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MAKING WAVES: AN INVESTIGATION OF PORTUGAL'S BLUE ECONOMY

Exploring areas of improvement and opportunities in the Entrepreneurial Ecosystem *by Greta Pfiz*

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Abstract

This thesis is a comprehensive exploration of the imperative to enhance ocean health, aligned with the United Nation's Sustainable Development Goal 14, which advocates for the sustainable utilization of oceans, seas, and marine resources. Rooted in the emerging concept of the Blue Economy (BE), the thesis underscores the BE's commitment to achieving economic growth while safeguarding a robust ocean ecosystem. It builds on prior literature recognizing the pivotal role played by sustainable entrepreneurs in fostering innovation, nature preservation, and livelihood support. The study focuses specifically on the recent emergence of blue entrepreneurship, addressing marine environmental challenges through entrepreneurial activities. Delving into the Portuguese entrepreneurial ecosystem (EE) and blue startups, the research employs a qualitative approach with 16 interviews involving industry, startup, and investor experts. Key insights emerge, highlighting the significance of entrepreneurial education for marine scientists, fostering collaboration between science and business students, and establishing a supportive regulatory framework. Ultimately, this thesis makes a substantial contribution by analyzing existing barriers and opportunities in the Portuguese Blue Economy, providing actionable guidelines for blue entrepreneurs.

Keywords: *Blue Economy, Blue Entrepreneurship, Portugal, Entrepreneurial Ecosystem*

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List of Abbreviations

BE : Blue Economy	5
BEn : blue entrepreneurs	7
BPF: Banco Português de Formento	27
EE : Entrepreneurial Ecosystem	7
EIF: European Investment Fund	27
SDGs : Sustainable Development Goals	5
VC : Venture Capital	6

Group Part

1 Introduction to the concept of blue economy and its potential in Portugal

A healthy ocean is the foundation for sustaining planetary life, providing oxygen, and absorbing carbon dioxide while supplying us with food and livelihoods (Thomson, 2022). However, the current state of the ocean is degrading, evidenced by a 30% increase in acidity since pre-industrial times, as outlined by the United Nations Sustainable Development Goals (SDGs). Further, marine plastic pollution has surged at alarming levels, exceeding 17 million metric tons in 2021, while persistent overfishing exacerbates biodiversity loss. (Sustainable Development Goals Report, 2023)

These challenges have unprecedented impacts on marine life and ocean health. Consequently, a sustainable ocean-based economy is crucial for mitigating emissions, strengthening food security, and safeguarding biodiversity (Ocean Panel, 2022). In line with Goal 14 of the SDGs, which is devoted to conserving and sustainably using the oceans, the World Bank conceptualizes the Blue Economy (BE) as the “sustainable use of ocean resources for economic growth, improved livelihoods and jobs while preserving the health of ocean ecosystems.” (UN Sustainable Development Goals, 2023; World Bank, 2017).

Considering the vast economic opportunities the ocean offers, experts have a growing consensus to use it sustainably (Sumaila et al., 2020). Thus, the concept of the BE revolves around the sustainable exploitation of oceanic resources that ensures economic advancement while protecting the ecosystem (Dharmapuri Tirumala & Tiwari, 2022).

Avenues for exploration include advancements in innovative technologies and the commercialization of novel products and services, including marine renewable energy or bioproducts derived from marine bioresources (Jesemann, 2020; Dijkstra et al., 2022).

Especially startups and entrepreneurs stimulate the growth of the BE since they - in contrast to established firms - show flexibility in applying radical approaches, providing them with a unique advantage in developing innovative solutions and commercializing untapped niches (Dijkstra et al., 2022; Lüdeke-Freund, 2019).

Prior literature argued that sustainable new ventures catalyze sustainable development by creating innovations that enable positive change (Wöhler & Haase, 2022). Despite the urgency of sustainable innovation within the ocean economy to achieve SDG 14, raising finance still poses a challenge, especially for sustainable startups (Fichter et al., 2023, Gast et al., 2017). Thus, previous research stressed the importance of establishing appropriate funding mechanisms to support the growth of the blue economy (Shiiba et al., 2022). Venture capital (VC), as recognized by previous scholarly works, plays a pivotal role as a funding mechanism for sustainable development (Bocken, 2015; Krosinsky, 2017). Further, an investor report by BlueInvest highlighted that VC contributed to most of the equity-funding rounds within the European BE and thus displayed an inclined interest to invest in the blue economy (BlueInvest, 2023).

Although the ocean is an essential economic driver for the EU's economic growth (European Commission, 2020), a funding gap of approximately 60 to 70 billion euros remains in Europe. While a strand of literature has investigated the reasons and impediments for traditional VC or VC with a sustainability focus to invest in green startups (Wöhler & Haase, 2022; Bocken et al., 2015), there is a scarcity of literature exploring the factors that influence whether blue startups successfully secure funding from VC or not. Hence, this study aims to extend existing research by closely examining the dynamics between investors and blue entrepreneurs (BEn). It aims to examine the specific criteria and requirements investors consider when making investment decisions for blue ventures.

Regarding the prospects for blue economy investments, Portugal is among the countries perceived as most attractive within the EU (Blue Invest, 2022). Stressed as a “fundamental component of Portugal’s development strategy” by former Prime Minister Antonio Costa, the blue economy has been flourishing within the country in recent years (Portugal.Gov.PT, 2023; Direção-Geral de Política do Mar, 2023). The National Ocean Strategy Plan 2013-2020 seeks to unlock the economic potential of the Portuguese maritime territory, promote blue growth, and strengthen the country’s capacities to turn Portugal into a leading maritime nation (National Ocean Strategy, n.d.)

Corroborating these efforts, this study seeks to investigate the entrepreneurial ecosystem (EE) within which blue ventures operate in Portugal. The concept of EE, established by previous literature, posits that entrepreneurs do not act in isolation but are influenced by external driving forces (Wurth et al., 2022). Thus, scholarly work has outlined the substantial impact of environmental conditions, including policies, support programs, funding, culture, and infrastructure, on entrepreneurial activities (Stam & van de Ven, 2019; Geurrero et al., 2020). Building upon this concept, this study concentrates on the mechanisms influencing the growth of blue entrepreneurial initiatives within Portugal.

Further, in a more detailed exploration, the research delves into the dynamics between blue startups and investors, seeking to comprehend the strategies how blue startups can effectively secure funding.

The remainder of this paper is structured as follows. Section 2 reviews the existing literature on entrepreneurial ecosystems, blue entrepreneurship, and funding mechanisms. Section 3 describes the methodological approach. Sections 4 and 5 present empirical results and discuss the outcome of the primary data collection and analysis. Section 6 concludes the analysis, highlights limitations, and provides avenues for future research.

2 Literature Review

2.1 The Concept of Blue Economy

The dual challenge of ensuring the sustainable use of natural resources while achieving economic and social objectives has been a central concern for the global community since the 1960s (Eikeset et al., 2018). Nonetheless, BE is a nascent term that only recently gained popularity when the concept emerged in 2012 at the United Nations Convention on Sustainable Development (UN, n.d). Although varying definitions are created by different organizations and entities (Sumalia et al., 2020), they collectively plead for an approach that contemplates the interplay between environmental health, economic activities, and social well-being to realize sustainability. Thus, applying the definition of the World Bank as stated above, this study refers to the concept of the BE as the sustainable use of marine resources to achieve economic growth, improved livelihoods and jobs while ensuring a healthy ocean ecosystem.

Acknowledging the seas and oceans as drivers for the European economy with promising potential for innovation and growth, the EU Blue Growth Strategy emphasizes sustainable growth in the marine and maritime sectors, including emerging sectors such as Renewable Energy, Biotechnology, Coastal Maritime Tourism, Aquaculture and Mineral Resources and traditional sectors like Shipbuilding & Ship repair, Transport, Fisheries, and Offshore oil & gas (European Commission, 2017). All these sectors have a remarkable carbon footprint and directly influence the aquatic ecosystem. Thus, an overarching BE strategy intends to evaluate and mitigate the cumulative impact of these sectors and foster synergies (Ababouch & Carolu, 2015).

