JOURNAL OF
Emerging Paradigms
in Computing Systems
JEPCS

Journal of Emerging Paradigms in Computing Systems (JEPCS) | Volume 03, Issue No. 02, 2026

ARTICLE TYPE: Research Article

Article ID: JEPCS-2026-0302-0033

Computational Blue Finance Governance: RegTech and Automated Compliance for Sustainable Ocean Investment

Kolawole Afuwape[1]

[1] Jindal Global Law School, O.P. Jindal Global University, Sonipat, 131001, India.

*Corresponding author: kolawole.afuwape@jgu.edu.in

Contributing authors: kolawole.afuwape@jgu.edu.in

Received: August 27, 2026 **Accepted:** September 24, 2026

Abstract- As blue economy activities continue to grow, the demand for sustainable investments in the ocean increases and expands to include blue bonds, marine renewable energy resources, sustainable fisheries, coastal infrastructure, and conservation. The study is proof of how Regulatory Technology (RegTech) and compliance computational governance can support blue finance by automating regulatory and sustainability requirements. The study is doctrinal and multidisciplinary, utilizing legal research, sustainable finance, and RegTech methodologies in the field of computational law. The paper introduces the existing regulatory frameworks and blue finance-related standards, requirements, and guidelines. This study covers RegTech solutions, including artificial intelligence (AI), regulatory application programming interfaces (API), distributed ledger technologies, smart contracts, automated reporting, and digital verification tools. The paper examines the positive effects of the use of RegTech in blue finance and how regulatory compliance can be converted into processes that are verifiable and auditable, which in turn would encourage sustainable finance. The study illustrates that RegTech can contribute to making regulatory processes more efficient, formalized, clear, and reliable, promoting sustainable investments. The paper also proposes a model of computational governance for blue finance, which integrates regulatory provisions, sustainability requirements, digital platforms, automation of compliance procedures, verification procedures, and supervision. The study highlights problems, such as the danger of algorithmic obfuscation, informational fragmentation, interoperability concerns, cybersecurity risks, and legal responsibility. The study argues that through RegTech solutions, computational governance can provide a feasible regulatory framework for blue finance, so long as automated compliance processes are transparent, verifiable, and accountable.

Keywords- RegTech; blue finance; computational law; automated compliance; sustainable ocean investment

1. Introduction

The development of the Blue Economy has increased the need for Blue Finance, including blue bonds, sustainable fisheries, marine renewables, coastal infrastructure, and ocean-conservation investment, to raise funds for sustainable oceans [1]. However, these activities operate within a complex regulatory framework that encompasses international ocean law, environmental norms, financial-market rules, sustainability standards, and corporate disclosure obligations. This plurality of regulations poses substantial challenges for compliance, information-gathering, and decision-making for investors, financial institutions, project developers, and regulators. Traditional compliance mechanisms, which rely heavily on manual legal interpretation, periodic reporting, and ex-post regulatory assessments, have proven insufficient in an investment environment characterized by escalating regulatory obligations for investment and an abundance of financial, environmental, and ocean-related data [2]. The convergence of law and computer science through RegTech

has the potential to address these shortcomings by deploying AI, natural-language processing (NLP), machine-readable regulation, legal ontologies, regulatory APIs, blockchain technology, smart contracts, and automated monitoring [3]. However, literature has focused predominantly on banking, securities, insurance, anti-money laundering, and traditional financial regulation, while blue-finance literature has explored financing instruments, sustainability standards, and ocean-governance challenges [4]. Thus, there has been limited scholarly engagement with the extent to which computational legal techniques can transform fragmented ocean, environmental, financial, and sustainability obligations into interoperable, machine-readable, and auditable compliance systems for sustainable ocean investment [5]. This study addresses this lacuna by conceptualizing computational blue finance governance as a mechanism for integrating legal rules, sustainability requirements, and data through automated compliance technologies. The paper makes three principal contributions.

- First, it develops a computational-law framework for translating natural-language blue finance obligations into legal ontologies, regulatory taxonomies, and rules-as-code.
- Second, it proposes a comprehensive RegTech architecture linking regulatory requirements to financial, environmental, and ocean data, AI-driven compliance analysis, regulatory APIs, automated reporting, blockchain verification, and continuous monitoring.
- Third, it identifies governance safeguards for automated compliance, including transparency, explainability, data integrity, interoperability, cybersecurity, human oversight, contestability, and accountability. The paper argues that computational RegTech technologies can reduce compliance costs, enhance sustainability assurance, and improve investor confidence, but that automation should be grounded in legally intelligible rules and meaningful human accountability to realise the transformative potential of technology on the rule of law.

1.1. Research Hypothesis

The use of regulatory technology and automated compliance procedures, or the computational blue finance governance, reduces the costs of compliance monitoring, enhances transparency, and expedites the flow of capital towards authentic sustainability development in marine investment funds. By using automated procedures, smart contracts, telemetry, and decentralized data and financial accounting, computational governance is a mechanism that prevents blue washing and ensures that private capital incentives are consistent with international law. Thus, the application of automated compliance processes helps to create a standard measure of ocean integrity and demonstrates that automated compliance procedures are an integral part of any successful fundraiser for the blue economy.

1.2. Research Objectives and Questions

Objective 1: Regulatory Tech Mapping Description: Research objective: To investigate the existing capabilities and design principles of Regulatory Technology or RegTech, used for automating compliance and risk management in sustainable ocean investments.

Research question: How could RegTech frameworks be designed to accurately trace compliance with blue finance practices, and what technical limitations might hinder their adoption?

Objective 2: The conceptual design represents a blockchain-based and smart-contract-controlled governance model that seeks to enforce real-time regulatory compliance while also preventing blue-washing by ensuring continuous automated assessment of relevant ocean-related activities against a set of ESG criteria.

Research question: How could systems of automated compliance be designed so that they constantly check that a given ocean investment reflects its stated goals?

Objective 3: Automation vs. Policy Description: Research objective: To analyze the legal and policy implications of automating compliance checks for international law, particularly in the complex domain of maritime border governance.

Research question: How could a shift from human to algorithmic governance be implemented, and what conflicts would arise if automated systems made decisions that appear to contradict established international treaties or agreements?

1.3. Contribution to the Study

The study contributes to the emergent field of computational law, specifically by advancing a computational blue finance governance framework that couples ocean governance, sustainable finance, and RegTech. The existing blue finance scholarship has predominantly focused on financial mobilization, sustainable investments, conservation finance, blue bonds, and the development of the oceanic sector. Simultaneously, research has tended to focus on conventional financial markets, banking, securities, anti-money-laundering and prudential compliance. By bridging the fields together, the study conceptualizes blue finance regulation as computationally operable legal governance, thus extending the scope of computational-law scholarship into the hitherto underdeveloped area of sustainable ocean investment.

A second contribution is reflected in the development of a legal-to-computational compliance pathway that transforms complex regulatory requirements into machine-readable compliance rules. The study proposes a sequence of legal rule identification, NLP-assisted extraction, legal ontology development, rules-as-code formalization, computational compliance testing, automated monitoring, verification, and human legal review. The study offers a methodological

bridge between doctrinal legal analysis and computational implementation and demonstrates how legal obligations related to sustainability, disclosure, use of proceeds, fisheries management, protection, investment governance, and similar areas may potentially be translated into operational compliance parameters.

Third, the study contributes a computational blue finance governance Architecture (CBFGA), which incorporates seven interconnected layers, including legal and regulatory sources, legal processing, legal knowledge representation, regulatory and sustainability data, computational compliance, verification and supervision, and accountability. The architecture moves beyond viewing RegTech as being merely an efficiency-enhancing technology and conceptualizes it as a digital regulatory infrastructure that interconnects fragmented oceanic, environmental, financial and sustainability regimes. Consequently, the study offers a structured model through which regulators, financial institutions, investors, certification bodies, technology providers, and other marine sector entities may potentially interact within a more coherent compliance ecosystem.

The study further contributes by underlining the importance of digital evidence and regulatory data integrity to computational blue finance governance. The Seychelles Blue Bond case illustrates the challenges of maintaining effective monitoring and alignment of financial instruments with Blue Economy objectives, while the Philippine blockchain-enabled seafood traceability case provides an example of how digital provenance and supply-chain information may be leveraged for fisheries-related verification. Collectively, the cases demonstrate the complementary role of financial compliance infrastructure and reliable marine sector data infrastructure, while demonstrating that blockchain, AI, or automated systems cannot independently establish legal truth, and cannot substitute institutional verification.

Finally, the study contributes to policy and regulatory scholarship by suggesting a pathway towards interoperable, adaptive and accountable blue finance regulation. It underlines that effective computational governance requires more than technological deployment: it requires harmonized regulatory taxonomies, machine-readable legal standards, interoperable data structures, common sustainability indicators, regulatory APIs, reliable verification mechanisms and clearly allocated institutional responsibilities. The study makes a conceptual contribution to the field of computational legal theory, while also providing a practical governance framework for regulators and market participants seeking to make sustainable ocean investment more transparent, monitorable, verifiable and legally accountable.

