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**ACCELERATING SUSTAINABILITY:  
INNOVATION PATHWAYS AND  
ENTREPRENEURIAL ECOSYSTEMS IN THE  
BLACK SEA BLUE ECONOMY**

**EBUN AKINSETE**

**ANASTASIA FLERIANOU**

**FREDERICK HERPERS**

**ELENI MANOUSIADI**

**LYDIA PAPADAKI**

**ILIAS KATRIS**

**PHOEBE KOUNDOURI**

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# Accelerating Sustainability: Innovation Pathways and Entrepreneurial Ecosystems in the Black Sea Blue Economy

Ebun Akinsete<sup>1</sup>, Flerianou Anastasia<sup>2</sup>, Frederick Herpers<sup>3</sup>, Eleni Manousiadi<sup>4\*</sup>, Lydia Papadaki<sup>5</sup>, Ilias Katris<sup>6</sup> and Phoebe Koundouri<sup>7</sup>

<sup>1</sup> Sustainable Development Unit, Athena RC; School of Economics and ReSEES Research Laboratory, Athens University of Economics and Business; UN SDSN Global Climate Hub

<sup>2</sup> Kantor Management Consultants Greece S.A

<sup>3</sup> Stratégies Mer et Littoral SAS (SML)

<sup>4</sup> Kantor Management Consultants Greece S.A

<sup>5</sup> Sustainable Development Unit, Athena RC; School of Economics and ReSEES Research Laboratory, Athens University of Economics and Business; UN SDSN Global Climate Hub

<sup>6</sup> Kantor Management Consultants Greece S.A

<sup>7</sup> School of Economics and ReSEES Research Laboratory, Athens University of Economics and Business; Department of Technology, Management and Economics, Denmark Technical University (DTU); Sustainable Development Unit, Athena RC; UN SDSN Global Climate Hub; UN SDSN Europe & Greece

\*Corresponding author: E-mail: e.v.manousiadi@kantor-group.eu

## Abstract

The sustainable development of regions worldwide is contingent upon the blue economy, which encompasses all economic activities associated with oceans, seas, and littoral areas. The Black Sea, situated at the intersection of Europe and Asia, possesses an immense potential for the development of a prosperous blue economy. Nevertheless, this potential is accompanied by a distinctive set of challenges that must be resolved in order to ensure the sustainable development of maritime industries in the region. DOORS Black Sea, an EU-funded initiative that establishes optimal and transparent research support for the Black Sea, addresses these issues. DOORS establishes a system of systems (SoS) to resolve the impacts of human and climate change on the marine ecosystem, thereby creating 'blue economy' prospects and regenerating the Black Sea. This system connects residents, research, and industry. Stakeholder engagement is essential for the success, value, and impact of DOORS. Together with researchers, they advance science and technology, rendering project labour more significant. In an effort to assist scientists in the prioritisation of Black Sea issues, Multi-Actor Forums (MAFs) convene national stakeholders from Romania, Bulgaria, Turkey, and Georgia, regardless of their background. The concentration is on blue economy policies and innovations that address gaps. This method also assists in the co-design of the region's system of systems, providing researchers with the datasets necessary to address environmental issues and expand the blue economy. This study examines the potential impact of the findings on the long-term expansion of the blue economy and related policy in the region.

**Key words:** Blue Economy, Stakeholders engagement, Black Sea, Innovation Acceleration, start-ups

## 1. Introduction

The Black Sea Blue Economy is composed of critical sectors, including aquaculture, tourism, shipping, and fisheries, all of which have the potential to generate substantial development, employment creation, and innovation. However, the vitality of marine ecosystems is the foundation of this commercial activity. The provision of essential ecosystem services, such as food provisioning, coastal protection, and recreational opportunities, is contingent upon the sustainable management of marine resources. Nevertheless, the region is confronted with substantial political, socio-economic, and environmental challenges, including the Russo-Ukrainian war, border changes, economic crises, habitat degradation, and overexploitation of fish stocks. These challenges threaten the region's economic potential and stability, as well as the biodiversity of the Black Sea. In order to facilitate the transition to a sustainable blue economy, regional initiatives and policies are acknowledging these challenges and are aligning with broader European objectives, such as the European Green Deal.

In 2019, two flagship strategies were implemented with the objective of enhancing sustainability and enhancing governance and cooperation in the Black Sea. These strategies are the Common Maritime Agenda (CMA) for the Black Sea, and in 2019, the Black Sea Strategic Research and Innovation Agenda (SRIA) was established (Connect Black Sea, 2019; European Commission, 2019). SRIA has four central aspirations for the Black Sea, including addressing the fundamental research challenges, developing products, solutions, and clusters, constructing critical support systems and research infrastructures, and fostering education and capacity development, while CMA aims to achieve healthy marine and coastal ecosystems, "a competitive, innovative, and sustainable blue economy for the Black Sea", and promote investment in the Blue Economy of the Black Sea (Connect Black Sea, 2023). The Black Sea SRIA's implementation plan was officially unveiled in 2023. Conversely, the CMA has been actively implemented since its adoption, with annual stakeholder conferences and meetings to advance its objectives.

In this context, innovation is poised to play a critical role in the transition to sustainability by addressing environmental and social challenges and facilitating the transformation of current unsustainable socio-technical systems (Schot & Steinmueller, 2018). This will be achieved through the development of clean technologies, alternative business models, and governance arrangements, which will create the requisite conditions for societies to achieve the ambitious Sustainable Development Goals. In the blue economy, sustainability is perceived as feasible through innovative sustainable ocean solutions, which encompass the traditional sectors of fishery, coastal tourism, and maritime transport, as well as the rapidly expanding aquaculture, marine renewable energies, and blue biotechnologies (Pace et al., 2023). On the one hand, these solutions are anticipated to reduce and mitigate anthropogenic impacts on the marine environment by promoting sustainable fishery practices or reducing maritime transport noise pollution. On the other hand, they will provide new sustainable business opportunities in promising sectors such as blue biotechnology or ocean energies. In addition to technological advancements, it is anticipated that social innovations will also contribute to the systemic transformation toward sustainability (Wittmayer et al., 2019) by safeguarding the well-being of coastal communities and the services provided by marine ecosystems (Akinsete et al., 2022). However, the requirements and prospects for innovation differ from one region to another, and it is crucial to consider local characteristics when developing a research and innovation agenda. In addition, in order to enable transformation processes in coastal communities, such an agenda should be predicated on a shared future vision of a sustainable blue economy. This vision should be capable of providing directionality ('Where to go?' 'For what purpose?') by identifying long-term objectives (Clark & Harley 2020; Pace et al. 2023; Schot & Steinmueller 2018), which can vary depending on the context of the communities.