2.2 The concept of sustainable blue entrepreneurship within the blue economy

As the development of the BE continues to be a global priority, the emergence of entrepreneurs active in the BE has witnessed significant growth in recent years (Dijkstra et al., 2021). This surge aligns with the broader trajectory of sustainable entrepreneurship, a subject of sustained scholarly interest since the inception of the 'green' or sustainable entrepreneurship concept in the last decade (Terán-Yépez, 2019), indicating a consistent growth in academic attention.

Central to the discourse on sustainable entrepreneurship is the overarching notion that entrepreneurs play a crucial role in preserving nature and supporting livelihoods (Sheperd & Patzelt, 2011). By using innovative technology or institutional solutions, sustainable entrepreneurs not only gain a competitive edge but also address environmental and social challenges simultaneously (Haldar, 2019). Consequently, entrepreneurship is increasingly perceived as a potential solution to environmental degradation rather than a contributor to it (Munoz & Cohen, 2017).

This evolution from general sustainable entrepreneurship to a more specialized domain is exemplified by the emergence of blue entrepreneurship. Differentiated from green entrepreneurship, blue entrepreneurship encapsulates entrepreneurial activities specifically dedicated to addressing marine environmental challenges (Dijkstra, van Beukering, & Brouwer, 2022; Habip & Doğan, 2022). Sustainable blue entrepreneurs and startups aim to transform ecological challenges into economic opportunities, reflecting a commitment to the principles of the Blue Economy (SwitchMed, n.d.).

Moreover, prior literature underscores the paramount role of sustainable entrepreneurs in advancing both development and environmental sustainability. Their transformative nature proves instrumental in driving improvements across industries, marked by the introduction of new technologies and business models (Burch et al., 2016). This transformative impact

positions startups as niche innovators, propelling momentum toward more sustainable systems and compelling incumbent entities to adapt (Hörisch, 2015; Kemp et al., 1998).

Acknowledging the importance of entrepreneurial activities in advancing sustainable development and innovation, previous studies delve into the essential role of ecosystems that facilitate the creation and growth of new ventures (Spigel, 2017).

2.3 The concept of entrepreneurial ecosystems

The theory of entrepreneurial ecosystems (EE) originated in the 1980s and 1990s, marking a paradigm shift in entrepreneurship studies by moving away from individualistic and personality-based research to a more comprehensive community perspective. This approach includes the role of social, cultural, and economic factors in entrepreneurial processes. (Aldrich 1990; Nijkamp 2003; Steyaert and Katz 2004) Thus, the literature outlined the critical influence of environmental conditions on entrepreneurship and growth (Urbano, 2019). Consequently, the entrepreneur is not perceived as an agent who acts in isolation but is part of a broader social, cultural, and institutional model. Previous literature described ecosystems as shaped by various factors, including local cultural perspectives, social networks and support mechanisms, investment and human capital, universities, and economic policies within a particular territory (Isenberg, 2011). Combining these elements can create an environment that nurtures the growth and evolution of innovative ventures (Spigel, 2017). Hence, the EE is an attempt to explicate how system conditions impact the actions of entrepreneurs in creating value (Stam, 2015).

By scrutinizing the factors that impede or drive entrepreneurial activities within a system, Guerrero et al. (2020) ascertained that conducive conditions include professional support, incubators and accelerators, networking, and investments. Further, Nabi et al. (2018) highlighted the importance of educational programs in fostering entrepreneurial activities and cultivating an entrepreneurial mindset across early levels of the education system. In

addition, Stam & van de Ven (2021) underscored that supply and finance accessibility are vital for small firms' survival and growth within an ecosystem. Conversely, unfavorable conditions involve lacking funding sources, challenging labor market conditions and social norms (Guerrero et al., 2020).

Emphasizing that these elements should not be evaluated in isolation, the literature suggests to examine these factors' collective and interconnected roles to gain insights into how they contribute to creating a conducive entrepreneurial ecosystem (Stam & van de Ven, 2021).

Due to the absence of a one-size-fits-all model for entrepreneurship, previous literature argued that regional or national nuances and different types of economies should be considered when evaluating EEs (Roudy et al., 2018). This approach enables a more nuanced comprehension of the varied factors and contexts impacting entrepreneurship.

Previous literature has employed the EE concept to examine the circular entrepreneurial ecosystem in Portugal, investigating how entrepreneurs navigate challenges when establishing circular businesses (Rocha et al., 2023). However, to the author's knowledge, studies have yet to apply the EE concept to explore the conditions for blue venture creation. Therefore, aiming to contribute to research on EE in specific territories and its impact on innovation and venture building, this study seeks to adopt the EE concept to investigate the BE in the Portuguese context. The objective is to contribute to the existing literature by delving into the set of factors enabling productive entrepreneurship applying the core principles of EE to the unique context of blue entrepreneurship in Portugal.

2.4 Funding as a critical factor in the entrepreneurial ecosystem, with a focus on private funding mechanisms (VC)

In the realm of EE, startups' survival and growth rely on specific conditions, with funding emerging as a pivotal factor in the success of young enterprises (Stam and van de Ven,

2021). A broader perspective from the World Economic Forum (2013) highlights the interconnectedness of startups' growth trajectories with simplified access to finance.

Financial backing becomes imperative for ensuring the long-term sustainability and responsible management of the ocean economy, aligning with BE objectives that underscore the critical role of financing innovation (Nham & Ha, 2023).

In the broader context of sustainable entrepreneurship and specifically within the BE, sustainable entrepreneurs face significant obstacles, with intense competition for funding from traditional sources acting as a significant barrier to the development of ventures (Bento et al., 2019; Calic & Mosakowski, 2016; Dijkstra et al., 2022). This sets the stage for the exploration of alternative funding sources, particularly the role of VC, as extensively discussed in recent literature.

VC emerges as a key player in funding innovative projects for sustainable ventures (Khan et al., 2021). Its potential as a catalyst for startups is underscored by empirical research, which highlights its role in overcoming the "valley of death" phase characterized by a shortage of financial resources (Savaneviciene et al., 2015). Beyond financial support, VC is recognized for its unique characteristics, such as long-term commitment, value added expertise, investor protection, reputation and influence (Lin, 2022). These traits make it well-suited for fostering sustainable startup investments (Lin, 2022), playing a crucial role in facilitating the commercialization of cutting-edge science and accelerating sustainable innovation (Bocken et al., 2015).

However, despite the promise of VC, the EU Blue Economy Report points to a significant financing gap in the BE sector (Addamo et al., 2022). This funding gap is identified as a major obstacle to ventures' consolidation and a primary barrier hindering entrepreneurship (Mambula and Sawyer, 2004; Guerrero et al., 2020). Efforts to meet funding targets outlined

in SDG 14, "Life Below Water," have fallen short with only 25% of the funding targets set for 2020 that have been reached by 2022 (World Economic Forum, 2022), necessitating a search for potential solutions through an examination of financing methods and instruments (Thompson, 2022).

Recently, Europe, and more specifically Portugal, has witnessed the emergence of dedicated funds seeking to exploit all the benefits derived from the BE. However, Dijkstra et al.'s (2022) research revealed that BEn face difficulties securing funding in the competitive investment environment. Beyond asymmetrical information, as reported by Canton et al. (2013), BEn's limited understanding of the overall funding process and the criteria chosen for investment decisions complicate venture growth prospects.

Therefore, an in-depth analysis of the dynamic between investors and startups becomes imperative. Such an examination will equip BEn with the necessary insights and tools to secure investment effectively, allowing them to capitalize on future opportunities within the evolving BE landscape in Portugal. This strategic approach is intended to positively contribute to the overall growth of ventures in the BE sector.

3 Methodology

3.1 Research Design & Data Collection Methods

Given the relatively nascent status of the BE and the intricate landscape of the Portuguese blue ecosystem, a qualitative research approach is deemed pertinent. This methodology facilitates the acquisition of in-depth insights, allowing for a comprehensive understanding of the current state of the BE in Portugal and the various factors influencing investment decisions within this sector (Williams & Moser, 2019). The research design uses 16 semi-structured interviews with industry experts who represent diverse perspectives, including those of ecosystem stakeholders (3 experts), 7 investors, and 6 startup professionals as depicted in Table 1.

