

Investigating interdependences between Blue Economy' sectors: insights from a strategic management perspective

Abstract

This study paper aims to examine the main interdependencies and synergies between Blue Economy sectors and related prominent business and economic actors. In particular, the research proposes emerging strategic management perspectives capable to better understand potential interdependences and synergies among BE sectors, also deepening the relevance of relationship established between main business actors populating these sectors. For this purpose, stakeholder relationship management, maritime spatial planning, and innovation ecosystem theories are suggested as the most fitting theoretical constructs to be applied. Grounding on a systematic academic literature review, insights from a grey review and anecdotal evidence emerging from a valuable business case focus on interdependences and synergies which may originate among Marine living resources, Marine Renewable Energy and Bioeconomy sectors. By stressing, the potential synergic interactions on which innovation ecosystems grounds on, this theoretical model is used for highlighting how parties involved in the ecosystem can support the introduction and diffusion of innovative processes, products and services in the Blue Economy domain, exploiting the aforementioned interdependences among BE sectors and actors, overcoming the technological issues that represent an obstacle to inter-sectorial upgrading and economic success. Research outcomes from the performed academic and grey literature review, jointly with evidence from the selected business case unveils that a strategic management perspective, which support the adoption of several managerial theories such innovation ecosystems, stakeholder relationships management and marine spatial planning allows a better understanding of the investigated phenomenon and favor the development of green and sustainable strategies pursued by prominent actors populating the BE industry and related sectors, thus supporting their license to operate when managing relationships with their main stakeholders.

Keywords: blue economy, innovation ecosystems, green strategies, aquaculture, marine spatial planning, synergies, stakeholder relationship management

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Abbreviations: BE, blue economy; MSP, marine spatial planning; SRM, stakeholder relationship management; MSs, member states; IOCAS, chinese academy of sciences; SDGs, sustainable development goals; RO, research objective

Introduction

The ocean allows life on this planet and supports various economic activities that grounds on proximity to seas, oceans and coasts. The Blue Economy (BE) industry and the related businesses and activities therefore do not comprehend only mere activities of exploitation of living and non-living resources (e.g., mineral, benthic, fisheries, etc.), but also include a broader strategic vision of seas/oceans as a key source of health and well-being, especially for coastal countries and coastal communities. According to the World Bank, indeed, the Blue Economy constitutes a broad and heterogeneous group of sectors and implies the "sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of ocean ecosystem". Through the improvement of all economic activities related to the oceans, seas and coasts, the blue economy covers a wide range of established and emerging interconnected sectors. The Blue Economy is a model of sustainable business aimed to the research of positive and long-term impact on the health of oceans, seas, coasts and seabed. The "Blue Economy" industry, indeed, is composed by all the

marine- and maritime-based as well as marine- and maritime-related activities and includes both established sectors, such as Marine Living Resources Coastal Tourism, etc., and emerging and innovative sectors such as Blue bioeconomy and biotechnology, Maritime Defense, etc. (See Section "The Blue Economy in the EU State Members: facts and figures").

It is therefore essential for both policy makers as well as managers and practitioners involved in the BE industry to achieve a better understanding and greater awareness related to the concept of "natural capital" and "marine ecosystems" as well as to their fragility.¹

In this vein, human activities and specifically business-related operations taking place in the BE context would greatly benefit from the adoption of more responsible and sustainable corporate strategies and a "greener" attitude toward the management of resources consuming processes and potentially polluting operations. By this way, involved economic actors are expected to still benefit from the immense resources and opportunities provided by the oceans/seas, jointly securing the efficient and responsible exploitation of these natural scarce resources.²

The Blue Economy plays a significant role in the overall economy of the European Union, representing about 1.5% of the Gross Value Added (equal to 218.3 billion euros in 2018) and constituting a

source of employment for 2.2%, directly occupying more than 5 million people (Table 1). Nonetheless, BE sectors do not only provide prominent business opportunities and positive economic spillovers for EU MSs but are also expected to determine several potential issues and concerns related to climate change, marine ecosystems conservation and coastal local community preservation.³ In order to face the increasing challenges posed by BE sectors' intrinsic characteristics and their recent market trends, in 2012, the European Commission developed the 'Blue Growth Strategy', positioning "blue growth" at the heart of maritime policy and defining the criteria and limits for exploiting resources provided by the seabed, coasts and waters of the EU Member States (MS), while generating economic growth and job opportunities.

The Blue Growth Strategy has triggered several initiatives and funding programs from the European Commission dedicated to oceans- and seas-related activities, aiming at facilitating cooperative strategies between marine and maritime enterprises and public authorities, aligning interests of different stakeholder categories, securing marine environment and ensuring sustainable growth patterns for BE sectors in the next future.

What is the Blue Economy?", The World Bank, 6 June 2017, retrieved 14 May 2018.

The outbreak of the COVID-19 pandemic has dramatically impacted on all EU MSs and severely affected a number of BE sectors. The implementation of restrictions policies and strict regulation on cross-countries passenger flows, for example, have significantly reduced the overall revenues and economic performances of both ferries and ro-pax shipping companies (belonging to the maritime sector), which in turn, determined even more severe impacts on coastal tourism companies, in terms of decreasing tourist arrivals and relatedly collapsing business volumes. In other terms, the ongoing effects originating from the global health crisis further highlights the existence of profound interdependencies between both established and emerging BE sectors, urging for a deeper investigation of current interdependences among BE sectors and their expected future evolutionary trajectories.⁴ Conversely, the strict links existing between both established and emerging/innovative BE activities and processes can also favor unprecedented opportunities for a sustainable economic growth within EU Member States and related coastal communities.

Given the above, the study, by assuming managerial perspective investigates the deep connections that exist between the different BE sectors, grounding on innovation ecosystems, SRM and MSP theoretical constructs.

For this purpose, first the study performs a systematic literature review on extant strategic management literature addressing the phenomenon, then it investigates prominent grey literature and, finally, it discusses an empirical business case from the BE industry which analyses the natural interdependences between the Marine living resources sector, the Bioeconomy and the Marine renewable energy sector and then suggests the importance of creating links and connections between main actors player involved in both the target sectors, in order to support the development of synergies among sectors and the development of collaborative strategies in the overall BE value network. The literature review and the anecdotal empirical evidence discussed provide useful insights for assessing the need for introducing the innovation ecosystem approach and SRM perspective as theoretical underpinning for the future research agenda on this issue. The research, indeed, provides useful insights

Table 1 Main indicators of the BE sector in EU in 2018

Indicator	EU Blue Economy 2018
Turnover	€750 billion
Gross value added	€218 billion
Gross profit	€94 billion
Employment	5 million
Net investment in tangible goods	€14 billion
Net investment ratio	22%
Average annual salary	€ 24,700

Source: Eurostat

for disentangling interdependences and synergies existing among different Blue Economy' sectors and activities, and offers practical and empirical evidences related to synergies existing between Marine living resources, Marine Renewable Energy and Bioeconomy sectors. In the case study discussed, for example, the marine resources, which constitute a valuable form of natural capital, become the shared resource input for synergically leverage business activities belonging to the three aforementioned BE sectors, while ensuring marine ecosystems protection, given the adoption of green and sustainable corporate strategies jointly developed by economic actors belonging to these sectors.

The reminder of the research is structured as follow. First, the manuscript study briefly introduces the investigated BE industry, sketching the main characteristics and market trends of the 7 established BE sectors, also providing useful insights on most promising emerging/innovative BE sectors and relatedly, most valuable facts and figures from the industry are discussed the economic (see Section "The Blue economy in the EU State Members: facts and figures"). Second, the research comments on the importance of diverse types of connections linking various BE sectors among them, considering both interdependencies, potential negative impacts, as well as promising business opportunities (See Section "Interdependencies and synergies within BE sectors: an innovation ecosystems' perspective"). Then the study sets both research objectives and methodological issues (See Section "Research design and Method"). Finally, the study reports main findings related to academic and grey literature review research activities as well as insights from the selected business case (See Section "Results"), before concluding.