Accelerators have emerged globally as a pioneering and influential method of nurturing high-growth and innovative startups, particularly in the tech sector (Miller & Bound, 2011). A substantial body of research reveals that such programmes have a positive impact on business founders, helping them to learn quickly, improve their business ideas, and build valuable networks. Most publications accept the definition proposed by Miller and Bound, who describe it as an open application yet highly competitive, focusing on small teams rather than on individual founders. Accelerators are differentiated from incubators in terms of their programme focus, entry points, duration, funding scheme, and programme intensity. A typical incubator supports ideas and business solutions at a very early-stage level, providing essential resources such as office space, while accelerators work closely with start-ups that already have a business idea or a product, providing more comprehensive support (e.g., mentorship, access to funding) (Wise & Valliere, 2014).

In general, accelerator programmes provide the start-up teams with fixed-term, structured support (Hochberg, 2016). Through a selective process, accelerator managers choose only the best applicants, i.e., start-up teams that display the right mix of team dynamics, technology, and market potential (Ester, 2017). Accelerator participants receive time-limited support, including intensive mentoring and programmed events for networking and education. In many cases, the accelerator applicants receive initial capital to further develop their business idea (pre-seed investment), usually in exchange for equity (Miller & Bound, 2011). In most of the cases, the applicants are young and in the start-up phase of their business, and I am interested in providing them rapidly scalable business models. Start-ups are in need of creating their own network to attract external knowledge, hence creating value jointly. They operate in a so-called “ecosystem”, a specific environment connecting several actors (large companies, incubators, investors, political actors, and academic organisations) all located in the same region (Tripathi et al., 2019). Customers are also a vital part of this system. These participants form a team of potential stakeholders that interact to evolve the company and thus jointly create value. Since different actors with a plethora of interests are a part of sustainable innovation, interaction with both internal and external stakeholders is required (Behnam et al., 2018)

Accelerator programmes—or, in brief, ‘accelerators’—typically have specific roles for participating groups, namely, accelerator managers, start-up members, and experienced mentors, experts, and investors (Richter et al., 2018). Accelerator managers select successful startup teams and oversee the programme's functioning. Start-up members benefit from the programme's activities, while experienced mentors provide expertise in business planning, entrepreneurship, legal issues, technology, and marketing. These roles ensure the success of the program and its participants. Accelerators offer a set of services that otherwise would be distinct and might increase the costs of a company, including access to investment, mentorship opportunities, co-working spaces, opportunities for new partnerships, and access to a broader network of investors. Within this ecosystem, trust among actors and the common vision of action are crucial as bases for all actors acting towards benefiting each other (Vargo & Lusch, 2004). Investors contribute economic resources in return for profits, while customers and employees share knowledge and skills (Sydow et al., 2016). This complex feedback circle becomes more effective when entrepreneurs adopt a leadership style that follows a humble inquiry approach, which calls for an open way of learning, prioritising the active listening of experts' advice (Shepherd & Patzelt, 2021).

The literature identifies several types of accelerators, each with different objectives and structures (Kos & Cvirn, 2017). General accelerators support high-growth startups across multiple industries, while vertical accelerators focus on a single sector, tailoring mentorship and investment to its specific needs. Corporate accelerators involve established companies aiming to achieve strategic business goals, either internally or through external partnerships (Hochberg, 2016). Government-backed

accelerators receive public funding to support innovation through subsidies, matched investments, or direct financing. University and research institution accelerators, often linked to incubators and technology parks, help commercialise academic research and facilitate technology transfer. Accelerators can also be classified based on their business models, which are generally categorised as profit-driven or mission-driven (Ester, 2017). Profit-driven accelerators prioritise scaling startups for investment, often providing seed funding in exchange for equity. In contrast, mission-driven accelerators focus on generating societal value, operating on a smaller scale with a more specialised approach.

Since the founding in 2005 of “Y Combinator” in the US, accelerators have seen rapid growth, with estimates of more than 3,000 programmes globally (Hochberg, 2016). Every accelerator proposes unique selling points and may vary in their scope, size, and target market and audience. Another crucial aspect of the accelerator programmes that have been widely tested in Silicon Valley is the close collaboration with external partners, including universities, governments, or industry associations and other organisations that could attract startups to Silicon Valley. The accelerator models have seen a rapid expansion across the US and a growth now rapidly in popularity in Europe. Accelerators play a crucial role in transforming the business environment, as they can attract new investors and shape the funding opportunities in the local ecosystem. They provide a well-thought-out environment that increases the chances of startups' success, which in turn attracts more funding opportunities and enhances the overall entrepreneurial ecosystem. Within the programme, innovative, ‘out-of-the-box’ ideas can be exploited, thus providing early recognition of threats, opportunities, and competition.

Findings of previous studies agree that accelerators provide an ecosystem where innovation can thrive and where different components can reinforce each other, leading to continuous innovation and repeated innovation and startup success. The entrepreneurial culture is steadily cultivated, influencing not only the individual's success but also reinforcing the entire business ecosystem, making it resilient and sustainable over time. Conventionally, accelerators are designed to bring together innovative business ideas, experts' knowledge, creativity, and funding opportunities (Richter et al., 2018). They usually demonstrate increases in revenue and employment for the successful startups (Blank & Dorf, 2020). One of the key challenges identified is associated with the fact that accelerator managers cannot predict in advance which startups will be successful. Overall, several researchers concluded that accelerators play a significant role in supporting startups in refining their business models, securing funding, and scaling up. However, there is still a need for empirical evidence that would link the participation in an acceleration directly with the startup's success.

However, there is evidence that suggests their long-term impact and how these programmes effectively drive policy decisions (Hochberg, 2016). Being adaptive and innovative plays a crucial role in maintaining and increasing their relevance and enhancing their impact on the regional business environment (Ester, 2017). From what is already known, accelerator models highlight the impact on the business environment in terms of creating an environment where innovation can dominate, highlighting the importance of access to talent, mentoring schemes, knowledge, and legal support. Open innovation plays a critical role in achieving sustainable growth and increasing long-term business survival (Jackson et al., 2015). The literature review suggests that there is a high potential for the business community to benefit from adopting and implementing some of the strategies and business models used in other well-established accelerators. Such programmes foster a culture of innovation and risk-taking, while, at the same time, participants benefit from structured support and mentoring and access to a broader network of investors. The innovation gap, which could be attributed to the existing cultural differences, higher levels of risk aversion, and limited access to venture capital, might

be reduced through the further tailoring and adaptation of the accelerator, but this requires a dynamic entrepreneurial environment.

## 2. Methodology

The H2020 DOORS Blue Growth Accelerator (BGA) was designed as a strategic initiative to support the development of sustainable blue businesses (i.e., businesses that are (close to) zero polluting and circular) in the Black Sea. The task of the BGA is to promote entrepreneurial culture and increase the capacity for blue innovation. Throughout its implementation, it fulfills the Black Sea CMA and supports the practical implementation of the SRIA Pillar 2 “Black Sea Blue Economy”. The activities planned in the BGA are designed to meet the needs of local/national Black Sea communities. The BGA boosts new business opportunities and activities, enhances competitiveness and innovation, and creates an ecosystem that supports the integration of SMEs of the region into global markets.