2. Literature Review

The current developments of computational law and legal informatics are advanced by the tendencies of legal rules, institutions, and decision-making processes to interact with computational technologies [6]. Researchers in the field of legal informatics have been working on problems such as representation, retrieval, processing, and application of legal information through information technologies. Computational law, on the other hand, investigates the formal or machine-analyzable representation of laws for later computational reasoning and decision-making [7]. One of the key assumptions is that a statement in natural language that is commonly found in legislation can be broken down into a set of concepts, conditions, permissions, prohibitions, obligations, and consequences that a computer can handle. This study seeks to offer an empirical foundation to explore how computational law can be used to formalize the various legal obligations that are placed on blue finance, while preserving the critical context, discretion, and interpretive elements of regulations. The study takes this approach, seeing computational law not as a digital rendering of the legal norms, but as a transfiguration of the legal norms into a particular form that is possible to be processed and verified by a computer.

One more research area that can be applied to cater the need of Blue Finance is the application of automated technologies in regulatory compliance, regulatory surveillance and transaction monitoring, commonly referred to as RegTech or RegTech [8]. RegTech might be regarded as a new area of work which utilizes information technologies to keep track of monetary transactions, gather reports, manage risks, and make sure compliance with regulations is maintained by using electronic solutions [9]. The evolution of regulatory technology is expected to rely heavily on the use of advanced technologies such as AI, NLP, machine learning (ML), blockchain, regulatory application programming interfaces, and data analytics [10]. At the same time, most of the literature and practice examples concern traditional finance, including such areas as banking, securities, and insurance, as well as the application of RegTech for combating money laundering. There is a rather limited amount of research on the use of RegTech for addressing the regulatory compliance needs of blue finance. This aspect is essential for the current study since the analysis focuses on the financial obligations of blue finance, which implies the processing of financial, sustainability, and ocean-related data.

The study relies on the rules-as-code and machine-readable law literature and practice. In particular, the term rules-as-code concerns expressing regulations in a format that could be processed by computerized systems to ensure that rules are followed. Similarly, machine-readable regulation aims to make regulatory information organized in a way that allows software to read it and perform specific actions initiated by its content. These ideas are relevant to Blue Finance because the financial products of this concept are subject to a wide range of regulatory requirements, stretching from traditional financial disclosure rules to ocean law sustainability standards. Therefore, representing regulation in a computational format would help address the needs of blue finance products, which often combine several areas of law [11]. In this context, the term legal ontology emerges, which refers to the representation of concepts and relationships

between concepts that are relevant to a particular area of law. This includes the concepts of investors, issuers, financial products, ocean-related activities, sustainability, regulation, verification, and enforcement of legal rules.

Legal regulation of financial activities is not limited to the activities of states and their institutions but also involves a wide range of private stakeholders [12]. This is even more evident in relation to blue finance because the regulation of ocean investments concerns not only traditional financial regulators but also environmental and maritime authorities. Therefore, this study also relies on the literature and practice of Regulatory Governance, which emphasizes the importance of networks of formal and informal organizations that have governance responsibilities and are not limited to state agencies. RegTech could be considered a part of regulatory governance networks because they allow for automating the collection of reports, monitoring of transactions, and screening of financial instruments for regulatory compliance [13].

At the same time, Sustainable Finance theory also informs the current research because one of the central goals of Sustainable Finance concerns incorporating sustainability factors into financial decision-making [14]. For the blue finance context, this means that in addition to general financial risks and profitability, the potential environmental impact of investments should be considered. Finally, the rule-of-law requirements for computational governance should also be considered when designing computational solutions for blue finance. The rule of law is not automatically met when financial rules are represented in a digital form and are enforced by automated systems that rely on data and algorithms [15]. Therefore, computational governance of blue finance should meet the rule-of-law standards of legality, transparency, accountability, proportionality, and access to justice, including the possibility of human involvement in decision-making [16,17].

The study focuses on the human-in-the-loop approach, which presupposes that the responsibility for the outcomes of automated systems rests with humans. Therefore, RegTech systems would perform limited functions, such as monitoring transactions for regulatory compliance, analyzing potential sustainability risks, and alerting human moderators about possible issues. By relying on the human-in-the-loop approach, this study addresses the problem of legal indeterminacy, which is especially acute in the blue finance context. Based on the existing literature and practice, the study relies on the idea of Computational blue finance Governance as a concept that combines computational law, RegTech, and regulatory governance approaches for addressing the needs of blue finance. Attention is paid to the following five aspects of computational blue finance governance: (i) legal formalization, (ii) regulatory data governance, (iii) automated compliance, (iv) verification and auditability, and (v) human accountability. As the name suggests, legal formalization concerns the transformation of legal norms into machine-readable or executable instructions.

The second step presupposes that data governance policies should ensure the reliability, accessibility, and trustworthiness of regulatory data and information regarding ocean investments. The third and fourth stages concern automated compliance with the regulatory requirements and the possibility of auditing such compliance. Finally, the fifth step implies that although automated systems will be used for processing and screening of financial transactions, the ultimate responsibility for compliance with regulations will rest with human moderators. In this way, RegTech tools will serve as a new type of legal infrastructure that will allow for connecting the requirements of ocean-related sustainability with the needs of financial regulators and investors.

3. Research Methodology

This study is an interdisciplinary doctrinal and computational legal research that leverages qualitative legal analysis, regulatory knowledge representation, NLP, rules-as-code, and conceptual system-architecture modelling. The doctrinal part identifies and analyses legal and regulatory obligations that touch upon blue finance. The computational part explores how to represent the above-mentioned obligations as machine-readable rules of compliance. The regulatory corpus comprises ocean law, finance, and environmental legislation, sustainable finance, investment rules, disclosure requirements, and applicable certification processes.

The second step focuses on processing the legal corpus through the NLP-based analysis to identify relevant information. The process commences with the training data, followed by legal entity recognition and obligation extraction with human validation. The elements identified encompass the actors, legal modality or prescriptive statements, action or inaction, object or target, conditions, time limits, exceptions, and consequences. For example, the obligation to disclose information can be transformed into a rule of imposing an obligation on an issuer to disclose certain sustainability-related information within a stipulated period. Similarly, the analysis extracts not only requirements but also prohibitions, permissions, and other conditional obligations, as well as qualifications, responsibilities, and exceptions.

The concepts identified are organized in the blue finance legal ontology (BFLO). The latter acts as the knowledge repository for computational governance by capturing the relationships between the regulatory actors, financial instruments, ocean-related activities, sustainability indicators, obligations, verification requirements, and consequences. For example, a blue bond that is used to finance a marine renewable energy project will have the attributes of financial instruments, while the corresponding ontology will link this instrument to the applicable disclosure, environmental impact, reporting, and verification requirements. Some of the obligations extracted from the regulatory corpus are organized as rules-as-code, which are employing relationships between an actor, condition, obligation, evidence, and consequence. To make rules-as-code more reliable, the formulation specifies not only obligations and their consequences but also the

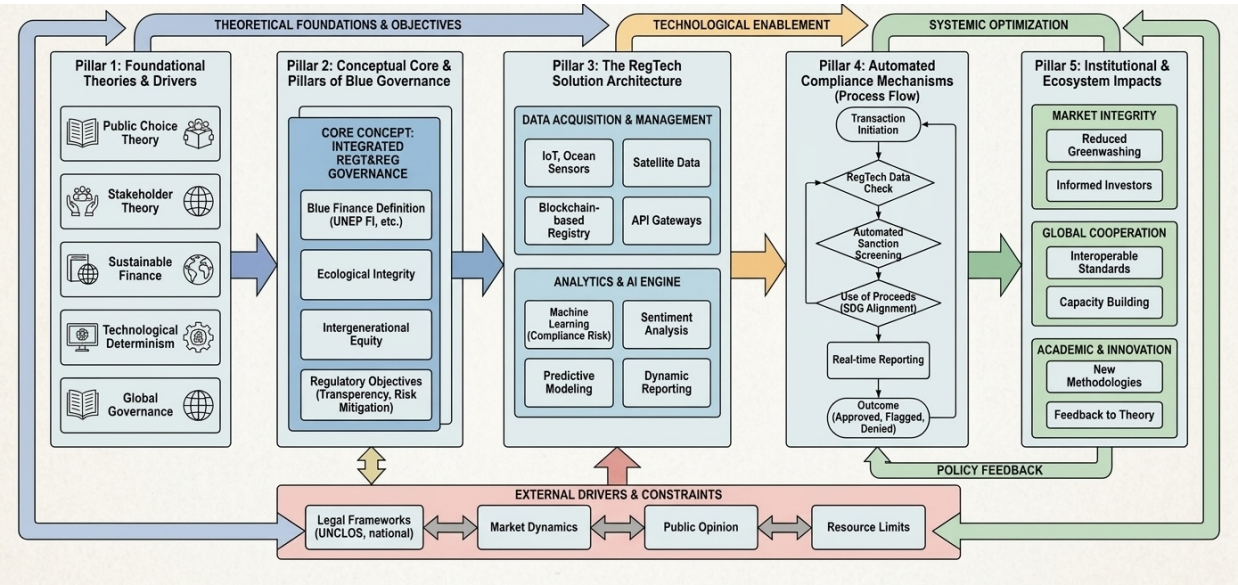


Figure 1: *Theoretical framework for Computational Blue Finance Governance.*

evidence necessary to establish default compliance. The approach helps to avoid binary coding of regulatory defaults and allows room for legal qualifications. For example, when confronted with normatively vague or discretionary formulations, the system resorts to human judgment. The overall computational blue finance governance architecture comprises seven layers as shown in Figure 1.