Material and method

The Blue economy in the EU State Members: facts and figures

The Blue Economy concept refers to all sectoral and cross-sectoral activities that are founded or are in some way dependent on the oceans or coastlines. Within the EU framework, the "Blue Economy" industry is composed by all marine- and maritime-based as well as marine- and maritime-related activities. Marine- and maritime-based activities are those businesses that grounds on operations carried out at sea, at its seabed or in coastal areas, such as the exploitation of living resources (fisheries and aquaculture), maritime transport, the exploitation of non-living resources (marine minerals) or the generation of renewable energy through facilities located at sea or exploiting its energy potential. Marine- or maritime-related activities, on the other hand, utilize or create products and services that derive directly from the sea or its presence. This category includes Seafood processing, Biotechnology, Shipbuilding and repair, Port activities, Technology & equipment and Digital services.⁵

The BE includes established sectors, that traditionally constitute the blue economy and are rooted within the sector, and emerging and innovative sectors, whose evolution has taken place in more recent years, which represent a great opportunity for investment and future development for the sector and the communities involved.

The 7 established sectors, as defined by the European commission in line with an assessment of their level of market maturity and their overall economic and social relevance respect to the entire BE industry are the following (European Commission, 2020):

1. Marine Living Resources: the sector refers to all the businesses which ground on the exploitation of living resources, i.e., capture fisheries (small-scale coastal, largescale and industrial fleets) and aquaculture (marine, freshwater and shellfish), their processing and their distribution.
2. Marine non-living resources: the sector includes the exploitation of oil & gas extracted from the seabed, as well as the exploitation of marine minerals.
3. Marine renewable energy: the sector refers to renewable energy (i.e., kinetic energy; potential energy; mechanical energy; thermal potential; osmotic pressure) that is installed and operated at sea and requires access to offshore grid and distribution systems.
4. Port activities: the sector includes activities carried out in port areas to ensure the arrival, departure and transfer of goods and passengers transported by sea.
5. Shipbuilding and repair: this sector includes several activities such as ship design, construction and repair.
6. Maritime transport: it refers to passenger transport, freight transport and service for transport.
7. Coastal Tourism: the sector is made up of all business activities which ground on heterogeneous forms of beach-based and water-based tourism, sports-recreational activities and all tourist activities that benefit from the presence or proximity to the sea.

While the established sectors represent the main source of gross value added for the BE industry, capable to attract significant private investments, innovative and emerging sectors that are advancing fast and gaining an increasing importance. The main emerging sectors are (European Commission, 2020):

Innovative marine renewable energy: this section includes new technologies aimed at generating energy from innovative renewable sources.

Blue bioeconomy and biotechnology: it refers to the creation of value and the realization of economic activities based on the sustainable use of natural capital and, specifically, marine resources.

Emerging marine minerals: several minerals that make up the raw material for many industrial sectors are found in large quantities on the seabed. For many coastal countries, the exploitation of mineral resources on the seafloor can be an interesting opportunity for growth, but the sustainable economic growth of these emerging businesses imposes the development of a well-informed and responsible regulatory framework capable to ensure a sustainable exploitation of the related marine resources.

Desalination: Desalination technologies have developed considerably in recent years, motivated by the increasing demand for

fresh water originating from a variety of sectors such as agriculture and livestock, as well as from global demographic trends.

Maritime defense: this sector is expected to become increasingly relevant with the BE domain, due to the high level of employment and the investments that the business has been predicted to generate in the future decade especially for supporting the targeted environmental goals set by the European Green Deal agenda.

Submarine cables: this sector includes the manufacturing and the management of critical infrastructures which secure the development of resilient data and telecommunications networks and which guarantee energy transfer and supply.

The BE, in addition hold also valuable direct and indirect impacts on several heterogeneous related economic activities not strictly connected to the sea or coasts, further increasing the pivot role played by this industry on several EU MSs.

The increasing attention awarded by academics, practitioners and policy makers to the aforementioned BE activities and business is also a consequence of potential issues originating from the BE specificities. Seas, oceans and coasts, in fact, are “economically and socially valuable” but, relatedly their “economic” and their “social” value is often difficult to quantify, as they guarantee the supply of living and non-living marine resources, provide a suitable habitat for various forms of marine life, contribute to the sequestration of CO₂, and are a fundamental element in the thermoregulation of the planet, the limitation of climate change and the preservation of biodiversity.⁶ Taking a broader view, it is easy to understand how, in addition to more traditional aspects such as the exploitation of marine resources, the BE is a key source of livelihood for EU MSs and related coastal communities. However, it is essential to achieve a better awareness of the value, not only in economic terms, of the natural capital of the seas and the oceans as well as those of the marine ecosystems embedded within them.⁷

Within such a dense network of interconnections, it is easy to understand how valuable are expected to be both the positive and the negative interdependencies as well as the potential synergies established between different BE sectors. Relatedly the existence of mutual dependencies between BE sectors is argued to constitute one of the main drivers for the recent growth of the BE industry, jointly with their common backbone, i.e., the marine environment.

The comprehension of the key role that interdependences and connections among various BE sectors is undoubted as well as the established of collaborative and synergic relationships between the economic actors populating the different BE businesses are argued to pave the way for pursuing sustainable corporate growth strategies by private companies operating in these businesses jointly ensuring a balanced equilibrium between all the legitimate interests of the different stakeholder categories involved in the BE overall value network. Nonetheless, only limited prior studies focused on the deep investigation of the typology, the nature and the potential impacts that characterize the interdependencies existing between various BE sectors as well as those the role of relationships and links among private and public entities that operate within the BE domain.

Given the above, this study by adopting a managerial perspective aims at investigating the deep connections that exist between the different BE sectors and related key institutional and economic actors. In particular, grounding on the theoretical constructs developed within the “innovation ecosystems”, the SRM and the MSP literature streams, this research tries to assess to what extent the links and

interdependences among BE sectors and among involved actors are expected to shape the development of the industry as a whole as well as the success of each company operating within it.

Interdependencies and synergies within BE sectors and related economic actors: a strategic management perspective

Within economic and managerial mainstreaming literature, the concept of synergy is based on the principle that the whole effect originated by the integration of two or more distinguished resources, capabilities or actors is better than the simple sum of the constituent parts; this means that by combining resources, capabilities, know-how or knowledge held by different actors belonging to the same organizations or by different organizations it is possible to achieve better performances respect to the sum of those achieved individually all the actors or organizations/entities involved.⁸ The joint attempts of the different actors involved make it possible to eliminate redundancies, reduce costs and to benefit from each other's economic and non-economic efforts.

The concept of interdependence is partly linked to the previous one, and grounds on the mutual dependences between/among two or more actors. Each entity/organization/person involved must make its/his/her own contribution to ensure its/his/her own survival/success but relatedly also to contributing at hose of all the other interdependent actors.⁹

The concept of interdependence is applicable not only to economic actors/agents or businesses, but also to sectors, industries or nations: a system of interdependencies is generated when each actor involved specializes in the realization of a specific product or service, all the actors must necessarily relate to each other to meet their needs and transfer each other goods and services they necessitate.

The type of relationship that is established between the parties involved determines the level of interdependence: when the level of dependence is high, each actor bases his activity on the presence of the other and his performance depends on the other's performance. In these terms the concept of interdependency, contrary to synergy, is also expected to include also potential negative effect on one part of the system (or one of the actors belonging to the network) due to negative performances or events related to the other ones.

