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Building a Digital Infrastructure for Blue Economy Investment Through FinTech

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Abstract: The sustainable blue economy represents a critical yet underfinanced frontier in global climate and biodiversity governance. Despite its potential to drive inclusive growth and ocean resilience, investment flows into marine and coastal sectors remain fragmented, opaque, and institutionally constrained. This article examines how financial technology (FinTech) innovations can build a digital infrastructure to mobilize and govern blue economy investments effectively. Using a mixed-method framework that integrates case studies of digital blue bonds, blockchain-based traceability systems, and artificial intelligence-driven impact assessment platforms, the paper develops a conceptual model for a digital blue finance infrastructure. The model highlights the interoperability between tokenized financing instruments, distributed ledger verification, and data analytics for transparent monitoring of marine investment outcomes. Empirical findings suggest that FinTech-enabled systems can significantly enhance accountability, reduce transaction costs, and attract blended capital into sustainable ocean projects. Furthermore, the study situates digital blue finance within emerging global policy frameworks such as the EU Sustainable Finance Strategy, the United Nations Ocean Decade, and the Association of Southeast Asian Nations blue finance initiatives. By linking FinTech architecture with environmental governance, the paper contributes to both sustainable finance theory and practical innovation design. It argues that digitalization is not merely a financial enabler but a structural catalyst for scaling equitable, accountable, and climate-aligned blue economy investments.

Keywords: blue economy finance, FinTech innovation, tokenization, sustainable ocean investment, digital finance infrastructure

1. Introduction: Digitalizing the Blue Economy Finance Ecosystem

The blue economy, which includes the sea and its resources, fisheries, aquaculture, shipping, tourism, and ocean-based renewable energy, is no longer part of the outer discourse in policy, but rather part of sustainability politics [1]. Being an economic growth and ocean stewardship, the blue economy will bring beneficial jobs, food sustainability, climate gains and solutions, and biodiversity safety [2]. It is never fulfilled in an even manner; on the one hand, the conceptual momentum has been established (in the policy circles, the multilateral strategies and donor programs), and on the other, the transference into the large-scale and responsibility investment has not yet been reached.

Initially, the reasoning stems from the oceanic ecosystem, and subsequently, human livelihoods and economic reliance invest in a multiplicity of capital and distributed economies, including port resilience and offshore renewable energy ventures, communal-level aquaculture, and systems in management of marine-protected areas [3]. Unlike most other green projects on planet earth, however, ocean projects are usually associated with complex risk profiles (physical climate risk, regulatory risk, enforcement risk, and biodiversity trade-offs), long payback and benefits whose sides are not linked directly [4]. The characteristics render it unsuitable for traditional commercial finance that favors fungibility, short-term, and apparent security. The result is chronic underfinancing: the potentially high-impact blue projects cannot raise debt and equity at scale, the publicly funded budgets have limited space, and the blended finance techniques cannot create a mechanism for presenting bankable pipelines. This finance gap has been described in detail and is a key focus of any policy or technical intervention, as the issue of finance of the blue economy is not only a problem of scale but also a problem of the design of instruments, risk distribution, and trust.

Second, the blue economy possesses several international regimes (ocean law, fisheries agreements, biodiversity instruments), regional policies, national marine policies, and local customary systems, which overlap but lack a consistent focus point of identifying the impacts, the responsibility of stakeholders, or transnational capital flows [5]. Some of the consequences of such a breakdown include informational asymmetry, whereby investors cannot get credible and comparable information on how they perform environmentally, and regulators are faced with challenges of interpreting different and/or inadequate reporting guidelines. There is also the marginalization of local rightsholders. It is also the conquering aspect of filthy aftermaths that even the threat of such a trans-regional fragmentation of government can even be able to elevate the ecological emptiness or the social injustice even more. Hence, high intensity of attitude to scaled blue finance must react immediately in technical

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financing patterns and institutional structure that propagate legitimacy, examination, and fair intervention of good [6].

Third, financial technology (FinTech) may be a game-changer enabler—not a panacea. Specific pain points are remediable with the help of digital finance technologies (tokenization, distributed ledgers, smart contracts, artificial intelligence (AI) analytics, Internet of Things (IoT) monitoring, and open application programming interfaces), which have constrained blue investment in the past [7]. The huge infrastructure will be tokenized in such a way that the small investors will have an opportunity to be involved in the process and improve the liquidity. The blockchain registries could create the use of proceeds and result provenance, which are immutable and lower the price of validation and information asymmetry. The IoT sensors will be able to generate real-time data on the ecological factors (e.g., vessel activity, water quality, yield), and the heterogeneous data will be synthesized by AI in such a way that the risks will be priced and the implications forecasted. Each of these instruments can change the structure of transacting in blue finance, cut the time-to-market, lower the due diligence cost, and build new structures of blended finance that can be more likely to reconcile the returns of the private and the common good.

But the critical eye of analysis should not blind one. Digitalization could complement the power formulation in which governance and data rights are not part of the calculation of who manages the ledger [8]. What are the criteria of confirmation, and to whom are the tokenized assets sovereign? The technology solutions may also collide with the legislation, which has never been passed based on programmable property, or where digital identity and Know Your Customer (KYC) establish principles of exclusion to the societies that live along the coast. Also, in the case of digital fixes, new systemic risks—cyber vulnerability, scoring impact bias by algorithm, and cross-border regulatory arbitrage—can be promoted [9]. In this regard, it needs to be institutionalized and framed in an inclusive manner with the purpose of ensuring that FinTech is transformative at any point in time in terms of legal coherence [10].

The key question, which has emerged to be determined in this paper, is how it is possible to develop a digital blue finance infrastructure that, on the one hand, finances on such a massive scale, and on the other hand, in no way negatively impacts the environment, social inequality, and trust among investors? It is an ideological and design-focused work as it is geared toward clarifying the legal and policy loopholes that presently exist in the block in the digital blue finance and proposing an institutional design, premised on the principles of transparency, interoperability, and accountability, which complements what FinTech can do rather than replacing the roles of governance. This introduction concludes with the statement of these diagnostic findings into research questions to be applied to represent the paper. What regulatory instruments would we be required to modify to legitimize tokenized blue assets? What way the verification regimes be aligned even among the jurisdictions and secure the rights of the communities? Which forms of governance (public–private partnerships, platform regulation, or multilateral registries) best fit the idea of liquidity and long-term stewardship? These questions are useful in the ongoing research and confirmatory model-forming of the paper as it goes through the doctrinal research.

This paper examines how FinTech-based digital infrastructure can help fill in the perennial financing gaps in the blue economy, especially in developing and coastal economies. The paper empirically examines the functions of capital mobilization, transaction costs, financial inclusion, and risk allocation of FinTech innovations through comparative case studies of mobile money-based fisheries finance schemes, blockchain-based supply chain finance platforms (Fishcoin), and blended finance models (Seychelles Blue Bond). The paper also focuses on the regulatory and institutional environment of the impact of FinTech-enabled blue finance development, with evidence-based policy implications for inclusive and sustainable investment.

Hypothesis:

The main assumption of the given study is that the development of digital financial infrastructure, including blockchain, analytics based on AI, and interoperable data systems, can significantly improve the mobilization, governance, and transparency of blue economy investments. The hypothesis here is that although blue finance has the potential to build a climate-resilient system, safeguard biodiversity, and facilitate inclusive economic growth, it is structurally underdeveloped and disintegrated in governance. It is hypothesized that digital platforms can decrease information asymmetry, decrease transaction costs, provide real-time confirmation of environmental and financial results, and increase the number of investors due to the use of FinTech innovations. The indirect claim of this hypothesis is that there exists a causal relationship between the two that a well-designed technological and regulatory integration is not facilitative but transformative and can manage systemic underfinancing and allow a scale of blue economy investment that has not been able to be reached through conventional finance and governance mechanisms.

There is a secondary, corollary hypothesis that the effectiveness of digital infrastructure in the process of stimulating investment in the blue economy depends on consistent legal, regulatory, and institutional frameworks. Although blockchain, AI, and data interoperability provide technical capability in transparency and efficiency, they are unlikely to produce any benefits in a setting where regulatory loopholes, cross-jurisdictional differences, and ineffective accountability systems exist. Thus, the research hypothesis is that the transformative potential of FinTech in blue finance is structurally contingent, and it must be aligned with normative frameworks that dictate sustainability disclosure, asset verification, and community rights. With this twofold framing of the hypothesis, that is, in terms of technological capability and regulation alignment, the study offers a doctrinal perspective of assessing the potential to systematically address both financial and governance limiters as a barrier to the blue economy by means of digital solutions.

Research problem:

Although the green finance has been growing exponentially in the last decade, the blue finance segment is in a conspicuous state of underdevelopment, technological, and institutional [11]. Although green bonds, sustainability-linked lenders, and environmental, social, and governance (ESG)-centered investment platforms have evolved in the terrestrial and energy-driven industries, ocean-based projects have also emerged [12]. Blue bonds, sustainable fisheries, marine-protected-area management, and ocean renewable energy are still in the process of overcoming serious obstacles on the way to investing [13]. Such obstacles are institutional: decentralized systems of governance, haphazard regulation, insufficient standardization of impact metrics, and intricate risk profiles deter the involvement of private capital.

