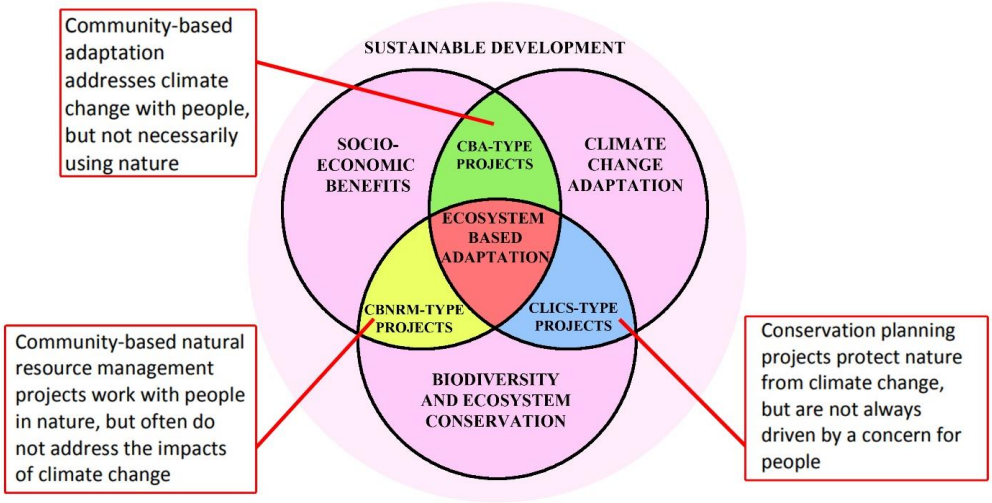

Fig. 7 Connections between EBA and other domains of practice in the whole framework of sustainable development. EBA is demonstrated as a three-way synergy between biodiversity, ecosystem, conservation, climate change adaptation, and society resilience.
Source: [15]

Finally, the Ecosystem-Based Adaptation (EbA) tool will be chosen because it is the most suitable for the Egyptian context, given that the coastal and marsh areas face various environmental issues and climate change impacts. This approach is selected because it guides urban planners in making informed planning decisions and exploring alternative solutions to develop effective management plans for coastal and marsh environments as shown in Fig. 7.

The Ecosystem-Based Adaptation (EbA) tool is particularly well-suited to addressing the challenges faced by Egypt's coastal zones, especially in Al-Zafarana, Ras Gharib, and Hurghada, due to its holistic approach that integrates ecosystem health with urban and regional development goals. The unique characteristics of these regions make EbA an essential tool for sustainable management. [1][38]

The successful implementation of Ecosystem-based Adaptation (EbA) tools in coastal management frameworks can be assessed through several key indicators. These indicators not only measure the effectiveness of EbA strategies but also facilitate stakeholder engagement and adaptive management practices. [1]

3 Results and Discussion

3.1. Proposed sustainable coastal management framework to set urban development priorities

One-time plans are not produced from marine spatial planning. It is an ongoing, lifelong process of learning and adaptation. MSP's development and application consists in ten different processes that direct the whole management of marine ecosystems as depicted in Fig. 6.

These ten phases are more than just a straight-line process that goes step to step consecutively. The procedure should have several feedback loops integrated in it. Early in the planning process, for instance, goals and objectives are probably going to be changed as later in the process benefits and costs of various management strategies are found. As new data is found and included into the planning process, analyses of current and future conditions will evolve. Participation of stakeholders will alter the course of development of the planning process. Planning is a dynamic process, hence as the process changes throughout time planners must be flexible enough to welcome changes.

These steps will be explained in detail as follows. This approach ensures a systematic process for addressing spatial and ecological challenges, promoting sustainable use, and enhancing the management of marine resources. Each step plays a crucial role in ensuring that marine spatial planning is effectively implemented, from initial planning through to ongoing management and adaptation.

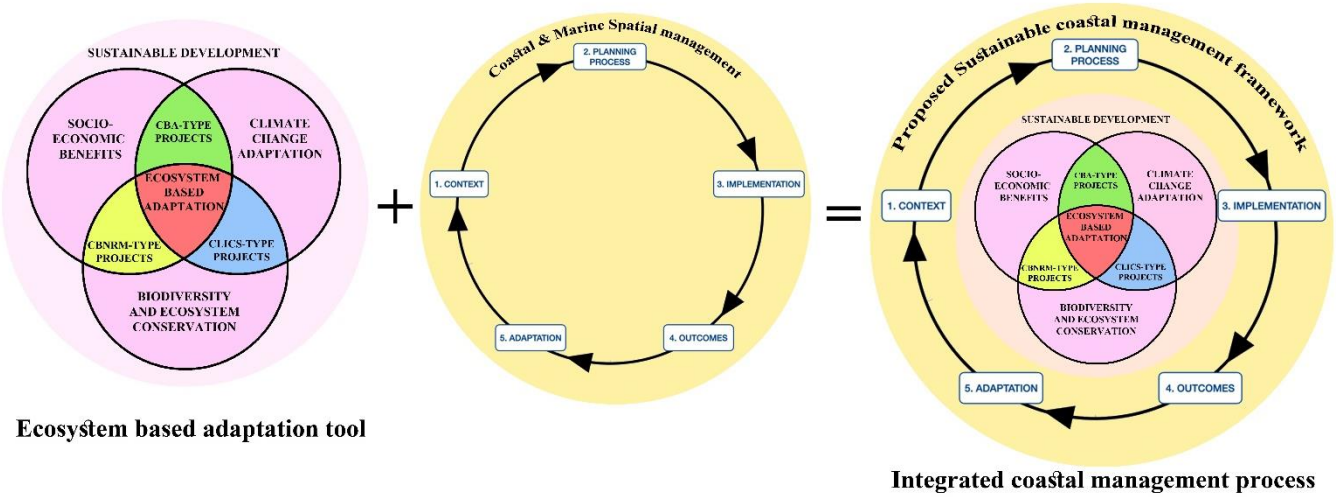

Fig. 8 Proposed Sustainable coastal management framework
Source: Researchers

As shown in Fig. 5 The proposed sustainable coastal management framework linkage to the sustainability that emphasize the importance of ecological, social, and economic dimensions. This framework aims to enhance resilience and adaptability in coastal zones, addressing the multifaceted challenges posed by environmental degradation and climate change. The following sections outline key aspects of this linkage. [1][39]