The sectors that constitute the heterogeneous BE context have a natural and physiological attitude to establish inter-sectorial bonds and interdependencies and the main economic actors which populate BE businesses can achieve synergies by developing collaborative strategies: this characteristic is attributable to the fact that all sectors included in the BE and often actors operating in the related value chain, albeit through very different activities, are realized in common geographical areas and see the presence of the sea as the key element behind their existence.¹⁰

Moreover, the aforementioned sectors share a fundamental strategic common backbone: they all grounds on the exploration and/ or exploitation of resources belonging to natural capital or adopt as main input for their processes outcomes originating from natural capital-based businesses. Natural capital, notably, identifies the world's stocks of natural assets, ranging from which include living and non-living resources from air, land, seas and oceans, etc., Humans tap into natural capital to enjoy resources that allow their survival, but the potential negative impacts that business activities embedded in BE could determine on the environment and specifically on marine ecosystems also poses challenging issues related to climate change,

risk of loss of biodiversity, pollution, as well as habitat degradation and conversion.¹¹ This urges for the pursuing of more responsible and eco-friendly strategies by companies which operate in businesses strongly dependent upon natural capital, such as BE businesses. Relatedly, the achievement of targeted environmental goals set at both international and European level would strongly benefit from the development of green strategies jointly pursued by the most prominent companies that hold a leading strategic position in interdependent value chains.

Interdependences and synergies between BE sectors vary in terms of nature, intensity and implications when considering specific dyad of sectors and, consequently potential threats and opportunities for all the actors involved in the overall value network is expected to vary accordingly. Negative interactions can compromise the profitability of an industry, altering its internal dynamics. Negative interactions between BE sectors are quite common: this is due to the fact that the sea attracts different and often conflicting interests.¹² Examples of negative interactions between BE sectors are quite common for example when it comes to the living and non-living resources sectors. For example, the extracting activities of non-living resources from the seabed, the implementation of which can have a serious impact on the condition of the surrounding marine ecosystem¹³ directly on several businesses belonging to the living resources sector.

In many cases, in fact, the interactions between the sectors considered are positive and allow actors to benefits from each other's efforts: for example, the facilities for electricity generation through the exploitation of wind energy have proved to be an excellent aquaculture site, allowing the breeding of algae and mollusks in the submerged parts of the infrastructure. The adoption of a multi-user perspective of some natural resources and both material or immaterial infrastructures can create synergies between heterogeneous sectors, exploiting commonalities that allow sharing costs or and maximizing efficiency. Interdependencies and synergies among BE sectors can be mitigated or intensified by the strategic behavior and corporate strategies of leading companies which dominate different interconnected key businesses and value chains. In this general, the effective attitude of relevant actors and stakeholders to combine their efforts for jointly developing innovative green strategies capable to reduce potential negative spillovers originated by BE-related activities is a key driver for supporting innovative processes, products and services in the overall value network, thus contributing to the success of all parties involved as well as to securing a balanced reward-incentive system for all relevant stakeholders involved.

All prior comments and insights demonstrate that several managerial theoretical perspective and related conceptual models constitute a valuable underpinning for investigating interdependencies and synergies between BE sectors and involved economic actors and stakeholders. In particular, the interactions among established and emerging BE sectors constitute an interesting empirical field for testing the academic and practical implications which should originate from the adoption of the strategic management perspective. In particular, stakeholder relationship management (SRM) theories, Marine Spatial Planning' (MSP) theoretical constructs related to the governance of the marine cluster as well as the "innovation ecosystems" theory emerge as the most promising managerial stream of literature for investigating the targeted phenomena.

Notably, SRM theories addresses the set of managerial practices aimed at managing the relationships of a company or organization with its relevant stakeholders.¹⁴ The relevance of each category

of stakeholders is dynamic and varies due to the business lifecycle phase. Managing relations with stakeholders implies a first activity of identification of stakeholders and their subsequent classification, identifying their interests and needs. It is then necessary to understand the extent to which each group influences the implementation of the activities of the enterprise or sector. Stakeholders are then hierarchized depending on the ability of different types of stakeholders to influence the organization, the legitimacy and urgency of their interests. Finally, the organization proceeds to interface and manage relations with stakeholders according to the defined hierarchical order. SRM constructs are argued to better understand how to secure the participation and involvement of salient stakeholders¹⁵ and how to manage the rewards-incentives system which allow each company/organization to hold a "license" to operate.

Marine Spatial Planning' (MSP) theoretical constructs can provide valuable insights for designing proper governance settings capable to dwell with inter-sectorial interdependences. The economic sectors linked to the sea are increasingly carrying out their activities in adjacent or overlapping sea areas, thus sharing inputs involved in their respective business processes. In this vein, interactions between sectors, businesses and economic actors become more and more common and competition for land availability in port and coastal areas, as well as propitious sea areas becomes increasingly intense. In this respect, there has recently been a greater awareness of the need to manage our seas and oceans in a more planned and integrated manner. In this perspective, therefore, MSP is a cross-border and cross-sectoral practice, which aims at synergically coordinate and integrate several heterogeneous human activities related to the sea, such as aquaculture, exploitation of renewable energies, exploitation of living and non-living resources or other uses taking place in within the marine ecosystem. MSP indeed also develops suitable managerial tools and governance setting models capable to guarantee a more balanced and sustainable framework which integrates private and public actors belonging to these interconnected business. In this vein, MSP practices are suggested to reduce conflicts between sectors for the exploiting of overlapping sea areas and related marine resources, by promoting synergies, joint investments and collaborative and integrate sustainable growth strategies pursued by actors embedded in diverse values chains for the protection of the marine environment.¹⁶

Within strategic management literature, a promising research stream of literature which is expected to provide valuable insights for supporting and favoring the introduction and diffusion of green-based innovations within the marine and maritime cluster domain is represented by the innovation ecosystems theory,¹⁷ Notably, along with a biological perspective, also in the management research field an ecosystem is defined as a system in which the constituting organisms and the physical environment around collaborate together for pursuing common and individual goals. When the primary target set is represented by the management of the introduction and diffusion of innovation, according to the innovation ecosystem theory, it becomes fundamental to identify and prioritize the diverse typologies of firms, organizations and other entities which can trigger the overall innovation process. According to Autio and Thomas,¹⁸ an innovation ecosystem can be seen as "a network of interconnected organizations connected to a focal firm or a platform that incorporates both production and use side participants and creates and appropriates new value through innovation". This theoretical construct, therefore, is expected to provide an insightful conceptual framework for investigating the structure of the network argued to favour the

introduction of innovative business processes, products, and services in the marine-based industries such as BE sectors.

Research design and method

The previous section has clearly outlined how beneficial could be the adoption of a managerial perspective toward the investigation of interdependencies and synergies among sectors and actors in the BE domain. Nonetheless, only a limited number of prior managerial academic contributions has addressed this issue in a comprehensive way. Therefore, given the above the study aims at:

- Providing a detailed academic review of managerial studies assessing potential interconnection and synergies among BE sectors and actors (RO1).
- Sketching a grey literature review for scrutinizing these phenomena along with a practical and industry-driven perspective (RO2).
- Providing valuable practical insights by discussing an ad hoc business case from the BE industry, in order to set in a practical way the next research agenda (RO3).

For the purposes of this research, we first carried out a systematic literature review on extant managerial contributions addressing synergies and interdependences in the BE domain in line with the main strategic management streams of literature reported in the prior Section, in line with RO1. In particular, a three-stage process is performed, namely encompassing (i) planning, (ii) execution, (iii) reporting phases.¹⁹ During the first (planning) stage, the main goal and the boundaries of the research are set. Academic contributions are selected among leading international journals. The second phase of the literature review consists in a four-phases process, including: i) the definition of paper selection criteria; ii) the selection of the final sample of paper, grounded on their pertinence respect to the main issue of the manuscript; iii) analysis of the main contents of the literature review, and finally, iv) synthesis and reporting of the literature review research outcomes.