In contrast to green finance, where global taxonomies, disclosure policies, and standardized markets have given clarity to the markets, blue finance has no such normative and infrastructural scaffold [14]. The result is a structural capital gap, in which potentially high-impact projects are never funded, commonly depending on small-scale donor assistance or limited government funds.

Technologically speaking, the lack of digital financial infrastructure that is suited to the blue economy is critical [15]. The growth of FinTech applications, in blockchain registries, tokenization platforms, risk and impact analytics using AI, and interoperable open data frameworks, has brought a paradigm shift to green finance, which opens more liquidity, transparency, and accountability [16]. Nevertheless, there is little empirical or doctrinal investigation of them applied to blue finance. The current literature sources focus on either (i) conventional sustainable finance activities in the terrestrial industry or (ii) isolated technological solutions without any systematic application in regulatory and institutional contexts of marine investment. Thus, there does exist a gap in the academic and practical knowledge of how digital financial infrastructure can be rallied to systematically rise to the challenges of undercapitalization and fragmented governance in the blue economy.

This paper fills this gap by theorizing a digital blue finance infrastructure, a unified legal, regulatory, and technology system expanding the mobilization of investment, accountability, and the structural shortcomings of the existing blue finance systems. The study is a powerful source in research and a constructive part, as it creates a roadmap on how to operationalize FinTech in ocean-based sustainable investment.

Research questions:

The research question is provided by the first research question: What role can FinTech systems play in creating a scalable and transparent digital infrastructural base to invest in the blue economy?

The secondary research question will be as follows: What are the governance and design attributes required to guarantee credibility, accountability, and policy compliance in digital blue finance systems?

Taken together, these questions address the nexus between technological innovation and regulatory coherence in financing a sustainable ocean-based investment.

Objectives of the study:

1) To theorize an upscaled and transparent digital infrastructure to invest in the blue economy by merging FinTech solutions (blockchain, AI, tokenization, and interoperable data systems).
2) To critically analyze the governance and design qualities that are needed to make it credible, accountable, and in line with national, regional, and international policies of sustainable development.
3) To determine and examine the legal and regulatory loopholes that limit the successful implementation of digital financial infrastructure on blue economy projects.
4) To create a normative framework, the digital blue finance infrastructure will integrate technological innovation with institutional, legal, and sustainability goals.

2. Literature Review: FinTech, Sustainable Finance, and Blue Economy Nexus

The scientific knowledge on sustainable finance has grown very fast during the last 10 years, which is supported by the following frameworks: green finance, ESG investment, and impact investing [17]. ESG impact investing considers both financial performance and measurable social or environmental performance, usually with a focus on long-term sustainability indicators [18]. Together, these frameworks have formed the theoretical and normative basis of mobilizing private capital toward environmentally and socially productive projects. Nonetheless, the frameworks are developed in the context of the terrestrial and climate-oriented spheres, yet they have not been used in the context of the oceans.

Blue finance is a thematic development of sustainable finance, acknowledging that marine and coastal resources, including fisheries, aquaculture, offshore energy, and marine conservation, need specific financial tools to enhance sustainable economic growth (Figure 1) [19]. Formalized are institutional efforts to create specific capital flows, policy alignment, and impact verification of ocean-based investments through institutional efforts like the United Nations Environment Programme Finance Initiative (UNEP FI), the World Bank Blue Economy Programme, and the EU Blue Economy Strategy. The frameworks offer a critical benchmark on the extent of scope, purpose, and regulatory multidomain of blue finance, positioning it as an emerging yet strategically important sub-discipline of sustainable finance [20].

The potential of FinTech in sustainable finance is enabling significant change by enhancing transparency, economic efficiency, and democratizing access to green investments. The FinTech industry enables positive ESG outcomes by harnessing digital technology to coalesce financial services with sustainability goals (Figure 2). However, our academic interest does not align with expectations, as significant gaps in empirical knowledge regarding greenwash, regulation, digital divide, and long-term impact on sustainable development persist [21]. The blockchain will facilitate the immutable storage and provenance of green bonds, tokenized loans, and ESG-compliant instruments, thus increasing their high levels of transparency, traceability, and trust (Figure 3) [22]. AI analytics will support predictive modeling of environmental scanning risks and financial performance, whereas digital platforms and interoperable data systems will support financial inclusion through cost reduction in transactions and allow fractional investment in sustainability-linked assets [23]. Regardless of these improvements, the literature shows that there is still a gap, as not many studies have been conducted in a systematic manner to understand how these FinTech mechanisms can be used in marine and ocean-based investments [24]. Most of the available literature is on land-based green finance, climate bonds, or broad ESG usage, but without combining the specific governance, ecology, and financial issues of the blue economy [25]. Based on this, there is a conceptual gap in institutional design, regulatory architecture, and digital infrastructure that is required to scale blue finance. To fill this gap, an interdisciplinary approach is taken, which involves analyzing the doctrine, evaluating the technologies, and policy insights on sustainability that are needed to come up with frameworks that can operationalize the FinTech-enabled blue economy investments.

Figure 1
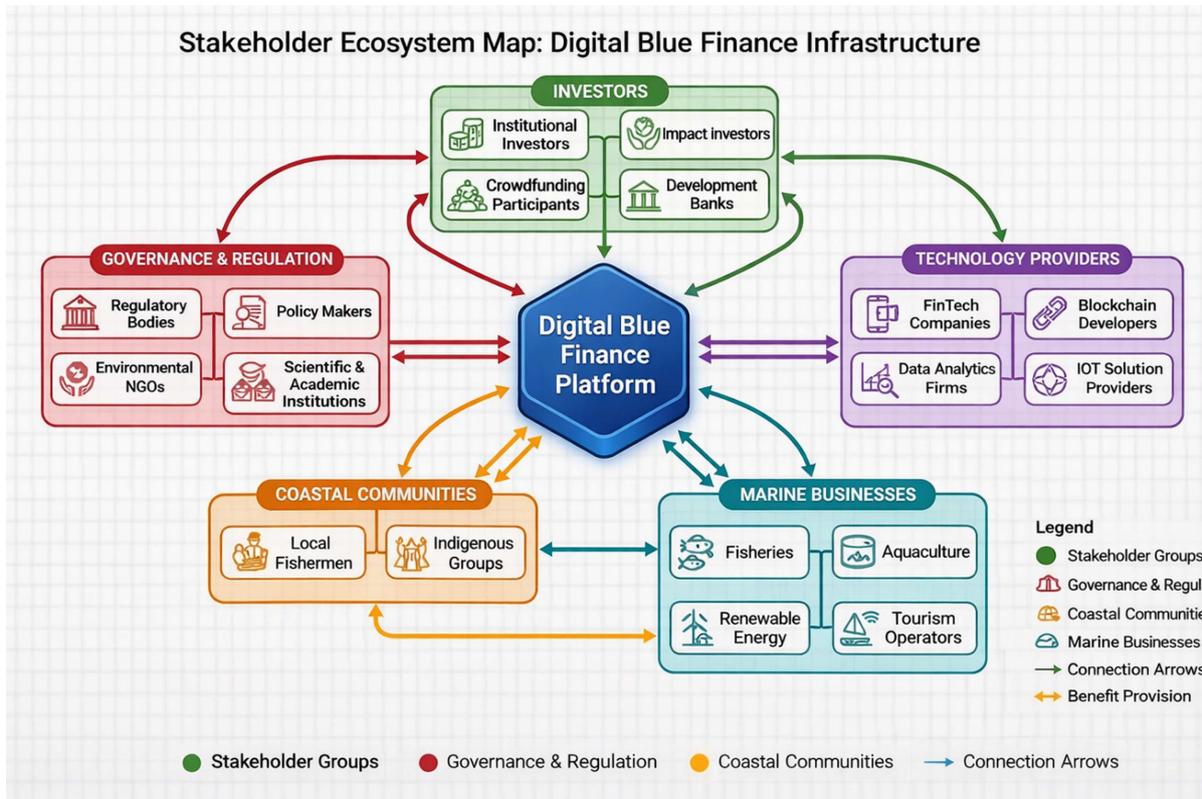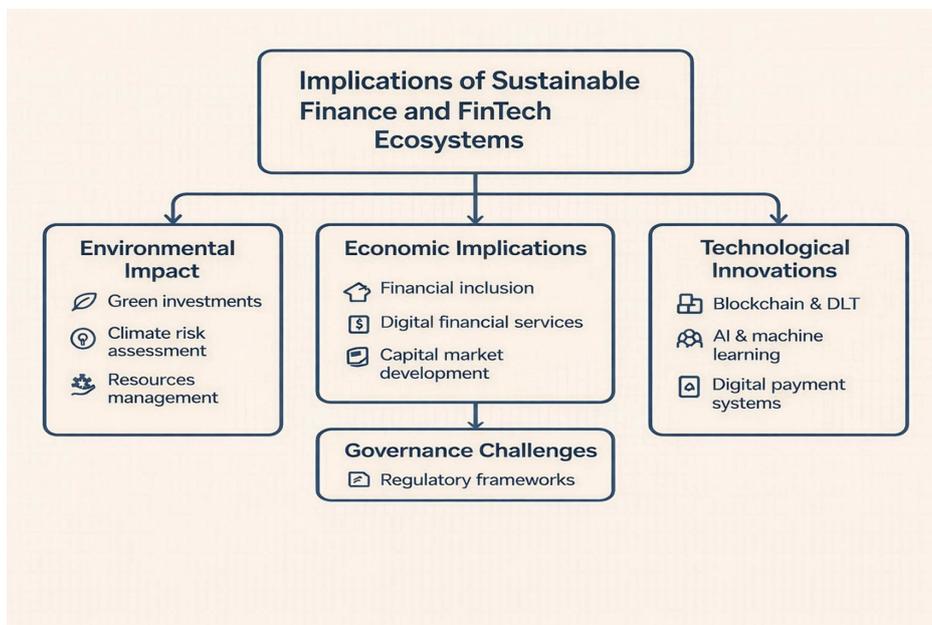**Methodological framework: construction of the digital blue finance model**