Conventional coastal management often relies on engineered structures such as seawalls, groins, and breakwaters. While these solutions can provide immediate protection, they frequently lead to habitat destruction, reduced biodiversity, and long-term ecological degradation, but proposed sustainable coastal management framework which integrate coastal management and Ecosystem-Based Adaptation which emphasizes working with natural ecosystems to enhance coastal resilience. It supports biodiversity preservation, promotes carbon sequestration, and provides co-benefits such as improved fisheries and recreation opportunities. EbA aligns closely with Sustainable Development Goals (SDGs), particularly SDG 14, which aims to conserve and sustainably use oceans, seas, and marine resources. [1], The methodology employed integrates Ecosystem-Based Adaptation (EbA) and Coastal spatial Management methodology to create a sustainable coastal management framework which aligned with SDG 14: Life Below Water, which focuses on conserving and sustainably using marine resources, the methodology ensures that coastal management.[25]

The proposed sustainable coastal management framework can be applied to set urban development priorities in the Al-Zafarana, Ras Gharib, and Hurghada region, as these areas present unique environmental, economic, and developmental challenges and opportunities that require a balanced approach.[25]

This framework offers a sustainable approach to urban development in the region. It aims to balance economic growth, environmental preservation, and community well-being, ensuring that development priorities are sustainable and resilient to future challenges.[37]

3.2. Application Proposed sustainable coastal management framework to set urban development priorities on (Al-Zafarana - Ras Gharib - Hurghada) sector

The Al-Zafarana - Ras Gharib - Hurghada **sector**, located along Egypt's Red Sea coast, holds substantial ecological, economic, and strategic value. Understanding these dimensions highlights why this sector is critical for sustainable development.

The Al-Zafarana - Ras Gharib - Hurghada sector is a region of critical ecological richness, economic vitality, and strategic value. Its sustainable management is essential for preserving its natural resources, enhancing its economic contributions, and ensuring resilience against climate and environmental challenges. This significance underscores the urgency of applying integrated coastal management frameworks to balance development with ecological and community needs.[38]

The Red Sea coast, encompassing these regions, is home to sensitive ecosystems like coral reefs, seagrass meadows, and mangroves. And These ecosystems provide critical services, including shoreline protection, carbon sequestration, and habitat for marine biodiversity.[26]

A major hub for tourism, heavily reliant on the health of marine ecosystems., Ras Gharib**:** An industrial and energy production center, facing environmental challenges from oil and gas activities. And Al-Zafarana**:** A growing center for renewable energy projects, particularly wind farms, requiring environmentally conscious planning. [1], finally Climate Vulnerabilities as These areas are particularly vulnerable to sea-level rise, coastal erosion, and extreme weather events. And Climate-related risks threaten urban infrastructure, ecosystems, and livelihoods, making adaptation critical.[33]

So Proposed framework in the Al-Zafarana - Ras Gharib - Hurghada **sector** not only address local challenges but also align with the broader objectives of **SDG 14**, promoting sustainable use and conservation of marine resources. This Proposed framework enhances ecological resilience, supports socio-economic development, and establishes a replicable model for other coastal regions and to propose a sustainable coastal management framework for setting urban development priorities in Al-Zafarana, Ras Gharib, and Hurghada is ideal due to the following reasons: Enhancing Resilience to Climate Change, Supporting Urban Sustainability, Promoting Socioeconomic Benefits, Reducing Development Costs and Aligning with Regional and Global Goals.[37]

Integrating an EbA tool for sustainable coastal management in Al-Zafarana, Ras Gharib, and Hurghada ensures a balanced approach that prioritizes urban development while safeguarding environmental and socioeconomic sustainability. This nature-based strategy creates a resilient and adaptive framework suited to the region’ s unique ecological and economic contexts.[30]

Linkages between EBA and other fields of practice within the overall context of sustainable development. EBA is shown as a three-way synergy between, biodiversity and, ecosystem, conservation, climate change adaptation, and societal resilience and the stages of implementing the approach.

3.2.1 phase one: Context

A. Introduction to the Area

The Zafarana - Ras Gharib - Hurghada sector is located in the northern part of the Red Sea Governorate and is characterized by promising developmental potential, with lands suitable for tourism and urban development, as well as mineral resources such as petroleum, in addition to various tourist attractions. The main issue in this sector is that, despite its ecological significance, it suffers from a decline in marine biodiversity and coastal erosion, along with exposure to natural hazards as shown in Fig. 11.

B. Social economic statement and Ecological Significance of the Zafarana - Ras Gharib - Hurghada Sector

This developmental sector is characterized by a concentration of ecological values, particularly mineral wealth centered around the city of Ras Gharib. The sector produces 65% of Egypt's total petroleum output, and its average fish production accounts for approximately 22.5% of the total fish catch in the governorate. Additionally, it is home to the Gifton Islands, which contain over 50% of the world's total gull population. The sector also features mountainous areas that promote safari tourism, along with renowned religious tourism sites, such as the Monastery of Saint Paul and Saint Anthony, which attract tourists from around the globe.[42]

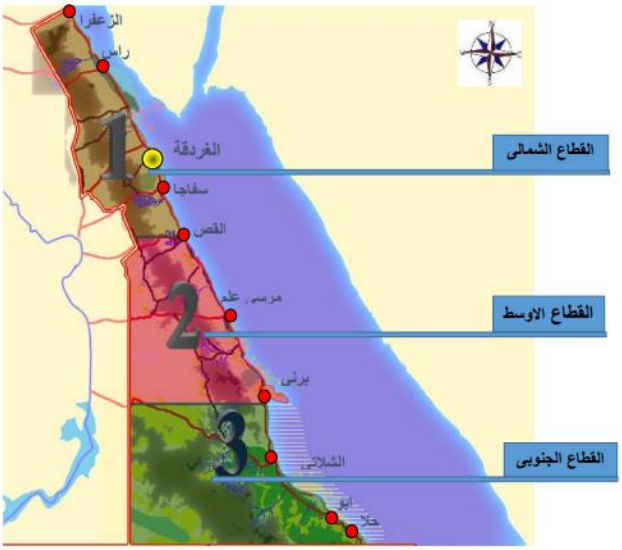

Fig. 9 study area
Source: [42]