Second, consistent with RO2, the study integrates the previous research activity by adding a grey literature review which allows to develop an ad-hoc conceptual scheme capable to stress all potential interdependencies and synergies among dyad of BE sectors. Finally, the single case study methodology is applied for introducing a more actors-focus approach toward the study of these phenomena, also providing further empirical support to our analysis. In particular, the case history reported grounds on the mutual interdependences and synergies which take place among business and actors Marine living resources sector, the Bioeconomy and the Marine renewable energy sector. The case put emphasis on the relevance of the common use of off-shore facilities both for off-shore wind power generation and algae cultivation also suggesting links and synergies between the aquaculture and the bioeconomy sector, e.g., the production of micro and macro algae as an input for a more sustainable development of the cosmetics industry.

The Grey literature review has been performed analysing the main research material produced by government departments, industries, non-government organizations and other entities. The main documents taken into account are reports and studies developed by the European Commission including, among others, the "Maritime Spatial Planning (MSP) for Blue Growth – Final Technical Study" and the "Blue Economy Report 2020", and the "Blue Growth Opportunities for marine and maritime sustainable growth" communication.

For the business case study, a careful selection has been conducted in order to identify one of the most significant form of synergy that can be generated between subsectors belonging to the BE. At the end of the selection process, the cooperation between aquaculture, offshore wind energy production and bioeconomy is set as a prominent research field. The reason behind this choice lies in the fact that the aquaculture-wind energy production represents one of the main types of relationship dyad determining various potential environmental issues.

Results

Evidence from the academic systematic literature review

Table 2 shows the main contributions from extant academic literature focused on the investigated topic. In particular, 25 papers have been selected as valuable for the aims of the study, most of them grounds on BE and MSP literature and provide a comprehensive state of the art on this issue.

Table 2 Systematic Literature Review: main research outcomes

ID	Authors	Year	Title	Research field	Main topic/Focus	Geographical coverage (area)	Aim	Main findings
1	Xiang JH ²⁹	2020	Laying Solid Foundation of Marine Biology, Innovating Marine Biotechnology, and Enabling Blue Bioindustry.	Blue economy & Innovation ecosystems.	Marine biology, blue bio-industry and marine biotechnology.	Asia	Analysis of the development of high-tech strategy in marine biology and promoting the blue bio-industry.	High contribution of the Chinese Academy of Sciences (IOCAS) in the growth of marine biology and blue bio-industry in Chinese market.
2	Ghazali R ³⁰	2020	Acceleration of maritime development in Indonesia.	Blue economy & Innovation ecosystems.	Marine development policies.	Asia	Uncoverge maritime policies in Indonesia applying a qualitative methodological approach.	The development of maritime policy is a priority of the government, especially inter-island connectivity, use of maritime potential, and increase of the importance of fishermen.
3	Stengos G., ³¹ Ponis ST, Plakas G, Yamas A.	2019	A proposed technology solution for preventing marine littering based on UAVs and IoT cloud-based data analytics.	Blue economy and Stakeholder Relationship Management.	Microplastics, marine debris and litter.	Not applicable	Proposing an innovative solution for the mitigation of the marine littering problem.	Providing tools for facilitating the proactive role of community members and stakeholders.
4	Lee K.-H, Noh J., Khim JS. ¹⁵	2020	The Blue Economy and the United Nations' sustainable development goals: Challenges and opportunities.	Blue economy and Stakeholder Relationship Management.	Marine Spatial Planning, Ecosystem-Based Management, Marine Strategy Framework Directive.	Not Applicable	Analysis of the relevance of stakeholders in the link between BE and SDGs.	Relationship between BE and SDGs-context and the influence of major stakeholders on the nature of the relationship.

Table Continued...

ID	Authors	Year	Title	Research field	Main topic/Focus	Geographical coverage (area)	Aim	Main findings
5	Luhtala H, Erkkilä-Välimäki A, Eliassen SQ, Tolvanen H ¹⁴	2021	Business sector involvement in maritime spatial planning – Experiences from the Baltic Sea region.	Blue economy & Maritime Spatial Planning.	Marine Spatial Planning, Ecosystem-Based Management, Marine Strategy Framework Directive.	Baltic Sea Region	Elaboration on the business sector's interest and involvement in MSP in the Baltic Sea region.	The indication that all spatial and organisational scales from local to international and from small enterprises to umbrella organisations should be considered in relationship with SRM.
6	Guerreiro J, Carvalho A, Casimiro D, Bonnin M, ¹⁶ Calado H, Toonen H, Fotso P, Ly I, Silva O, da Silva ST	2021	Governance prospects for maritime spatial planning in the tropical atlantic compared to EU case studies.	Blue economy & Maritime Spatial Planning.	Marine Spatial Planning, Ecosystem-Based Management, Marine Strategy Framework Directive.	Atlantic Sea Region	It intends to summarize the main conclusions on the state of the art and MSP prospects in the Tropical Atlantic, also referring to the ongoing MSP process in several EU countries.	The importance of MSP and its potential impact in Tropical Atlantic Region.
7	Cavallo M, Pérez Agúndez JA, Raux P, Frangoudes K ³² .	2021	Is existing legislation supporting socially acceptable aquaculture in the European Union? A transversal analysis of France, Italy and Spain.	Blue economy and Stakeholder Relationship Management.	Seafoods and Aquaculture.	Europe	Identifying the social constraints hampering aquaculture growth in France, Italy and Spain as well as the measures established to overcome them.	Lack of a single solution to enhance social acceptability of aquaculture since this depends on a number of social, economic and environmental factors that may differ from site to site, and countries need to adopt a more integrated approach where concerns of local communities and stakeholders are understood and taken into account.

Table Continued...

ID	Authors	Year	Title	Research field	Main topic/Focus	Geographical coverage (area)	Aim	Main findings
8	Cavallo M, Frangoudes K, Agúndez JP, Raux P ³²	2020	Exploring troubles, attitudes, and strategies related to integrated aquaculture. A case of the andalusia region (south of spain).	Blue economy & Maritime Spatial Planning.	Marine Spatial Planning, Ecosystem-Based Management, Marine Strategy Framework Directive.	Europe	Discussing the problems and opportunities associated with an integrated aquaculture development along the coast of Andalusia through an in-depth analysis of legislative documents and face-to-face interviews.	Features about management of the aquaculture sector that has been characterized by a sectoral approach with little integration into the existing economic activities and socio-cultural context leading to conflicts among fisheries and lack of acceptance from local communities.
9	McKinley E, Aller-Rojas O, Hattam C, ³³ Germond-Duret C., San Martín IV, Hopkins CR., Aponte H., Potts T,	2019	Charting the course for a blue economy in Peru: a research agenda.	Blue economy & Innovation ecosystems.	Marine Spatial Planning, Ecosystem-Based Management, Marine Strategy Framework Directive.	South America	Presentation of the findings of the workshop "Advancing Green Growth in Peru".	Identification of priorities such as MSP, development of some network and political support for a peruvian BE.
10	Katila J., Ala-Rämi K., Repka ³⁴ S, Rendon E., Törrönen J	2019	Defining and quantifying the sea-based economy to support regional blue growth strategies – Case Gulf of Bothnia.	Blue economy & Maritime Spatial Planning.	Marine Spatial Planning, Ecosystem-Based Management, Marine Strategy Framework Directive.	Europe	Estimating the economic significance of blue economies for the Gulf of Bothnia (GoB) region of Finland.	Emerging of the importance of local economic data for better understanding of the potential of BE.
11	Fotiadou A, Papagiannopoulos-Miaoulis I. ²⁰	2019	Introduction of blue energy in the Mediterranean: The conceptualization of the sea as space and emerging opportunities for Greece and Mediterranean countries.	Blue economy & Maritime Spatial Planning.	Marine Spatial Planning, Ecosystem-Based Management, Marine Strategy Framework Directive.	Europe	Identification of how the introduction of Blue Energy can function as a driving force for the conceptualization of the Mediterranean Sea as space and, subsequently, for its regulation.	Highlighting of the opportunities that Blue Energy technologies can bring to Greece and to any Mediterranean country for a prosperous, environmentally friendly and sustainable future.
12	Saha K., Alam A ²⁷	2018	Planning for blue economy: Prospects of maritime spatial planning in Bangladesh.	Blue economy & Maritime Spatial Planning.	Marine Spatial Planning, Ecosystem-Based Management, Marine Strategy Framework Directive.	Asia	Exploration of the implication of Maritime Spatial Planning for ocean resource management to achieve BE goals.	Implications of the introduction of MSP as a potential tool.