Figure 2
Implications of sustainable finance and the FinTech ecosystem


The review creates the rationale behind the study with both the conceptual applicability of the concept of sustainable finance regimes and the under-explored opportunities of FinTech within blue finance, which requires a doctrinally informed model of digital blue finance infrastructure.

3. Methodological Framework: Construction of the Digital Blue Finance Model

The current research is doctrinal legal research, which is concerned with the systematic definition, elucidation, and

Figure 3
Architecture of a digital blue finance—conceptual blueprint about finance, governance, and sustainability
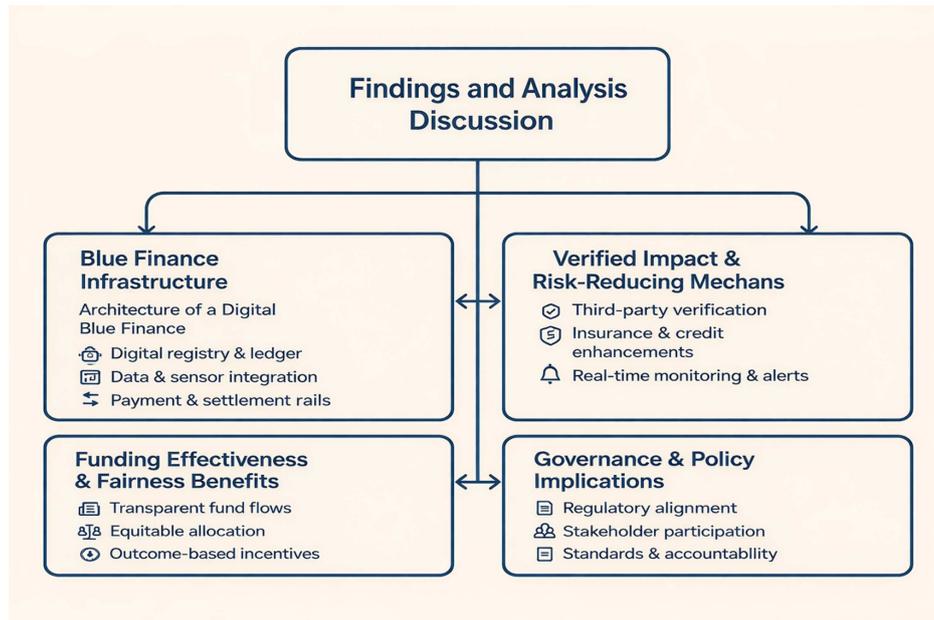
combination of available legal norms, regulatory frameworks, and policy structures that regulate digital finance and blue economy investment. The doctrinal approach is suitable since the focus is on conceptualizing and assessing the sufficiency of the current legal and regulatory tools, rather than gathering or processing more primary empirical data, to determine how FinTech innovations can be successfully integrated into the blue economy finance governance.

In this respect, doctrinal research aims at:

1) Examine the existing law and policy tools governing sustainable and digital finance on a global, regional, and national basis.
2) Evaluate their conceptual, internal, and normative fit in financing the blue economy.
3) Develop a conceptual and normative framework of a digital blue finance infrastructure that is based on the tenets of transparency, accountability, and sustainability.

3.1. Research design and structure

This paper will follow a two-pronged methodology and integrate normative legal analysis with conceptual sustainability analysis to discuss the potential of FinTech-enabled digital infrastructure to facilitate fintech-driven blue economy investment. It is analyzed through carefully selected six regulatory and policy tools, which have been selected because of their direct relevance to digital finance and sustainability governance, as well as ocean-based investment.

First, the paper performs a normative discussion of three binding EU legal documents that form a regulatory framework in FinTech-enabled sustainable finance in the European Union. These are (i) the EU Sustainable Finance Disclosure Regulation (SFDR), which sets the mandatory disclosure requirements of sustainability and influences the legal credibility of ESG-labeled blue investments; (ii) the Markets in Crypto-Assets Regulation, which regulates digital assets, tokenized financial

instruments and blockchain-based investment mechanisms that are increasingly proposed to finance the blue economy; and (iii) the EU Data Governance Act, which governs access, sharing, and trust of data as the legal basis of data-driven FinTech applications such as traceability. The instruments are chosen because they all govern financial transparency, digital innovation, and data infrastructure, which is imperative to FinTech-enabled blue finance.

Second, the research is based on a conceptual and normative benchmarking analysis through three complementary sustainability frameworks. The UNEP Finance Initiative Sustainable Blue Economy Finance Principles are used to establish specifications of objectives of responsible blue finance in a sector. The EU Taxonomy Regulation is applied to determine that the FinTech-enabled blue economy endeavors to have passed the legal requirements of environmental sustainability and to align disclosure needs of SFDR with the substantive sustainability levels. UN Sustainable Development Goals (SDGs) or SDG 14 offer a universal standard of development that measures the greater socio-economic and environmental achievement concerning the EU environment.

All six instruments have been selected due to the following reasons: they are functionally complementary, normatively sound, and directly applicable to blue economy investment with the help of FinTech. The combination of the two facilitates an organized evaluation of the legal regulation of digital financial innovation, conceptual consistency with sustainability goals, and operationalization within the blue economy investment frameworks.

3.2. Validity of models and empirical strategy

Figure 4 illustrates the validity of models and the empirical strategy.

This paper is a validation of the suggested digital blue finance infrastructure because it studies how the FinTech-enabled systems operate in the actual investment context, as opposed to being hypothetical concepts. The model is evaluated based on its

Figure 4
Empirical strategy and model validation framework for digital financial infrastructure in the blue economy
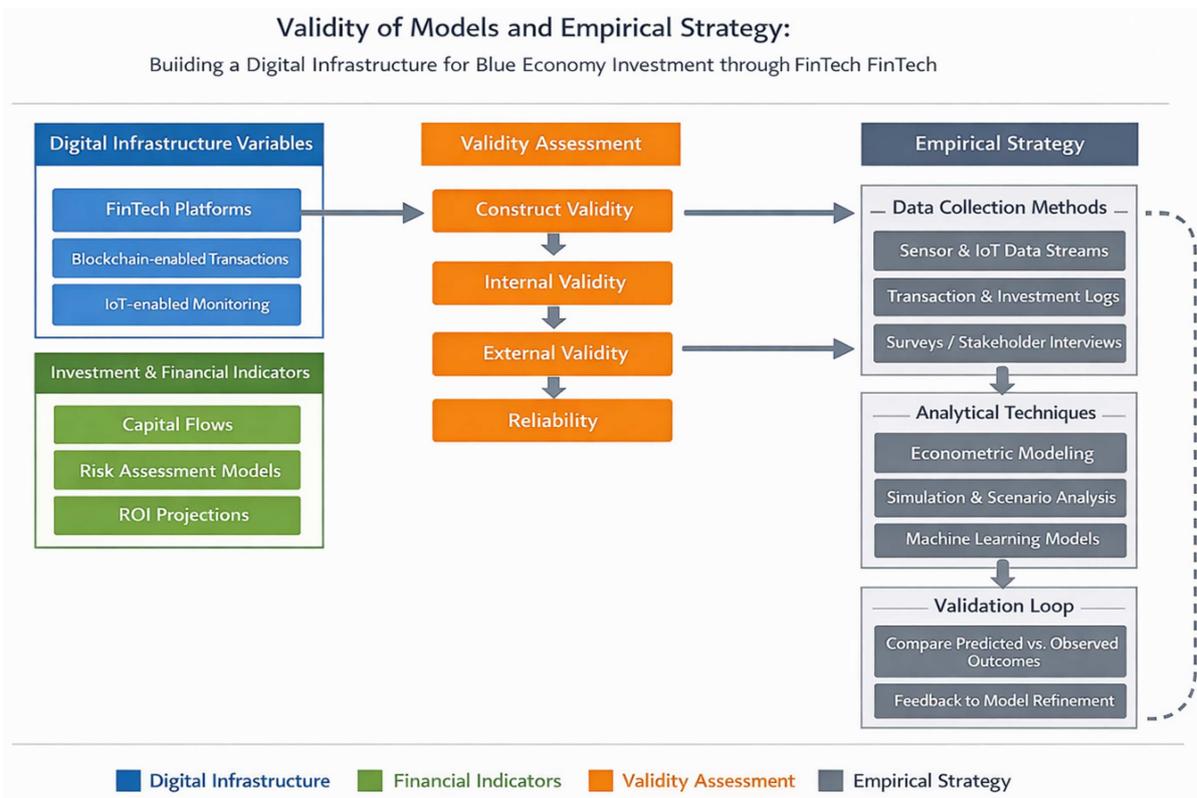
operational feasibility and regulatory congruence, as well as its capacity to provide quantifiable financial, governance, and sustainability results on blue economy investments.