Table 1

Description of anonymized expert interviewee

Expert Types	Role	Company Description
Investor 1	Investment Analyst	Independent Venture Capital firm specializing in global technology companies
Investor 2	Investor	Investment firm focuses on startups in the pre-seed, seed, and series A stages, specializing in diverse sectors
Investor 3	Co-Founder and Managing Partner	A biotech-focused venture capital company, investing in early-stage companies across Europe
Investor 4	Founder and General Partner	Venture capital firm engaging in Series Seed or Series A investments, specializing in startups with technology differentiation
Investor 5	Chairman and Investor	Co-investment fund leveraging private investment in high-growth startups
Investor 6	Investment Analyst	Investment firm dedicated to sustainable investment, emphasizing sustainable development expertise as a central element in their investment strategies
Investors 7	Managing General Partner	Venture capital firm investing in tech and ocean related startups. Supporting scalable high tech and sustainable companies.
Entrepreneur 1	Founder	Software Company specializing in 3D CGI-like applications for Audio Post Production across various entertainment mediums
Entrepreneur 2	Founder	A sustainable seafood company employing innovative aquaculture techniques to cultivate high-quality bivalve species
Entrepreneur 3	Founder and CFO	A biotechnology company specializing in the discovery and early development of new pharmaceutical drugs derived from marine compounds.
Entrepreneur 4	Founder and CEO	A biomedical innovation company dedicated to introducing smart technologies to the Orthotics and Prosthetics market.
Entrepreneur 5	Founder	A company advancing marine restoration with oyster reefs
Entrepreneur 6	Founder	A company developing green antifouling solutions
Industry Expert 1	Director General	Maritime Policy within a Governmental Department at the National Level
Industry Expert 2	Strategic Advisor	Blue Biotech Hub Project from Governmental Institutions
Industry Expert 3	Secretary-General	Entity recognised by the government, responsible to increase the importance of the BE in the economy of the specific country

These interviews are thoughtfully crafted to delve into the nuances of the Portuguese blue ecosystems, aiming to uncover both the existing challenges and opportunities. Thus, the questions of the interview guide were created based on literature findings and gaps, and then tailored to the interviewees' field of expertise. Simultaneously, the interviewers seek to understand the funding process for blue startups, unraveling the methodologies and criteria VCs adopt in their decision-making when considering investing.

Furthermore, the research endeavors to shed light on the entrepreneurial journey, elucidating the paths undertaken by entrepreneurs as they navigate the EE in the Portuguese context. Structured around open-ended questions, these interviews are designed to facilitate the collection of nuanced and detailed data, drawing from a spectrum of viewpoints (Saka & al., 2023).

3.2 Sampling method

A purposeful sampling method was employed to ensure that participants possessed pertinent insights into the Portuguese BE ecosystem. This method entails selecting participants based on specific criteria to ensure their suitability for addressing the research questions (Saka et al., 2023). While applying standard criteria such as geographical location (participants based in Portugal) and language proficiency (fluent in English), tailored criteria were devised to align with the distinctive characteristics of ecosystem stakeholders, investors, and startups. Specifically, niche startups and those dedicated to sustainable blue initiatives were exclusively chosen, with a deliberate focus on founders and CEOs to tap into their wealth of firsthand experience. Regarding VCs, engagement with investment analysts from traditional and specialized firms was selected to explore the similarities and divergences in their investment decision-making processes. Lastly, industry experts affiliated with Portuguese governmental organizations supporting the BE were contacted to secure insiders' perspectives on the dynamics and intricacies of the ecosystem.

3.3 Data Collection Procedures & Ethical Considerations

Participants were reached through various channels, including professional networks, industry organizations, and academic institutions. These diverse recruitment sources enhance the representation of insights and perspectives within the study.

Furthermore, creating and utilizing interview protocols (see Appendix A, B and C) tailored to the specific characteristics of the three distinct participant groups (industry experts, investors, startups) played an essential role in guiding the interview process.

These protocols were procedural guides for conducting interviews, providing a structured framework that guaranteed consistent and reliable data collection (Jacob & Furgerson, 2012).

The interview protocols were developed in an iterative manner to ensure that the data collected directly addressed the research objectives and questions. Creating these protocols involved a comprehensive review of relevant literature, which helped identify key research themes and topics for exploration. In the next step, a pilot interview guide was written with open-ended questions to facilitate discussions on these themes, allowing for in-depth participant responses. After testing the pilot guide during our first interviews, an improved guide was developed using the interviews' learnings.

Each interview protocol was structured to incorporate ethical and purposeful data collection. Commencing by obtaining informed consent from participants. Clear and comprehensive information about the study's purpose, participants' rights, confidentiality assurances, and the voluntary nature of participation was provided. Participants were explicitly informed about the recording of the interview and were asked for their explicit consent before proceeding. Additionally, the protocols outlined core research themes and topics, strategically aligning the discussions with the overarching research objectives. This

meticulous approach ensured that the interviews delved into the key areas of interest, fostering a focused exploration of the predetermined research themes.

3.4 Data Analysis and Coding

The oral interviews were transcribed using real-time AI transcription software (Otter.ai, n.d.). The subsequent analysis employed coding techniques based on the methodology outlined by Stuckey (2015). The process involved open, axial, and selective coding to systematically sort, organize, and derive theories from the gathered information. This coding approach facilitated the creation of coherence by assembling pieces of information, ultimately leading to a comprehensive understanding of the findings (Williams & Moser, 2019). The identified key themes were organized and presented in Tables 2 and 3 in the appendix.

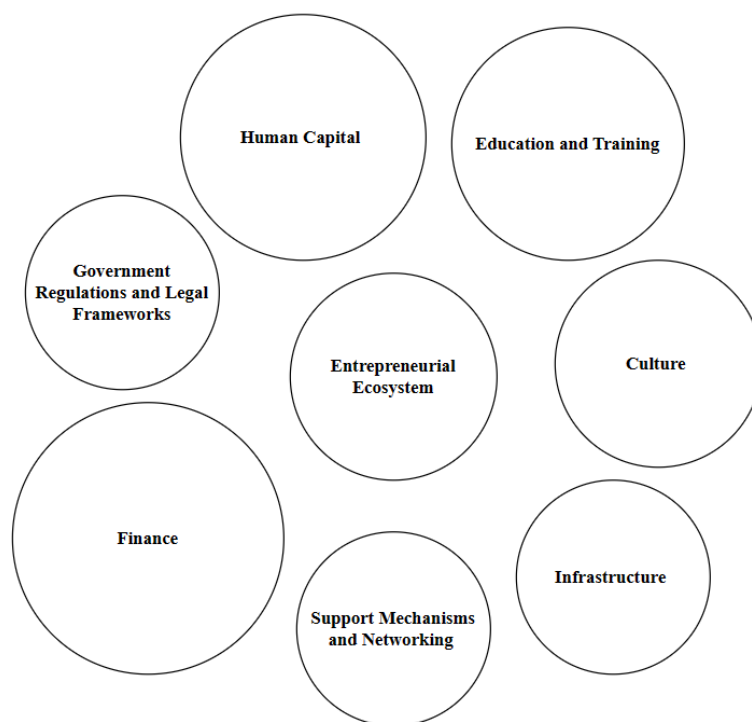
3.5 Data Presentation

The following section provides a snapshot of the current state of the BE ecosystem in Portugal, examining the areas of improvement and opportunities for its development.

4 A snapshot of the blue entrepreneurial ecosystem in Portugal: Exploring areas of improvement and opportunities – by Greta Pfiz

The following section employs the analytical framework (see Figure 1) to delineate the barriers and opportunities for blue venture growth in Portugal’s entrepreneurial ecosystem identified in this study. It incorporates the role of external factors encompassing social, cultural, and economic forces to comprehend their impact on blue entrepreneurship development in this region. Thus, this section aims to answer the following research question: “How does the entrepreneurial ecosystem in Portugal shape the development of blue entrepreneurship?”. Further, subsequent sections connect the interview findings to existing literature.

Figure 1: *Factors influencing the entrepreneurial ecosystem*



Note. Size indicating importance of theme during interviews.

4.1 Areas of improvement for the actors in the ecosystem

4.1.1 Human Capital

The Global Ocean Science Report of 2020 highlighted the pivotal role of human resources in ocean science enterprises to propel research and innovation. It thus recognized the growing importance of the human factor when establishing a thriving BE. Further, Portugal displays a strong presence in the field of ocean science with more than 300 employed ocean science researchers per million inhabitants. Hence, Portugal is second in Europe in this regard, following Norway. (Isensee, 2020)

However, despite the emphasis from many interview participants on the quality of education in Portugal, particularly in academic and scientific domains, they didn't overlook another critical aspect of successful BE endeavors - entrepreneurial knowhow. Thus, a nuanced perspective emerged, revealing that scientists, including those specializing in fields like marine biology, may not inherently embody the ideal entrepreneurial profile.