Table Continued...

ID	Authors	Year	Title	Research field	Main topic/Focus	Geographical coverage (area)	Aim	Main findings
13	Phelan A, Ruhanen, L. Mair J ¹⁰	2020	Ecosystem services approach for community-based ecotourism: towards an equitable and sustainable blue economy.	Blue economy & Innovation ecosystems.	Community-based ecotourism, blue economy, ecosystem services, coastal tourism, sustainable livelihoods.	Asia	Examination of the role of community-based ecotourism within the developing market dynamics of the BE.	Elaboration of a model for community-based ecotourism in the BE.
14	Papageorgiou M ²²	2016	Coastal and marine tourism: A challenging factor in Marine Spatial Planning.	Blue economy & Maritime Spatial Planning.	Marine tourism, Coastal tourism, Marine Spatial Planning, Tourism planning.	Undefined	Analysis of the role of MSP in organizing and planning coastal and marine tourism activities.	High potential of CT in the economic ecosystem and the capacity of MSP in mitigating conflicts and creating synergies between coastal and marine tourism with other human uses.
15	Douvere F ³⁵	2006	The importance of marine spatial planning in advancing ecosystem-based sea use management.	Blue economy & Maritime Spatial Planning.	Ecosystem-based management, Marine spatial planning, Sea use management.	Australia	Analysis of the use of integrated management and MSP at policy and decision-making levels.	Identification of the reason of the importance of MSP as an essential step to achieve ecosystem-based sea use management.
16	White C, ³⁶ Halpern B, Kappel C	2012	Ecosystem service tradeoff analysis reveals the value of marine spatial planning for multiple ocean uses.	Blue economy & Maritime Spatial Planning.	Ecosystem-based management, efficiency frontier, multisector planning, bioeconomic model, renewable energy.	Undefined	Producing a tradeoff analyses from economics to simultaneously assess multiple ecosystem services to access potential conflicts among renewable energies.	Demonstration of the utility, feasibility, and value of MSP and giving support for the management transitions needed for society to address the challenges of an increasingly crowded ocean environment.
17	Gopnik, M, Fieseler, C, Cantral, L, McClellan, K, Linwood P, Crowder L	2012	Coming to the table: Early stakeholder engagement in marine spatial planning.	Blue economy & Maritime Spatial Planning.	Ocean policy, Stakeholder collaboration, Marine spatial planning.	USA	Engaging a variety of US ocean stakeholder to understand the importance of MSP through the sharing of informations and concerns and the dependence on ocean resources of the same stakeholder category.	Presence of stakeholders who want to be engaged in MSP earlier and of the conflicts about the correct balance between environmental and economic goals.

Table Continued...

ID	Authors	Year	Title	Research field	Main topic/Focus	Geographical coverage (area)	Aim	Main findings
18	Lester, S, Costello C, Halpern, B, Gaines S, White C, Barth J	2013	Evaluating tradeoffs among ecosystem services to inform marine spatial planning.	Blue economy & Maritime Spatial Planning.	Ecosystem-based management, Ecosystem services, Efficiency frontier, Marine spatial planning.	Not applicable	Rewriting an ecosystem service tradeoff analysis framework and provides a more comprehensive synthesis for how it can be applied to MSP and marine ecosystem-based management.	Needs of MSP that requires tradeoffs among ecosystem services and inferior planning options and finds compatible services.
19	Guerry A, ³⁸ Ruckelshaus M, Arkema K, Bernhardt J, Guannel G, Kim C	2012	Modeling benefits from nature: using ecosystem services to inform coastal and marine spatial planning.	Blue economy & Maritime Spatial Planning.	Decision support tool, ecological production function, marine InVEST, modeling marine ecosystem services, coastal and marine spatial planning.	Canada	Analysis of the marine integrated valuation of ecosystem services and InVEST tool.	The potential help of the marine integrated valuation of ecosystem services and InVEST tool shaping the dialogue and informing decision making in a MSP context.
20	Young M ²³	2015	Building the Blue Economy: The Role of Marine Spatial Planning in Facilitating Offshore Renewable Energy Development.	Blue economy & Maritime Spatial Planning.	Offshore renewable energy; marine spatial planning; sectoral management; regulatory complexity; environmental impacts; coastal state jurisdiction.	Not applicable	Examining the role of MSP in helping offshore renewable energy development.	Significant role in promoting the speedy and environmentally sound deployment of offshore renewable energy by assisting in overcoming the various hurdles to the development of MSP.
21	Voyer L, ³⁹ van Leeuwen J	2019	'Social license to operate' in the Blue Economy.	Blue economy and Stakeholder Relationship Management.	Blue economy, social license to operate, maritime industry.	Not applicable	Exploration of perceptions of who grants a SLO, what kind of concerns impact a SLO and how sectors work to obtain, or maintain, a SLO by comparing the responses of individual sectors to these three critical questions.	Emerging of the importance of broader societal and political engagement in questions about appropriate use and management of private sector activities in the ocean.

Table Continued...

ID	Authors	Year	Title	Research field	Main topic/Focus	Geographical coverage (area)	Aim	Main findings
22	Ounanian K, Delaney A, Raakjaer J, Ramirez, Monsalve P	2012	On unequal footing: Stakeholder perspectives on the marine strategy framework directive as a mechanism of the ecosystem-based approach to marine management.	Blue economy and Stakeholder Relationship Management.	Marine strategy framework directive, Ecosystem-based approach, Stakeholder involvement, Marine sectors.	Not applicable	Analysis of five marine sectors active in the marine environment (fisheries, offshore renewable energy, offshore oil and gas, navigation, and coastal tourism) and on non-industry stakeholders represented by environmental Non-Governmental Organizations (eNGOs) and how they have engaged in the Marine Strategy Framework Directive (MSFD) stakeholder consultation process.	Emerging of three central themes: shift from political to ecological boundaries, need of political coordination and support, generate a balance between positive and negative implications.

Source: Authors' elaboration

When it comes to academic contributions grounded on innovation ecosystems theories, addressing the BE sectors' specificities, the pioneering paper from Phelane et al.¹⁰ shed lights on the potential opportunities provided by the ecosystem-approach in terms of innovative sustainable strategies in the ecotourism domain: the paper study shows how the phenomenon of eco-tourism, mainly of a community-based nature, encourages the sustainable use of marine natural resources. The study develops a model for the analysis of ecotourism within the BE, emphasizing the importance of the interactions that exist between the coastal community, the local economy and the natural ecosystems of the targeted areas and how the set of interactions between the different actors involved contributes to create mechanisms aimed at protecting the natural and cultural heritage.

With regard to MSP-grounded papers, Fotiadou and Papagiannopoulos-Miaoulis²⁰ analyze the relevance of offshore areas for coastal countries in many respects, emphasizing the new opportunities deriving from the possibility of exploitation of diverse forms of energy and the pursuit of energetic self-sufficiency objectives. In this vein, the way in which the progressive introduction of different Blue Energy' typologies can guide the planning and management of the different marine areas of the Mediterranean is deepened.