By bringing together key partners, encouraging synergistic efforts, organising training and mentorship programmes, and facilitating access to investors, the BGA provides practical support for growth and job creation to support the development of businesses in the region while promoting the circular economy in the coastal communities. The implementation of the BGA in the Black Sea enables the effective exploitation of the DOORS research results while engaging entrepreneurs in a new way of thinking. The BGA is meant to serve as a model within the Black Sea, developing new maritime technologies and providing a paradigm for other marine regions.

Since this is the first time that a startup accelerator is employed in the Black Sea region, focusing on marine and maritime sectors, and to maximise the impact in the region, the “[Black Sea Accelerator \(BSA\)](#)” was developed in collaboration with the H2020-funded project BRIDGE-BS. It is important to note a distinction between two terms that will be used throughout this methodological paper. While the accelerator was initially conceptualised as the DOORS BGA, comprising the call for Accelerator, the selection of startups, the training programmes, the formation of a Special Interest Group to support investment opportunities, and the definition of innovation pathways, the acronym BSA will be used to refer to all joint activities related to the call launch, startup selection, and training activities.

By leveraging best practices in accelerator programme design, the chosen methodological approach provides a clear roadmap for achieving the desired outcomes. The BSA is designed to foster innovation within the blue economy by attracting and supporting high-potential startups that contribute to sustainable economic growth. A key focus is on providing comprehensive support and mentorship to early-stage SMEs and startups, equipping them with the necessary tools to develop and scale their business effectively. The initiative also aims to reinforce regional collaboration by facilitating access to funding opportunities and fostering strategic partnerships between entrepreneurs, investors, and key stakeholders. Furthermore, the BSA promotes sustainable business while providing a comprehensive support and mentorship programme and facilitating access to funding and new partnerships.

DOORS and BRIDGE-BS generated and jointly agreed on the following ‘BSA mission statement’: We are committed to identifying Black Sea Blue Economy opportunities and the entrepreneurs who can exploit them. Through the “Black Sea Accelerator”, we will enable these entrepreneurs to exploit these opportunities by training and facilitating their access to funding and investment opportunities. We will achieve this through training, utilisation and transfer of technologies and knowledge for the marine and maritime-related jobs.” The BSA integrates a comprehensive set of activities designed to support entrepreneurship, facilitate collaboration, and enhance access to funding within the Blue Economy. The programme provides customised training and mentorship, equipping SMEs and startups with the necessary skills to navigate business development, sustainable innovation, and

investment strategies. Through targeted mentoring sessions and a small-scale apprenticeship initiative, entrepreneurs gain hands-on experience by working alongside industry experts, ensuring that their ventures are well-positioned to capitalize on emerging opportunities.

A core component of the BSA is its emphasis on collaboration between researchers and businesses. By establishing a network of entrepreneurs and organizing matchmaking events, the accelerator fosters knowledge exchange, facilitates partnerships, and integrates key DOORS research findings into business development strategies. Additionally, the development of a digital matchmaking platform provides an interactive space where startups can connect with potential investors and funding opportunities. The BSA also plays a crucial role in facilitating access to funding, offering consultancy support for business plan development, expert guidance on fundraising strategies, and structured networking activities to engage with investors. These efforts aim to bridge the gap between research-driven innovation and market implementation, strengthening the investment ecosystem in the Black Sea region.

The BSA was launched through an open call for applications, attracting participation from across the Black Sea region and beyond. Eligible applicants had to be registered legal entities headquartered in the Black Sea region (Bulgaria, Georgia, Moldova, Romania, Türkiye, and Ukraine). Non-regional startups were considered if they aimed to export solutions to the region and operated as early-stage businesses. By selecting the most promising startups, the BSA aimed to accelerate innovation in key blue economy sectors, including coastal tourism, maritime transport, ocean renewable energy, and marine ecosystem protection. The application process allowed startups to submit comprehensive proposals online. Applications were assessed based on three key dimensions: the innovation concept, market potential, and team capacity. The program followed a transparent and structured evaluation process to select high-potential ventures contributing to a sustainable blue economy, as it was designed to support the most viable and innovative startups. A critical component of the evaluation was the business model, which examined the target market, scalability, and financial viability of the proposed solutions. Additionally, startups were required to define their Technology Readiness Level (TRL) and disclose existing capital resources, ensuring that selected solutions were advanced enough (TRL 4 or above) to transition into market-ready applications.

The evaluation framework also considered the broader regional impact and sustainability of the proposed innovations. Startups demonstrating alignment with the Common Maritime Agenda (CMA) and Strategic Research and Innovation Agenda (SRIA) received higher scores, as their solutions contributed to long-term policy objectives in the Blue Economy. Furthermore, applications showcasing synergies between entrepreneurs, researchers, and investors were prioritized to foster collaboration, knowledge transfer, and business growth. The assessment criteria also examined innovation potential, sustainability, scalability, and regional relevance. Special attention was given to the protection of intellectual property (IPR), as businesses with secured or pending IPR applications were considered better positioned for competitive market entry. Applications underwent a multi-phase evaluation, beginning with an eligibility check, followed by a detailed review by an expert panel comprising specialists in business development, marine technologies, and policy-making.

During the final evaluation, reviewers assigned scores (1-5) based on how well the startups addressed concept originality, market fit, financial sustainability, and team readiness. High-scoring applications demonstrated clear objectives, structured financial planning, and a capable team, ensuring their ability to scale and contribute to the regional economic landscape. The analysis of the applications received for the BSA provides valuable insights into the diversity, readiness, and sectoral focus of the participating start-ups. While a few applications were rejected due to their limited relevance to the Black Sea region or lack of alignment with Blue Economy sectors, 22 out of 29 applications successfully progressed through the evaluation process.

Applications were received from across multiple Black Sea countries, including Türkiye, Georgia, Romania, Bulgaria, and Ukraine, alongside submissions from businesses based in Italy, Spain, Germany, and Greece, which also demonstrates external interest in expanding operations into the region. In terms of sectoral representation, the applications spanned a range of blue economy industries, with the highest number focusing on fisheries and aquaculture (7 applications) and blue biotechnology and related products (6 applications). Other sectors, such as Tourism and Recreational Activities, Ports, Transport & Logistics (Shipbuilding and Repair), and Nature-Based Solutions for Coastal and Marine Environments, each attracted five applications. Some proposals addressed multiple sectors, which captures the interdisciplinary nature of some blue economy ventures.