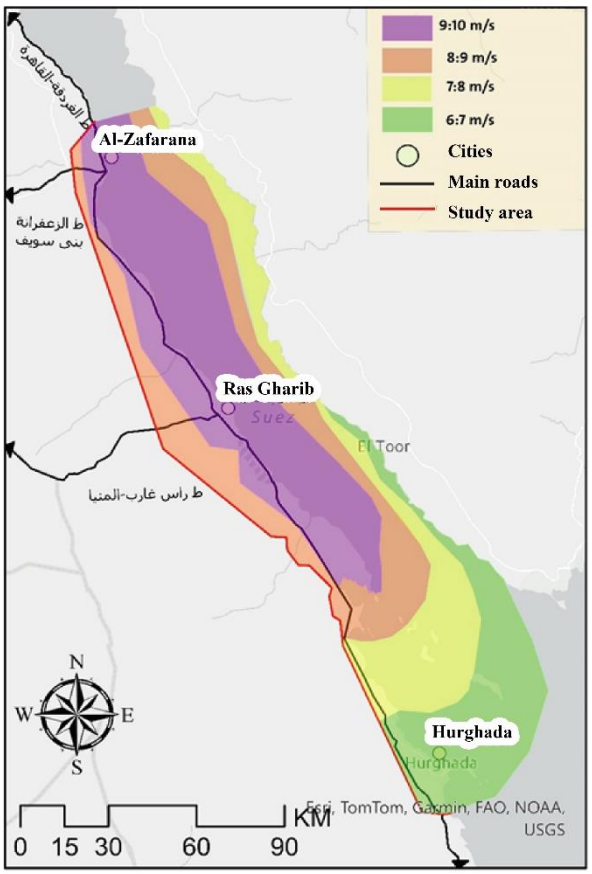

Fig. 10 Wind speed in the sector
Source: Researchers based on [35] [36]

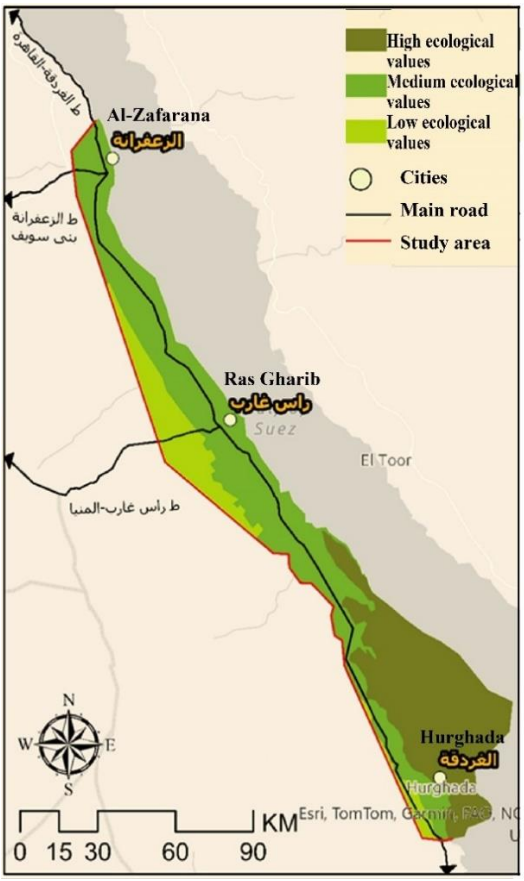

Fig. 11 Ecological Values of the Sector
Source: Researchers based on [35] [36]

A. Biodiversity and ecosystem situation and Marine Environmental Degradation

The increase in petroleum transportation in the Gulf of Suez has led to a decline in marine biodiversity, with approximately 160 million tons of petroleum products transported annually through the Gulf. The coastal line of the developmental sector has experienced erosion due to unsustainable urban development practices and human activities, alongside erosion and sedimentation processes resulting from water movement and ship traffic at an average depth of 0.5 km along the shore from 1984 to 2024 as shown in Table 1.[43]

Moreover, the area of damaged coral reefs in the Gulf of Suez has increased by 5,225 square meters due to ship movement and oil spills. This rise in damaged coral reef area has contributed to an increased extinction rate of marine organisms that rely on coral for their growth. as shown in Fig. 12 Consequently, 20 species of coral and rare fish have gone extinct, while 6,000 square meters of coral reefs in the developmental sector have deteriorated.[42]

Table 1 Coastal Erosion Development in the Sector

Year	Backfill amount (km2)	Amount of erosion (km2)
1984	o.5	0.4
2004	6	0.8
2024	6.8	2.2

Source: [36] [35]

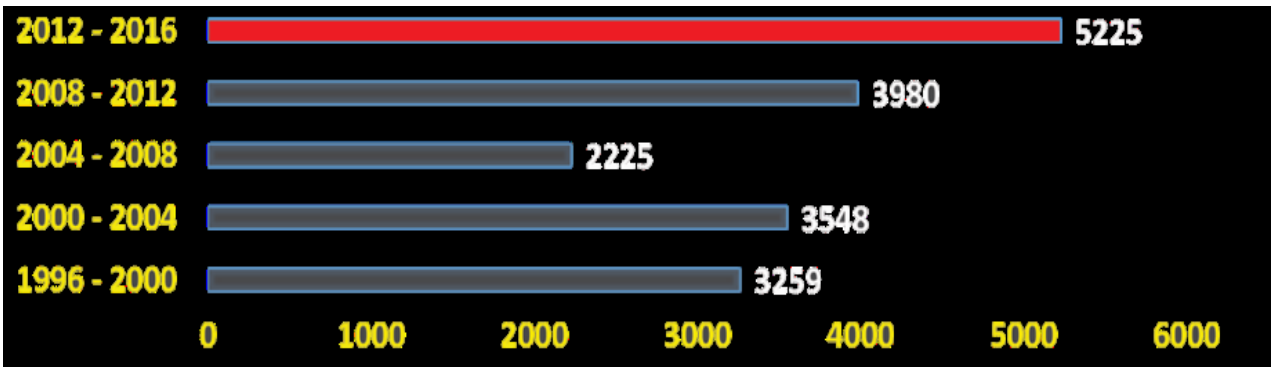

Fig. 12 The area of damaged coral reefs in square meters.
Source: Researchers

B. Climate change situation and Exposure to Natural Hazards (Floods)

Fig. 15 illustrates the distribution of the main valleys in the governorate, indicating that the sector is at risk from flood runoff, with three major valleys traversing the area. Additionally, Table 2 shows that the intensity of the flood runoff in the sector is strong, resulting in significant economic losses, particularly in Ras Gharib, where mining and industrial activities are concentrated, as well as in Hurghada, where tourist villages and hotels face considerable economic damage,

Fig. **13** and Fig. 14 shows Maritime Traffic Density and type of vessels in the sector.