As argued by Papageorgiou,²² marine and coastal areas are home to a wide range of human-made infrastructures, sovra-structures and activities. In this perspective, MSP practices are suggested as a key tool for improving the effective and efficient management of business operations taking place at sea or by the coast. Analogously, these managerial practices can also ensure the protection of the

environment, the prosperity of many interrelated BE sectors and a more responsible allocation of land spaces and resources in marine and coastal ecosystems, thus limiting conflicts among involved stakeholders and promoting synergies between BE sectors.

In 2015 Young²³ analyzed the possible correlation between MSP practices and the promotion of the use of renewable forms of energy through offshore facilities. The oceans represent an opportunity to meet the growing demand from increasingly energy-demanding populations and activities through the supply of energy from renewable sources; relatedly, MSP is playing a central role in promoting a more conscious use of the oceans and could help solving the problems related to the development of the BE sector, thus accelerating the transition to forms of offshore renewable energy.

Issues related to managerial theories on Stakeholder Relationship Management (SRM) have been extensively covered in academic literature, however they have rarely been applied to activities within the BE. In this vein, Ounanian et al.,²⁴ analyzed five marine-based sectors (fisheries, offshore renewable energy, coastal tourism, offshore oil & gas and maritime transport) and explored how prominent actors belonging to these sectors manage other with stakeholders belonging to related industries, within the Marine Strategy Framework.

The recent contribution of Lee et al.,¹⁵ proposes an innovative perspective on the role played by key stakeholders in the process of aligning the BE with the Sustainable Development Goals established by the United Nations. The study highlights how the most relevant stakeholders can directly or indirectly influence the growth and sustainable development goals pursued by BE actors.

Overall, the systematic literature review performed demonstrate that academic contributions focused on the role of interdependences and synergies among BE sectors and actors in the managerial research fields is mainly concentrated in the last two years (2019-2020), reflecting the increasing interest toward the targeted phenomenon

(Figure 1). The 59.9% of the sample papers were published from 2019 onwards and addressed a number of BE sectors such as marine biology, blue bio-industry, in standing alone perspective, without focusing on main linkages and synergies among sectors.

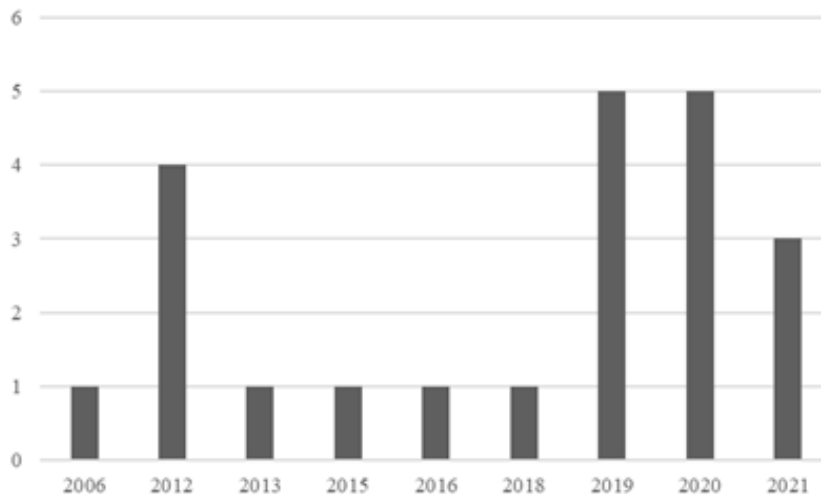


Figure 1 Histogram of the year of publication.

Source: Authors' elaboration.

The theoretical perspectives on which research papers grounds show a fairly heterogeneous distribution, with a clear prevalence of SRM-based manuscripts (Figure 2). This observation highlights the

importance of an effective management of relations with the various actors active in this area, as well as the relevance of achieving a vision as transversal and complete as possible.

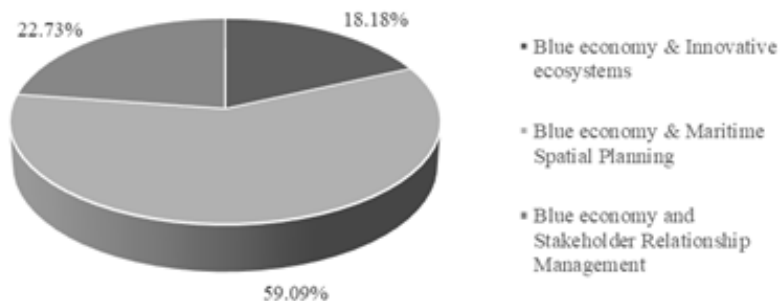


Figure 2 Pie chart of theoretical perspective.

Source: Authors' elaboration.

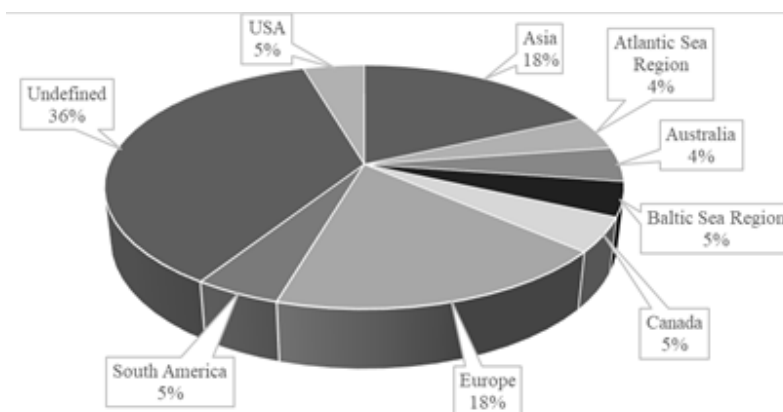


Figure 3 Pie chart of geographical distribution of studies.

Source: Authors' elaboration
Insights from the grey literature

When it comes to the main research focus, it is possible to note a wide range of managerial issues, including the management of emerging technologies, organizational best practices as well as the pursuing of both sustainable and green strategies.

In terms of geographical coverage 36% of the sample studies do not assume a clearly stated geographical perspective or a narrow geographical coverage, just privileging a more international approach toward these issues. The European and Asian continents, on the other hand, is the focus of 36% of the selected papers. These academic contributions also consider institutional and regulatory dimensions related to the topic. To complete the literature framework defined

within the research, it is necessary to provide brief findings with respect to grey literature. The collection and analysis of the grey literature made it possible to realize a synoptic scheme including all the possible interaction between BE sectors: the Table 3 shows the multitude of conflicts and synergies that can emerge between different businesses and activities included in the investigated BE sectors. The grey literature review represents a key insight source for the purpose of this study, providing a more industrial perspective and allowing the achievement of a more comprehensive and balanced view on the topic. This type of analysis also enables the research to benefit from more recent and updated data and information, increasing the timeliness of the final result.