The validation is done via a comparative case-based approach based on the actual application of FinTech in ocean-based related industries. The empirical study examines three practical applications, such as (i) blockchain-supported fisheries traceability and incentive schemes (e.g. Provenance and Fish-coin), which are used to determine the effect on transparency, ESG certification, and access to capital; (ii) digitally enabled blue finance instruments, especially the Seychelles Blue Bond, which are analyzed for their contribution to enhancing disclosure, investor confidence, and capital mobilization; and (iii) digital payment and mobile money systems in coastal and fisheries finance, which are evaluated in terms of their contribution to financial inclusion.

Practical indicators that are widely used in FinTech and sustainable finance are used to assess model performance, such as investment volumes, trade costs, traceability coverage, the quality of disclosures (Figure 5), compliance with regulations, and small-scale actors (Figure 1). It uses evidence based on project documentation, development finance reports, UNEP FI publications, and regulatory disclosures and findings to determine the implementation patterns and constraints that are triangulated across cases.

The analysis takes the adoptive approach of functional technology and considers blockchain as a transparency and trust layer (Figure 3), AI and data analytics as ESG and risk assessment decision support tools, and digital payments as the financial access layer (Figure 4). This method is an indication of the way FinTech solutions are implemented in practice and

not as isolated technologies. To connect theory with practice, the paper finds practical avenues of testing, such as regulatory sandboxes, pilot programs in fisheries and coastal areas, and blended finance programs involving both public and private participants. Implementation issues—regulatory fragmentation, data quality constraints, capacity disjunction, interoperability expenditure, and legal ambiguity—are comprehensively included to make the policy and investments relevant.

The study establishes the basis of digital blue finance infrastructure testing, adaptation, and scaling to sustainably invest in the blue economy by basing the model on applied case evidence and operational metrics.

## 4. Findings and Analysis Discussion

The results of the research by Kaur et al. [26] demonstrate that FinTech has the potential to offer a multidimensional infrastructure that can handle the long-term financial, operational, and governance issues of the blue economy. Through a critical combination of digital finance technologies and doctrinally based regulatory and institutional theories, an ecosystem of ocean-based investments can be developed and scaled, made transparent and accountable. These are investigated on the four dimensions that are interconnected: system architecture, impact verification, financing efficiency, and governance.

4.1. Blue finance infrastructure: architecture of a digital blue finance

A digital blue finance infrastructure is built on the partnership between four fundamental elements. One of the applications

Figure 5
Salient features of the digitalization of the blue economy finance ecosystem
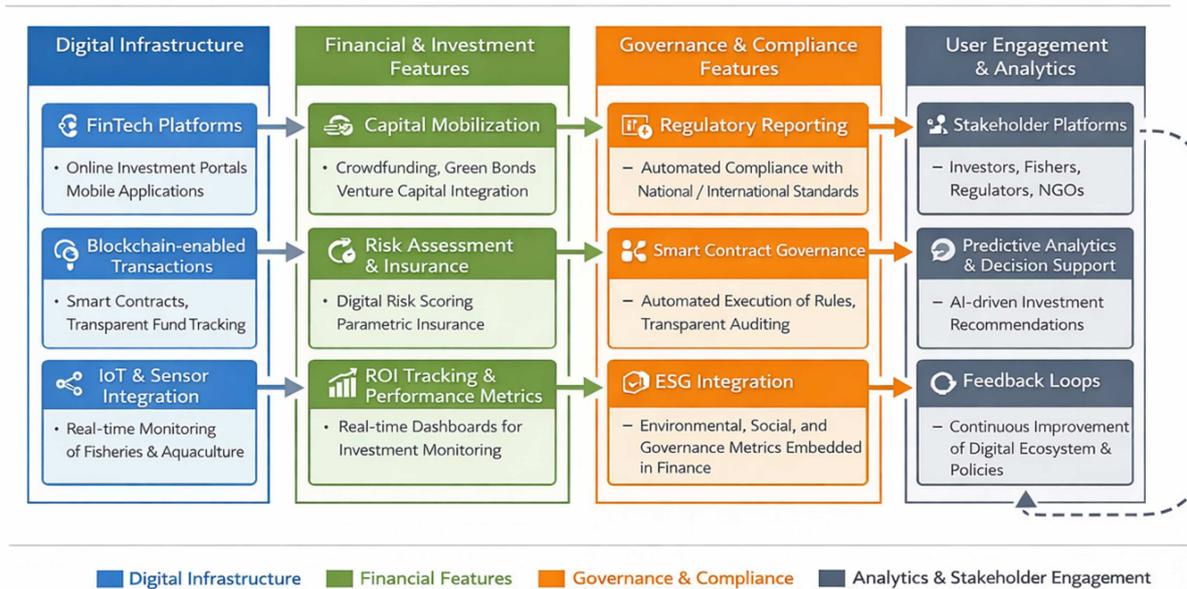
of digital issuance is the development and issuance of tokenized blue bonds or sustainability-linked loans, where investors can invest in offshore wind farms or the development of marine-protected areas [27]. Indicatively, the Seychelles Blue Bond showed how capital flows can be formalized through digital issuance and thus enables accurate tracking of the allocation (Figure 5) [28]. By automating the implementation of ESG-related actions, for example, paying only when confirmed conservation results are met, smart contracts cut administrative pressure and enhance transparency (Figure 5) [29]. Mechanisms of traceability can be ensured using blockchain-based mechanisms to maintain end-to-end transparency of fund flows (Figure 3); pilot projects have been conducted in the Pacific Islands to track tuna supply chains using blockchain to ensure real-time verification of sustainable catch practices [30]. Lastly, the ESG data verification systems integrate environmental and social impact indications provided through IoT sensors, satellite surveillance, and standard reporting, which give credible evidence about the outcomes of the projects (Figure 4) [31]. These elements are incorporated collectively to create a self-sufficient digital ecosystem, which coordinates the flows of investments with sustainability goals (Figure 5).

4.2. Verified impact and risk-reducing mechanisms

IoT and blockchain integration increase the level of transparency and risk management (Figure 4) [32]. The IoT sensors are capable of continuously monitoring the marine parameters, including the water quality, the health of the corals, or aquaculture harvests [33]. These metrics are then stored in blockchain networks, making them immutable so that they can never be manipulated or misreported. An effective case is the Smart Oceans Project of the World Bank, in which sensors connected to the IoT are placed in marine conservation zones to send data on the ecological condition in real time, which is stored in distributed ledgers to make it accountable to shareholders and populations

(Figure 5) [34]. This strategy reduces the reputational and operational risks, as well as verifiability, implying that the reported ESG results can be checked, eliminating the risk of greenwashing and enhancing the confidence of investors.

4.3. Funding effectiveness and fairness benefits

Digital platforms and tokenization improve access and lower the costs, especially for small-scale investors (Figure 2) [35]. An example is the Pacific Blue Investment Platform, which applies the concept of tokenization via blockchain to enable small investors in a variety of jurisdictions to finance sustainable fisheries to reduce transaction costs and mobilize capital faster [36]. These mechanisms enhance inclusiveness, allow blended finance approaches that bring together public and private funds, and allow the community to participate in projects that used to be closed because of size, risk, or geographic distances (Figure 2).

4.4. Governance and policy implications

As much as technological infrastructure brings efficiency in operation, it is effective based on consistent governance structures [37]. Regulatory sandboxes such as those adopted in Singapore and the EU permit the use of tokenized blue finance instruments in controlled conditions that balance innovation and investor protection [38]. Standardization frameworks of data are also important as they will facilitate cross-border interoperability of ESG reporting, verification, and data of transactions (Figure 3) [39]. In their absence, digital blue finance is subject to being fragmented, ambiguous in the law, and the exclusion of vulnerable parties [40]. Thus, the successful governance of the digital infrastructure should align digital infrastructure with regulatory control, maintaining credibility, responsibility, and conformity to the wider sustainability and ocean governance targets (Figure 1) [41].

Taken as a whole, these findings reveal that adequately designed digital blue finance infrastructure, based on technological innovation and sound governance, can change an investment flow into the blue economy and make the results scaled, transparent, and socially inclusive (Figure 3).