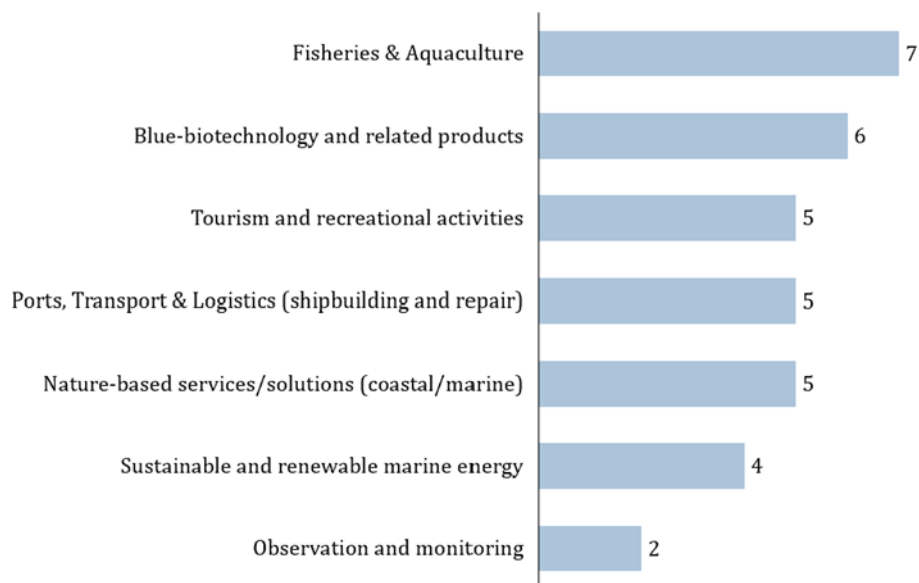
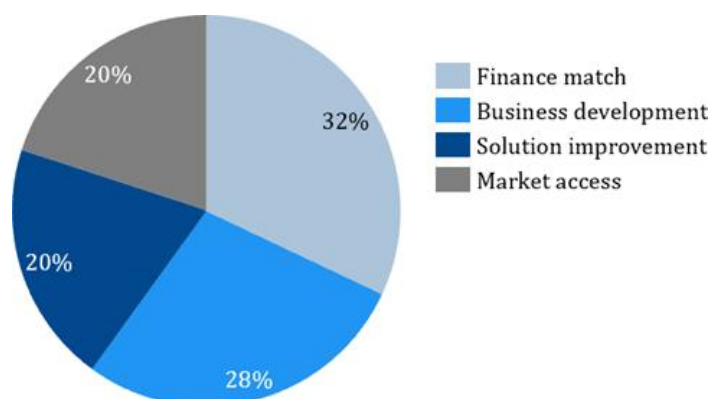


Figure 1 Sectors represented in the BSA call, and number of applications addressing these sectors

The Technology Readiness Level (TRL) of the selected projects varied, with the majority (64%) positioned within the mid-range TRL 4-6, indicating that many participants were still validating their technologies. Meanwhile, 36% of applicants had projects at TRL 7-9, which suggests a more advanced stage, closer to market entry and commercialisation. Regarding team structures, most participating startups operated with small teams (five people or fewer), which underscores their early-stage status and the potential need for scaling support in both human resources and operational capacity. Participants expressed varying support needs, with a strong emphasis on financial matching (32%) and business development (28%), aligning with the BSA's mission to provide targeted guidance in these areas.



*Figure 2 Type of support needed by the BSA, as requested by the applicants*

Additionally, applicants had diverse levels of experience in the blue economy, with many businesses active in the industry for over four years, while others were relatively new, with 0-6 months or 2-4 years of experience. This distribution indicates that the BSA attracted both early-stage startups and more established ventures. A significant number of applicants indicated a focus on developing new products (17 applicants), which aligns with the BSA's objective of fostering innovation and bringing novel solutions to market. Some proposals also emphasized new services, which also reflect the broader scope of entrepreneurial activity within the accelerator.

In parallel to the BGA, a series of stakeholder engagement workshops were realized in the Black Sea countries in the form of Multi-Actor Forums (MAFs), which are essentially living labs (Seyhan, et al., 2025) (Papadaki, et al., 2023). These forums are uniting national stakeholders from Romania, Bulgaria, Moldova, Turkey, Georgia, and Ukraine, representing a diverse array of backgrounds, to help scientists prioritize Black Sea issues. The focus is on blue economy sectors and policies, as well as the utilization of innovations coming from the BGA to address identified gaps. To identify the innovation gaps associated with the development of the Blue Economy in the Black Sea and the attainment of CMA and SRIA priorities, the second round of MAFs in each of the aforementioned countries focused on the establishment of a shared vision for the Black Sea, as well as the downscaling of innovation pathways in each country. Innovation pathways are a significant milestone for the BGA in the advancement of the Blue Economy sectors, as they provide guidance for economic growth and sustainable development.

First, a 'Normative Qualitative Scenario' (Vision – see Figure 3) was created to oversee the backcasting process, which is based on appreciative inquiry and systems innovation (Skea, 2021) (Edelman et al., 2005). The normative scenario was chosen rather than an outlook or exploratory approach, as the objective of this exercise was not merely to extrapolate existing trends and forecast future outcomes based on input assumptions, nor to concentrate on specific plausible futures. The main driver for the normative scenarios, which serve as the basis for the innovation pathways developed in the subsequent phase, has been to identify patterns that align with long-term objectives and agendas, including the Paris Agreement (Dagnachew et al. 2019; Skea et al. 2021). In our case, the 'Vision' is an embodiment of goals based on the existing Black Sea Vision for 2030 (Connect2BlackSea, 2025). It seeks to build on this over a longer time horizon (2050) by incorporating feedback from the first round of MAFs, feedback from H2020 DOORS project partners, the main outputs of the policy gap analysis, and the UN Sustainable Development Goals. Working to a longer timeframe (i.e., beyond 2030) is a key aspect of systems innovation; it is rarely what happens in the short term but requires mid- and long-term actions.

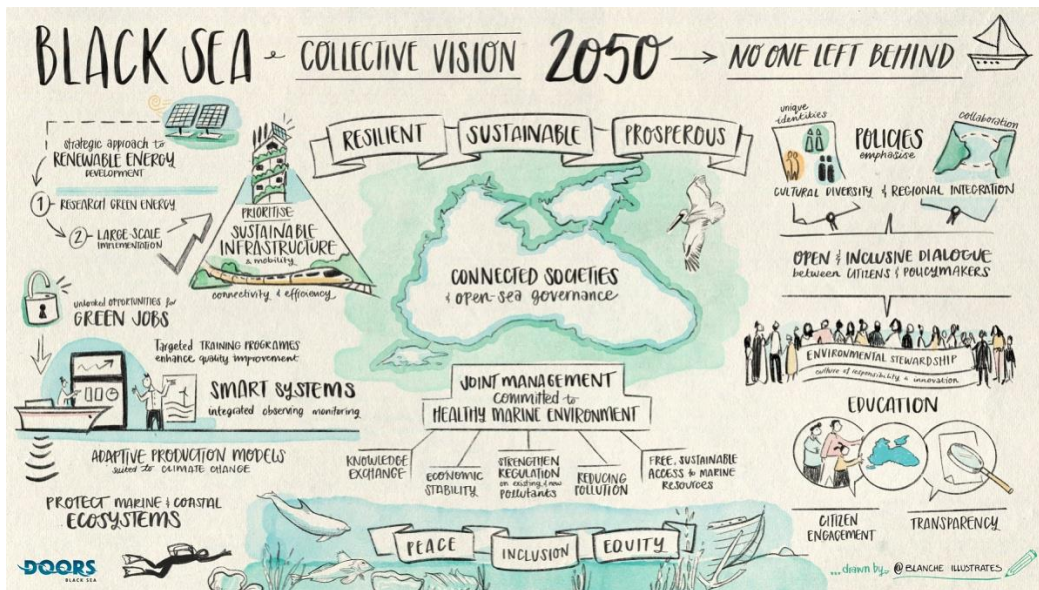


Figure 3 Black Sea vision for 2030 (co-developed and validated in the MAFs)