While the interviewees perceived scientists as potentially suitable for founding a blue startup, they also acknowledged the scientists' lack of the skills and motivations needed to manage a company. Therefore, the interviewees noted that Portugal showcases a high quality of scientists that can contribute to the development of the BE but still needs to cultivate blue entrepreneurs. As one interviewee mentioned, "We do have great scientists with deep knowledge of the processes of the ocean, and there is a lot of investment in training these people. But when it comes to translating this knowledge into value or commercially viable solutions, Portugal falls short. So, there is still a gap here in training. We have very high-quality human resources, so we have great scientists, but we don't have great blue entrepreneurs." (Industry Expert 1)

The narrative gained depth as another participant highlighted the challenge, emphasizing the scarcity of blue entrepreneurs and the predominance of scientists with an academic orientation. This sentiment was captured by Entrepreneur 2, "There are plenty of scientists, but they often

lack a business mentality; they are academic-minded people. There are very few blue entrepreneurs who possess the managerial business skills to transform an idea into a successful company. So, I think Portugal has plenty of scientists, a good amount of technical people, but very few blue entrepreneurs, blue business-minded people."

In addition to that, the resistance of scientists to tap into the field of entrepreneurship further hampers blue venture development. Scientists find comfort in their roles as researchers or professors and, thus, may not perceive an urgency to make amendments to their career trajectory. As expressed by Industry Expert 1, "There is still some resistance of the human resources I would say, people who are doing marine biology, they are not entrepreneurs by nature."

4.1.2 Education and Training

Although Portugal can pride itself on a plethora of highly educated scientists, inadequate funding for scientific education presents a persistent issue. Consequently, students often need to seek academic development abroad, exposing a need to acquire essential infrastructure from labs in foreign countries. As the participant highlighted, "We are sending students abroad to other labs to learn, hoping that some of them will come back to populate the ecosystem in the long-term." (Industry Expert 2). This need to send talents abroad for academic development poses an obstacle to nurturing the next generation of scientists within the country.

When delving deeper into the entrepreneurial dimension of human resource needs, it became evident that entrepreneurs are often not trained to operate within a specific scientific field, such as the marine biology sector. Their formation at business schools is interdisciplinary and broad, thus potentially lacking the opportunity to form a direct link to the specific requirements of running a business in scientific niches, including the BE. "The entrepreneurial ones are in the business schools, and most of them have broad business training rather than specializing in a

specific sector. And maybe that is the target, not necessarily us, who are marine scientists, but those who are business trainees, that need to be trained afterwards in the different colors of the economy, you know, green economy, blue economy, and so on.” (Industry Expert 1)

While there was consensus among the experts regarding the aim of adapting education systems to enhance blue venture creation, they diverged in their opinion on which academic disciplines should be subject to modifications. While some experts highlighted the need to bring science-based entrepreneurship courses closer to business students, others stressed the importance of introducing entrepreneurship courses in scientific fields of study. Thus, Investor 7 stressed “Ultimately, it’s everything about management, right? Everybody needs to know management. Business students do not need to know science, they can always get a specialist. But management is at the center.”

Furthermore, for business students aiming to gain experience in scientific fields, the interviewees mentioned that pursuing this ambition can be challenging due to the limited number of scientific companies operating within Portugal. It was emphasized that experiential learning and obtaining practical experiences are important for following a career path in scientific fields like the BE. A professional shared his journey, stating, “I worked several years in science-based companies, which are not my fields, and I learned how to work with these kinds of people. And because of that, I started my company, which is a science-based company. [...] My experience was in Switzerland; in Basel, plenty of science-based companies exist. There, it is easy to acquire that knowledge. But in Portugal, that is very difficult.” (Entrepreneur2)

Moreover, the connection between the worlds of scientists and entrepreneurs still needs to be stronger. It is crucial to create more contact points between business and science students throughout their education. At the present time business students stay within their domain and the same applies to scientists. During the interviews, it was highlighted that this circumstance

requires more communication and collaboration between these two worlds. “I don't see this bridging of gaps between scientists and entrepreneurs happening in Portugal [...]” (Entrepreneur 2).

However, the interviewees noted that for blue venture success, forming a skilled team of scientists and entrepreneurs is crucial. That underscores the importance of unifying talents from different backgrounds to form highly skilled teams for venture development in the BE.

4.1.3 Entrepreneurial Culture

A discernable attitude that surfaced during the interviews is that Portugal lacks the necessary cultural mindset necessary to foster entrepreneurial endeavors. It was highlighted that perceived economic and political stability factors impact the willingness to take risks and engage in innovation. External factors, including socioeconomic consequences resulting from the Covid crisis and the war, adversely affect the inclination to take risks.

A prevailing belief is that limited state budget resources and competing priorities have constrained the allocation of funds to nurture innovations. Industry Expert 1 expressed this: "The state budget is limited. And there are other priorities like health. There was COVID; after that, there was a strike here. Financially speaking, Portugal was in a bad state for a few years, and then COVID came. Now it's the war. It is always a question of political will."

In addition, it was observed that entrepreneurship, hence starting one's own business and embracing risks, is less prevalent in Portugal. One interviewee noted, “In Portugal, we don’t have an entrepreneurial culture. In Europe, it is normal to create a company, but here in Portugal, it is not that easy. We are developing and improving but don’t have that culture yet. Here in Portugal, we don’t like risk” (Investor 5). The reasons for this are partly the failures of past entrepreneurs trying to build a business in the BE, coupled with a need for more support mechanisms in the early stages of venture development. Consequently, from the interviews, the

impression arose that the confluence of historical setbacks and the absence of robust support structures throughout the venture development cycle has created a challenging landscape for fostering entrepreneurial initiatives in Portugal.

“I think being an entrepreneur is not as attractive as it used to be. There have been some harsh failures, which inhibited some people from taking risks, like my own company closing. There have been some examples of how hard it is, and as I told you, it is much more comfortable to be an academic in marine space than it is to be an entrepreneur. And for as long as this is true, maybe we will not shift that much” (Industry Expert 1).

Moreover, participant insights elucidated that risk aversion not only stems from the entrepreneur side but extends to the investor side. The underlying concept of investing in innovation, for instance in the ocean space, to contribute to economic and scientific development has only recently taken hold in Portugal. As one participant stated, "Portugal is way behind other parts of the world that have realized that investing in innovation, entrepreneurship, venture capital, and so on works. Portugal has no tradition of true investments in innovation until recently. The ocean has always been there. But the notion that you can invest in innovation and take risks, invest in startups, make them work, and change a country based on that is not old in Portugal " (Investor 5).

4.1.4 Support mechanisms and networking

Throughout the interviews, the link between risk aversion and the presence of adequate support mechanisms became apparent. Interviewees accentuated that, in contrast to the past when no acceleration program specifically focused on the BE existed, there are now multiple specialized programs in Portugal. Despite notable strides in the ecosystem to foster blue venture growth and advance support, interviewees mentioned the necessity for a paradigm shift in how ventures obtain support, stressing the importance of a long-term focus and continued guidance.

“I think the accelerators are in a stage where you probably need to shift the paradigm of just accelerating massive numbers of companies and then leaving them on their own to actually doing more long-term campaigning and mentoring” (Industry Expert 1).

In addition, it is essential to establish initiatives that can reach widespread participation and foster collaboration, promoting support on a larger scale. Instead of introducing more initiatives alongside the existing ones, the key is to enhance the current ones, emphasizing expanding their support mechanisms to reach critical mass. These initiatives need to be designed in a way that they can ensure support at various maturity stages of the startup.

“I think there is kind of a movement that has not yet given very strong results. Currently, everything is very scattered. There are only a few initiatives. Something that is big scale in Portugal, that does not exist yet” (Investor 5).

“I believe that work needs to be done at several stages for the majority of the startups, and one way to look at this is to empower the existing programs at a very early stage and then add new programs on stages that are a bit more developed. [...] There is no intention of cannibalizing anything; quite the contrary, .” (Industry Expert 2).