- The first layer concerns the regulatory sources that comprise treaties, laws, regulations, and standards.
- The second layer relies upon the NLP-driven legal processing that encompasses obligation extraction.
- The third layer builds the legal knowledge base based upon ontologies, taxonomies, and machine-readable rules.
- The fourth layer deals with data that includes financial, ESG, project, ocean, and environmental data.
- The fifth layer concerns the computational compliance engine that uses rules engines, machine-learning algorithms, and regulatory application programming interfaces.
- The sixth layer supports regulatory verification, digital certification, automated reporting, monitoring, and auditing.
- The last layer is constituted by the accountability infrastructure that integrates human factors and institutional elements, such as legal review, regulatory intervention, and judicial oversight.

This manner, the system architecture contributes to a continuous process supporting legal research, computational governance, and regulatory accountability.

The present study employed a qualitative and doctrinal methodology; hence, the NLP framework was used as conceptual analytical tools to classify and interpret legal texts rather than perform an empirical machine learning experiment that would require datasets, trained models, and statistical results. Therefore, some ML methods have some advantages and disadvantages, and hybrid ML methods take advantage of the strong points of the individual ML algorithms [18]. Moreover, given that this study uses a qualitative, doctrinal, and multidisciplinary approach rather than an empirical machine-learning design, performance indicators such as precision, recall, and F1-score are inappropriate and should instead be considered as topics for further investigation [19], it remains unclear whether the model is valid. Logical validation checks to see if the rule will have the desired effect under the specified circumstances. Normative validation of automation assesses its resistance to the lawfulness, transparency, explainability, accountability and rule of law.

The overall contribution of this study is doctrinal based legal analysis which culminates in the creation of the CBFCF. The framework consists of five pillars that are connected: legal formalization, data governance, automated compliance, verification and auditability, and human accountability [20]. The framework sees RegTech as the "computational legal infrastructure that provides for digital governance, but also for regulatory accountability". The framework explains a compliance methodology from Natural-Language Law to NLP Extraction, Legal Ontology, Rules-as-Code, Compliance Engine, Ocean and Financial Data, Automated Compliance Assessment, Verification, Human Legal Review, Regulatory Intervention and Audit Trail [21].

The proposed Blue Finance Legal Ontology (BFLO) can be defined by its conceptual model, which can be read by a machine that includes such classes as Legal Instrument, Legal Provision, Regulatory Authority, blue finance Activity, Environmental Objective, Compliance Obligation, Data Requirement, Verification Mechanism, and Enforcement Measure. Simultaneously, the mentioned legal data ontology comprises relationships such as contains Provision, applies to, imposes obligation, regulated by, requires Data, verified by, and enforced through. For example, United Nations Convention

on the Law of the Sea (UNCLOS) Article 61 can be encoded as legal Instrument → UNCLOS → contains provisions → Article 61 → imposes obligation → Conservation Measure → applies to → Living Marine Resources → requires → Maximum Sustainable Yield/Best Scientific Evidence → enforced through → National Fisheries Regulations. As a result, it is possible to extrapolate a sample rule from the encoded information. If a blue finance Activity impact living marine resources in an applicable maritime zone, the competent authority should apply conservation measures based on available scientific evidence. Consequently, it could be concluded that a textual rule can be converted into linked legal classes, relationships, and machine-processable compliance rules without declaring the ontology's legal authority. The methodology assists in the achievement of automated regulatory compliance, formalizing the roles of blue finance, whilst capturing legal qualifications and providing accountability and the rule of law.

4. Discussion

4.1. Regulatory Architecture of Blue Finance

Blue finance is not based on a single regulatory framework but on a pluralistic one [22]. The regulatory bedrock of blue finance is a mix of the international law of the sea, environmental and climate law, financial-market regulation, sustainable-finance standards, investment governance and sector-specific guidelines for fisheries, marine renewable energy, conservation, and coastal infrastructure. Internationally, the UNCLOS sets the cornerstone for the conservation and sustainable use of marine resources, environmental protection and the jurisdiction of maritime areas, and the Paris Agreement and Sustainable Development Goals set general climate and sustainable-development goals. These instruments are supplemented by more specialized instruments such as fisheries-management instruments, biodiversity rules, environmental impact requirements and new sustainable financial-instrument standards. The consequence is, therefore, normative plurality, institutional fragmentation and differentiated regulatory demands, which are likely to pose significant problems when it comes to the translation of legally dispersed obligations into coherent compliance requirements.

Another difficulty is that blue finance ties financial regulation to the substantive obligations of environmental and ocean-governance [23]. For instance, a blue bond may be deemed credible not only if it meets the standards for conventional securities, disclosure, and investor protection, but also if proceeds are reinvested in qualified marine activities, the environmental goals are demonstrably met, and the sustainability statement is verifiable. This establishes a regulatory nexus of financial regulators, environmental authorities, maritime institutions, project developers, investors, certification bodies, and international organizations. In the context of this study, the regulatory framework suggested can be seen as a multidimensional issue in terms of financial legalities, environmental integrity, ocean sustainability, data governance, and investment accountability. These normative domains should therefore be institutionalized and represented in an interoperable way if their computational transformation is to be implemented.

4.2. RegTech and the Computational Transformation of Blue Finance

RegTech is the technology that is enabling this disjointed regulatory landscape to become a predictable regulatory compliance framework [24]. Traditional compliance typically relies upon legal practitioners interpretations of regulatory language, collection of documentary evidence, periodic submission of reports, and provision of information to regulators. These processes are still necessary but are inefficient when many legal instruments have duplicate or continually evolving requirements for these processes. RegTech provides computational features such as NLP, machine learning, regulatory APIs, knowledge graphs, rules engines, automated reporting, and distributed ledger technologies that can identify, monitor, and verify regulatory compliance [25]. The transformation in blue finance is especially important because it integrates compliance data from all aspects of finance, including environmental indicators, biodiversity information, fisheries data, carbon metrics, project-performance information, and marine-spatial information.

The computational transformation should then be seen as a legal formalization process, not just digitalization. The digitization of a regulation simply makes it accessible electronically in legal form. The computationalization of a regulation aims to make the operating requirements of a regulation computable and to preserve legally relevant conditions and exceptions in an electronic form. Obligations and regulated entities can be extracted from natural-language provisions via NLP, relationships can be defined as concepts in legal ontologies, and certain obligations can be captured in the form of rules-as-code that can be executed. A regulatory provision, consequently, can be translated into a structured compliance rule that connects an actor, an activity, a condition, an evidence requirement, and a legal consequence. However, computational representation must always be traceable to the authoritative legal source, since a computational representation cannot gain legal authority just by being run by a computer.

4.3. The Proposed CBFGA

The CBFGA is constituted by interlinked layers of regulatory, semantic, technology, and accountability layers. The first of those layers comprises authoritative regulatory sources including treaties, statutes, regulations, regulatory guidance, and sustainability standards. The second is a legal processing layer where natural language processing methods allow identifying legal entities, requirements, prohibitions, permissions, conditions, and exceptions. The third layer is a legal knowledge layer based on ontologies and regulatory taxonomies that enable linking concepts between financial,

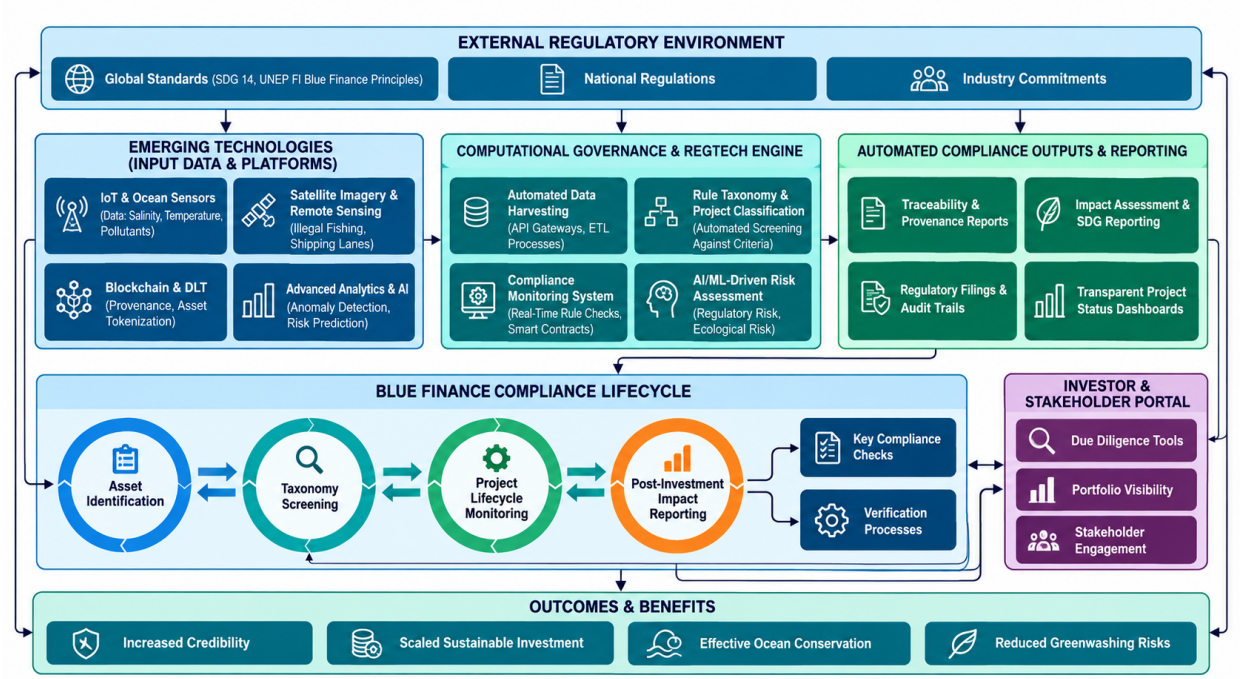


Figure 2: *Emerging technologies and automated compliance within the Computational Blue Finance Governance framework.*

environmental, and ocean governance systems. The fourth one is a data layer bringing together financial data and data related to ESG, fisheries, biodiversity, climate, projects and marine monitoring. The above layers form the basis for the fifth layer, where rules engines and analytical models conduct compliance checks, while verification and supervision layers produce notifications, reports and audit logs.