Subsequent to the establishment of a long-term vision, it was necessary to identify a few established critical milestones for 2050. We employed the SDGs, which are widely recognized as the most aspirational and, more importantly, the most significant framework that currently governs sustainable development. Lee et al. (2020) investigated the scientific evidence regarding the relationship between the BE and the SDGs and the alignment of stakeholders regarding this relationship. The review revealed that the following SDGs are the most relevant to the Blue Economy: SDG 12 "Responsible Consumption and Production," SDG 14 "Life Below Water," SDG 15 "Life on Land," SDG 16 "Peace, Justice and Strong Institutions," and SDG 17 "Partnerships for the Goals." With regard to the midterm period, we employed the Black Sea Strategic Research and Innovation Agenda (SRIA) and the BS SRIA Implementation Plan to identify significant milestones that must be accomplished by 2030. The four BS SRIA Pillars, namely (1) BS Knowledge Bridge, (2) BS Blue Economy, (3) Key Infrastructure and Policy Enablers, and (4) Empowered citizens and enhanced blue workforce, were designated and utilized as critical milestones for all Black Sea countries Figure 4.

Working vision for the Black Sea

The Black Sea is resilient and sustainable, with connected societies, fostering multi-disciplinary research and incentivizing innovation in coastal, marine and maritime sectors - developing smart, integrated observing and monitoring systems. In addition, education is provided opportunities for green jobs are unlocked, and specific programs exist to enhance citizen-policy dialogue. Through these efforts, the Black Sea region is able to mitigate and adapt to climate change impacts, while fostering a sustainable blue economy, managing and protecting marine and coastal ecosystems, adopting circularity principles and mobilizing green energy. The Black Sea region is an example of peace, inclusion and equity, leaving no one behind.

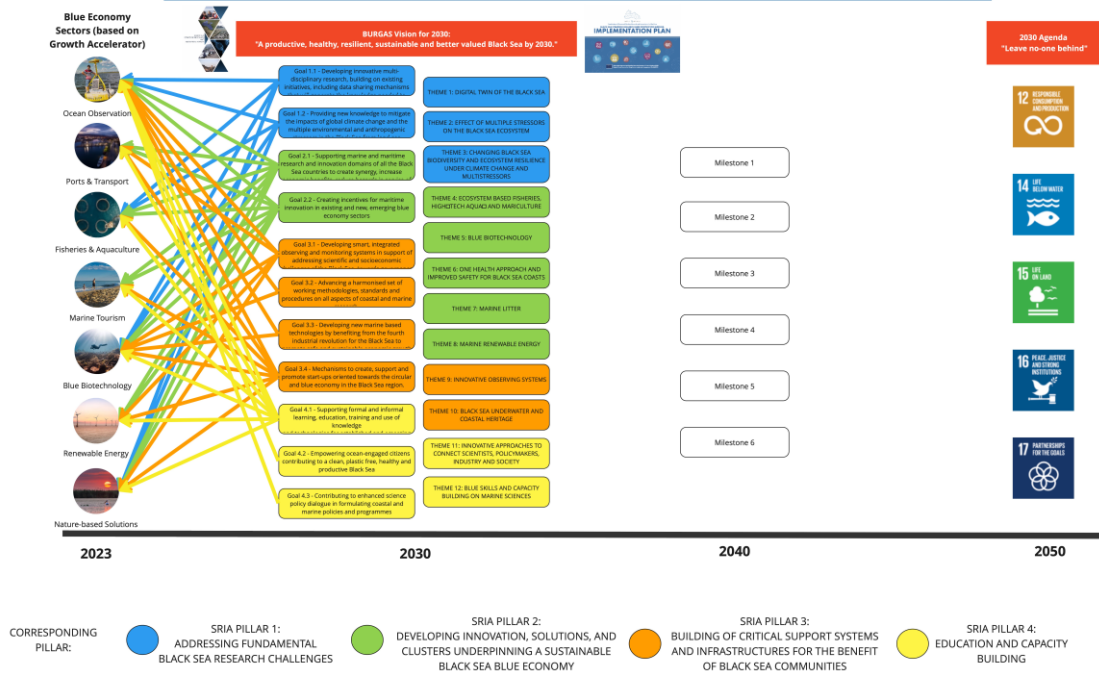


Figure 4 Preliminary innovation pathways canvas used for the second round of Multi-Actor Forums

During the second round of Multi-Actor Forums, stakeholders were engaged in a facilitated discussion to assess the working vision and the preliminary innovation pathways. They were asked to revise the working vision for the Black Sea and define the milestones in each prioritized sector<sup>1</sup> for the short-term (2025-2030), mid-term (2030-2040), and long-term (2040-2050) using the Future Radars tool. They also linked relevant innovations from the BGA to each of these milestones. In addition to increasing awareness, this process improves the development of SoS and capacity-building initiatives, which are crucial for the sustainable advancement of the blue economy.

### 3. Case study: Innovation pathway for the Fisheries & Aquaculture sector in Georgia

This study examines the innovation trajectory of Georgia's fisheries and aquaculture sector. Figure 1 illustrates the innovation trajectory, delineated into three primary temporal segments: short-term, mid-term, and long-term. In accordance with the Burgas vision for 2030 (Connect2BlackSea, 2025), which aims for "a productive, healthy, resilient, sustainable, and better valued Black Sea by 2030," stakeholders established short-term objectives (milestones) pertaining to essential infrastructure, policy, and technology implementation, aligning them with the SRIA pillars and themes. By 2030, emphasis should be placed on essential infrastructure, policy formulation, and technological adoption, encompassing mariculture seafloor installations, fish feed production utilising local raw materials, and the integration of cutting-edge technologies in mariculture operations. Moreover, regulatory assistance via the legal advancement of aquafarms and the establishment of a portal for fishermen could facilitate improved sector governance, while ecosystem-oriented initiatives, such as the

<sup>1</sup> In the first round of Multi-Actor Forums, which were conducted in each of the six Black Sea countries, the Blue Economy sectors were prioritized according to their significance for each country.

identification of fish spawning areas, bolster biodiversity protection. A Black Sea Hackathon could also promote regional innovation and collaboration, establishing a foundation for sustained industrial progress.

In the medium term (by 2035), regional and national strategies should focus on expanding and integrating innovative aquaculture solutions, focusing on sustainable fisheries management, organic mariculture development and responsible aquaculture investments. Technological innovations, such as storm-resistant cages, TIV collectors, and advanced monitoring systems, could bolster industry resilience, while infrastructure investments in minor port and marina development, as well as seabed mariculture installations, would facilitate industry growth. In the long term (2040-2050), the emphasis should be placed on traceability, renewable energy, and ecosystem-based fisheries management, guaranteeing adherence to global sustainability standards. International cooperation for fisheries protection, along with the establishment of traceability and certification standards will fortify the legislative framework. Sustainable techniques, like the use of renewable energy, paludiculture in coastal regions, and the growing of macrophytes, will significantly bolster environmental sustainability. Collectively, these accomplishments could establish Georgia as a regional frontrunner in the sustainable blue economy, harmonising innovation, conservation, and economic viability within the Black Sea area.