Table 3 Interactions, interdependences and synergies between BE sectors: research finding from the grey literature

	Shipping and ports	Coastal and Maritime Tourism	Oil and gas	Pipelines and cables	Fishing	Marine aquaculture	Offshore wind energy & marine renewables	Marine aggregates and marine mining	Conservation
Offshore wind energy and marine renewables	<p>Synergies: OWFs depend on nearby ports with the capacity to provide logistic services (es construction/maintenance)</p> <p>Conflicts: proximity with shipping routes increases risk of collisions</p>	<p>Synergies: recreational activities can be done near OWFs as they could take advantage from the exclusion of other activities in the area such as fishing or shipping</p> <p>Conflicts: OWFs can change the coastal landscape and discourage tourism in the area</p>	<p>Synergies: potential use of the same facility for both OWE and oil/gas extraction</p>	<p>Synergies: potential integration of OWFs with marine grid systems</p> <p>Conflicts: competition for the installation of facilities in the same area</p>	<p>Synergies: increase of fish stocks near OWFs</p> <p>Conflicts: risk of collision with the turbines and risk of damage to the facility due to the usage of fishing gear</p>	<p>Synergies: OWFs can be co-used as an aquaculture location</p> <p>Conflicts: aquaculture equipment hinder maintenance operations</p>	<p>Synergies: potential integration of marine turbines with other marine renewable facilities</p> <p>Conflicts: competition for the installation of facilities in the same area</p>	<p>Conflicts: the installation of OWFs in sea areas licensed for marine aggregate extraction is not allowed.</p>	<p>Synergies: OFWs may create artificial reefs and increase biodiversity in the area</p> <p>Conflicts: Potential negative impact on wildlife</p>
Tidal and wave	<p>Conflicts: location overlapping</p>	<p>Synergies: potential increase in visitors at project locations</p> <p>Conflicts: visual impact</p>	<p>Synergies: potential common use of infrastructure and supply chain</p> <p>Conflicts: location overlapping</p>	<p>Synergies: dependence of ocean energy from the submarine cables sector</p>	<p>Conflicts: potential displacement of fishing activities from areas of project development and during the installation phase</p>	<p>Synergies: potential of co-location</p> <p>Conflict: location overlapping</p>	<p>Synergies: Synergies in research and development activities, supply chain sharing and grid connections.</p> <p>Conflict: location overlapping</p>	-	<p>Conflicts: potential negative impact on wildlife</p>
Coastal and Maritime Tourism	<p>Synergies: shipping transport increase wealth economic development</p> <p>Conflicts: Conflict: location overlapping</p>	-	<p>Synergies: coexistence with local sectors</p> <p>Conflicts: visual impact and environmental issues</p>	<p>Conflict: negative impact on marine cultural heritage</p>	<p>Synergies: fishing can represent a form of tourism</p> <p>Conflicts: location overlapping</p>	<p>Conflicts: negative impact on nearby ecosystems and water quality, potential negative visual impact</p>	<p>Conflicts: negative visual impact</p> <p>Synergy: facilities can be excursion sites</p>	<p>Synergies: tourism opportunity</p>	<p>Conflicts: mass tourism can harm local ecosystems</p> <p>Synergy: eco-tourism</p>

Table Continued...

	Shipping and ports	Coastal and Maritime Tourism	Oil and gas	Pipelines and cables	Fishing	Marine aquaculture	Offshore wind energy & marine renewables	Marine aggregates and marine mining	Conservation
Marine aggregates and marine mining	Conflicts: location overlapping and risk of collision	Conflicts: sand extraction activities can determine a negative impact on beach quality	Conflicts: location overlapping	Conflicts: location overlapping	Conflicts: dredging activities can impact of fish and mollusc populations Synergies: dredging activities can attract fish species	-	-	-	Conflicts: dredging activities can harm marine archaeological sites and damage ecosystems. Synergies: dredging activities moves the sand, setting nutrients free and increasing biodiversity.
Shipping and Ports	-	Synergies: ports generate touristic traffic Conflicts: safety issues related to marine traffic	Conflicts: risk of damage to pipelines due to anchors or collisions	Conflicts: risk of damage to pipelines due to anchors or collisions	-	Synergies: operators can benefit from the presence of nearby ports Conflicts: risk of detours, collisions	Conflicts: risk of detours, collisions Synergy: operators can benefit from the presence of nearby ports. Offshore Wind Facilities can interfere with radar technologies and determine risks of collision with boats	-	Conflicts: potential negative impact on wildlife, air quality and sea pollution
Oil and Gas	Synergies: synergies occur in supply and transfer of oil and gas in port structures Conflicts: shipping prohibition near the extraction facility	-	-	Synergies: Oil and Gas sector generates the main demand for pipeline construction	Conflicts: Displacement of fishing operations during extraction activities	Synergies: potential co-location of extraction facilities and aquaculture sites Conflict: location overlapping	Synergies: potential co-location of extraction facilities and marine renewable energy facilities, synergies in terms of supply chain and R&D. Conflicts: location overlapping	-	Synergies: potential creation of ideal habitats for different marine species Conflicts: negative impact in marine wildlife, risk of oil leakage
Pipelines and cables	Conflicts: potential restriction of shipping in specific areas	Conflicts: temporary beach closure during installation activities	-	-	Conflicts: risk of fish entanglements	-	Synergies: development of wind farms and integrated offshore grids Conflicts: location overlapping	Conflicts: location overlapping	Conflicts: risk of fish entanglements and negative implications in terms of noise, and disturbance of marine life

Table Continued...

	Shipping and ports	Coastal and Maritime Tourism	Oil and gas	Pipelines and cables	Fishing	Marine aquaculture	Offshore wind energy & marine renewables	Marine aggregates and marine mining	Conservation
Fishing	Conflicts: overlaps between shipping routes and fishing areas, risk of oil and wastewater spills	Synergies: fishing can be a touristic attraction	Conflicts: risk of oil leakage and its consequences on fish stocks, exploration and drilling activities may disturb fish populations	Conflicts: anchoring and trowing is forbidden in specific areas where pipelines and cables are not submerged	-	Synergies: co-employment of resources and know how Conflict: pollution from aquaculture sites can alterate marine ecosystems	Synergies: creation of artificial reef may increase biodiversity Conflict: potential negative impact on fish species	Conflicts: alteration of the sedimental characteristics of the seabed	Conflicts: invasive fishing techniques can harm non-target fish species, mammals, seabirds and juvenile fish specimens
Marine aquaculture	Conflicts obstacle to navigation, leakage of oil or wastewater can impact on aquaculture	Synergies: potential aquaculture-related touristic activities Conflicts: negative visual impact, decrease in seawater quality impacting indirectly on tourism	Conflicts: risk of oil leakage and consequences on environment and health, indirectly affecting tourism	Conflicts: potential release of contaminants during the installation procedures can damage aquaculture activities	Synergies: potential cooperation by sharing knowledge and resources Conflicts: introduction of diseases from fish stocks, risk of degrading of water quality and harness wild species	Synergies: cooperation between different aquaculture activities	Synergies: co-location of OWFs and aquaculture sites	Conflicts: seabed dredging activities can release hazardous contaminants, thus affecting fish species	Synergies: opportunity to create sustainable aquaculture activities Conflicts: potential restrictions on farmed species

Source: Authors' elaboration from EU reports, industry-specific studies, documents provided by specialized advisors and industry-related newspress

The intense network of interaction here described represent a physiological feature of the BE: having the seas, oceans and coasts as fulcrum of their activity, different operators necessarily must come into contact one with the others as they often get to carry out their business in common areas or using common inputs. The volume of interactions that can take place between sectors and prominent economic actors constitutes the reason underlying the study: most profiles of conflict can be regarded as opportunities of transformation into a synergic relationship.

A business case on synergy profiles between Marine living resources, Marine Renewable Energy and Bioeconomy sectors

In line with RO3, this Sub-Section provide anecdotal empirical evidence on potential interdependencies and synergies, focusing on links emerging between Marine living resources (aquaculture sector), Marine Renewable Energy (wind energy production from offshore platform) and Bioeconomy (micro and macro algae for pharmaceuticals and cosmetics uses). These type of interactions has been investigated as, for its intrinsic characteristics, the aquaculture sector is expected to generate several potential forms of conflicts and synergies respect to other established or emerging BE sectors, and several collaborative business opportunities are increasingly materializing among actors belonging to the respective value chains.