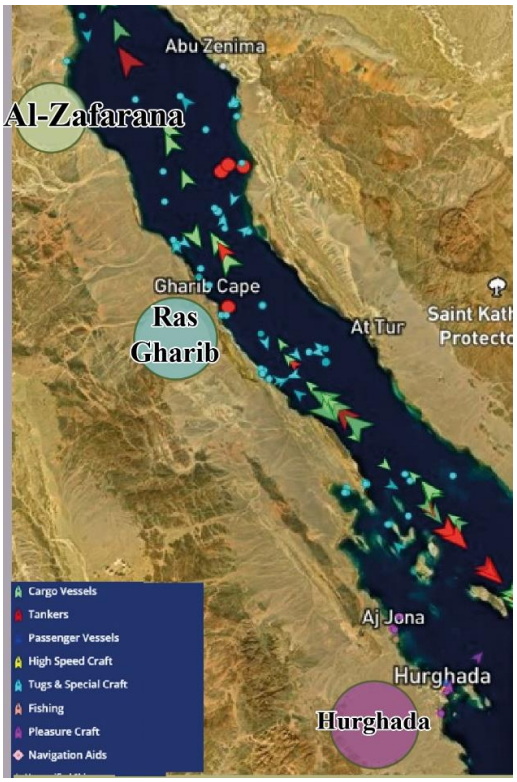

Fig. 13 Types of vessels passing through the sector
Source: https://www.marinetraffic.com/en/ais/home/centerx:-12.0/centery:25.0/zoom:4

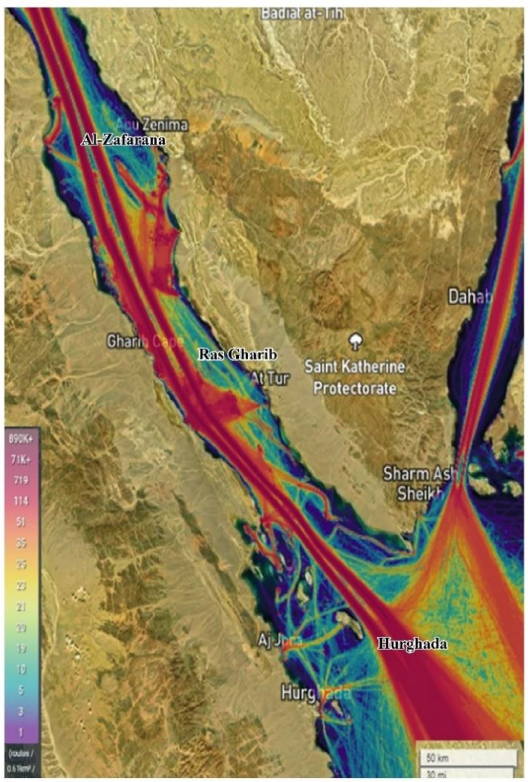

Fig. 14 Maritime Traffic Density in the Development Sector in 2023
Source: https://www.marinetraffic.com/en/ais/home/centerx:-12.0/centery:25.0/zoom:4

Fig. 15 The main locations of wadis in the Zafarana - Ras Gharib - Hurghada sector
Source: Researchers

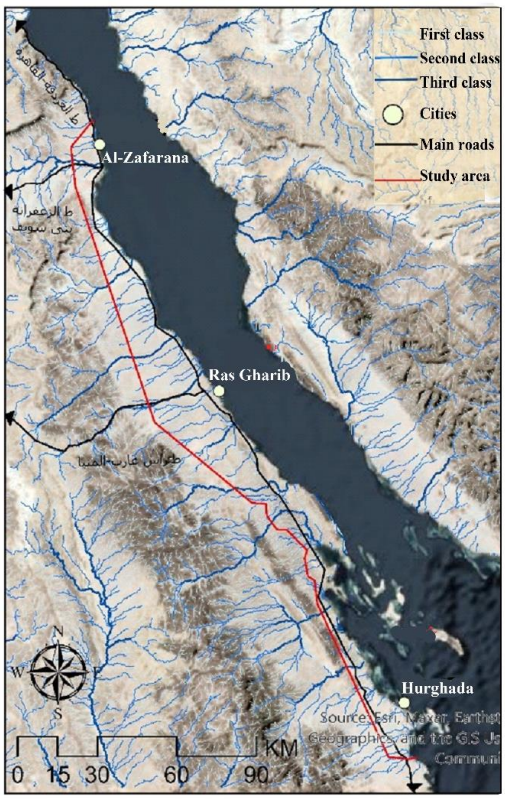

Fig. 16 Arrange the flood outlets for the Zafarana - Ras Gharib - Hurghada sector
Source: Researchers

Table 2 Main Characteristics of the Flood Pathways in the Development Sector

Valley name	Flood degree	Speed	Recurrence rate
Wadi Araba	Medium	6 m/s	5 years
Wadi Ras Gharib	Strong	7 m/s	2 years
Wadi Al-Malha	Strong	9 m/s	1.5 years

Source: Researchers based on [35] [36]

A. Economic analysis

The land resources in the development sector are concentrated, especially the mineral resources in the Ras Gharib section, which are considered the backbone of industry at the governorate level and particularly at the national level in Egypt. The tourism resources are in the Hurghada section as follows:

- **Petroleum resource:** The Red Sea Governorate produces about 65% of Egypt's oil. The most important current oil fields in Ras Gharib are: Amer, Bakr, Ras Gharib, Karim, Oyoun, Umm El Yusr, Kheir, Shaqir, Ras El Bahar, Al-Gamsa, and Esh El Malaha, there are about 13 pipelines transporting crude oil that connect these fields.
- **Mining and Quarries:** The sector is characterized by the abundance of mineral resources, especially cream marble, gypsum, and white sand, which have significant uses in the glass industry. There are also several quarries producing granite, clay, limestone, and sandstone.[43]
- Additionally, there is salt in the Ras Shaqir area, with an annual production of about 6,000 tons of salt, which is utilized solely for industrial purposes.[42]

In addition to tourism activities, the tourism components are diverse due to its status as a coastal city, with a coastline extending up to 40 km. Other tourist attractions include medical tourism, the marine life museum, mountain tourism, scientific tourism.[43]

Table 3 Percentage of Workers in Economic Activities within the Development Sector

	Agriculture	Industry	Tourism	Trade	Transport	Services
Ras Gharib	1%	45%	13%	10%	5%	28%
Hurghada	1%	8%	56%	15%	16%	40%

Source: Researchers based on [35] [36]

Table 4 Data on exploited quarries in the sector

type of extracted material	Quarries exploited (Quarry)	Relative importance (%)	Annual production (1000 m2)
Marble	59	47.6	147.5
Marble chips	4	3.2%	16
Granite	4	3.2%	2
White sand	39	31.5%	282
Gypsum	11	8.9%	220
Clay	3	2.4%	90
Sandstone	1	0.8%	7
Limestone	3	2.4%	30
Total	24	100%	794.5

Source: Researchers based on [35] [36]

B. Ecosystem

Natural reserves are available in the development sector in the form of islands in the Red Sea, characterized by the diversity of marine life and rare birds, such as seagulls, which comprise more than 50% of the total seagull population globally. These seagulls are concentrated around the city of Hurghada, located 11 km deep in the sea.

Groundwater resources in the region consist of two types: magnesium chloride, found in the coastal area with total salinity concentrations ranging between 2,500 and 12,000 mg/L, and calcium chloride, limited to the coastal strip with salinity ranging from 4,000 to 15,000 mg/L, while petroleum resources are concentrated in Ras Gharib and the marine area of Hurghada, as illustrated in the following Fig. showing the geographic distribution of resources and economic opportunities in the development sector.

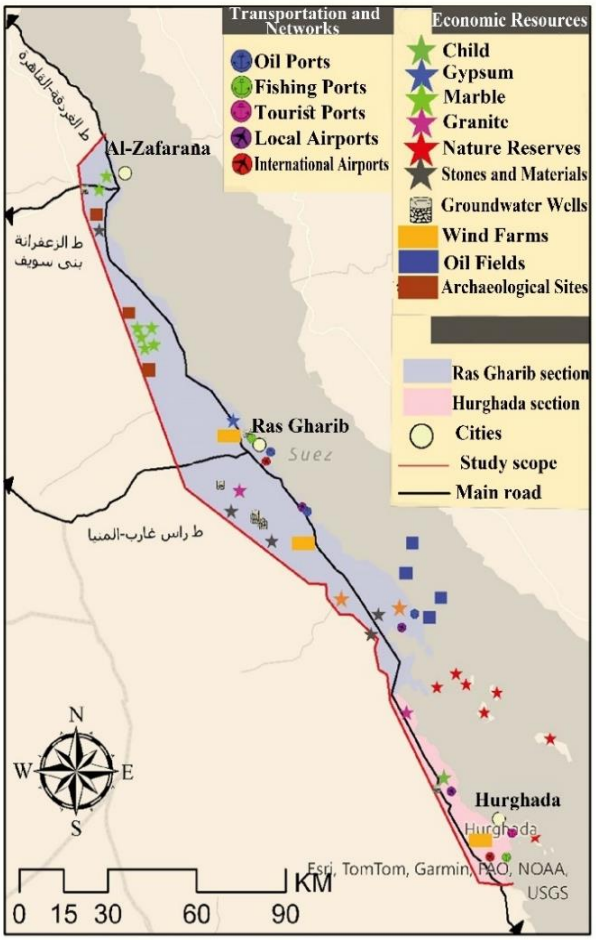

Fig. 17 Environmental Resources in the sector
Source: Researchers based on [36]

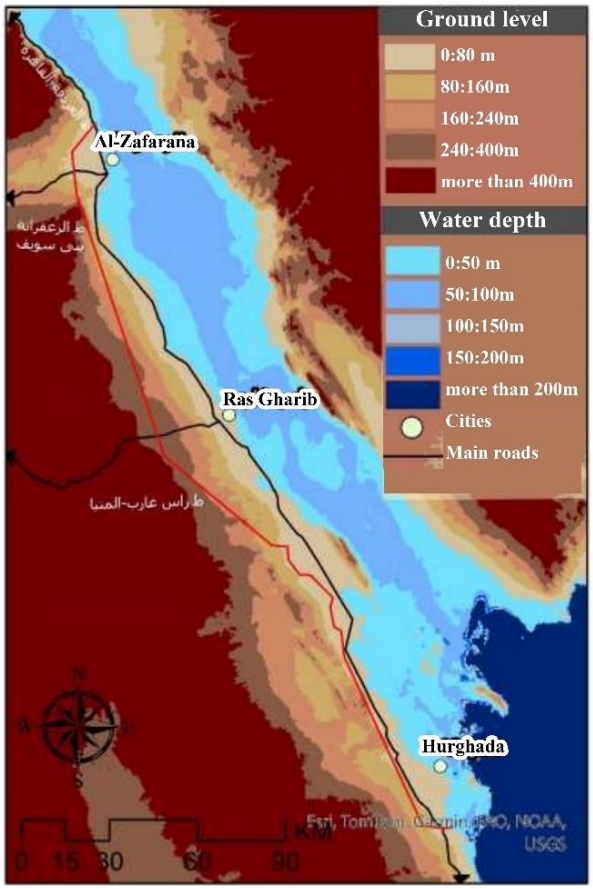

Fig. 18 Land Elevation and Water Depth in the Sector in 2024
Source: Researchers based on [36] [35]

The geology of the sector is rich, forming the basis for industrial development, as it contains resources used as building materials, such as limestone and sand as shown in Fig. 17.[42]

The bathymetric study summarizes that the marine area under investigation ranges in depth from 0 to 100 meters, while the coastal area being studied ranges from 0 to 400 meters above sea level, as illustrated in Fig. 18.