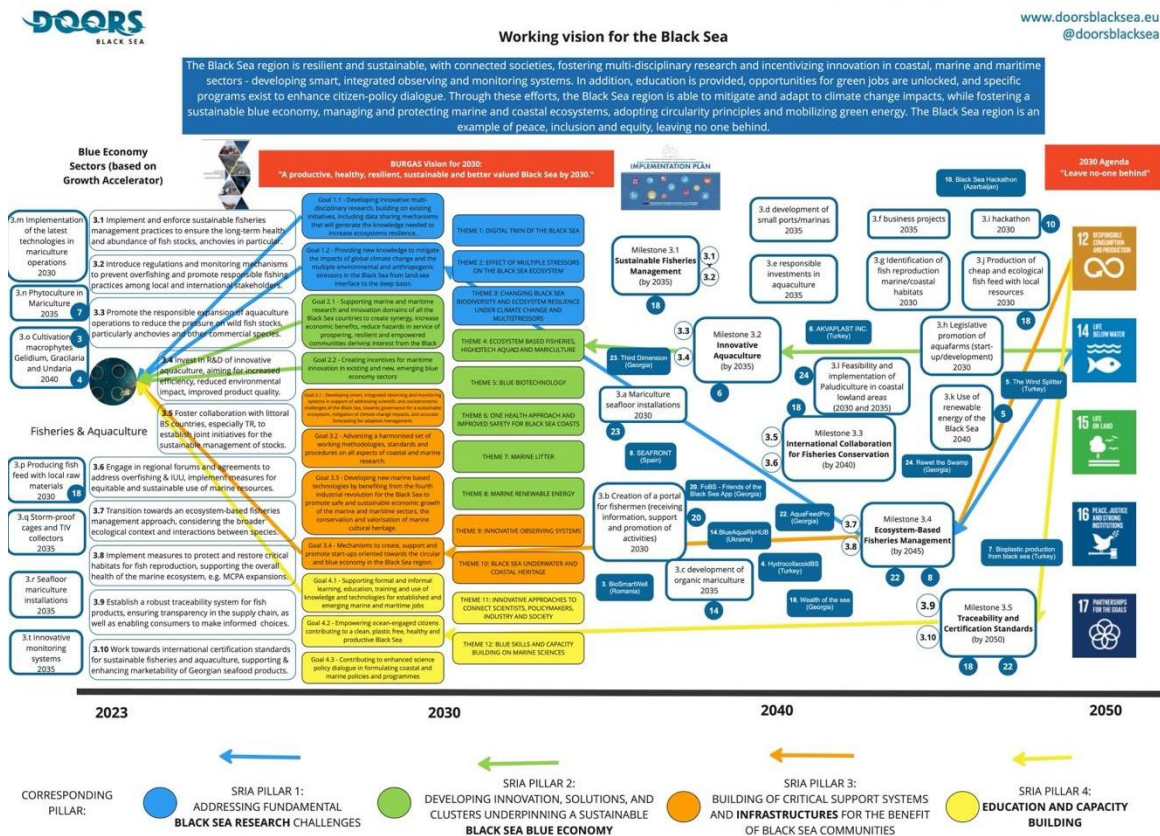


Figure 5 Innovation pathway for the Fisheries & Aquaculture sector in Georgia

During the Multi-Actor Forums, the BGA was used to align preliminary innovation milestones with concrete entrepreneurial solutions. The goal was to assess the potential of start-ups to contribute to the strategic transformation of the “Fisheries and Aquaculture” sector in Georgia and how they could be incorporated into short-, medium-, and long-term planning within the SRIA framework to bolster the Burgas Vision 2030. Startups were mapped based on their innovation nature, Technology Readiness Level (TRL), and alignment with sectoral priorities such as local value creation, ecosystem-based management, circular economy, and digital governance. Examples include AquaFeedPro, FoBS

– Friends of the Black Sea, Wealth of the Sea, AKVAPLAST INC., Bioplastic from Algae, BlueAquaReHUB, Third Dimension, Digital Village, and BioSmartWell (see Table 1). These startups were strategically mapped to the Fisheries & Aquaculture milestones in Georgia, highlighting the diversity and potential of entrepreneurial solutions to address sustainability challenges in the Black Sea region.

*Table 1 Indicative list of BGA start-ups that were selected for the Fisheries & Aquaculture sector in Georgia*

BGA Start-up	Short Description	TRL
AquaFeedPro (Georgia)	Local aquaculture feed production using circular, low-cost inputs. Mapped to long-term milestones for SRIA.	4
FoBS – Friends of the Black Sea (Georgia)	Mobile app for real-time coastal water quality data and awareness. Enhances marine engagement.	4
Wealth of the Sea (Georgia)	Cold storage and processing for Black Sea fish to stabilise supply and improve market access.	4
AKVAPLAST INC. (Turkiye)	Robust aquaculture cage systems for storm-prone marine environments, supporting innovative mariculture	5-6
Bioplastic from Algae (Turkiye)	Produces sustainable bioplastics from Black Sea algae; supports phyculture and blue biotech goals.	4-5
HydrocollacidBS (Turkiye)	Extracts agar and alginate from seaweed, fostering macrophyte-based aquaculture innovation.	5
BlueAquaReHUB (Ukraine)	Hub for organic mariculture and recreational aquaculture tourism. Supports ecosystem-based fishery innovation.	6
Third Dimension (Georgia)	Developer of seabed mariculture platforms and novel cage technologies for sustainable aquaculture.	5-6
Digital Village (Georgia)	Web-based platform for marine data monitoring and environmental tracking. Supports smart governance.	4-5
BioSmartWell (Romania)	Blue biotech company creating marine-based biomaterials; contributes to innovation-led business milestones.	6

Table 2 presents the milestones and matching innovation per SRIA Pillar. When it comes to innovation pathways, a course of action within this sector aimed at comprehending and safeguarding marine ecosystems, along with SRIA’s emphasis on scientific knowledge and ecological resilience (Pillar 1), can be described as follows. By 2030, identifying marine and coastal environments for fish reproduction (S1) will advance SRIA Goal 1.1, facilitating interdisciplinary research and data-sharing essential for comprehending biodiversity trends and enhancing conservation policies. This milestone concurrently fits with SRIA Goal 1.2 by furnishing critical knowledge to alleviate the impacts of climate change and human-induced stresses, hence guaranteeing the sustainability of fisheries and the health of coastal ecosystems. By 2040, the viability and execution of paludiculture in coastal lowland regions (M1) will augment ecosystem resilience through the incorporation of climate-adaptive agriculture methods into wetland and coastal management. Further research on sustainable fisheries management (M2) supported by existing innovative solutions, such as “Wealth of the sea” or “Rewet the Swamp” both located in Georgia, combined with innovative monitoring systems (M3) and the use of renewable energy (M4) can support the resilience and mitigation of climate change in the Black Sea. The implementation of ecosystem-based fisheries management by 2045, as identified in M2, bolstered by innovations like SEAFRONT and AquaFeedPro, will facilitate a transition in fisheries governance towards a science-driven, adaptive management paradigm, thereby safeguarding biodiversity and ensuring long-term economic sustainability in the Black Sea.