In this perspective, the algae manufacturing business is an increasingly important sector within the emerging and innovative BE sectors and it is notably linked to the aquaculture sector. Although coastal populations have always used seaweed for multiple uses, this sector has developed rapidly in recent years due to the growing

demand from a new customer sector, namely cosmetics. These marine organisms are used in the production of sunscreen, moisturizers, and detergents.²⁵

Although there is little awareness in this regard, in addition to the economic value generated by the production of seaweed, these organisms play a fundamental role in regulating the balances that exist in several natural ecosystems: algae, in fact, are characterized by extremely rapid growth rates and are responsible for the sequestration of a primary share of CO₂, and the consequent release of high volumes of oxygen thanks to the photosynthesis process. Algae can also be a fundamental form of protection against coastal erosion and are a fundamental habitat for the growth and proliferation of countless marine species. It is therefore not difficult to understand how this business has in a short time become promising driver for the development of bioeconomy, given the important prospects in terms of economic and non-economic value attributable to the production of algal biomass.

Bioeconomy is an innovative development model introduced in recent years: it can be defined as an economic system based on the sustainable use of resources included in natural capital in the processes of transforming these resources into goods and services. The bioeconomy therefore includes the traditional sectors that are realized through the exploitation of biological resources, such as fisheries or agriculture, but more importantly extends to new innovative sectors, such as bioenergy and biotechnology. The bioeconomy aims to establish a system for the exploitation of natural resources that generates more efficient and sustainable value chains, protects biodiversity and accelerates the transition at European level towards a circular economy with reduced emissions of pollutants.

The business case selected unveils several links and interdependencies that can be created among both businesses and actors grounding on the three aforementioned BE sectors. In particular, the selected case history deepens a particular form of synergy that concerns the sectors of algae production and offshore wind production, apparently distant, but which have been able to exploit the common marine-based connotation to create efficiencies that generate advantages for both activities involved.

In recent years, the coastal areas of the North Sea have become a site for algae cultivation: the availability of suitable areas for carrying out such activities is, however, limited and this criticality represents an obstacle to the satisfaction of the growing demand for these organisms. It was therefore necessary to increase the scalability of the business by researching new forms of cultivation at sea, an activity that to date is difficult to achieve due to several technological obstacles.

The consortium project "Wier & Wind" arises in this context: the renewable energy sector has in fact established innovative interactions with the algae production sector, providing for the placement of cultivation sites in the submerged parts of the turbines that make up the so-called wind farms.

The project then puts into practice the fundamental theories of MSP, creating a system of multi-uses of marine space. In this vein, MSP paradigms and practices promote the elimination of conflicts between business operations and actors operating in common and adjacent sea areas, while encouraging the establishment of synergistic relationships increasingly aimed at identifying sustainable common solutions (Saha et al, 2018).²⁷

Norther Wind Farm is located 23km off the Belgian coast and has 44 turbines generating electricity fed into the domestic grid. The farm covers a total area of two hectares in which, after the launch of the Project, algae cultivation sites have been installed in the many stretches of sea located between the turbines, otherwise unused. The project is supported at European level by the EU Interreg project, in order to promote cooperation between the BE sectors and to establish a synergistic and environmentally friendly system.

The initiative brings benefits for all partners involved, as offshore cultivation implies better results in terms of crop quality and algae growth rate, while offshore wind power facility managers can benefit from the multi-uses nature of the marine spaces thus enjoying greater acceptance by coastal local communities. The reported business case therefore sheds lights on the viability of SRM practices as a prominent tool for managing relations with several stakeholders categories in the BE sector.²⁸

Implications for academics, managers and policy makers

The BE encompasses all sectoral and cross-sectoral economic activities based on or related to the oceans, seas and coasts and therefore includes those activities that are marine-based or marine-related. This impressive industry mixes both established sectors (i.e., those that traditionally contribute to the Blue Economy) as well as emerging and innovative sectors, which bring new opportunities for investment and hold huge potential for the future development of coastal communities. In addition, BE is also linked to many other economic activities and, relatedly, its impact goes beyond the above-mentioned sectors (including both established and emerging/innovative businesses), as some BE sectors generate significant indirect economic effects (i.e., up into the supply chain) and induced

economic effects (i.e., general consumption and expenditure stemming from the household disposable income generated by BE activities). As BE offers important sources of sustainable economic development for Member State economies and coastal communities at the European level but is argued to be a prominent industry also in other several foreign countries worldwide, a growing attention from both academics, managers and policy makers is expected to be awarded to this industry in the next future.

As both scholars and practitioners have already argued the existence of profound interdependencies between both established and emerging BE sectors, which predominantly originate from the exploitation of natural capital embedded in marine resources and marine ecosystems. Relatedly, all the human activities from BE sectors can negatively impact on the future availability of these scarce marine resources. In this vein, the reduction of human impacts on the ecosystems and the improvements of ecosystems' condition for preserving the environment as future capital (in social, economic and financial terms) jointly with the development of collaborative strategies among economic actors which operates in different BE sectors, are fundamental for pursuing mutual business synergies while ensuring the achievement of green goals.

In this perspective, a deeper investigation of current and future interdependences and synergies which exist or may originate among BE sectors is fundamental for supporting both the main BE sectors and the involved local communities. The research outcomes, in particular, support the ongoing academic debate on this topic and also provides useful insights for both practitioners and policy makers.

First, the managerial perspective suggested for investigating interdependencies and synergies among BE sectors and related economic actors adds to the extant academic debate on the phenomenon by providing a more exhaustive and comprehensive theoretical framework for scrutinizing of potential risks and critical issues that originate among sectorial interdependencies, also considering emerging business opportunities and synergies that can be shared by different sectors and related economic actors, thus transforming threats in opportunities. In this vein, innovation ecosystems theory, SRM practices and MSP constructs are suggested as fruitful theoretical perspectives for setting the future research agenda. In particular, the outcomes from the systematic literature review performed on extant strategic management literature addressing the phenomenon sets the ground for next contributions from scholars.

Second, the analysis of documents and reports from policy makers and industry experts which address on a more practical point of view both interactions and opportunities which link established and emerging BE sectors has allowed to develop a synthetic framework capable to disentangling interdependences and synergies existing among different Blue Economy' sectors, activities and economic actors. In this vein, the research outcomes are expected to support policy makers at both regional and local level when setting policies and actions aimed at supporting business activities related to BE industry in coastal areas. The outcomes suggests an analytical conceptual grid for better identifying negative and positive connections among sectors and provide insights for prioritizing supporting programs and related actions by public entities and authorities involved in the sector.

Finally, the case study reported and discussed, by providing anecdotal evidence on business opportunities and potential synergies among the Marine living resources sector, the Bioeconomy and the Marine renewable energy sector, suggests to managers and practitioners involve in BE sectors viable innovative managerial

solutions for setting new collaborative initiative which ground on inter-sectorial collaboration and aim at developing green strategies jointly pursued by both private and public actors operating in different BE businesses.²⁹⁻⁴¹

Limitations and conclusion

The entire research has been conducted with the ultimate purpose of pinpointing the main repercussions at academic, managerial and policy makers level descending from the development of an ecosystem where both the economic system, the community and the environment benefit from a value co-creation made by connected and interdependent actors.

The main findings of this study underline how issues related to synergy and conflict profiles within BE are still little explored in academic literature. Nevertheless, the results can be the foundation for a future strengthening of the network of interdependencies that make BE an increasingly cohesive, harmonious, and sustainable ecosystem.

This research highlights the need for deeper investigation of the interrelation and synergies between BE sectors and tries to use it to understand this phenomenon in the world of ecosystems which starts from an industrial logic but then ends up being based on relationships between actors. SRM also has an excellent value and therefore for the future the aim is to further develop case histories within this sector in order to understand the specific individual economic operators that determine the possibility of transforming potentially negative interactions in opportunity.

Nonetheless the study still suffer inherent limitations. In particular, the research only partially empirically supports the theoretical constructs and the managerial perspectives proposed for investigating interdependences and synergies among BE sectors and actors, proving a single business case. In addition, other theories and models grounded on strategic management literature should be scrutinized in order to evaluate their potential applicability to the BE domain for further fostering the proposed managerial perspective in the study on the phenomenon.

Conflicts of interest

The author declares that there is no conflicts of interest.

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