The last element of the CBFGA is the accountability layer. It is critical since computational compliance can never claim to act as an independent substitute for the authority of regulation. Thus, human review, explainability, auditability, contestation, and corrections for mistakes in the data or computation become essential elements of the architecture. One of the basic design principles here is to ensure the possibility of tracing any significant automated decision back to the regulatory decision, the computational rule, data, and the underlying legal sources. The following traceability is created through a chain of legal and technical provenance: legal source → machine-readable rule → compliance data → computational decision → verified outcome → human regulatory decision. Figure 2 shows emerging technologies and automated compliance within the CBFA.

4.4. Automated Compliance across the Blue Finance Lifecycle

Automation can be deployed at various stages of the blue finance lifecycle, from project identification and instrument design [26]. In the pre-financing phase, a compliance engine may check whether a proposed project complies with the established criteria, including environmental, sustainability, and industry-specific requirements. During the issuance process, an automated system may analyze disclosure documents and ascertain whether there is any inconsistency between the financing purpose and project characteristics [27]. After issuance, the system can keep track of the use of proceeds, sustainability indicators, and reporting. In case the collected data suggests some deviation from the predetermined criteria, automated alerts may be sent to compliance officers, certifiers, or regulators. Finally, at maturity or exit, the system can facilitate impact assessment, verification, and archiving of the project's full compliance record. What we get as a result is the shift from regular compliance checks to regulatory monitoring throughout the lifecycle of a project.

Automation also requires a distinction between deterministic and interpretive compliance. While filing deadlines, data fields, threshold values, or documentation requirements are relatively easy to automate, open-textured norms such as proportionality, materiality, reasonableness, significant environmental damage, or conflicting legal interests may necessitate legal interpretation. For this reason, the proposed architecture implies a tiered approach where simple requirements can be automatically checked; questionable requirements can be flagged; and complex legal issues can be escalated to human decision-making. This solution appears better than the attempt to fully automate legal reasoning, as it acknowledges the difference between the tasks performed by a machine and a human being in a regulatory system.

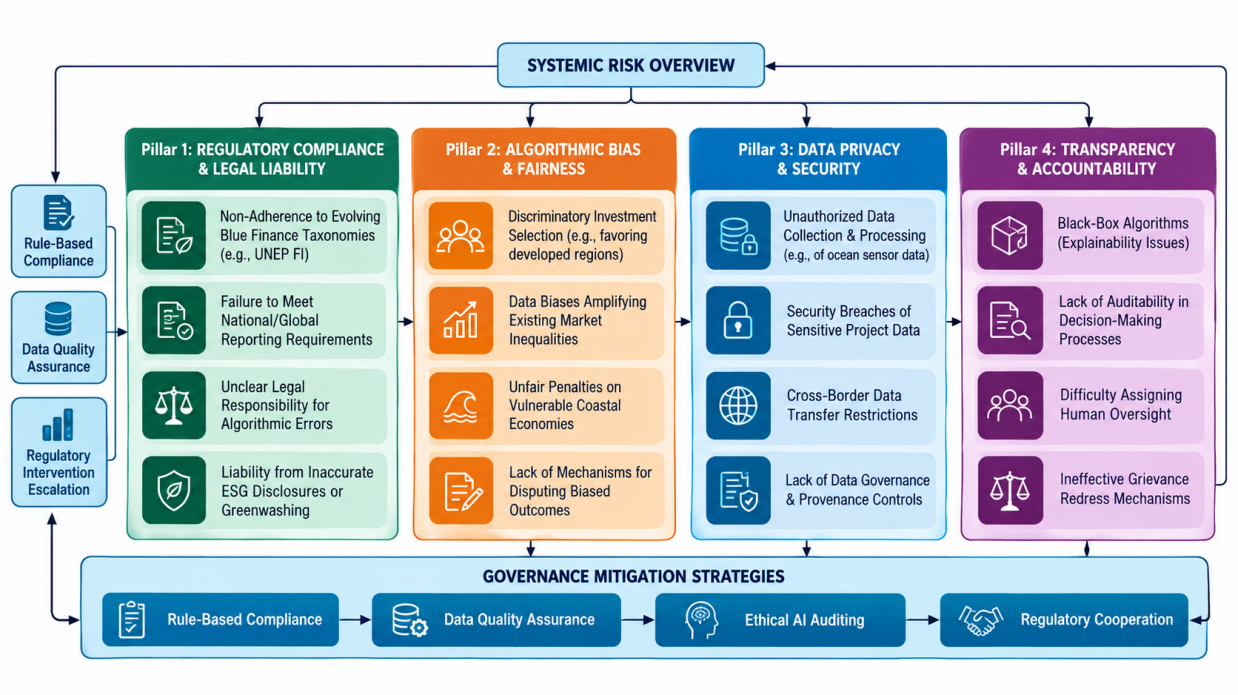


Figure 3: *Legal and governance risks of automated Blue Finance compliance.*

4.5. Emerging Technologies and Blue Finance Compliance

There are several emerging technologies that may enhance this regulatory framework. AI and NLP would make it possible to analyze regulatory texts, extract obligations, classify documents and detect anomalies [28]. Blockchain and other tamper-proof distributed ledger technologies could ensure provenance and auditability where multiple parties are involved in accessing information regarding project financing, supply chains, sustainability certificates, or transactions involving marine resources. Regulatory APIs would enable structured interaction between financial organizations, regulators, certification entities and project information systems. Smart contracts could additionally execute the consequences of a contract or financing deal automatically based on specified conditions being fulfilled. Taken together, these technologies can convert the current practice of compliance into an ongoing and interoperable regulatory process.

However, the use of these technologies should be adjusted to the specific nature of marine and financial data. Information about the oceans may come from satellites, vessel monitoring systems, sensors, remote sensing platforms, scientific databases, governmental and private organizations, and all of them will have their own standards and levels of reliability. Blockchain technology could maintain the integrity of the information being recorded but cannot guarantee its truthfulness at the time of recording. AI can detect patterns and anomalies but can also produce incorrect classifications. Finally, APIs could increase interoperability but create the risks related to cybersecurity and governance of data. Therefore, emerging technologies should be used as complementary parts of the compliance ecosystem rather than independent guarantors of regulatory integrity.

4.6. Legal and Governance Risks of Automated Blue Finance Compliance

First, the "computationalization" of blue finance poses legal and governance risks of algorithmic opacity and incorrect decision making [29]. If an AI system determines a certain project as being either compliant or non-compliant, all parties involved should be able to understand the relevant law and the key pieces of evidence underpinning the decision. The issue of black-box systems is especially concerning in cases where automated decisions affect financing, regulatory compliance, or the reputation of the concerned party. The risk of algorithmic bias exists if the training data used for automated systems are heavily skewed towards big institutions projects and do not properly reflect smaller fishery, community or developing country businesses operations. This kind of bias would mean that technology would become an instrument of regulatory exclusion by mistake. Hence, any such compliance systems must allow for explainability, bias testing, documentation, validation, and challenging of incorrect results.

Secondly, there are several risks associated with the governance of data, cybersecurity, interoperability, and liability. blue finance systems will have to deal with sensitive commercial data and environmentally important and possibly sensitive marine data. Loss, alteration, and manipulation of such information would affect financial and environmental compliance. Interoperability issues might occur because of incompatible data formats, different classifications of laws and standards

used by regulators or because of changes in regulations which would make encoded rules outdated. One of the most complicated legal questions is related to the problem of liability; it might apply to the software developers, data providers, financial institutions, certifiers, compliance officers, or regulators depending on the situation. Figure 3 shows the legal and governance framework within CBFGA.