Furthermore, concerning the propensity to network, one investor noted that networking is not prevalent among scientists. While he noticed that tech entrepreneurs have the drive to reach out, travel and make new connections, he recognized that he is “not sure if scientists know how to reach out to others that have built entrepreneurial ventures” and that leads him to think that “if you are not smart enough to reach out and ask the right questions, then you don’t deserve to have capital ” (Investor 7). That clearly shows the importance of providing training to scientists on effective networking and connection-building, which is necessary for obtaining the support and capital needed to establish their ventures. Moreover, it highlights the significance of the internal drive within the entrepreneur to achieve success.

4.1.5 Infrastructure

The interviewees emphasized the crucial role that apt infrastructure plays in facilitating the development of the blue economy. By providing platforms and space that allow for prototyping and testing intricate, innovative solutions, the risk burden can be effectively alleviated for entrepreneurs, as expressed by Industry Expert 2: “Provide lab space, specialized lab space to have technical platforms to provide services for these companies with high-end equipment and an expertise that would kind of de-risk the process of development and doing prototyping and testing at smaller scales before the industrial scale”.

While these infrastructures do not exist to date, the interviewees mentioned the progress happening in Portugal, with the establishment of the so-called "blue hubs" being built in port areas. Thus, the Hub Azul network integrates seven different Innovation Hubs across various regions in Portugal, contributing to the country's infrastructure development. The main objective of these hubs is to accelerate the decarbonization and digital transformation of the BE in Portugal, to turn the nation into a leader in science-based ocean governance (Hubazul, 2023).

4.1.6 Government and Regulatory Framework

A recurring theme during the interviews was the regulatory landscape in Portugal and the governmental regulations that are currently in place. Participants highlighted the need for a supportive regulatory framework to navigate legal constraints. For instance, challenges in retrieving marine resources were attributed to a lack of full regulation and cumbersome involvement of multiple entities, which leads to confusion about how to obtain access to these resources. To date, entrepreneurs working with marine bioresources face a complex situation concerning access and licensing. Thus, one interviewee mentioned that currently, “Licensing it’s a nightmare and the processes are badly built” (Industry Expert 3). He pointed out that numerous authorities are involved in the process of acquiring licenses, and the workflow is

uncertain with no specified deadlines for the authorities to give answers. That indicates the pressing need for regulatory reforms that streamline these processes. Participants stressed the importance of making regulatory and licensing processes more predictable and faster. Simplifying these processes is deemed crucial to attract businesses, streamline approvals, and facilitate the operational aspects of the marine sector.

"We need to create a framework that is supportive of business development in the sector. Getting access to marine resources is not fully regulated. There is a lot of confusion about how to get this, you need to involve too many entities. It is a big mess for an entrepreneur who wants to work with marine bioresources. Both on the access side and the licensing side as well, too many entities" (Industry Expert 2).

Furthermore, while participants acknowledged the availability of public funding schemes, the challenges in obtaining these were highlighted. Hence, interviewees raised concerns about the time and bureaucratic processes involved in receiving grants from the government. It was emphasized that the time the government takes to disburse grants builds bureaucratic hurdles, and thus, the need for streamlined funding processes for improved startup support was underscored.

"Funding can also be from grants. The challenge here is not so much to obtain the grants; it is actually the time the government takes to pay the grant to the startups and all the bureaucracy to obtain the grants, which takes time and resources from the startup" (Entrepreneur 2).

4.1.7 Funding

Discerning the funding prospects for blue venture startups within the Portuguese entrepreneurial ecosystem, interviewees recognized notable shifts in equity funding. They affirmed that, in contrast to the past, the investment landscape has evolved, leading to the emergence of specialized funds dedicated to supporting startups operating in the blue economy. Recent developments, such as the program Portugal BLUE launched in October 2020, enforce

the equity funding dynamics, focusing on climate impact and SDGS in Portugal. Thus, Portugal BLUE, a collaborative effort of the European Investment Fund (EIF), the Banco Português de Fomento (BPF), and the Portuguese government, aims to increase blue economy investments by attracting private capital through VC and private equity funds. (EIF, 2021)

These transformative initiatives undertaken are echoed in the observations of industry insiders. As Investor 1 highlighted, he observed a clear development in the past decade, stating, "I started to look into the BE in 2010, and at the time, there was no funding for this sector. However, in the last years, I have seen the appearance of several venture capital funds dedicated to the BE." However, he also noticed that "this change has been very recent" (Investor 1). Emphasizing the recent nature of this occurrence, Investor 2 confirmed that "There have been very few funds until recently" and that "tech-intensive blue startups still suffer from a general lack of equity sources of funding here in Portugal."

While several interviewees acknowledged the previously mentioned shifts in the funding landscape, the perception of the equity funding landscape as premature persisted. Hence, Industry Expert 1 evaluated venture capital at stage four out of ten, recognizing that "we have a bigger understanding of the venture capital industry" and that "there are different sectors with different needs, including deep tech, life sciences, blue biotech. So, there are some specialized investors." Nonetheless, the participant stressed the need for diversification of the funding ecosystem to be compatible with the varied needs of startups in different stages.

When scrutinizing the availability of funding across different funding stages of the venture cycle, it was observed that most investors aim to invest in growth startups. One participant noted that "a large group of investors wants to invest in growth, so series A upwards, but startups do not reach that funding phase. There is a need for a kind of funding with a more long-term perspective to fund companies that are in a very, very early stage because the majority of companies in the sector are still in the pre-revenue stage. Growth is still far away." (Industry

Expert 2). Adding to this point, another participant concluded that “there is a decent number of investors for Series B, that would be close to revenue. Very, very few for Series A, and almost none for the early stage. If that is the case, the pipeline of new companies will remain very small because obviously you need to fund early-stage to get to Series A and Series B.” (Entrepreneur 2)

Additional comments echoed concerns about the depth and scale of venture funds in Portugal. Thus, a general lack of depth and scale was brought to attention, hampering blue startups’ access to funding. The analogy of a *chicken and egg situation* was invoked, where “on the one hand, we could argue that there is a sufficient number of funds given the available investment opportunities.” But alternatively, it could be reasoned that “an increase in capital and funds might potentially lead to the creation of more investment opportunities as people are encouraged to create more startups” (Investor 2).

Beyond the quantity of specialized funds available, additional comments were made on the size of investments. As noticed by the participants, “the problem is that volume is very small [...]” and “the capital available in Portugal is lower than you would see abroad” (Investor 1).

One participant further emphasized the unmet need to achieve critical mass to induce transformative change since “currently everything is very scattered. There are only a few initiatives. But something that is really big scale in Portugal, that does not exist yet” (Investor 5).

Throughout the interviews, it became apparent that the current lack of capital in various funding stages is intricately linked to the sector’s complexity and high initial costs. As one interviewee noted, for instance, “Tech tends to be much easier to fund, and you see a lot more tech funds around the world, just because it requires so much less capital to become a success” (Investor 1). Another interviewee added that she believes “it is a tougher sector than others like IT. IT is cheap, it is just yourself, a computer, and some hardware, and you can do a business, an online

business, and things like that. Whenever it is blue, so whenever it is in the ocean, it is tough per se, a hard environment to work in, and there is a high cost there” (Industry Expert 1).

The smaller funding sizes within Portugal demand startups to go abroad for subsequent rounds of funding since “they are not going to raise a subsequent round at a much higher valuation with a much higher level of funding in Portugal,” as mentioned by Investor 1. However, one startup founder shared his difficulties in attracting investments from abroad. The prevailing sentiment was that for foreign investors, startups in emerging fields like blue biotech, with a limited track record, are not perceived as promising investment opportunities. He conveyed the prevailing perception among investors “Okay it is interesting, but it is in Portugal.” And added, “(...) I think in Europe, everything is so close, but we are still a little bit far away here in Portugal (...), it’s easier for them to invest in Germany and France, rather than Portugal” (Entrepreneur 3).

The advice for startups to seek subsequent rounds in foreign countries, coupled with the perceived hurdles in attracting foreign investment funds because of geographical considerations, emphasizes the need to enforce the appeal of Portuguese blue startups on the global stage.