Another pathway under the fisheries and aquaculture sector corresponds with SRIA Pillar 2: Developing products, solutions, and clusters underpinning Black Sea Blue Growth. The milestones

listed under this Pillar provide a linked framework that promotes the growth of a sustainable and resilient mariculture sector in the Black Sea. The foundation is set by mariculture seabed installations (S2, M11) and the use of cutting-edge technology (S3) to enable novel aquaculture (M5), such as organic mariculture (M6) and phyculture for bioplastic production (M7) by 2040. These developments help to ensure environmental sustainability and resource efficiency, notably through the growth of macrophytes (M8), which improve ecosystem services and offer raw materials for blue biotechnology. In the long run, guaranteeing traceability and certification (L2, L3) increases market trust and regulatory compliance, ensuring that aquaculture goods meet international specifications. The manufacture of ecological fish feed (S4, S5) contributes to the sector's sustainability by lowering reliance on imported feeds and maximising local resources. Solutions, such as the “Wealth of the sea”, could help transforming fish storage, processing, and distribution systems of the country. To support this expansion, small port/marina development (M9) and storm-proof cages and TIV collectors (M10) offer the infrastructure required for robust operations, assuring the industry's long-term survival. This integrated strategy promotes technical innovation, sustainability, and economic growth, establishing the Black Sea as a centre for sophisticated and responsible aquaculture.

Table 2 Mapping of the Milestones and Matching Innovations onto the SRIA Pillars for the Fisheries & Aquaculture sector in Georgia

SRIA Pillars	Short-term (2025-2030)	Mid-term (2030-2040)	Long-term (2040-2050)
Pillar 1 - Addressing fundamental Black Sea research challenges	S1. Identification of fish reproduction marine/coastal habitats	M1. Feasibility and implementation of Paludiculture in coastal lowland areas	L1. Ecosystem-Based Fisheries Management <b>Matching Innovation: SEAFRONT (Spain), AquaFeedPro (Georgia)</b>
		M2. Sustainable Fisheries Management <b>Matching Innovation: Wealth of the sea (Georgia), Rewet the Swamp (Georgia)</b>	
		M3. Innovative monitoring systems	
		M4. Use of renewable energy of the Black Sea <b>Matching Innovation: The Wind Splitter (Turkey)</b>	
Pillar 2 - Developing products, solutions and clusters underpinning Black Sea Blue Growth	S2. Mariculture seafloor installations <b>Matching Innovation: Third Dimension (Georgia)</b>	M5. Innovative Aquaculture <b>Matching Innovation: AKVAPLAST INC. (Turkey), Third Dimension (Georgia)</b>	L2. Establishment of traceability accreditation and certification in fisheries and aquaculture
		M6. Development of organic mariculture <b>Matching Innovation: BlueAquaReHUB (Ukraine)</b>	
	S3. Implementation of the latest technologies in mariculture operations (by 2030)	M7. Phyculture in Mariculture <b>Matching Innovation: Bioplastic production from algae (Turkey)</b>	
		M8. Cultivation of macrophytes Gelidium, Gracilaria and Undaria <b>Matching Innovation: BioSmartWell (Romania), HydrocollacidBS (Turkey)</b>	
	S4. Production of cheap and ecological fish feed	M9. Development of small ports/marinas (by 2035)	L3. Traceability and Certification

	with local resources <b>Matching Innovation: Wealth of the sea (Georgia)</b>	M10. Storm-proof cages and TIV collectors (by 2035)	Standards <b>Matching Innovation: Wealth of the sea (Georgia), AquaFeedPro (Georgia)</b>
	S5. Producing fish feed with local raw materials <b>Matching Innovation: Wealth of the sea (Georgia)</b>	M11. Seafloor mariculture installations (by 2035)	
<b>Pillar 3 - Building of critical support systems and research infrastructures for the benefit of Black Sea communities</b>	S6. Creation of a portal for fishermen (receiving information, support and promotion of activities) <b>Matching Innovation: FoBS (Georgia)</b>	M12. Responsible investments in aquaculture (by 2035)	n/a
		M13. Business projects (by 2035)	
	S7. Legislative promotion of aquafarms (start-up/development)	M14. International Collaboration for Fisheries Conservation <b>Matching Innovation: Wealth of the sea (Georgia)</b>	
<b>Pillar 4 - Education and capacity building</b>	S8. Hackathon <b>Matching Innovation: Black Sea Hackathon (Azerbaijan)</b>	M15. Capacity building in engineering and operational skills.	L4. Education on sustainable energy solutions for aquaculture.
	S9. Capacity building for mariculture operators on advanced techniques and automation.	M16. Education of industry players on sustainable financing and ESG principles.	L5. Knowledge sharing, joint research programmes, and transnational training.

Building Critical Support Systems and Research Infrastructures for the Benefit of Black Sea Communities (Pillar 3) is connected to several short- and mid-term milestones that create a comprehensive support framework for sustainable fisheries and aquaculture. The establishment of a portal for fishermen (S6) acts as a centralized hub for information, assistance, and promotion, improving access to resources and industry expertise. This objective can be reinforced by the FoBS innovative solution, identified in the BGA (see Table 1). This digital infrastructure is supplemented by responsible investments in aquaculture (M12) and business initiatives (M13), which promote sector growth by ensuring financial sustainability and encouraging entrepreneurship. Legislative support of aquafarms (S7) creates a legislative framework that encourages the growth of start-ups and the expansion of aquaculture operations, providing stability for industry stakeholders. On a larger scale, international collaboration for fisheries conservation (M14) ensures that regional efforts are consistent with global best practices, supporting sustainability, biodiversity protection, and long-term profitability of fisheries.

Finally, the milestones that fall under Pillar 4: Education and Capacity Building, aim to provide Black Sea communities with the skills, knowledge, and innovation-driven mentality required for a sustainable and competitive blue economy. The Hackathon (S8) encourages an environment of creativity and problem-solving by bringing together professionals, researchers, and industry stakeholders to create cutting-edge solutions to marine and aquaculture concerns. Strengthening technical understanding and developing engineering and operational skills (M15) ensures that

professionals are well-prepared to install and operate contemporary aquaculture systems. Similarly, capacity building for mariculture operators (S9) focusses on innovative methods and automation to increase the sector's efficiency and production. Aside from technical training, education in sustainable energy solutions for aquaculture (L4) and sustainable financing and ESG principles (M16) ensures that industry participants incorporate environmentally responsible and financially viable methods into their operations. Finally, information sharing, collaborative research initiatives, and transnational training (L5) promote cross-border collaboration and the exchange of best practices and innovations throughout the Black Sea area.