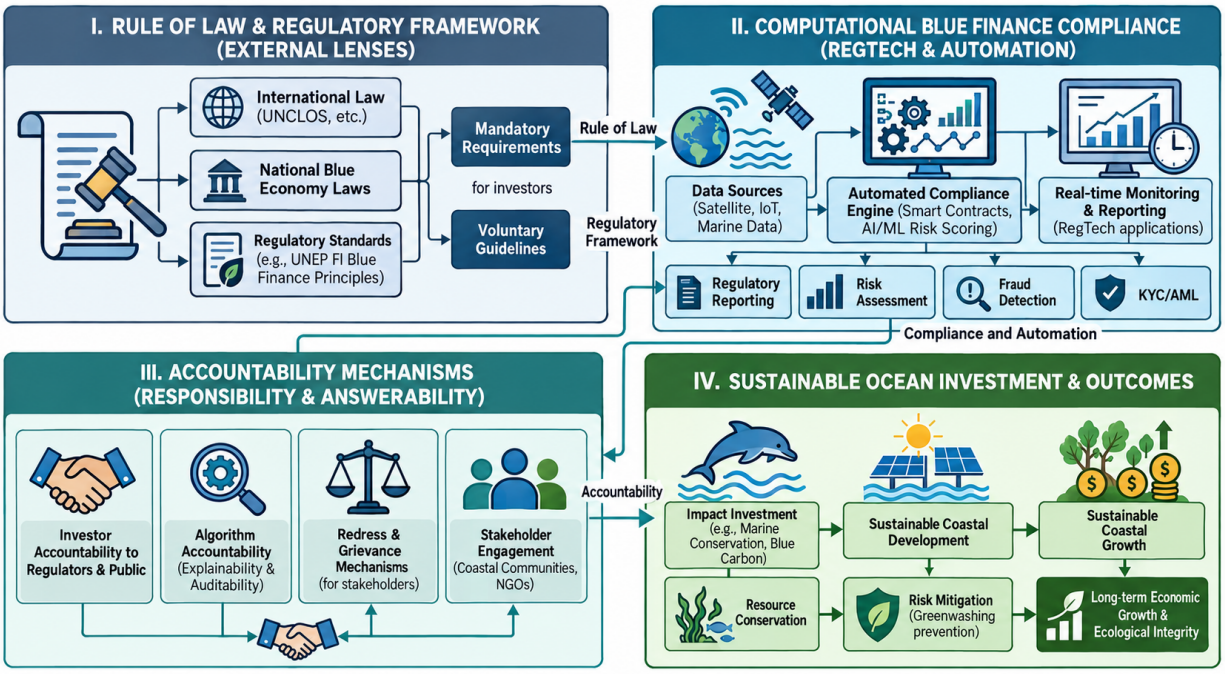


Figure 4: *Accountability and the rule of law in Computational Blue Finance Governance.*

4.7. Accountability and the Rule of Law in Computational Blue Finance

The legitimacy of computational blue finance governance in the final instance rests on maintaining accountability and the rule of law [30]. Computational blue finance systems must not generate a situation wherein the regulated and the decision makers operate in a legal vacuum of accountability and opacity. Legality, transparency, procedural fairness, proportionality, reason-giving, and judicial review standards must, accordingly, apply to computational systems for compliance. Every decision generated by a computational system must be accompanied by the appropriate audit trail, including the rule involved, pertinent data, computational processes, and human interventions. If a computational system cannot make a proper resolution to a particular legal question, it should escalate rather than invent an answer. Human intervention in computational processes appears critical in the case of environmental regulation, when factual and legal uncertainties are integral to decision-making.

This leads to the key implication of the suggested framework. Computational governance, through RegTech, may increase visibility, interoperability, continuity, and audibility of regulatory requirements and compliance, but cannot decide on the issues of the legitimacy of legal norms and conflicts among normative positions. Thus, the CBFGA proposes the positioning of computational systems within the hierarchy of authority, where legislation and authoritative legal interpretation are in the first place. Then, the computational systems implement the relevant obligations, verified data provide the evidential backing, and ultimately decision-making authority belongs to human institutions. In other words, the model suggested should be "law supported by accountable computation," and not "law by algorithm." This is the basis of computational blue finance governance in terms of normative considerations. Figure 4 shows the accountability and the rule of law in computational blue finance governance.

5. Implementation/Case Analysis

The CBFGA is further elaborated through two distinct real-world examples, which represent different dimensions of digitalized Blue Finance governance [31]. The Seychelles Blue Bond and a blockchain-based seafood traceability system in the Philippines. The cases were purposively selected as they relate to two key components of the proposed architecture [32].

The Seychelles example demonstrates the governance challenges involved in linking marine-finance instruments to sustainability objectives, monitoring, and compliance, while the Philippine system demonstrates how distributed-ledger

technology can be used to convert fragmented fisheries information into a traceable compliance infrastructure. The cases are not intended as fully automated RegTech systems but provide empirical implementation evidence by which the authors can test the proposed computational architecture. This distinction is methodologically important to prevent the researchers from attributing capabilities to existing systems that they do not presently possess.

The first case examines the Seychelles Blue Bond issued by the Seychelles issuing a US$15 million sovereign Blue Bond in 2018 with World Bank support, making it an important early example of capital-market financing directed toward sustainable marine-resource management [33]. The transaction was supported by a US$5 million World Bank guarantee and a $5 million concessional loan from the Global Environment Facility [34]. Proceeds were directed to fisheries and marine resource management via associated financing and grant mechanisms. The World Banks Independent Evaluation Group later noted that the bonds monitoring and compliance management framework was insufficient to ensure continuing alignment with Blue Economy objectives [35]. Seychelles therefore provides a useful comparison point for the present study, as it demonstrates that mobilizing blue capital is not equivalent to establishing computationally verifiable blue-finance compliance. With the proposed CBFGA, the bonds sustainability commitments could be converted into machine-readable eligibility, allocation, reporting, and impact-verification rules, with financial and environmental data linked via a legal ontology and automated compliance engine. The case provides empirical justification for introducing continuous digital monitoring, standardized sustainability indicators and automated alerts into blue finance governance.

Seychelles produces three principal analytical results. First, the case demonstrates a governance-to-capital gap where a financial instrument successfully mobilizes resources for marine purposes but encounters difficulty in demonstrating continuous conformity with sustainability goals [36]. Second, it demonstrates the importance of verification and the need for data interoperability because investors and regulators require proof linking the use of proceeds to measurable marine outcomes. Third, it illustrates why blue finance requires more than conventional financial disclosure: compliance must relate to fisheries, biodiversity, conservation, and marine-management data.

The proposed architecture addresses this by establishing a traceable chain of legal obligation → sustainability indicator → verified data → compliance rule → regulatory output. The justification for selecting Seychelles is therefore particularly strong due to the documented weakness in monitoring and compliance, providing a real-world governance problem against which the proposed RegTech architecture can be tested. The second case examines blockchain-enabled seafood traceability in the Philippines. Tracy blockchain-based information system has been designed to improve traceability across the Philippine fish supply chain from bait to plate [37]. It was designed in response to practical problems concerning fragmented standards, regulatory requirements, export documentation, and catch certification.

The underlying case study notes that blockchain technology can provide real-time supply-chain visibility and improve transparency across fisheries actors. This case is directly relevant to computational Blue Finance because credible financing and sustainability certification increasingly depend upon the availability of reliable evidence concerning the origin, legality, and sustainability of marine products. Within the proposed CBFGA, blockchain-based traceability can form the verification and integrity layer, and NLP and rules-as-code can ascertain whether the underlying information satisfies applicable fisheries, sustainability, certification, and disclosure requirements [38]. The system thus demonstrates how computational infrastructure can convert dispersed fisheries records into auditable compliance evidence to support investors, financial institutions and regulators.

The Philippine case provides complementary results to Seychelles, as while the Seychelles example demonstrates the difficulty of monitoring financial resources remaining aligned with blue-economy objectives, the Philippine system demonstrates how digital traceability can improve the quality, provenance, and accessibility of compliance data upon which such monitoring depends. The two cases validate different stages of the proposed architecture: Seychelles supports the need for automated monitoring, compliance management and sustainability verification, while the Philippine system supports the need for interoperable data, distributed verification and auditable flows of information. Their combination justifies the CBFGAs seven-layer architecture comprising regulatory sources, legal processing, legal knowledge, data infrastructure, computational compliance, verification/supervision and human accountability.

However, neither case demonstrates whether blockchain or automation can independently determine legal compliance, and both reinforce the importance of authoritative legal rules, reliable data, independent verification and human oversight. The findings underpin a human-centred "RegTech", where computation can enhance the compliance process by increasing the speed, consistency, traceability and evidentiary quality of compliance, while legal institutions retain interpretive and decision-making power. The two cases are chosen because they are complementary to the proposed Computational blue finance Governance Architecture. Seychelles case is evidence of a real problem of blue finance governance and compliance, and the Philippine case is evidence of an existing digital infrastructure that can address the data, traceability, and verification challenges. Their choice is therefore made notwithstanding the methodological pitfall of hypostatizing solely hypothetical scenarios.

More importantly, both cases are not construed as proof that there is already a fully automatic regulatory system. The cases serve as benchmarks for implementation, however, and are used to test the proposed computational architecture. This separation allows the study to make a nuanced argument: that the financial, regulatory, and technological environment created by current blue finance projects has already made it possible to implement computational compliance, but important institutional and technological spaces are yet to be filled. The Seychelles Blue Bond is especially defensible

since it is a real and internationally recognized use of blue finance that links the process of financial mobilization to the marine sustainability goals. The US$15 million sovereign Blue Bond provided financing for sustainable fisheries and marine resource management, thereby creating a direct relationship between capital-market activity and ocean-governance outcomes [39]. Its analytical significance for this study derives not merely from its status as an innovative financing instrument but also from the documented difficulties associated with its monitoring and compliance.

The World Banks Independent Evaluation Group identified weaknesses in the monitoring and compliance-management arrangements associated with the Blue Economy approach, providing an empirically grounded regulatory problem for computational intervention. The case consequently demonstrates that successful mobilization of blue finance does not guarantee continuous, transparent or computationally verifiable compliance with sustainability objectives. The Seychelles case therefore provides a particularly strong justification for the automated compliance, sustainability-monitoring, regulatory-reporting, and verification components of the CBFGA.