The lack of private capital for funds is an issue spread over Europe and especially prevalent in Portugal. During the discussion with one investor, it became evident that “in Europe, we have a very social system. A lot of money is concentrated in the state, and state pension funds do not invest in technology or science. So, a big part of the capital in Europe is frozen and will not get into science and innovation.” He thus advocated for more private capital, which is more flexible without stringent conditions (Investor 7). That succinctly encapsulates well how the lack of private money is not only a country wide but a continentwide issue, which hampers innovation due to inflexibility and strict criteria for investment from public funding sources.

4.2 Opportunities for the ecosystem

This section addresses potential solutions that aim to advance the future expansion of blue ventures within Portugal. Hence, it highlights critical opportunities conducive to promoting blue entrepreneurship by building upon insights from diverse stakeholders operating within the ecosystem. Beyond elucidating existing challenges, the interviewees offered discerning perspectives on avenues that can contribute to the development of blue entrepreneurship. This section aims to chart a pathway forward by analyzing the interdependent roles of different agents in the ecosystem and highlighting strategic initiatives and cooperative efforts that might lead Portugal to a more resilient and sustainable blue entrepreneurial environment.

4.2.1 Education and training resources

When asking the respondents how Portugal might solve the lack of blue entrepreneurs, one typical response was that more needs to be done to provide scientists with the fundamental knowledge and abilities needed to run a business. The focus was to incorporate business and entrepreneurship courses into scientific fields of study at an early stage. Beyond enabling students to acquire essential scientific knowledge, the aim is to ensure they develop a clear vision of a career path encompassing entrepreneurial endeavors. Thus, one interviewee suggested “to train the next generation of scientists with a much more entrepreneurial perspective, teaching students in a much more applied way. So, we need to make sure that within their basic training, entrepreneurship and business are incorporated.” This endeavor can be enforced by “making sure that some of these people actually do their thesis in companies and not just the basic research environment” (Industry Expert 2). Moreover, to ensure that scientists are exposed to business, one investor was suggesting that scientists should have entrepreneurship courses that are obligatory in science-based fields of studies, stating that “They should have a fixed subject. It is not an option. You must do it. Otherwise, you don’t

graduate. If you do not want to create a company, that is fine – do the subject and forget about it. But you have to understand how that world works” (Investor 7).

Further, it was suggested that "several initiatives and training programs should be introduced to bring business schools and sciences together" (Industry Expert 2). In this manner, the system can bridge the previously mentioned gap between the scientific and entrepreneurial fields and thus foster a network of more vital collaboration. This notion was enforced by the proposition to foster strong collaboration through joint projects or collaborative problem-solving initiatives. Hence, one interviewee suggested that “it is all about getting businesspeople and scientists into contact and making them work together on a concrete solution, which could be a training setting, like a project or a case study, or in a real business context. But they should be able to work together, so they will learn how to speak to each other. And by doing so, they can build bridges between the two worlds” (Entrepreneur 2).

Further building on the idea of bridging gaps and bringing different parties together, the interviewee suggested, "We need to find a way to integrate platforms, which can build a bridge between scientific research, entrepreneurs, and investors. This is something that is not in place yet." Enforcing this connection is pivotal for advancing innovation and entrepreneurial initiatives in the blue economy since “there is much so-called blue research in the universities and research centers, that is not translated into a business idea. This means no entrepreneur takes this idea and creates a startup. And then, there is no obvious link with investors that can fund that startup. This is not trivial because these are worlds with very different people not used to speaking with each other, and sometimes might not even like to speak with each other, because they are so different.” (Entrepreneur 2).

4.2.2 Support mechanisms, infrastructure, and culture

During the interviews, it was highlighted that enhancing the efficacy and quantity of support mechanisms and improvements in the provided infrastructure can reduce risk aversion among entrepreneurs, advancing an environment more conducive to innovation. Notably, the discussion emphasized the concept of “failing without fear”, with one interviewee advocating the reinstatement of programs that existed in the past. Thus, she mentioned that “we had a program called entrepreneurship passport many years ago (...), and this was a very safe instrument for entrepreneurs because it allowed them to test an idea. If you fail after one year, nobody will charge you anything.” (Industry Expert 1)

Furthermore, the interviewees underscored the relevance of adequate infrastructure, particularly in an investment-intensive sector characterized by high initial costs attributed to expensive infrastructure. Ongoing initiatives aimed at establishing blue hubs, centers, and labs play a pivotal role in driving entrepreneurial endeavors. They allow entrepreneurs to develop and test solutions without incurring substantial financial losses. As highlighted by Industry Expert 1, “We will have bioreactors in Lisbon for large-scale production. No single entrepreneur will invest in doing that. But many entrepreneurs could use these shared facilities to test and develop, and that is the reason, it is to de-risk again, the investment.” This underscores how collaborative spaces can mitigate financial risk, enabling multiple entrepreneurs to benefit from shared resources and infrastructure for testing and development.

4.3.3 State support, regulatory framework, and funding

During the interviews, a common theme was the importance of simplifying processes to reduce bureaucratic hurdles and thus provide a conducive environment for businesses. Thus, one interviewee stated that there is a need to “make the regulatory and licensing processes more predictable and faster.” (Entrepreneur 2)

Further, to enhance investor confidence and create a more attractive environment for companies, it was stated that creating a more competitive legal framework is crucial. This was underlined by a participant, stressing that “if you do have a competitive legal framework, it is a huge competitive advantage for any company, and then investors will want to be in that sector.” (Industry Expert 2)

Concerning funding opportunities for blue entrepreneurs engaged in projects and ventures, emphasis was placed on the need to stimulate private capital. According to Investor 7, current regulations are focused on wealth preservation and not wealth creation. Thus, “Any sort of institutional investor cannot put more than 2% of the assets under management into alternative illiquid assets.” Hence, “Portugal is very conservative (...) and there are several rules across Europe, which disincentives to invest in venture capital and other asset classes.” Consequently, an opportunity to increase investments in venture capital could be to introduce laws and frameworks in Portugal that incentivize more private capital. For instance, one Industry expert noted that “companies, pre-revenue companies could have tax benefits. The non-habitual residence agreement, which will continue for people working in value added and research sectors, is a huge advantage. Due to this agreement, instead of paying 40% tax on income, beneficiaries of this agreement will pay 20%. That is a huge incentive. A synergy of incentives, when thoughtfully organized within a structured framework, can create an extremely interesting environment for most investors and startups.” (Industry Expert 2)

Thus, current efforts ignited by Fórum Oceano (Portugal’s BE Cluster), to establish the Hub Azul Dealroom, a platform that is built to connect matching startups and investors profiles, is an important initiative to connect blue economy projects with potential funding sources (HubAzul Dealroom, 2023).

4.3 Discussion

Exploring the intricate dynamics of external factors, including cultural, social, and material forces, is crucial to understanding the impact of entrepreneurial ecosystems on regional economies. In accordance with prior studies, which view EE as systems constructed with interconnected components (Roundy et al., 2018), the interviews revealed the interdependencies between the elements that enable successful blue venture development.

First, it can be noted that, in line with previous research, interviewees highlighted the importance of skilled human capital, apt to start businesses within the BE. Consistent with the claim of Spigel (2017), the findings underscore the significance of achieving the optimal blend of technical skills and entrepreneurial expertise for a team of blue entrepreneurs. Hence, entrepreneurs equipped with risk tolerance and business acumen are vital to ensure the development of blue ventures. The outcomes clearly show that even if the human capital in Portugal is classified as highly skillful concerning their technical expertise, more entrepreneurial support is needed to transform technical, innovative solutions into commercially viable outcomes. The National Ocean Strategy Report 2013-2020 (Direção-Geral de Política do Mar, 2020) stresses the importance of recognizing and enhancing the qualifications of the skilled workforce in numerous sea-related activities. While ensuring a proficient skill set related to the sea is crucial to development and innovation in this field, it is essential to recognize the need to integrate this technical expertise with business skills.

That connects with the argument of Guerrero et al. (2021) that underlines universities' pivotal role in fostering entrepreneurship. Consequently, Portuguese universities could enhance their commitment to prioritizing entrepreneurship in the educational programs of scientific fields. Thus, in line with the findings of Nabi et al. (2018), which argued that entrepreneurial education programs lead to increased entrepreneurial intentions and inspirations, the findings of this study suggest that obligatory entrepreneurial courses could present a potential pathway to inspire

science students to embark on entrepreneurial ventures. Moreover, to foster growth in blue entrepreneurship, students enrolled in business schools at the higher education level should have the chance to learn about the blue economy and its potential opportunities.