5. Discussion: Sustainable Finance and FinTech Ecosystems Implications

The theoretical background of the study places FinTech at the center of enabling blue economy investment and incorporates information on knowledge of the technology adoption models (Figure 6), institutional theory, and sustainable finance concepts [42]. The model of technology adoption assumes that digitally based technologies may contribute to efficiency, transparency, and access to capital within the investment ecosystems (Figure 5) [43]. Institutional theory emphasizes the importance of both formal and informal regulatory rules in influencing investment behavior [44], whereas the resource-based perspectives emphasize the importance of strategically expending both financial and technological resources to sector-specific opportunities [45]. Through the operationalization of these frameworks, the research tests the anticipations of digital infrastructure to enable investment in marine and coastal industries and connects the learning results with the expectations.

Empirically, the results indicate that FinTech platforms are useful in facilitating capital mobilization, eliminating information asymmetries, and monitoring sustainable projects in the blue economy. The findings are consistent with other studies in green finance where digital financial instruments were demonstrated to aid in efficient environmental investment allocation (Figure 2) [46]. As an example, as in the case of green bonds and digital investment platforms in the renewable energy market, blue economy finance facilitated by FinTech may offer increased transparency, quicker transactions, and more individuals access to small- and medium-scale investors (Figure 3) [47]. The principles of green finance signal directly to the blue economy strategies through the provision of frameworks, mechanisms (such as blue/green bonds), and risk assessment tools to finance sustainable

ocean use, fill investment gaps (around financing marine renewables, sustainable fisheries and coastal resilience), and manage risks such as overexploitation and pollution using innovative financial tools (Figure 1). Green finance experience aids in creating new products, such as blue loans, and investing in the creation of standards in ocean-based sectors to bring in private funds to support a sustainable blue economy (Figure 5) [48].

Meanwhile, the discussion does not ignore the drawbacks of FinTech in terms of addressing the issue of sector-specific challenges completely. The effectiveness of digital platforms may be restricted by the infrastructural gaps that constrain digital literacy of the coastal communities, ecosystem-specific risky investment, and uncertainties of the regulations (Figure 2) [49]. These limitations highlight the fact that although digital infrastructure may greatly improve the process of making investments, it is a component of an oiler strategic ecosystem incorporating policy support, alignment of regulations, and capacity-building efforts (Figure 3). Such limitations enhance the practical applicability of the research by giving policymakers and practitioners practical information as well as making sure that theoretical assumptions are informed by realities in the sector.

Figure 6 illustrates the implications of sustainable finance and FinTech ecosystems.

5.1. Digital blue finance as a subfield of sustainable FinTech conceptualization

Digital blue finance may be understood as a narrow branch of sustainable FinTech that aims to mobilize capital, increase transparency, and make sustainable investments in the blue economy, especially fisheries, aquaculture, marine conservation, and maritime transport (Figure 1) [50]. In contrast to the conventional FinTech or green finance, Digital Blue Finance borders ecological stewardship, ocean governance, and digital infrastructure [51]. It focuses on sustainability results, including financial returns, and uses blockchain, IoT-based monitoring, and digital tokens to guarantee traceability in ocean-related activities (Figure 5) [52].

Figure 6
Digital blue finance infrastructure framework
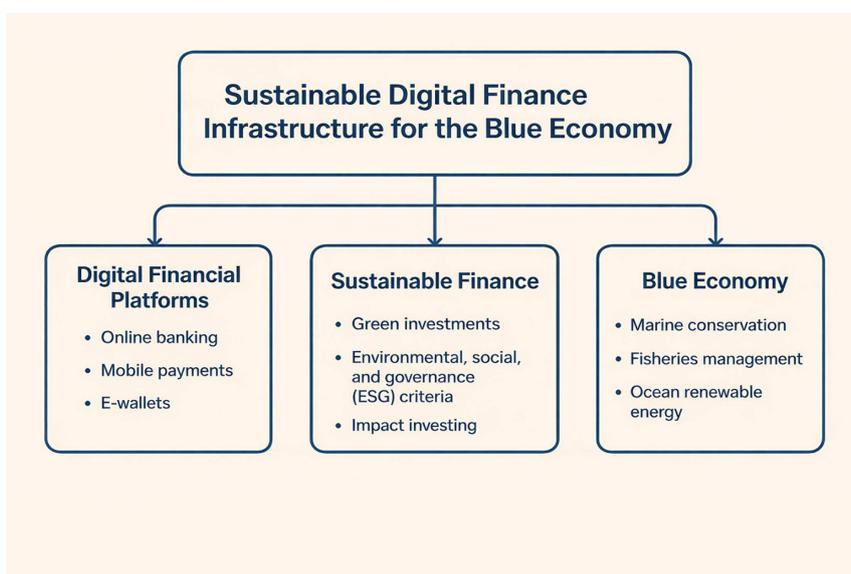
As an example, the Ocean Risk and Resilience Action Alliance (ORRAA) has demonstrated insurance-related instruments in fisheries through digital solutions that have enabled small-scale fishers to obtain immediate compensation in case of extreme weather that interferes with the quantity of catches (Figure 1) [53]. This is an example of the way digital blue finance goes beyond traditional financing by placing environmental and social governance indicators directly on investment instruments.

5.2. Expanding financial innovation and environmental

Governance theories on digital infrastructure:

Digital blue finance builds on financial innovation theory by incorporating infrastructure-based logic, in which the foundation of financial services is digital, distributed, and interoperable, but not institutional [54]. In conventional financial innovation, such instruments as derivatives, green bonds, or carbon credits are mostly financial instruments, which are based on reporting and auditing processes (Figure 4) [55]. Digital blue finance, in contrast, uses digital infrastructure, blockchain-ledgers (Figure 5), AI-powered monitoring, and cloud-based ecosystems to automate compliance, decrease information asymmetries, and enhance policy consistency [56].

This integration is also advantageous to environmental governance theory (Figure 6). The traditional governance approaches, where the state plays a key role by monitoring, enforcing regulations, and consulting the stakeholders, are complemented by decentralized monitoring and automated reporting. In the example of the fisheries sector, the Food Trust blockchain platform by IBM can be modified to enable supply chain participants to track seafood up to retail to verify that the supply chain meets sustainability certifications [57]. This integration reflects a paradigm shift: the governance is algorithmically enhanced and data-focused, thus having less room to commit fraud, overfishing, and illegal trade, and giving regulators real-time information (Figure 6).

5.3. Digitalization improving traceability and accountability in marine finance

There is increasing academic evidence regarding the transformative nature of digitalization in marine finance [58]. Digital tools, such as blockchain registries, remote sensing, smart contracts, traceable fund flows, transparent reporting, and accountability mechanisms, are digital tools (Figure 3). Such systems enable the donors, investors, and regulators to monitor the use of funds, check on the claims of sustainability, and make the distribution of benefits equitable.

Besides, predictive modeling and risk assessment can be performed using data analytics combined with digital ledgers. The connection of environmental sensors, satellite images, and financial flows will help the stakeholders to identify the non-sustainable practices at an early stage (Figure 2) [59]. The Seafood Business for Ocean Stewardship (SeaBOS) program is an initiative designed to regulate the adherence of large seafood corporations to corporate social responsibility practices using digital reporting and certification dashboards that enable the alignment of corporate business to conservation objectives [60]. Importantly, these examples point out that digitalization not only automates finance but also operationalizes governance and introduces real-time

accountability, making financial performance and environmental performance impossible to practice separately.

It is important to emphasize that digital blue finance represents not merely a technological advancement but a comprehensive framework that integrates financial systems, governance structures, and ecological sustainability (Figure 5) [61]. This clarifies the entrance of a new frontier of sustainable investment into the marine economies by conceptualizing it as a separate subfield, applying theory using the logic of digital infrastructure, and showing empirical success in traceability and accountability (Figure 4). Its disruptive capacity is demonstrated by real-world applications such as blockchain-based fisheries finance and sensor-based surveillance of aquaculture, as well as the necessity of a strong regulatory harmonization, data governance, and involvement of stakeholders (Figure 1).

5.4. Policy and institutional contributions

The design and implementation of digital public infrastructure (DPI) to achieve sustainability considers policy and institutional contributions [62]. These contributions provide practical contributions to the multilateral banks, regulators, and policymakers, informing the construction of a framework, including the EU Sustainable Finance Platform, ASEAN Blue Finance Hub, and the UN (United Nations) Ocean Decade investment strategy.

5.5. EU Sustainable Finance Platform: enhancing sustainable finance

The EU Sustainable Finance Platform is an advisory organ that is a group of specialists in the fields of business and government, and it advises the European Commission on sustainable finance policies [63]. It also has the mandate to advise the EU taxonomy and the EU sustainable finance framework to drive more private capital investment in sustainable projects. This platform supports communication between the parties who have an interest in the issue, which guarantees that the sustainability aspect will be included in the financial decision-making process.

The recommendations of the platform have been used to shape the EU Taxonomy Regulation that offers a classification framework of environmentally sustainable economic activities. The regulation can help financial institutions to recognize and invest in sustainable projects and thus encourage the shift toward a low-carbon economy.