Computational architecture could translate applicable eligibility conditions, use-of-proceeds requirements, sustainability indicators and reporting obligations into structured rules that could continuously evaluate available project and financial information. Rather than replacing the legal judgment of regulators, such a system could identify missing disclosures, information inconsistencies or deviations from predefined requirements and generate alerts for human review. The value of the case is therefore diagnostic as well as illustrative: it identifies a real governance deficiency, the difficulty in maintaining effective monitoring and compliance across a blue finance instrument, as well as why conventional periodic reporting may benefit from computationally assisted supervision. The case therefore provides a defensible empirical basis for arguing that RegTech can improve the traceability, timeliness, and consistency of blue finance compliance.

The Philippine blockchain seafood-traceability case is defensible for a different but complementary reason. It provides evidence that distributed digital infrastructure has already been applied to practical fisheries-governance and supply-chain problems. Blockchain-enabled traceability can create a persistent record of information concerning the movement and provenance of seafood, addressing fragmentation of information in the supply chain, certification, and regulatory documentation. Its relevance to computational Blue finance lies in the fact that investment compliance ultimately depends upon the availability and reliability of underlying evidence. Financial institutions, investors and certifiers cannot effectively evaluate sustainability claims where information about the origin, legality, production and environmental characteristics of marine products is fragmented or difficult to verify. The Philippine case therefore provides a real-world technological foundation for the CBFGAs data-integrity, provenance, and audit-trail layers.

The technological significance of the Philippine case should nevertheless be framed carefully: blockchain does not independently determine whether an activity is legally compliant, nor does recording information on a distributed ledger establish that the information entered the system is truthful. Its principal contribution is to improve the integrity and traceability of recorded information once appropriate data has entered the system. For the purposes of this research, that distinction is important because it allows blockchain to function as a verification and evidentiary layer within a broader computational legal architecture. When combined with legal ontologies, machine-readable rules, regulatory APIs, and automated compliance engines, traceability data could potentially be evaluated against applicable fisheries, environmental, certification, and sustainable-finance requirements. The Philippine case therefore supports the technological feasibility of one important component of the proposed architecture without overstating blockchains legal or regulatory capabilities.

The combined significance of the two cases is therefore greater than that of either case considered individually. Seychelles represents the financial-governance dimension of blue finance, demonstrating the difficulty in monitoring whether capital remains aligned with marine sustainability objectives; the Philippines represents the marine-data and technological dimension, demonstrating how digital traceability can improve the availability and provenance of information necessary for effective monitoring. Together, they establish the two conditions required for computational blue finance governance: legally defined compliance obligations and sufficiently reliable digital evidence against which those obligations can be assessed. This supports an end-to-end CBFGA pathway in which legal rules are extracted and formalized, relevant ocean and financial data are collected, computational rules evaluate compliance, digital systems preserve evidence and audit trails, and legally significant or uncertain outcomes are referred to competent human authorities.

Finally, the cases are easily defensible in that they provide a well-contained contribution, not an overstated claim of technological novelty. The study does not claim that Seychelles Blue Bond or the traceability system in the Philippines is a ‘full RegTech implementation of computational blue finance governance’. Instead, the cases show clear governance and information issues that the proposed architecture will be adopted to address and has the potential to resolve. Seychelles sets the baseline for the need to enhance monitoring, reporting, and verification [40]. The Philippines sets the example for how data provenance and traceability can be enhanced with digital technologies [41].

The conclusion of the argument is that there are existing initiatives for blue finance and marine data that can serve as the empirical blocks for an integrated compliance infrastructure in the form of a computational tool. The CBFGA further builds on these advances by bringing legal formalization, data governance, automated compliance, verification, and human accountability together into a single regulatory architecture, which thus contributes more forcefully and defensibly to the field of computational law and legal technology scholarship.

6. Findings

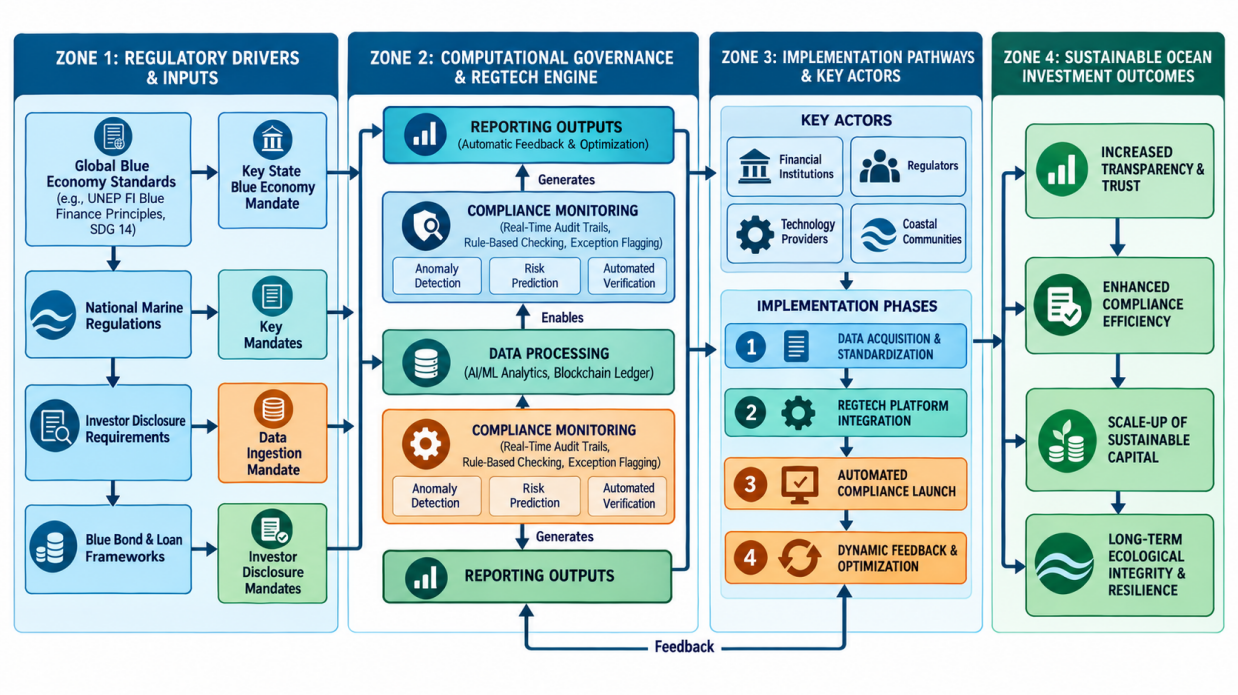


Figure 5: *Computational Blue Finance Governance framework: RegTech and automated compliance findings.*

The findings suggest that computational blue finance governance has the potential to transform regulatory compliance from a predominantly periodic and document-based process into a continuous, data-driven, and auditable process as shown in Figure 5. The Seychelles Blue Bond demonstrates governance complexities that may arise when financial mobilization is not accompanied by sufficiently robust mechanisms for monitoring sustainability commitments, while the Philippine blockchain traceability case demonstrates the potential of digital infrastructure to improve provenance and accessibility of marine-sector information. Considered together, the cases support the proposition that effective blue finance regulation requires clearly formalized legal obligations and reliable digital evidence against which those obligations can be assessed.

The CBFGA therefore represents a shift from technology being used merely to facilitate transactions to technology functioning as computational regulatory infrastructure connecting ocean law, sustainable-finance standards, environmental information and financial supervision. From a legal perspective, however, computationalisation raises a fundamental distinction between translating law into executable rules and reducing law to algorithmic instructions. Not every legal norm is capable of complete formalization because environmental and financial regulation frequently contains open-textured concepts, proportionality requirements, exceptions, discretionary powers, and context-dependent standards. A rules-as-code system can efficiently determine whether a prescribed report was submitted, whether specified information is present, or whether a predetermined threshold has been exceeded. It cannot necessarily determine the legally appropriate interpretation of concepts such as materiality, significant environmental harm, reasonable measures or proportionality without contextual legal reasoning.

Consequently, the findings support a hybrid model of regulatory automation, in which computational systems undertake repetitive, objective and evidence-based compliance functions while legally indeterminate matters remain subject to qualified human interpretation. The findings also raise questions about algorithmic accountability and the rule of law. Decisions of compliance algorithms may have substantial regulatory consequences if they determine investment eligibility, financing terms, project certifications, regulatory alerts, or enforcement priorities. Regulated entities must therefore be able to determine which legal rule was applied, what data were relied upon, how the system reached its outcome and which authority remains responsible for the decision. The CBFGA therefore requires explainability, traceability, audit logs, data provenance and meaningful human review.

A particular safeguard is the treatment of computational uncertainty: where the system cannot confidently establish compliance because the relevant rule is ambiguous, the evidence is incomplete, or there are competing legal interpretations, the appropriate output should be "requires legal review" rather than an apparently definitive automated decision. This preserves contestability and prevents technological systems from acquiring de facto law-making authority.

From the regulatory governance perspective, computational blue finance could address the problem of institutional fragmentation by establishing channels for the exchange of compliance information between financial regulators, maritime,

environmental, certification, investment, and project-development agencies. However, technological interoperability does not equal regulatory conformity: different agencies will likely adopt different approaches to compliance, define different sets of required indicators, impose different reporting cycles and legal requirements, use different evidence standards, and apply different regulatory checks. Thus, building institutional consensus on the very idea of computational blue finance and establishing common legal ontologies and regulatory data standards are critically important areas for engagement. In particular, the creation of the CBFGA should be driven by an institutional governance design that clarifies questions of data ownership, validation, and the compliance-automation lifecycle, as well as responsibility for regulatory violations and exceptions.