Contrary to Rocha et al. (2023) perception that entrepreneurship in Portugal has experienced a notably positive evolution, partially attributed to the increased propensity to take risks, the findings of this study ascertain a lower willingness to take risks among blue entrepreneurs. That challenges blue venture creation since a conducive culture for entrepreneurship is a fundamental pillar within an entrepreneurial ecosystem (Isenberg, 2008). The perceived lower willingness to take risks among blue entrepreneurs could stem from the complexity and higher initial costs attributed to blue ventures, in contrast to, for instance, IT startups. Therefore, creating adequate infrastructure is vital to de-risk entrepreneurial endeavors, especially in the early stages. Thus, current efforts to establish and invest in national coastal infrastructure hubs, which provide access to laboratories, testing areas, prototyping spaces, and pre-and industrial scale-up facilities, are essential to attract and foster entrepreneurship (Recuperar Portugal, 2022).

Even though the equity funding landscape is transforming, induced through initiatives like Portugal BLUE, interviewees repeatedly emphasized the challenges of securing funding. Despite the growing maturity of agents within the blue entrepreneurial ecosystem and the increasing number of specialized funds for supporting blue ventures, further efforts are required to establish funding opportunities for early-stage blue entrepreneurs. Particularly, since more capital and investment inside the ecosystem carries the potential to attract more talent to become part of the entrepreneurial community, including individuals from outside the region (Roundy et al., 2018).

Intermediaries, including incubators and accelerators are vital components in the entrepreneurial ecosystem, providing mentorship and support to startups and early-stage businesses (Theodoraki et al., 2022; Guerre et al., 2021). The critical nature of these

intermediaries was also underscored during the interviews, with consensus on the efforts made to institute accelerators and incubators. However, the interviewees agreed that the efficacy of the support could be further augmented, envisioning more long-term support and mentorship.

Group Part

5 Conclusion and Implications

Given the urgency to contribute to the growth and development of the BE to ensure the sustainable use of oceanic space and marine resources, it is deemed essential to foster environmentally conscious entrepreneurial activities. Recognizing Portugal as “one of the most attractive countries for BE investments due to its coastal advantage and abundant marine-based economic opportunities” (Blue Invest, 2023), the aspiration is to gain a leading position concerning sustainable blue venture creation.

Within this context, this research study aimed to comprehensively explore the environment that influences the growth potential of the BE in Portugal. Based on qualitative research, conducting

semi-structured interviews with industry experts, the study unravels the web of external factors – educational, cultural, legal, infrastructural, and funding – that shape the path of blue ventures in Portugal.

Concerning the relatively frequently mentioned factor of skilled human capital influencing blue venture development, it is suggested to consider the essential role of entrepreneurial programs, which can synergize technical know-how and business acumen. Building on the efforts anchored in the National Ocean Strategy, which stresses the importance of education and professional training, this study suggests extending programs and initiatives that encourage entrepreneurial activities for sustainable ocean management within business schools and scientific academia.

Concerning the cultural setting that impedes entrepreneurial activities due to risk avoidance, this study recommends extending accelerator programs focusing on long-term mentoring. Further, more initiatives can be implemented to help transition from a university project to an actual business model. These programs can be designed over several months to ensure continued guidance that nurtures entrepreneurial confidence.

The findings suggest that the current legal framework results in lengthy licensing processes due to the involvement of multiple entities. Hence, building an attractive legal framework that allows streamlined processes is deemed essential and boosts startup founders' and investors' confidence. In addition, tax incentives for sustainable blue companies can increase the appeal of venture creation in the blue economy.

First and foremost, building a diverse team with technical and business expertise is crucial for success, as venture capitalists prioritize the managerial experience of entrepreneurs in uncertain markets. This involves not only advising scientists to seek partners with a business background and vice versa but also advocating for universities to foster courses with collaborative group projects intentionally incorporating students from various programs. This proactive approach

fosters early-stage collaboration, preparing individuals to work seamlessly together in the dynamic landscape of entrepreneurship.

Overall, this thesis contributes to the development of the Portuguese BE, providing a precise analysis of the current barriers and opportunities within the blue ecosystem in Portugal.

5.1 Limitations

The selected research method leaves some limitations that need to be acknowledged, and efforts have been made to address these constraints. The chosen research method, involving 16 semi-structured interviews, engaged only about 25% of the experts initially contacted (16 out of 60). This limited sampling size may hinder the complete representation of the BE landscape in Portugal, complicating generalization. The authors chose experts with diverse industry knowledge for the interviews to ensure multiple perspectives within the Portuguese BE sector. While these interviews aimed to collect nuanced data for a holistic understanding of BE's trajectory, future research could enhance robustness by expanding the sample size to include a broader group of BE experts in Portugal.

Further, the interview format poses a potential limitation, introducing subjectivity and social desirability bias into data collection. This bias can impact response interpretation, questioning nuances, and interview rapport, potentially distorting data (Fisher, 1993). Despite efforts to minimize this limitation through strategies establishing confidentiality, anonymity, and rigorous data analysis, future research may explore alternative methodologies, such as peer debriefing or triangulation, to enhance the robustness of qualitative investigations.

Moreover, the dynamic nature of the BE, shaped by evolving policies, market trends, and environmental factors, poses a challenge within our four-month timeframe. This limitation may yield a static snapshot, not fully capturing the dynamic nature of the topic and providing findings only relevant to the present. Recognizing this constraint, we recommend that future research adopts a longitudinal approach, tracking the evolution of the BE sector in Portugal

over time for a more comprehensive understanding of changes. This approach enhances the validity of findings, allowing for the validation or refinement of our present observations (Ployhart & Vandenberg, 2010).

5.2 Future Research

This research provides opportunities for further investigation into the Portuguese BE sector. Subsequent studies could focus on specific external factors influencing the BE industry in Portugal. For example, an in-depth investigation might analyze the Portuguese educational and training system to establish guidelines and programs bridging the gap between science and business students, thereby enhancing the professional qualifications of the future workforce in the BE. Another potential area is a detailed examination of the legal and regulatory framework for the BE in Portugal, identifying limitations and proposing strategies to streamline the framework for blue initiatives, ultimately enhancing Portugal's appeal to investors. Additionally, a comparative study with a leading European country in the BE sector, such as France or the Netherlands (BlueInvest, 2023), could provide insights into best practices, offering valuable lessons for Portugal. These diverse investigations have the main objective of contributing significantly to the growth of the BE in Portugal.

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Appendix A: Interview Guide with Industry Experts

Background:

- Can you tell me more about your background, your experiences and your touchpoints with the blue economy?

Evolution of the Blue Entrepreneurship Ecosystem:

- How have you observed the evolution of the blue entrepreneurship ecosystem in Portugal over the years?
- Are there any notable trends, developments, or shifts in the ecosystem that you have noticed?

Opportunities for Accelerating Involvement:

- What are the key opportunities that have the potential to accelerate the involvement of entrepreneurs in the blue economy in Portugal?
- Are there specific sectors or niches within the blue economy that offer particularly promising opportunities?

Quality of Human Resources:

- How would you describe the quality of human resources available for the advancement of the blue economy in Portugal?
- What skills and expertise do you believe are essential for individuals working in this sector?

Maturity of Ecosystem Agents:

- Could you provide insights into the maturity of key ecosystem agents such as venture capital firms, incubators, accelerators, and associations in Portugal that support the development of blue entrepreneurship?
- Do you think these ecosystem agents are adequately meeting the needs of blue entrepreneurs?

Startup Culture and Risk-Taking Behavior:

- What can you tell us about the prevailing startup culture within the blue economy in Portugal?
- How do entrepreneurs in this sector typically approach risk-taking and innovation?

Challenges Regarding Involvement:

- What are the primary challenges that entrepreneurs face when trying to become involved in the blue economy in Portugal?
- Are there any regulatory, financial, or market-related obstacles that stand out?

Potential Solutions to Overcome Challenges:

- In your opinion, what are some potential solutions or strategies to address the challenges identified in the blue entrepreneurship ecosystem?
- Are there specific initiatives, policies, or collaborations that could be beneficial?