5.6. ASEAN Blue Finance Hub: ASEAN ocean sustainability

Created by the Asian Development Bank, the Association of Southeast Asian Nations (ASEAN) Blue Finance Hub specializes in propelling the realization of sustainable projects in the blue economy in Southeast Asia [64]. It hopes to develop bankable projects of up to 300 million dollars in 2030 to help governments in the preparation and financing of infrastructure projects that will lead to environmental sustainability [65].

In Indonesia and the Philippines, the ASEAN Blue Finance Hub has enabled countries to come up with initiatives that deal with marine pollution and coastal resilience [66]. Such efforts are also bringing in the involvement of the private sector, and this shows that institutional design can organize resources to support ocean sustainability.

5.7. UN Ocean Decade: investment in ocean science and sustainability

The UN Ocean Decade attempts to identify the main and persistent under-investment in ocean science. It recognizes that financial incapacity has limited the capacity of the global science community to learn and know how to manage the ocean sustainably [67]. The strategy aims to turn around the disintegration of ocean science with a common structure instead of reinforcing it. In many cases, before the Ocean Decade, ocean science was in silo without enabling international collaboration and without any requisite interdisciplinary, big-science, or even complex endeavors to comprehend wicked ocean problems [68].

The initiative does have its share in enhancing the stewardship of the sustainable fisheries through the provision of the scientific knowledge and tools necessary to advance decision-making, as well as the development of collaboration and partnerships. The Ocean Decade mandate is to enhance our knowledge about the ocean system to provide science-based solutions to achieve sustainable development, such as better management of fisheries [69].

The policy and institutional assistance also hold significance toward this aim of creating a DPI to ensure sustainability. New insights can be provided by such initiatives as the EU Sustainable Finance Platform, ASEAN Blue Finance Hub, and the UN Ocean Decade investment strategy, which are created to provide actionable insights to our multilateral banks, regulators, and policymakers [70].

6. Conclusion

The paper illustrates how technological innovation, financial processes, and governance systems interact in a complicated manner to form digital blue finance. On the technological side, the findings indicate that participation in digital platforms through blockchain and distributed ledger technology and AI-based analytics can facilitate transparency and traceability as well as real-time tracking of investments in the blue economy. These technologies minimize the lack of information and enhance confidence among investors, particularly on marine conservation, aquaculture, and sustainable fishery-oriented projects. The financial aspect means that instruments that are enabled by FinTech, including tokenized marine assets, green bonds, and impact-driven loans, radically expand access to capital and add sustainability metrics to the investment criteria. The governance aspect shows that a robust institutional package, regulatory certainty, and structures in line with ESG standards are key attributes of accountability, mitigation of environmental risk, and policy coherence across multi-jurisdictional marine projects.

All findings have a thread in common because FinTech was a catalyst for building accountable, scalable, and inclusive marine investment ecosystems. The digital platforms have the potential to automate compliance and reporting, and they democratize participation and allow smaller players, such as coastal communities and Small and Medium-sized Enterprises (SMEs), to engage in marine finance efforts. This enhances local stewardship, is consistent with financial incentives and sustainable outcomes, and is more resilient to the ocean and maritime-thorough investment ecosystem. FinTech can bridge the interface between financial innovation and environmental governance; FinTech can help and allow governance, bridging the divide between capital flows and quantifiable ecological results.

This research contributes to the blue economy and FinTech literature by establishing and empirically demonstrating a digital blue finance infrastructure, which can allow closer and more effective, transparent, and resilient investment in ocean-based sectors. It directly bridges the gaps in the existing literature by showing how FinTech solutions, which have been examined with the focus largely on green finance, can be refocused on the needs of blue economy investment, such as access to capital, risk management, and regulatory alignment. The results not only contribute to the theoretical knowledge on technology-enabled sustainable finance but also offer practical recommendations to policymakers and practitioners who may want to utilize digital tools to help achieve sustainable ocean-based development. In such a way, the study provides a realistic and academic basis for the incorporation of digital finance in the plans of sustainable blue growth.

Future research can also take place in several directions. They need to develop digital ESG data standards to harmonize the measurement, verification, and reporting of marine investment benefits across jurisdictions, so that marine investments can be compared equally and their benefits can be verified equally. The AI ethics in sustainability verification should be researched to reveal the prejudice of algorithms, data confidentiality, and safeguard the responsibility of automated evaluations of effects. The studies of cross-jurisdictional regulatory interoperability will be specifically important on projects between the legal domains of two or more maritime jurisdictions, as compliance possibilities would lessen the friction of the legal process and would offer support in transferring cohesive transnational regulation of ocean-based investments. All these fields of study will, in summary, make the blue finance ecosystem more complete, holistic, and ethical.

Ethical Statement

This study does not contain any studies with human or animal subjects performed by the author.

Conflicts of Interest

The author declares that he has no conflicts of interest to this work.

Data Availability Statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Author Contribution Statement

Kolawole Afuwape: Conceptualization, Methodology, Validation, Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration.

References

[1] Kurniawan, S. B., Roziqin, A., Ahmad, A., Ahmad, M. M., Alfanda, B. D., Pambudi, D. S. A., . . . , & Imron, M. F. (2026). Tackling marine pollution in the blue economy: Synergies between wastewater treatment technologies and governmental policies. *Marine Pollution Bulletin*, *222*, 118627. https://doi.org/10.1016/j.marpolbul.2025.118627

[2] Arfanuzzaman, M. (2025). Navigating the blue economy: Unlocking ocean-based solutions for sustainable growth and global stewardship. In R. C. Brears (Ed.), *The Palgrave*

encyclopedia of sustainable resources and ecosystem resilience (pp. 1–16). Cham: Palgrave Macmillan. https://doi.org/10.1007/978-3-030-67776-3_60-1

[3] Penca, J., Ertör, I., Ballesteros, M., Briguglio, M., Kowalewski, M., Pauksztat, B., . . . , & Pascual-Fernández, J. J. (2025). Rethinking the Blue Economy: Integrating social science for sustainability and justice. *npj Ocean Sustainability*, *4*(1), 40. https://doi.org/10.1038/s44183-025-00138-1

[4] Ameli, N., Chenet, H., Falkenberg, M., Kothari, S., Rickman, J., & Lamperti, F. (2025). Driving sustainability transitions through financial tipping points. *Earth System Dynamics*, *16*(1), 333–345. https://doi.org/10.5194/esd-16-333-2025

[5] Kelling, I., Bennett, N., Barclay, K., Jeffs, A., Pita, C., Krogh-Poulsen, B., . . . , & K., Wiese. (2026). Beyond growth: Reshaping fisheries for a wellbeing economy. *Marine Policy*, *183*, 106898. https://doi.org/10.1016/j.marpol.2025.106898

[6] Moses, Z., & Tafadzwa, J. (2025). Innovative blue finance investment model for sustainable ocean economies for resilient coastal development. *Indiana Journal of Economics and Business Management*, *5*(2), 74–85. https://doi.org/10.5281/zenodo.15377590

[7] Kou, G., & Lu, Y. (2025). FinTech: A literature review of emerging financial technologies and applications. *Financial Innovation*, *11*(1), 1. https://doi.org/10.1186/s40854-024-00668-6

[8] Foreman-Peck, J., & Zhou, P. (2025). Digitalisation and the digital economy. In J. Foreman-Peck & P. Zhou (Eds.), *Applied economics in globalised economies: Problems and policies* (pp. 331–368). Cham: Palgrave Macmillan. https://doi.org/10.1007/978-3-031-85621-1_12

[9] Anang, A. N., Ajewumi, O. E., Sonubi, T., Nwafor, K. C., Arogundade, J. B., & Akinbi, I. J. (2024). Explainable AI in financial technologies: Balancing innovation with regulatory compliance. *International Journal of Science and Research Archive*, *13*(1), 1793–1806. https://doi.org/10.30574/ijsra.2024.13.1.1870

[10] Goswami, S., Chouhan, V., & Saraswat, P. (2025). FinTech adoption: Driving financial inclusion at the bottom of pyramid. *Future Business Journal*, *11*(1), 150. https://doi.org/10.1186/s43093-025-00570-2

[11] Bennett, M., March, A., & Failler, P. (2024). Blue Economy financing solutions for the fisheries and aquaculture sectors of Caribbean island states. *Fishes*, *9*(8), 305. https://doi.org/10.3390/fishes9080305

[12] Ahmad, F., Boumaiza, A., Sanfilippo, A., & Al-Fagih, L. (2025). A comprehensive review on green finance and its impact on net zero energy transition: From the perspective of renewable energy development. *Energy Strategy Reviews*, *62*, 101948. https://doi.org/10.1016/j.esr.2025.101948

[13] Karuppiah, K., Garza-Reyes, J. A., & Virmani, N. (2025). Pathways to a sustainable blue economy: Exploring its barriers in an emerging economy. *Business Strategy and the Environment*, *34*(5), 6095–6110. https://doi.org/10.1002/bse.4294

[14] Gavalas, D. (2025). Green finance frameworks for sustainable shipping industry and blue economy: A review. *Maritime Technology and Research*, *7*(3), 277132. https://doi.org/10.33175/mtr.2025.277132