The development sector is characterized by high ecological values, with areas of high ecological value constituting 37% of the total area of the development sector, which is home to fishery resources, oil fields, and natural islands.[43]

A. social

The development sector is home to 67% of the governorate's population, with 56% in Hurghada and 11% in Ras Gharib, where Hurghada has the highest population concentration in the size category of 100,000 to 250,000 people. The average population density in the sector is 11 people/km², lower than the regional average of 42 people/km².[42]

3.2.2 phase two: Planning process analysis

In this phase we analysis current context to specify the weakness point in the sector

Table 5 Weakness Points in the Sector

	Weakness Points in the Sector
ecosystem	The traffic density in the Gulf of Suez has increased to reach 890,000 lanes per 0.6 square kilometers per year.
	Oil spills from ships have led to the emergence of marine pollution and the resulting environmental degradation.
	The passage of the central regional road through the residential area causes traffic mixing within the residential block.
	Economic activities are concentrated west of the Gulf of Suez, with weak attention to other areas.
	The water consumption rate has increased to about 300 liters per person per day compared to the global average of 168.2 liters/day.
	The increase in soil salinity and the salinization of agricultural land, leading to losses.
social	The dumping of human activity waste on the sea floor has led to the depletion of resources and a reduction in economic production.
	The spread of unlicensed activities, which constitute 47% of total activities.
	The unemployment rate has risen to 11.3%.
	There is a shortage in health services with an average of 161 people per bed, while the standard approved by the World Health Organization is no more than 200 beds per person.
	There is a shortage in 71% of educational services with an average of 390 students per teacher.
	Weak production in the handicraft industry
climate	Erosion of the shoreline due to unsustainable urban development.
	More than 7 fires have occurred in the industrial oil grease area.
	The risk of oil pollution is high, leading to environmental threats.
	The increase in solid waste, about 150 tons/day, which is disposed of in an unhealthy manner.
	The average solid waste production has increased to 50 tons per person per year compared to the global average.

Source: Researchers

3.2.3 phase three: implementation& out comes

In this phase we reached to the main decisions in the sector of ecosystem, social and climate.

Table 6 main issues in the sector

	Issues
ecosystem	The increase in maritime transport to 890,000 ships/0.6 km² annually has led to the deterioration of marine biodiversity.
	Oil spills due to the transportation of oil and the burial of waste in ships.
	The area of coral reefs decreased by 25% between 2012 and 2016
social	The increase in pollution rate (150,000 tons per year) exceeds the permissible limit (1,500 thickness per year.
	Increased violations of industrial and tourism activities and illegal fishing of marine resources.
	The density of maritime transport decreased while the productive capacity of the tourism sector increased.
	The qualitative deterioration in the marine environment has increased due to human activities.
climate	The width of the coastline retreated during the period 1984-2024 by an average of 0.5 meters per year.

	The width of sandy beaches retreated by an average of 6.8 km² during the same period. Tsunami waves and earthquakes have hit the coasts. The Red Sea fault line passes near the sector. Rates of drought and desertification are increasing by 1.6% annually.

Source: Researchers

Table 7 main decisions in the sector

	decisions
ecosystem	Establishing a petroleum industrial complex in Ras Gharib on an area of 200 acres. Localizing a wind farm in the north of Ras Gharib with an area of 150 acres.
social	Establishing a sanitary landfill for hazardous industrial waste 1.5 km from the industrial zone and 4 km from regional roads. Connecting archaeological sites in Ras Gharib with tourist areas in Hurghada and the Hurghada-Red Sea link to southern Upper Egypt
climate	Installing monitoring devices to observe coral reef habitats

Source: Researchers

3.2.4 phase four: adaptation alternatives

Alternative concept Restoring the functional performance of ecological values by Dividing the sector into three ecological zones and proposing uses and activities that meet the requirements and needs of the ecological values in the coastal area. This involves utilizing available resources, which reduces pressure on marine biodiversity and ensures sustainability.