Appendix B: Interview Guide with Investors for semi-structured interviews

Introduction Questions:

Position in the company:

- Could you briefly introduce your role within your company and share some insights into why you decided to follow this career path?
- What are the core responsibilities associated with your role, and what are your day-to-day objectives?

Firms' philosophy and investment approach:

- Can you describe your firm's overall philosophy and approach to investment?
- Can you describe how your firm has arrived at its current investment focus?

Core Questions: Investment criteria

Identification of potential startups and criteria for investment:

- How does your firm identify potential investment opportunities, and could you describe the methods or processes used?
- When assessing the potential of a startup, what criteria and factors are typically taken into consideration?
- Are there specific criteria or attributes that carry more weight in your investment decisions? Could you elaborate on the ones that play a significant role?

Ideal Profile of investment decisions:

- Can you describe the ideal profile of a startup that your firm is interested in investing in?
- How do you assess the management team and founders of a startup before making an investment decision?
- Are there any specific factors or conditions that would definitely refrain you from investing in a specific startup?

Risk assessment and return:

- When selecting startups for investment, how does your firm manage risk, and what are the primary risk factors that you consider?

Core Question: Challenges and risks / Barriers

Risk and challenges

- What are some of the risks or challenges you have faced during your past investments?
- What strategies do you employ to overcome these risks and promote more investment?

Barriers for investing

- What are the primary barriers or challenges to investing in your domain?
- How do regulatory and policy issues impact investment decisions in your view?

Core Question: Success and failure startups

Measure of success

- How do you define success when it comes to investments in startups?
- If applicable, could you share examples of startups in your portfolio that achieved success? What contributed to their success/why were they successful?

Startup Failure

- Can you provide examples of startups in your portfolio that were not successful or not able to reach scale? What led to their failure/why were they not successful?

Core Question: Outlook

- Could you please share your perspective on the future of investments and highlight any significant trends you consider essential or emerging in this landscape?
- How do you envision the role of venture capital funding in shaping the future of sustainable development?

Ending Questions

- Is there anything else that you would like to address, or do you think it is important to address that hasn't been brought up during this questionnaire regarding the funding challenges of entrepreneurs?

Appendix C: Interview Guide with Startups for semi-structured interviews

Introduction about company, position and career path

- Could you provide a brief introduction of yourself and your role at *Company*, as well as an overview of your company's mission and activities?
- What impact did sustainability play when you were choosing your career path?
- How is it growing now? How many employees does your company have?
- What is very novel about your business model, where do you see your competitive edge or unique selling point?
- How does *Company* balance between profit maximisation and environmental sustainability, and can you share any specific strategies or initiatives you have undertaken in this regard?

Core Questions: Funding journey

- Do you receive external funding, and what motivated you to seek external support?
- Where do you get funding from and how did you identify this funding source?
- How much investment did you raise per investor? And in which funding stage are you currently in?
- Can you share more details about the overall journey of securing funding for *Company*?
- How would you describe the process of finding a suiting investor/funding source?
- What lessons have you learned from your funding experiences that you would share with other startups?

Questions: Investor support

- Can you describe the ways in which your investor(s) have contributed to the development and execution of your business, beyond providing financial support?
- How did investor support help you in achieving your sustainability goals?
- Can you provide examples in what ways investor support has contributed to your success?
- How has investor collaboration influenced your decision-making and operational processes within *Company*?
- What key insights or best practices have you gained from your experiences in collaborating with investors which you believe would be valuable for other startups operating in the blue economy sector?

Core Question: Barriers in the funding journey

- Did you face any challenges or obstacles during the funding process, and how did you overcome them?
- From your perspective, what factors do you believe motivated investors to support *Company*? What do you believe investors are looking for?
- Did you get rejected from investment, and can you pinpoint what led to this rejection?
- Are you currently missing investments? How sufficiently did your investment cover your needs?

Ending Questions

- Is there anything else that you would like to address or you think is important to address that hasn't been brought up during this interview?
- Is there anyone that you think could help us in our research? Would you be willing to connect us with further contacts in your network?
- Do you have any comments, observations, or criticism regarding the interviewing process?

Appendix D: Description of anonymized expert interviewees

Expert Types	Role	Company Description
Investor 1	Investment Analyst	Independent Venture Capital firm specializing in global technology companies
Investor 2	Investor	Investment firm focuses on startups in the pre-seed, seed, and series A stages, specializing in diverse sectors
Investor 3	Co-Founder and Managing Partner	A biotech-focused venture capital company, investing in early-stage companies across Europe
Investor 4	Founder and General Partner	Venture capital firm engaging in Series Seed or Series A investments, specializing in startups with technology differentiation
Investor 5	Chairman and Investor	Co-investment fund leveraging private investment in high-growth startups
Investor 6	Investment Analyst	Investment firm dedicated to sustainable investment, emphasizing sustainable development expertise as a central element in their investment strategies
Investors 7	Managing General Partner	Venture capital firm investing in tech and ocean related startups. Supporting scalable high tech and sustainable companies.
Entrepreneur 1	Founder	Software Company specializing in 3D CGI-like applications for Audio Post Production across various entertainment mediums
Entrepreneur 2	Founder	A sustainable seafood company employing innovative aquaculture techniques to cultivate high-quality bivalve species
Entrepreneur 3	Founder and CFO	A biotechnology company specializing in the discovery and early development of new pharmaceutical drugs derived from marine compounds.
Entrepreneur 4	Founder and CEO	A biomedical innovation company dedicated to introducing smart technologies to the Orthotics and Prosthetics market.
Entrepreneur 5	Founder	A company advancing marine restoration with oyster reefs
Entrepreneur 6	Founder	A company developing green antifouling solutions
Industry Expert 1	Director General	Maritime Policy within a Governmental Department at the National Level
Industry Expert 2	Strategic Advisor	Blue Biotech Hub Project from Governmental Institutions
Industry Expert 3	Secretary-General	Entity recognised by the government, responsible to increase the importance of the BE in the economy of the specific country

Appendix E: Barriers and opportunities for the blue venture development

	Barriers	Opportunities
HUMAN CAPITAL AND EDUCATIONAL PROGRAMS	> Lack of blue entrepreneurs, deficiency in the presence of blue entrepreneurs, notable absence of business acumen and drive among scientists to manage a company effectively. > Reluctance towards entrepreneurial pursuits among scientists, preferring the familiar confines of academia and research environments where they are more comfortable. > Collaboration deficiency between scientists and entrepreneurs, discernible gap between scientists and entrepreneurs, even during academic studies.	> Introducing obligatory entrepreneurial programs in scientific fields of studies to help students understand entrepreneurship, and providing them with the knowledge and skills needed to build a company > Introduce more science-based entrepreneurship courses in business schools > Make it more attractive for students to work in the industry, for instance by creating collaborative master thesis projects with science-based companies > Facilitate collaborative projects that bring together science and business students. Establish platforms designed to connect and foster collaboration between students from scientific and business disciplines.
Culture and support mechanisms	> Risk aversion and lack of entrepreneurial culture. > Limited networking endeavors among scientists wanting to create a company	> Creating long-term guidance and support programs throughout all stages of the venture development cycle
Infrastructure	> High end equipment needed which leads to high costs for testing and developing prototypes	> Creating the adequate infrastructure, for instance the construction of bio reactors in Lisbon. Providing specialized lab space for entrepreneurs to de-risk their product development processes.

Government and Legal	>Regulatory challenges persist in the incomplete oversight of accessing marine resources, characterized by intricate processes involving numerous entities. > Entrepreneurs face uncertainties as the acquisition of access and licenses lacks proper regulation, with authorities lacking defined deadlines for providing responses. > Delays in government grant disbursement to startups and bureaucratic hurdles in obtaining these grants contribute to prolonged processing times.	> Creating a legal framework that is supportive of business development by streamlining workflows, making the regulatory and licensing processes more predictable and faster. > Competitive framework with lower income tax for companies and investors.
Finance	> Lack of equity funding sources, very few private venture funds leading to limited capital for innovation and science development. > More funding in later stages of the venture development cycle, Series A or Series B. Lack of funding for early stage startups. > Wealth preservation mentality over wealth creation mentality. Limited propensity to take risks	> Introduce laws and incentives for investors, establish an incentive plan for the private sector to invest in VC. > Establish more specialized funds