[15] Sharma, V., Rupeika-Apoga, R., Singh, T., & Gupta, M. (2025). Sustainable investments in the blue economy: Leveraging fintech and adoption theories. *Journal of Risk and Financial Management*, *18*(7), 368. https://doi.org/10.3390/jrfm18070368

[16] Elias, O., Awotunde, O. J., Oladepo, O. I., Azuikpe, P. F., Samson, O. A., Oladele, O. R., & Ogunruku, O. O. (2024). The evolution of green fintech: Leveraging AI and IoT for sustainable financial services and smart contract implementation. *World Journal of Advanced Research and Reviews*, *23*(1), 2710–2723. https://doi.org/10.30574/wjarr.2024.23.1.2272

[17] Joshipura, M., Mathur, S., & Kedia, N. (2024). Sustainable investing and financing for sustainable development: A hybrid review. *Sustainable Development*, *32*(5), 4469–4485. https://doi.org/10.1002/sd.2912

[18] dos Reis Cardillo, M. A., & Basso, L. F. C. (2025). Revisiting knowledge on ESG/CSR and financial performance: A bibliometric and systematic review of moderating variables. *Journal of Innovation & Knowledge*, *10*(1), 100648. https://doi.org/10.1016/j.jik.2024.100648

[19] Jadhav, H. L., Maind, S. N., Pandey, P. P., & Pawar, G. G. (2025). Green investment and fintech: Financing the blue economy. In V. Sharma, T. Singh, A. de Bem Machado, & R. Rupeika-Apoga (Eds.), *FinTech for sustainable finance and a well-blue economy* (pp. 83–106). Cham: Springer. https://doi.org/10.1007/978-3-031-92390-6_5

[20] Jiang, Y., Huang, L., Zhu, X., Song, W., & Liu, Y. (2025). Effect of blue finance and marine environmental quality on the marine fishery economy. *Fishes*, *10*(4), 147. https://doi.org/10.3390/fishes10040147

[21] Hasan, M. H., Hossain, M. Z., Hasan, L., & Dewan, M. A. (2024). FinTech and sustainable finance: How is FinTech shaping the future of sustainable finance? *European Journal of Management, Economics and Business*, *1*(3), 100–115. https://doi.org/10.59324/ejmeb.2024.1(3).09

[22] Khan, S., Katoch, R., & Mahendru, D. (2025). Blockchain and FinTech synergies: Driving sustainability in the blue economy. In V. Sharma, T. Singh, A. de Bem Machado, & R. Rupeika-Apoga (Eds.), *FinTech for sustainable finance and a well-blue economy* (pp. 171–195). Cham: Springer. https://doi.org/10.1007/978-3-031-92390-6_9

[23] Ahmad, F., Boumaiza, A., Sanfilippo, A., & Al-Fagih, L. (2025). A detailed comprehensive role of digital technologies in green finance initiative for net-zero energy transition. *Advanced Energy and Sustainability Research*, *6*(10), 2500066. https://doi.org/10.1002/aesr.202500066

[24] Pant, P., Mishra, K. K., Zaheer, A., Botes, L. J., & Grobler, W. C. (2025). The future of Fintech-driven sustainable finance in marine industries. In V. Sharma, T. Singh, A. de Bem Machado, & R. Rupeika-Apoga (Eds.), *FinTech for sustainable finance and a well-blue economy* (pp. 313–331). Cham: Springer. https://doi.org/10.1007/978-3-031-92390-6_16

[25] Rogge, E. (2025). Blue bonds: Sustainable financing for the blue economy around the Indian Ocean. *Jindal Global Law Review*, *16*(1), 155–177. https://doi.org/10.1007/s41020-025-00263-5

[26] Kaur, K., Kapur, B., & Kurucz, A. (2025). The role of fintech in promoting sustainable blue economy. In V. Sharma, T. Singh, A. de Bem Machado, & R. Rupeika-Apoga (Eds.), *FinTech for sustainable finance and a well-blue economy* (pp. 1–20). Cham: Springer. https://doi.org/10.1007/978-3-031-92390-6_1

[27] Bosmans, P., & de Mariz, F. (2023). The blue bond market: A catalyst for ocean and water financing. *Journal of Risk*

and Financial Management, *16*(3), 184. https://doi.org/10.3390/jrfm16030184

[28] Christiansen, J. (2024). State capacity and the 'value' of sustainable finance: Understanding the state-mediated rent and value production through the Seychelles Blue Bonds. *Environment and Planning A: Economy and Space*, *56*(2), 402–417. https://doi.org/10.1177/0308518X231201467

[29] Liang, L., Ding, T., Tan, R., & Song, M. (2025). The impact of new generation information technology on enterprise ESG. In L. Liang, T. Ding, R. Tan, & M. Song (Eds.), *The ESG systems in Chinese enterprises: Theory and practice* (pp. 267–289). Springer Nature Singapore. https://doi.org/10.1007/978-981-96-5459-8_10

[30] Ismail, S., Reza, H., Salameh, K., Kashani Zadeh, H., & Vasefi, F. (2023). Toward an intelligent blockchain IoT-enabled fish supply chain: A review and conceptual framework. *Sensors*, *23*(11), 5136. https://doi.org/10.3390/s23115136

[31] Pozzi, F. A., & Dwivedi, D. (2023). ESG and IoT: Ensuring sustainability and social responsibility in the digital age. In S. Tiwari, F. Ortiz-Rodríguez, S. Mishra, E. Vakaj, & K. Kotecha (Eds.), *Artificial intelligence: Towards sustainable intelligence* (pp. 12–23). Cham: Springer. https://doi.org/10.1007/978-3-031-47997-7_2

[32] Ahmed, S. (2025). Enhancing data security and transparency: The role of blockchain in decentralized systems. *International Journal of Advanced Engineering, Management and Science*, *11*(1), 167–176. https://doi.org/10.22161/ijaems.111.12

[33] Flores-Iwasaki, M., Guadalupe, G. A., Pachas-Caycho, M., Chapa-Gonza, S., Mori-Zabarburú, R. C., & Guerrero-Abad, J. C. (2025). Internet of Things (IoT) sensors for water quality monitoring in aquaculture systems: A systematic review and bibliometric analysis. *AgriEngineering*, *7*(3), 78. https://doi.org/10.3390/agriengineering7030078

[34] Tiwari, D., Bhati, B. S., Nagpal, B., Sankhwar, S., & Al-Turjman, F. (2021). An enhanced intelligent model: To protect marine IoT sensor environment using ensemble machine learning approach. *Ocean Engineering*, *242*, 110180. https://doi.org/10.1016/j.oceaneng.2021.110180

[35] Tanveer, U., Ishaq, S., & Hoang, T. G. (2025). Tokenized assets in a decentralized economy: Balancing efficiency, value, and risks. *International Journal of Production Economics*, *282*, 109554. https://doi.org/10.1016/j.ijpe.2025.109554

[36] Louey, P. (2022). The Pacific blue economy: An instrument of political maneuver. *Marine Policy*, *135*, 104880. https://doi.org/10.1016/j.marpol.2021.104880

[37] Aryatama, S., Miswan, M., Fahriyah, F., Pribadi, T., & Suacana, I. W. G. (2024). Enhancing governance efficiency through digital transformation in public services: Lessons from global practices. *Global International Journal of Innovative Research*, *2*(5), 1019–1027. https://doi.org/10.59613/global.v2i5.171

[38] Obasun, O. A. (2025). Blockchain as a disruptive force transforming industries, redefining markets, and shaping the future of global economies. *American International Journal of Business Management*, *8*(4), 124–156.

[39] Olawale, H. O., Ogedengbe, A. O., Ameyaw, M. N., Jejeniwa, T. O., & Friday, S. C. (2024). Standardizing compliance practices across AML, ESG, and transaction monitoring for financial institutions. *Journal of Frontiers in Multidisciplinary Research*, *6*(2), 75–93. https://doi.org/10.54660/.JFMR.2024.5.2.75-93

[40] Higgins, N., Ferri, D., & Donnellan, K. (2023). Enhancing access to digital culture for vulnerable groups: The role of public authorities in breaking down barriers. *International Journal for the Semiotics of Law – Revue internationale de Sémiotique juridique*, *36*(5), 2087–2114. https://doi.org/10.1007/s11196-022-09959-6

[41] Olaniyi, E. O., Solarte-Vasquez, M. C., & Inkinen, T. (2024). Smart regulations in maritime governance: Efficacy, gaps, and stakeholder perspectives. *Marine Pollution Bulletin*, *202*, 116341. https://doi.org/10.1016/j.marpolbul.2024.116341

[42] Wang, S., Wang, Y., Wang, C., Dai, L., & Li, Y. (2026). The coordinated development of the "center-periphery" structure in regional economy: The dual driving force of technological innovation and digital economy. *International Regional Science Review*, *49*(1), 91–142. https://doi.org/10.1177/01600176251377371

[43] Ebrahimi, B., Farahmand, Fegh-hi., N, & Nasiri, M. (2026). Proposing an information technology management model in the FinTech sector using a mixed-methods approach (Case study: Tehran Stock Exchange Organization). *Digital Transformation and Administration Innovation*, *4*(1), 1–12. https://doi.org/10.61838/dtai.211