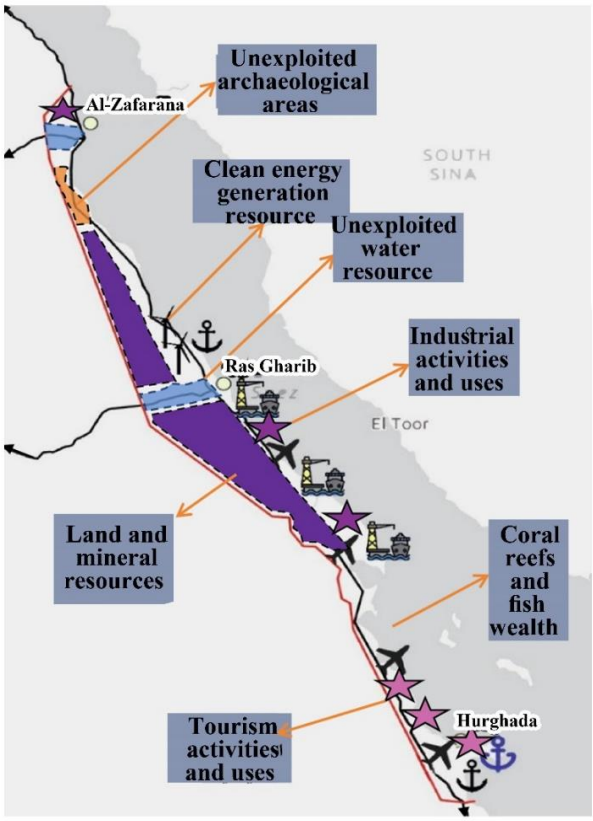

Fig. 19 Concept of the second alternative
Source: researchers

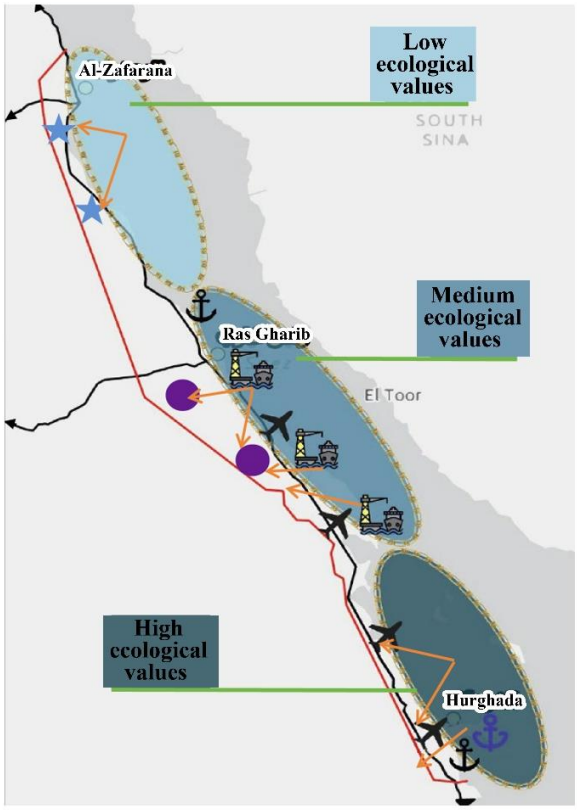

Fig. 20 Concept of the first alternative
Source: Researchers

Fig. 19 and Fig. 20 show Alternative concept is Utilizing available resources in the coastal area by Developing the desert hinterland and establishing specialized environmental units based on the types, quantities, and locations of resources, with the aim of achieving the highest economic return.

4 Conclusion

The Ecosystem-Based Adaptation (EbA) framework offers several advantages over conventional coastal management practices by integrating nature-based solutions with sustainable development principles. Below is a detailed comparison in terms of sustainability**,** cost-effectiveness**,** and resilience.

Coastal and Marine Spatial Planning (MSP) plays a critical role in addressing the challenges of managing human activities in coastal and marine environments, particularly in regions like the Zaafarana - Ras Gharib - Hurghada sector. By adopting Ecosystem-Based Management (EBM), which promotes a comprehensive, ecosystem-wide approach, planners can ensure that these ecosystems remain healthy and resilient while supporting economic and social objectives. This study highlights the importance of coordinated land and maritime use to sustainably manage tourism, mining, and transportation activities. Despite significant advances in MSP tools and

methods, gaps remain in the effective application and integration of these practices. Bridging these gaps will require a continued focus on improving institutional capacity, resource allocation, and the legitimacy of planning processes to ensure the long-term success of MSP initiatives in the region.

Moreover, the research emphasizes the need for continuous monitoring and adaptation in spatial planning processes. The dynamic nature of coastal and marine ecosystems, combined with evolving human activities, demands a flexible, adaptive approach to management. Ensuring stakeholder involvement and cross-sector collaboration will be essential in refining the MSP framework, allowing for sustainable development that aligns with both ecological preservation and economic growth in the Zaafarana - Ras Gharib - Hurghada sector.

Applying the Ecosystem-based Adaptation (EbA) tool to develop a sustainable coastal management framework for the Al-Zafarana, Ras Gharib, and Hurghada region results in a balanced approach that protects the environment, enhances economic opportunities, and supports resilient urban development. This holistic framework ensures that these coastal cities can thrive sustainably while mitigating the risks associated with climate change and environmental degradation.

The proposed framework effectively addresses the coastal and marine challenges in the Al-Zafarana - Ras Gharib - Hurghada sector, balancing ecological preservation and urban development. By integrating EbA and ICZM, the framework enhances climate resilience, promotes biodiversity conservation, and supports the sustainable growth of key economic sectors such as tourism and renewable energy.

The framework identifies priority areas for urban development that minimize ecological disruption while maximizing social and economic benefits.

Recommendations include restoring degraded ecosystems, implementing adaptive land-use policies, and monitoring ecological and socio-economic indicators to ensure long-term sustainability. So, the study highlights the importance of nature-based solutions and collaborative management in achieving sustainable coastal development aligned with national and global goals. This comprehensive approach ensures that the Al-Zafarana - Ras Gharib - Hurghada sector can serve as a model for sustainable coastal management in similar regions.

References

[1] Ministerie van Verkeer en Waterstaat, "Pre-policy Document on the North Sea," 2008.

[2] C. Ehler and F. Douvere, "Marine Spatial Planning: a step-by-step approach toward ecosystem-based management.," *Unesco*, p. 99, 2009.

[3] E. Gissi, S. Fraschetti and F. Micheli, "Incorporating change in marine spatial planning: a review," *Environmental Science & Policy*, pp. 191-200, 2019.

[4] E. D.-. Tejo , G. Metternicht, E. Johnston and L. Hedge, "Marine Spatial Planning advancing the Ecosystem-Based Approach to coastal zone management: A review," *Marine Policy*, pp. 115-130, 2016.

[5] R. Zuercher, N. C. Ban, W. Flannery, A. D. Guerry, B. S. Halpern, R. A. Magris, S. L. Mahajan, N. Motzer, A. K. Spalding, V. Stelzenmüller and J. G. Kramer, "Enabling conditions for effective marine spatial planning," *Marine Policy*, vol. 143, 2022.

[6] C. Ehler, J. Zaucha and K. Gee, "Maritime/Marine Spatial Planning at the Interface of Research and Practice," *Maritime Spatial Planning*, 2019.

[7] C. E. Collier, "Enabling conditions for community-based comanagement of marine protected areas in the United States," *Marine Policy*, 2020.

[8] M. Rutherford, "Science and social control: the institutionalist movement in American economics, 1918-1947," *Erasmus Journal for Philosophy and Economics*, 2010.

[9] . J. Gehman, . L. Lefsrud and S. Fast , "Social license to operate: Legitimacy by another name? New Frontiers," *Canadian Public Administration*, vol. 60, p. 293– 317, 2017.

[10] H. Grimmel, H. Calado, C. Fonseca and J. L. S. d. Vivero, "Integration of the social dimension into marine spatial planning – Theoretical aspects and recommendations," *Ocean & Coastal Management*, pp. 139-147, 2019.