The societal implications are similarly critical, as automation influences not only institutional regulators and investors but also fishing communities, coastal populations, marine-resource users, and beneficiary projects in developing countries. While compliance costs may be reduced and access to capital enhanced by automation, systems poorly designed could exacerbate existing disparities where smaller operators have less access to digital infrastructure, technical expertise, or capacity to create sophisticated sustainability datasets. Data-intensive compliance may thus become a barrier to participation in blue finance markets if regulatory technology is designed exclusively in response to the requirements of large financial institutions and corporate project developers. Socially legitimate architecture must therefore incorporate considerations of proportionality, accessibility, data protection, procedural fairness and mechanisms by which affected communities can contest inaccurate data or adverse computational outcomes. Digitalization should accordingly enhance participation in sustainable ocean finance rather than create new forms of digital regulatory exclusion.

Overall, the results seem to support the idea of human-focused and accountable computational blue finance governance. Both the Seychelles and the Philippine cases illustrate the necessity of enhanced control mechanisms or showcase the potential of digital traceability, and the suggested CBFGA links these abilities to legal formalization, automated analyses, verification, and supervision. The main conclusion that can be drawn from the study is that RegTech should be regarded as a tool that makes existing rules more accessible, interoperable, continuously monitored, and subject to audits rather than replacing the role of the regulator and the legal system in general. Its legitimacy would always depend on the ability to maintain the clear separation between rules, their implementation, data, their analyses, and the decisions made by the humans in the loop. Therefore, the main normative message that the study offers is that automation should be used to operationalize legal compliance and not substitute for legal accountability; in other words, computational efficiency should always be subordinated to legality, transparency, fairness, contestability, and the rule of law.

7. Policy Recommendations

Firstly, policymakers should agree on a coherent regulatory and legal framework for computational blue finance governance that brings together ocean law, financial regulation, environmental protection, sustainable finance standards, and investment governance. Regulatory agencies should define common definitions, taxonomies and eligibility criteria for Blue Finance instruments, and translate relevant obligations into structured, machine-readable regulatory specifications. Interoperable legal ontologies and regulatory APIs should connect financial institutions, maritime authorities, environmental regulators, certification bodies and project developers, reduce regulatory fragmentation and duplication while ensure automated compliance systems operate from authoritative and consistently interpreted legal rules.

Secondly, regulators and financial institutions should develop risk-based RegTech and automated compliance infrastructure across the lifecycle of blue finance. Automated compliance systems should initially be applied to objectively verifiable functions, such as project eligibility, disclosure requirements, use-of-proceeds monitoring, reporting deadlines, sustainability indicators, and documentation verification. AI, NLP, rules engines and anomaly-detection tools should complement rather than replace professional compliance and regulatory judgment. Sandboxes and controlled pilot programmes should be established for blue bonds, sustainable fisheries finance, marine renewable energy and ocean-conservation investments, enabling regulators to test computational systems before large-scale roll-out and to detect technical, legal and operational weaknesses.

Thirdly, policymakers should establish standards for blue finance data governance and interoperability and develop digital-verification rules. Information about marine resources, biodiversity, emissions, fisheries activity, environmental impact, project performance, and payments is critical to sustainable ocean investment, and so regulators should define common data schemas, requirements for metadata, provenance, and verification procedures. Blockchain or other technology should be used in cases where they contribute to traceability and auditability and not replace independent verification of the information itself. They should pay attention to data quality, cybersecurity, privacy, cross-border information exchange, and correction of inaccurate or tampered data.

Fourthly, algorithmic accountability and human oversight need to be embedded as essential governance principles for automated blue finance compliance. Regulatory technology should be subjected to transparency, explainability, independent auditing, assessment of bias, version control, and documented accountability for computational outputs. Automated systems need to differentiate between deterministic compliance questions and legally uncertain matters; the latter should be automatically escalated to qualified human reviewers for resolution.

Regulated entities should have access to meaningful explanations of adverse automated assessments and appropriate mechanisms for review, correction and appeal. Responsibility should remain clearly allocated among regulators, financial institutions, technology providers, data suppliers and independent verifiers so that automation does not create an accountability gap. Finally, policymakers should pursue inclusive and internationally interoperable computational blue finance governance, particularly since developing coastal economies and small-scale marine-resource users may otherwise face disproportionate digital-compliance costs.

Capacity-building, technical assistance, open standards and proportionate compliance requirements should enable smaller institutions and developing-country projects to participate in emerging blue finance markets without sacrificing environmental integrity. International organisations, financial regulators, ocean-governance institutions and standard-setting bodies should collaborate on interoperable regulatory taxonomies and cross-border compliance standards. Ultimately, policy should pursue a human-centred model of RegTech in which computation improves regulatory efficiency, traceability and sustainability assurance while legal institutions retain responsibility for interpretation, enforcement and accountability.

8. Conclusion & Future Work

The study proves that computational blue finance governance can offer a theoretical basis for increasing the regulatory efficiency and transparency of ocean investments. The cases and reports considered in the work reveal that blue finance covers a set of complexes, multi-layered, and multi-jurisdictional areas, ranging from ocean law to banking regulation, sustainability, and investment laws and regulations. At the same time, technologies such as RegTech, NLP, legal ontologies, rules-as-code, machine learning, and blockchain, along with various regulatory APIs, can ensure that individual aspects of blue finance regulation become objects of computational governance. The paper's main argument is that the regulation of blue finance can benefit from a combination of legal norms and technological solutions to ensure the automated assessment of financial, environmental, and oceanic data against regulatory requirements. This approach aims to make RegTech a part of computational legal infrastructure that connects sustainability and compliance with regulation and oversight.

The analysis of cases provides sufficient grounds for arguing that the cases support the thesis. The Seychelles Blue Bond example shows how critical it is to ensure effective verification and reporting for blue finance products to meet sustainability goals. On the other hand, the blockchain-based traceability solution for Philippine fisheries is a chance to increase the trustworthiness and transparency of fisheries supply chains. Therefore, the two cases demonstrate how legal and regulatory requirements for blue finance can benefit from the application of automated technologies. However, the main message is that automated systems should be used to increase the efficiency of regulatory compliance; at the same time, the analysis discovers that ambiguous, disputed, and context-dependent aspects of regulation may require human expertise and supervision.

The paper's research also has limitations that should be taken into consideration. First, the proposed architecture is based on conceptual studies rather than actual regulatory software that has been tested with enough data. Second, the cases used as the basis for illustration only partially prove that automated methods can increase the efficiency of blue finance governance. Third, the paper reveals that it may be difficult to formalize regulatory requirements for blue finance using computational methods because of the complexity and diversity of applicable legal frameworks. Finally, there are challenges related to utilizing automated compliance technologies for blue finance, including data security, interpretability, regulatory changes, data quality, and potential biases. Therefore, the research contributes to the understanding of how regulation of blue finance can benefit from RegTech, but it does not provide sufficient evidence that automated approaches are universally applicable and superior to existing methods.

The future work can be conducted to expand the current research based on the findings and limitations identified in the paper. Firstly, future research should focus on the task of realizing computational governance of blue finance on a large scale. Further analysis can reveal opportunities for building a complete and machine-readable corpus of laws and regulations related to blue finance. It will also be essential to design a legal ontology, analyze the performance of NLP in processing regulatory texts, and encode rules-as-code. In addition, an empirical study that compares the automated and traditional blue finance compliance methods can verify whether regulation using RegTech can be advantageous. Finally, additional research is needed to identify the opportunities and challenges associated with applying AI in blue finance governance, including issues of interpretability, traceability, data trustworthiness, smart contracts, legal jurisdiction, and liability. Thus, follow-up studies can benefit the current one by building an extensive body of evidence that can become the basis for developing computational governance systems for blue finance, with an emphasis on accountability and sustainability.

Author Declarations

Author Contributions (CRediT): Kolawole Afuwape: Conceptualization; Formal Analysis; Investigation; Writing - Original Draft; and Writing - Review & Editing. The author has read and approved the submitted version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: Not applicable.

Acknowledgments: Not applicable

Conflicts of Interest: The author declare no conflict of interest.

Ethics Statement: Not applicable.

Declaration of Generative AI: During the preparation of this manuscript, the author used LLM tools for language refinement, grammatical correction, and improvement of readability. The author subsequently reviewed and verified the resulting content and take full responsibility for the accuracy, integrity, and content of the manuscript.

References

[1] Patil, A. A. (2027). Blue Finance for Small Island Economies: Innovative Mechanisms for Ocean-Based Sustainable Development. *Blue Economy Innovation for Sustainable Tourism and Climate Resilience*, 359-388.

[2] Jahangir, R., Zulaikha, S., Nagayev, R., & Dewi, I. R. (2026). AI-enabled financial regulation and regulatory governance of AI: a comprehensive bibliometric-systematic literature review. *Quality & Quantity*, 1-48.

[3] Sebastian, S. (2025). Regulatory Technology (RegTech) Adoption in Fintech Governance, Risk, and Compliance Frameworks: Challenges, Opportunities, and Legal Implications. *Issue 4 Int'l JL Mgmt. & Human.*, *8*, 860.

[4] T. Singh, S. Aggarwal, A. K. Srivastava, and S. Dsouza, "From compliance to catalyst: RegTech's role in the blue economy," *Journal of Economic and Administrative Sciences*, pp. 1–25, 2025, doi: 10.1108/JEAS-05-2025-0304.