[44] Sultanuzzaman, M. R., Lee, C.-C., & Akther, S. (2026). Unlocking sustainable development: The asymmetric impact of green finance on energy efficiency in developing countries. *Economic Change and Restructuring*, *59*(1), 8. https://doi.org/10.1007/s10644-025-09948-2

[45] Zhang, R., Madni, G. R., Anwar, M. A., & Shahzad, A. A. (2026). Fourier ARDL modeling of natural resources, productive capacities, climate resilience, and green innovations for ecological sustainability. *Natural Resource Modeling*, *39*(1), e70024. https://doi.org/10.1111/nrm.70024

[46] Irfan, M., Bhute, N. S., Yadav, A. K., & Dias, R. (2026). Sustainable investment portfolios with AI: Bridging green finance and technological innovation. In S. K. Kunjumuhammed (Ed.), *Legal and regulatory considerations of leveraging sustainable finance* (pp. 235–256). IGI Global. https://doi.org/10.4018/979-8-3373-0350-5.ch009

[47] Rayun, S. M. N., Salam, M. A., Islam, W., & Leong, V. S. (2026). Green FinTech innovations: Empowering inclusive development and advancing towards the sustainable economy. In M. Masri, M. A. Sait, & M. Anshari (Eds.), *Promoting inclusivity and accessibility with FinTech* (pp. 245–278). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3373-1112-8.ch009

[48] Oseni, A. A., Bamiro, N. B., Ashafa, S. A., & Olohunlana, S. D. (2025). Sustainable Halal financing framework for blue and green economy. In M. A. Salisu, L. Raimi, N. B. Bamiro, & I. O. Elegbede (Eds.), *Green and blue economy frameworks for halal industry sustainability* (pp. 253–273). Springer Nature Singapore. https://doi.org/10.1007/978-981-96-1729-6_14

[49] Du, Z.-Y., & Wang, Q. (2024). Digital infrastructure and innovation: Digital divide or digital dividend? *Journal of Innovation & Knowledge*, *9*(3), 100542. https://doi.org/10.1016/j.jik.2024.100542

[50] Zhao, X., Muhammadullah, S., Kazemzadeh, E., Kostakis, I., Ghosh, S., & Doğan, B. (2025). Economic growth and sustainable development: The role of financial inclusion, FinTech, eco-innovation, and economic complexity. *Sustainable Development*. https://doi.org/10.1002/sd.70322

[51] Ekpemuaka, E., Odunlade, O. R., & Maiyaki, S. F. (2025). Resilience in Africa's transition to a sustainable digital and

blue economy: Policy and regulatory framework in Nigeria. In P. Ordóñez De Pablos, M. D. Lytras & S. Malik (Eds.), *Securing sustainable futures through blue and green economies* (pp. 149–172). IGI Global. https://doi.org/10.4018/9798369378939

[52] Cromwell, J., Turkson, C., Dora, M., & Yamoah, F. A. (2025). Digital technologies for traceability and transparency in the global fish supply chains: A systematic review and future directions. *Marine Policy*, *178*, 106700. https://doi.org/10.1016/j.marpol.2025.106700

[53] Jouffray, J.-B., Barbour, F. P., Blasiak, R., Feine, J., Gallagher, L., Johansson, D., ..., & Norström, A. V. (2023). *Ocean sand: Putting sand on the ocean sustainability agenda*. Ocean Risk and Resilience Action Alliance (ORRAA). https://oceanrisk.earth/wp-content/uploads/2023/05/ORRAA_Ocean_Sand_report.pdf

[54] Eaves, D., Coyle, D., Vasconcellos, B., & Deshmukh, S. (2025). *The economics of shared digital infrastructures: A framework for assessing societal value. (IIPP Policy Report 2025/02)*. UCL Institute for Innovation and Public Purpose. https://www.ucl.ac.uk/bartlett/sites/bartlett/files/2025-04/the_economics_of_shared_digital_infrastructures.pdf

[55] Zhai, X., Ji, Q., & Wu, F. (2024). Climate-driven financial innovations: Green financial tools. In F. Wu, D. Zhang, & Q. Ji (Eds.), *Climate finance: Supporting a sustainable energy transition* (pp. 101–136). Springer Nature Singapore. https://doi.org/10.1007/978-981-97-3308-8_3

[56] Pandiri, L., Paleti, S., Kumar Kaulwar, P., Malempati, M., & Singireddy, J. (2023). Transforming financial and insurance ecosystems through intelligent automation, secure digital infrastructure, and advanced risk management strategies. *Educational Administration: Theory and Practice*, *29*(4), 4777–4793. https://doi.org/10.53555/kuey.v29i4.9669

[57] Tang, J. (2025). Applications of blockchain technology for enhancing traceability and food safety management in the beef supply chain. *Emirates Journal of Food and Agriculture*, *37*, 1–20. https://doi.org/10.3897/ejfa.2025.168820

[58] Shan, S., Mirza, N., Umar, M., & Hasnaoui, A. (2023). The nexus of sustainable development, blue financing, digitalization, and financial intermediation. *Technological Forecasting and Social Change*, *195*, 122772. https://doi.org/10.1016/j.techfore.2023.122772

[59] Andries, A., Morse, S., Murphy, R. J., Lynch, J., & Woolliams, E. R. (2022). Using data from earth observation to support sustainable development indicators: An analysis of the literature and challenges for the future. *Sustainability*, *14*(3), 1191. https://doi.org/10.3390/su14031191

[60] Blasiak, R., Dauriach, A., Jouffray, J.-B., Folke, C., Österblom, H., Bebbington, J., ..., & Crona, B. (2021). Evolving perspectives of stewardship in the seafood industry. *Frontiers in Marine Science*, *8*, 671837. https://doi.org/10.3389/fmars.2021.671837

[61] Shiiba, N., Wu, H. H., Huang, M. C., & Tanaka, H. (2022). How blue financing can sustain ocean conservation and development: A proposed conceptual framework for blue financing mechanism. *Marine Policy*, *139*, 104575. https://doi.org/10.1016/j.marpol.2021.104575

[62] Eluri, P. R. R., Annapurnaiah, K., Uday Bhaskar, T. V. S., Kiran Kumar, N., Padmanabham, J., Karthik, T. N. C., ..., & Srinivasa Kumar, T. (2025). Empowering the blue economy: The role of ICT in ocean observations, data, information and advisory services. *CSI Transactions on ICT*, *13*(1), 3–25. https://doi.org/10.1007/s40012-025-00407-x

[63] van den Hurk, A., & van, der Klooster., I. (2024). The European Commission's Sustainable Finance Action Plan and other international initiatives. In D. Busch, G. Ferrarini, & S. Grünewald (Eds.), *Sustainable finance in Europe: Corporate governance, financial stability and financial markets* (pp. 17–95). Cham: Palgrave Macmillan. https://doi.org/10.1007/978-3-031-53696-0_2

[64] Kurniawan, M. D., & Do, C. V. (2025). Enabling youth participation in the blue economy: A comparative analysis of policies and legal frameworks in the EU and ASEAN. In W. Leal. Filho, A. L. Salvia, J. P. P. Eustachio, & M. A. P. Dinis (Eds.), *Handbook of sustainable blue economy* (pp. 1–32). Cham: Springer. https://doi.org/10.1007/978-3-031-32671-4_120-1

[65] Glemarec, Y. (2023). Financing green and climate-resilient infrastructure in ASEAN countries. *Environmental Progress & Sustainable Energy*, *42*(4), e14097. https://doi.org/10.1002/ep.14097

[66] Mathis, J. E., Gillet, M. C., Disselkoen, H., & Jambeck, J. R. (2022). Reducing ocean plastic pollution: Locally led initiatives catalyzing change in South and Southeast Asia. *Marine Policy*, *143*, 105127. https://doi.org/10.1016/j.marpol.2022.105127

[67] Guan, S., Qu, F., & Qiao, F. (2023). United Nations Decade of Ocean Science for Sustainable Development (2021-2030): From innovation of ocean science to science-based ocean governance. *Frontiers in Marine Science*, *9*, 1091598. https://doi.org/10.3389/fmars.2022.1091598

[68] Lausen, J. N., & Buerkert, J. S. (2025). Fragmentation revisited: A critical analysis of the effects of introducing the BBNJ Agreement into the ocean governance landscape. *Nordic Journal of International Law*, *94*(2), 184–210. https://doi.org/10.1163/15718107-bja10098

[69] Karcher, D. B., Tuohy, P., Cooke, S. J., & Cvitanovic, C. (2024). Knowledge exchange at the interface of marine science and policy: A review of progress and research needs. *Ocean & Coastal Management*, *253*, 107137. https://doi.org/10.1016/j.ocecoaman.2024.107137

[70] Miao, Q., & Nduneseokwu, C. (2024). Environmental leadership and governance: Strategies, mechanisms and multi-levels. In Q. Miao & C. Nduneseokwu (Eds.), *Environmental leadership in a VUCA era: An interdisciplinary handbook* (pp. 159–206). Springer Nature Singapore. https://doi.org/10.1007/978-981-96-0324-4_5