[11] D. A. Gill, M. B. Mascia, G. N. Ahmadia, L. Glew, S. E. Lester, M. Barnes, I. Craigie, E. S. Darling, C. M. Free, J. Geldmann, S. Holst, O. P. Jensen, A. T. White, X. Basurto, L. Coad, R. D. Gates, G. Guannel, P. J. Mumby, H. Thomas, S. Whitmee, S. Woodley and H. E. Fox, "Capacity shortfalls hinder the performance of marine protected areas globally," *Nature* , 2017.

[12] K. A. Alexander, A. Fleming, N. Bax, C. Garcia, J. Jansen, K. H. Maxwell, J. M. Thomas, T. Mustonen, G. T. Pecl, J. Shaw, G. Syme and E. Ogier, "Equity of our future oceans: practices and outcomes in marine science research," *Rev Fish Biol Fisheries*, 2022.

[13] N. J. Bennett, J. Blythe, C. S. White and C. Campero, "Blue growth and blue justice: Ten risks and solutions for the ocean economy," *Marine Policy*, 2021.

[14] F. Douvere, "The importance of marine spatial planning in advancing ecosystem-based sea use management," *Marine Policy*, pp. 762-771, 2008.

[15] V. Lo, "Ecosystem-based Adaptation & Disaster Risk Reduction: A compilation of country experiences & synthesis of information," 2015.

[16] F. Douvere, F. Maes, A. Vanhulle and J. Schrijvers, "The role of marine spatial planning in sea use management:The Belgian case," *Marine Policy*, p. 182– 191, 2007.

[17] D. Lawrence , R. Kenchington and S. Woodley , "The Great Barrier reef: finding the right balance," *Melbourne University Press*, 2002.

[18] E. D.-. Tejo and G. Metternicht, "Poorly-designed goals and objectives in resource management plans:Assessing their impact for an Ecosystem-Based Approach to Marine Spatial Planning," *Marine Policy*, p. 1220131, 2018.

[19] F. Maes, "The international legal framework for marine spatial planning," *Marine Policy*, pp. 797-810, 2008.

[20] U. N. E. C. f. E. (ECE), "spatial Planning: Key instrument for development and effective governance," 2008.

[21] E. Ostrom, "A General Framework for Analyzing Sustainability of Social-Ecological Systems," *Science*, pp. 419-422, 2009.

[22] Federal Maritime and Hydrographic Agency, "Draft Spatial Plan for the German Exclusive Economic Zone," 2008.

[23] P. Jones, W. Qiu and E. D. Santo, "Governing marine protected areas: Social– ecological resilience through institutional diversity," *Marine Policy*, pp. 5-13, 2013.

[24] C. E. Collier, "Enabling conditions for community-based comanagement of marine protected areas in the United States," *Marine Policy*, 2020.

[25] W. Qiu and P. J. Jones, "The emerging policy landscape for marine spatial planning in Europe," *Marine Policy*, pp. 182-190, 2013.

[26] F. Saunders, M. Gilek, A. Ikauniece, R. V. Tafon, K. Gee and J. Zaucha, "Theorizing Social Sustainability and Justice in Marine Spatial Planning: Democracy, Diversity, and Equity," *sustainability*, 2020.

[27] R. Tafon, F. Saunders and M. Gilek, "Re-reading marine spatial planning through Foucault, Haugaard and others: an analysis of domination, empowerment and freedom," *JOURNAL OF ENVIRONMENTAL POLICY & PLANNING*, 2019.

[28] C. L. S. Coryn, L. A. Noakes, C. D. Westine and D. C. Schröter, "A Systematic Review of Theory-Driven Evaluation Practice From 1990 to 2009," 2010.

[29] P. J. Ferraro, J. N. Sanchirico and M. D. Smith, "Causal inference in coupled human and natural systems," 2019.

[30] R. D. Long, A. Charles and R. L. Stephenson, "Key principles of marine ecosystem-based management," *Marine Policy*, 2015.

[31] G. Delacámara, T. G. O. Higgins , M. Lago and S. Langhans , "Ecosystem-Based Management: Moving from Concept to Practice," 2020.

[32] R. Gibble, L. Miller and M. C. Harwell, "Using Stakeholder Engagement,Translational Science and Decision Support Tools for Ecosystem-Based Management in the Florida Everglades," 2020.

[33] K. K. Arkema, G. M. Verutes, S. A. Wood, C. C.-. Samuels, S. Rosado, M. Canto, A. Rosenthal, M. Ruckelshaus, G. Guannel, J. Toft, J. Faries, J. M. Silver, R. Griffin and A. D. Guerry, "Embedding ecosystem services in coastal planning leads to better outcomes for people and nature," 2015.

[34] . L. Crowder and N. Elliott , "Essential ecological insights for marine ecosystem-based management and marine spatial planning," *Marine policy*, pp. 762-771, 2008.

[35] m. a. m. ahmed, "Economic Study of the Marine Fishery Sector in the Red Sea Governorate," *The Egyptian Journal of Agricultural Economics*, no. 4, 2018.

[36] Ministry of Housing, "Urban Development Strategy for Coastal Fronts (Red Sea Coast Area)," 2017.

[37] M. A. A. A. Ahmed, "An Economic Study of the Marine Fisheries Sector in the Red Sea Governorate", Egyptian Journal of Agricultural Economics, No. 4, 2018.

[38] E. A. Abaku and A. C. Odimarha, "SUSTAINABLE SUPPLY CHAIN MANAGEMENT IN THE MEDICAL INDUSTRY: A THEORETICAL AND PRACTICAL EXAMINATION," *International Medical Science Research Journal*, 2024.

[39] E. E. Golia, "The impact of heavy metal contamination on soil quality and plant nutrition. Sustainable management of moderate contaminated agricultural and urban soils, using low cost materials and promoting circular economy," *Sustainable Chemistry and Pharmacy*, 2023.

[40] I. e. a. Van Kamp, "Urban environmental quality and human well-being: Towards a conceptual framework and demarcation of concepts; a literature study.," Landscape and urban planning, 2003.

[41] A. U. M. &. A. A. G. Berbekova, "Toward an Assessment of Quality of Life Indicators as Measures of Destination Performance.," Journal of Travel Research, 61(6), 1424– 1436., (2022).

[42] Ministry of Housing, Ras Ghareb City Strategic Plan Report", 2017.

[43] Ministry of Housing, "Hurghada City Master Plan Report", 2020.