## 4. Discussion

A key aspect of the BSA was its alignment with broader European and regional Blue Economy initiatives, notably the CMA and the Black Sea SRIA. The integration of innovation pathways ensured that supported startups contributed to objectives such as climate resilience, circular economy principles, and sustainable marine resource management. Through engagement with multi-actor forums (MAFs), the BSA created a feedback loop where entrepreneurs, researchers, and policymakers collaboratively shaped the accelerator's priorities. One illustrative example is AquaFeedPro Georgian startup that emerged as a promising solution within the aquaculture sector. The startup addresses a critical bottleneck in Georgia's fish farming sector—dependence on costly imported feed—by proposing local, environmentally sustainable alternatives. Although still in early-stage development (TRL 4), AquaFeedPro's business model is tightly aligned with SRIA goals, including ecosystem-based fisheries and high-tech aquaculture. Its planned production facility aims to leverage local raw materials and circular production methods to reduce environmental footprint and increase competitiveness. During the second round of MAFs, AquaFeedPro was mapped to long-term innovation milestones, including the development of traceability and certification systems by 2050, demonstrating the role such startups can play in long-term sectoral transformation.

Preliminary findings from the implementation of the BSA suggest a significant impact on fostering innovation and entrepreneurship in the Black Sea region. The programme has successfully supported over ten startups, each operating in distinct blue economy sub-sectors. The establishment of a regional network of entrepreneurs has enhanced knowledge exchange and facilitated cross-border and cross-sectors partnerships. Moreover, the programme's stakeholder-driven approach has created a more inclusive innovation ecosystem, ensuring that support mechanisms extend beyond the immediate scope of the accelerator. Future rounds of business accelerators could focus strategically on milestones where few or no matching startups were identified. For instance, areas such as innovative monitoring systems, business project development, or education on sustainable financing principles showed fewer matches and could be prioritized in future accelerator calls or specialized support rounds.

## 5. Limitations

The design and implementation of the BSA has provided valuable insights in fostering innovation in the Blue Economy, however, several limitations should be acknowledged. The selection process of the Accelerator was intentionally inclusive, diverging from the highly selective nature of typical business accelerators. The decision was made in this one of its kind efforts in the Black Sea, to admit a higher number of start-ups regardless of the market readiness or the early stage of development. This strategic openness allowed for a broader representation of emerging innovations, however, it may have diluted the Accelerator's capacity to provide more individualised support. Additionally, the BSA remained heavily focused on business solutions and therefore, the innovation pathways were tailored

to the needs of the region and the feedback of Black Sea based stakeholders. Therefore, maybe other potential avenues, including research-only projects, or community-led initiatives, were not prioritised. This meant that, despite being practical for the goals of the BSA, other impactful innovations might have been excluded.

Moreover, the identification of innovation pathways, relying heavily on the input from stakeholders during the MAFs, thus being inherently subjective. The mapping of pathways reflected the stakeholders' perceptions and expectations, rather than being grounded in empirical or quantitative validation. A level of interpretive bias might have been allowed, despite the fact that this participatory process was critical to ensure the relevance and alignment with the regional and local needs. Lastly, the unique socioeconomic and environmental characteristics of the Black Sea region, played a crucial role in shaping the structure of the accelerator and the outputs. While this local identity in our activities was essential, it may limit the generalisability of the outputs to other contexts. Therefore, any replication of the BSA model would require adaptation to different regional frameworks.

## 6. Conclusions

The Black Sea Accelerator has emerged as a model initiative for bridging the gap between research-driven innovation and market readiness in the maritime economy. By integrating entrepreneurial support, stakeholder engagement, and policy alignment, the programme offers a replicable framework for fostering sustainable economic growth in emerging maritime economies. By fostering collaboration between start-ups, researchers, investors, and policy actors, the BSA laid the groundwork for a more integrated and resilient innovation ecosystem in the Black Sea. BSA, coupled with continued stakeholder engagement would be essential to building a truly transformative and inclusive blue economy in the Black Sea. The MAFs have helped tailor these collaborations to specific national contexts, particularly through the co-development of innovation pathways. These pathways act as strategic roadmaps connecting concrete business solutions to long-term policy milestones under frameworks such as the Black Sea SRIA and the CMA. This connection between bottom-up innovation and top-down governance structures is critical for building a resilient and mission-orientated innovation ecosystem in the Black Sea.

The participatory visioning process enabled by the MAFs provided a nuanced understanding of national capacities, institutional readiness, and sector-specific challenges. It allowed for the articulation of short-, mid-, and long-term priorities while anchoring innovation to real needs and policy gaps. For example, innovations in sustainable aquaculture, local feed production, marine monitoring, and blue biotechnology were strategically mapped to Georgia's national milestones for the Fisheries and Aquaculture sector.

Future iterations of business accelerators focusing on the Blue Economy in the Black Sea are suggested to focus on addressing the challenges described above through enhanced investment facilitation mechanisms.

Although some Black Sea countries, both in the EU and in partner countries, are witnessing a growing trend in investment support to wards innovative start-ups (e.g. Bulgaria, Türkiye and to some extent Ukraine), the visibility and awareness of such financing actors towards the potential return of investments in blue economy solutions remains limited. In many other cases, investment support for innovative commercial solutions remain simply beyond the radar of local financial actors and the blue economy sector is particularly neglected.

Scalability of innovative and sustainable business solutions for the blue economy in the Black Sea will depend on the availability of dedicated public grants (including guarantees), private investments and

business acceleration mechanisms. These are currently scarce across the region and within each Black Sea country, hence challenging the ability of innovative blue economy enterprises and sectoral innovative solutions providers to scale-up through time. The limited capacity of financing actors, within and across the Black Sea countries, to support start-ups and innovative business models for the blue economy remains an obstacle to the fulfillment of greater sustainable innovation potentials for the region. These gaps require urgent support.

Strengthening public-private partnerships and integrating the accelerator into larger European funding frameworks, such as Horizon Europe and the European Maritime, Fisheries and Aquaculture Fund (EMFAF), will be critical steps towards the broader vision of ensuring long-term sustainability in the region. Its emphasis on innovation pathways connected business solutions with long-term policy gaps, thus offering a roadmap for sustainable sectoral transformation.

In the absence of any EU and regional policy support, for example through the follow-up of the Black Sea Synergy<sup>2</sup> initiative by EU External Action Services, the risk is that the high potential being showcased through the support provided via the BSA will remain untapped, with negative consequences in terms of increasing stressors for ecosystems and limited return in GVA and quality jobs for coastal communities across the region.

In order to support the legacy of the BSA, a dedicated grant could be considered, aiming to coordinate national financing actors (potentially) interested in supporting innovative blue economy solutions for the Black Sea. Working at each Black Sea country level, and coordinating regional cooperation amongst such financing ecosystem, would allow to raise overall awareness, availability and capacity of financing support.

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<sup>2</sup> [https://www.eeas.europa.eu/eeas/black-sea-synergy\\_en](https://www.eeas.europa.eu/eeas/black-sea-synergy_en)

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