[5] Khaskheli, M. B., Zhao, Y., & Lai, Z. (2025). Sustainable maritime governance of digital technologies for marine economic development and for managing challenges in shipping risk: Legal policy and marine environmental management. *Sustainability*, *17*(21), 9526.

[6] Kheong, L. T. (2026). AI-Driven Legal Automation: Ethical and Regulatory Challenges in a Digital Society. In A. Wagner (Ed.), *International Handbook of Legal Language and Communication: From Text to Semiotics* (pp. 1–24). Springer Nature Switzerland. https://link.springer.com/rwe/10.1007/978-3-031-87993-7_406-1

[7] Stanizzi, S. (2026). Beyond optimization: the non-computable core of law and the limits of AI-mediated legal decision-making. *International Journal of Law and Information Technology*, *34*, eaag009.

[8] Qureshi, M. I., & Khan, N. (2026). Technological Evolution in Fintech: A Decadal Scientometric and Systematic Review of Developments and Criticisms. *International Journal of Finance & Economics*.

[9] Salampasis, D., & Samakovitis, G. (2024). Regtech frontiers: Innovations, trends, and insights redefining compliance. In H. K. Baker, G. Filbeck, & K. Black (Eds.), *The Emerald Handbook of Fintech: Reshaping Finance* (pp. 65–87). Emerald Publishing Limited.

[10] Jinying Li, Ananda Maiti, and Jiangang Fei, 'Features and Scope of Regulatory Technologies: Challenges and Opportunities with Industrial Internet of Things' (2023) 15 Future Internet 256.

[11] Maathuis, H., Stalenhoef, M., Van Otterloo, S., Zwaal, R., Van Montfort, K., & Sent, D. (2026). Designing effective explainable AI: a human-centered evaluation of explanation formats in financial decision-making. *Frontiers in Artificial Intelligence*, *9*, 1668029.

[12] Jordana, J., & Triviño-Salazar, J. C. (2026). Turning vulnerability into strength: how independent regulatory agencies enhance accountability and build stakeholder trust. *Regulation & Governance*, *20*(3), 832-846.

[13] Nithin, G., Ramya, H. P., & Manjunath, B. R. (2026). Regulation and inclusivity in finance and accounting: Navigating regulatory frameworks and technological advancements. In N. Mansour, A. K. Singh, & V. Garg (Eds.), *Regulation and inclusivity in finance and accounting: Navigating regulatory frameworks and technological advancements* (pp. 1–27). Springer Nature Switzerland.

[14] Hosen, M., Rahman, A. A., Yee, B. C. W., Arefin, S., & Gopinathan, S. (2026). Sustainable finance and behavioral choice: The role of risk perception in investment decisions aligned with the SDGs. In *Tenable Engineering for a Sustainable Future* (pp. 151-171). Elsevier.

[15] Bouwmeester, M. (2025). Checks and balances under pressure in the welfare state: Disentangling the rule of law risks of automation and welfare conditionality. *European Journal of Social Security*, *27*(2), 98-120.

[16] Borgesano, F., De Maio, A., Laghi, P., & Musmanno, R. (2025). Artificial intelligence and justice: a systematic literature review and future research perspectives on Justice 5.0. *European Journal of Innovation Management*, *28*(11), 349-385.

[17] Y. Lee and E. Park, "Toward sustainable agentic AI systems: A survey of architectures and methodologies," *Sustainable Development*, 2026, doi: 10.1002/sd.70942.

[18] Azevedo, B. F., Rocha, A. M. A., & Pereira, A. I. (2024). Hybrid approaches to optimization and machine learning methods: a systematic literature review. *Machine Learning*, *113*(7), 4055-4097.

[19] D. Broby and J. V. Camus, "Blue finance: Financial innovation for sustainable oceans," *FinTech and Sustainable Innovation*, vol. 2, Art. no. A11, 2026, doi: 10.47852/bonviewFSI62027953.

[20] Sargiotis, D. (2024). Key principles of data governance: building a strong foundation. In *Data Governance: A Guide* (pp. 137-163). Cham: Springer Nature Switzerland.

[21] A. Akremi, "Ontology-driven legal rule auditor for secure, trustworthy, and governed RAG systems," *Computers*, vol. 15, no. 8, Art. no. 471, 2026, doi: 10.3390/computers15080471.

[22] 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.

[23] Mohd, S. (2026). Bridging the Blue Finance Gap: A Critical Review of Market-Based Mechanisms for Ocean Sustainability. In: Gupta, V.P., Reyed, R.M., Haghi, A.K. (eds) The Blue Economy and Environmental Sustainability: Advancing Global Governance, Innovation, and Finance for a Resilient Future. World Sustainability Series. Springer, Cham. doi: 10.1007/978-3-032-13638-1_6.

[24] D. Obiri, S. O. Esezoobo, B. Adejo, and D. O. Elikwu, "RegTech architectures for intelligent compliance and risk analytics: An interdisciplinary framework integrating law, information systems, and data analytics," *Multiverse Journal*, vol. 3, no. 1, pp. 72–92, 2026, doi: 10.63084/wa022y62.

[25] Bagherifam, N., Naghdi, S., Ahmadian, V., Fazlzadeh, A., & Baghalzadeh Shishehgarkhaneh, M. (2025). Digital regulatory governance: The role of RegTech and SupTech in transforming financial oversight and administrative capacity. *International Journal of Financial Studies*, *13*(4), 217.

[26] Antiya, D. S. (2025). Harnessing AI for data-driven compliance and security in cloud environments: A blue-green infrastructure approach. In *Integrating blue-green infrastructure into urban development* (pp. 245-270). IGI Global Scientific Publishing.

[27] Sadok, H., Sakka, F., & El Maknouzi, M. E. H. (2022). Artificial intelligence and bank credit analysis: A review. *Cogent Economics & Finance*, *10*(1). doi: 10.1080/23322039.2021.2023262.

[28] Boukhelifa, Y., & Merabet, R. (2024). Evaluating the Role of Natural Language Processing in Automating Regulatory Compliance and Legal Risk Management in the Banking Sector. *Studies in Knowledge Discovery, Intelligent Systems, and Distributed Analytics*, *14*(7), 1-13.

[29] E. Lioliou, M. M. Seitanidi, and L. Stadtler, "Governance under algorithmic opacity: How financial firms construct accountability and control around AI in risk disclosures," *Information Systems Frontiers*, 2026, doi: 10.1007/s10796-026-10762-y.

[30] C. García-Llorente and I. Olmeda, "Algorithmic governance in banking: A comparative analysis of risk-based and accountability-oriented oversight," *Journal of Banking Regulation*, vol. 27, Art. no. 19, 2026, doi: 10.1057/s41261-026-00320-6.

[31] E. Kabaklarlı, Z. Ayvaz, M. Petrova, I. Kotsev, and Z. Kyriazi, "Economic, innovation and finance perspectives of sustainable blue economy: A focus on fisheries and aquaculture," in *Handbook of Sustainable Blue Economy*, 2026, pp. 1–36, doi: 10.1007/978-3-031-32671-4_93-1.

[32] Kılıç, A. O. (2024). Seychelles blue bond: Indebting ecological restructuring of fisheries. *Marine Policy*, *163*, 106144.

[33] Chavarría-Flores, A., & Warren, P. (2024). Sovereign climate bonds: Policy innovation for just transitions in developing countries. *Journal of Climate Finance*, *7*, 100041.

[34] 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.

[35] March, A., Evans, T., Laing, S., & Raguain, J. (2024). Evaluating the world's first sovereign blue bond: Lessons for operationalising blue finance. *Commodities*, *3*(2), 151-167.

[36] United Nations Framework Convention on Climate Change (UNFCCC), Seychelles First Biennial Update Report (BUR) under the United Nations Framework Convention on Climate Change, February 2024, https://unfccc.int/sites/default/files/resource/Clean%20Version_Seychelles%20FBUR_19%20Feb%202024.pdf

[37] Shamsuzzoha, A., Marttila, J., & Helo, P. (2024). Blockchain-enabled traceability system for the sustainable seafood industry. *Technology Analysis & Strategic Management*, *36*(11), 3891–3905. doi: 10.1080/09537325.2023.2233632.

[38] Olaleye, I. O., Olowojuni, O., Blessing, A. O., & Rodríguez-Molina, J. (2026). Blockchain-Based Certification in Fisheries: A Survey of Technologies and Methodologies. *IoT*, *7*(1), 1. doi: 10.3390/iot7010001.

[39] Laing, S., & Pouponneau, A. (2026). Blue finance: financing for ocean conservation and sustainable use. In *The Elgar Companion to Ocean Governance and the Sustainable Development Goals* (pp. 212-233). Edward Elgar Publishing.

[40] Palacios, M. M., Wartman, M., Ebrahim, A., Macreadie, P. I., Mossop, K., Martin, R., & Costa, M. D. P. (2026). Exploring Seychelles' blue carbon readiness through stakeholder perceptions. *Ocean & Coastal Management*, *280*, 108302.

[41] E. G. Pardiñan, R. M. Bondad, and J. C. Mangubat, "Key informants' perception on records digitization and a web-based technology platform for accreditation of Philippine State Universities and Colleges," *Education and Information Technologies*, vol. 30, no. 8, pp. 11127–11150, 2025, doi: 10.1007/s10639-024-13256-z.