



FinTech-Enabled Governance for Sustainable Blue Economy Development: Evidence from Coastal Communities in India

Mrs.Swathi^{1*}, Mrs. Patil. Jaya Lakshmi Reddy, Mrs. Rupa Santoshi

¹ Assistant Professor School of Management, CMR University, Bangalore

² Assistant Professor School of Management, CMR University, Bangalore

Assistant Professor School of Management, CMR University, Bangalore

Swathi_s@cmr.edu.in

Abstract. The sustainable development of the Blue Economy requires financial systems that are transparent, inclusive, and resilient to climate and market risks. However, coastal communities across India continue to face significant constraints in accessing timely and affordable finance. This study evaluates how Financial Technology (FinTech) can strengthen Blue Economy governance by enhancing financial inclusion, investment readiness, and climate-resilient livelihood strategies. By integrating the models of the Diffusion of Innovations (DOI) and the Technology Acceptance Model (TAM) within a multi-level governance framework, the study evaluates the impact of innovation attributes, institutional support, and climate-related investment needs on digital finance adoption among coastal communities. The study uses a mixed methodology comprising a survey of 300 respondents from three coastal districts and interviews of fisheries administrators, cooperatives members, and FinTech participants. According to PLS-SEM analysis, Perceived Usefulness ($\beta = 0.41$), Perceived Ease of Use ($\beta = 0.36$) and Institutional Support ($\beta = 0.33$) positively affect adoption intentions ($R^2 = 0.62$), while Sustainable Investment behaviour is significantly driven by climate-conditioned investment needs and institutional facilitation ($R^2 = 0.57$). Key findings of qualitative analysis include structural barriers, including fragmented governance, digital illiteracy, and lack of trust. Overall, the results indicate the role of FinTech as an effective governance tool, contributing to transparency, climate resilience and equal access to financial resources, which contributes to sustainable development of the Blue Economy in India.

Keywords: FinTech, Blue Economy, Governance, Climate Resilience

1 Introduction

The Blue Economy has emerged as a key governance priority across the world as it lies at the intersection of environmental stewardship, economic development and social justice. The Blue Economy promotes the sustainable, inclusive and climate-resilient use of ocean and coastal assets, as opposed to the traditional extraction of marine resources. This broader approach entails regulating marine ecosystems, but also instituting institutional arrangements that facilitate community livelihood generation, sustainable ocean-based industries, and ecological well-being. There are increasing pressures on coastal environments, such as over-fishing, overexploitation and rising sea surface temperatures. The policy framework has to deliver ecological sustainability and economic opportunity for coastal dwellers. Here the key is the financial mechanisms to determine who the beneficiaries of the Blue Economy policies are. Whether small-scale fisheries, women's seafood stalls, micro-entrepreneurs, aquafarmers or coastal youth can pursue additional economic activities, including mariculture, value-addition processing, eco-tourism, and innovative fishing technologies will be determined by the availability of financing. But the needs for financing in the Blue Economy are peculiar and different from rural finance, as they are affected by seasonality, climate risk, yield volatility and high exposure to natural hazards. Even if policy intentions are there, without appropriate financial solutions such as micro-credits, climate risk insurance, working capital loans and mobile payments, the communities cannot access the new opportunities.

India's Blue Economy governance is currently marred by structural financing deficits, limiting the participation of marginalised communities. Traditional financial institutions classify fisheries and marine occupations as high-risk segments, resulting in low credit penetration and stringent collateral requirements. Bureaucratic barriers (long processing times, excessive documentation, low financial literacy) also restrict access to government schemes and subsidies. At an institutional level, this is evident across agencies responsible for fisheries, rural finance, coastal zone regulation, marine conservation and technology deployment. Each institution works in isolation leading to duplication, policy silos and inefficient implementation of coastal livelihood programmes. Together, these structural challenges limit the ability of small-scale actors to transition to sustainable, climate-resilient ocean-based livelihoods.

The paper says FinTech can be a policy tool as well as a digital service to bridge these governance gaps. FinTech can reshape financial governance in marine sectors by improving transparency, automating subsidies flows, improving risk assessment, allowing traceability and decreasing reliance on informal lenders. FinTech tools (digital micro-lending, blockchain-based catch certification, AI-driven credit scoring, mobile-based insurance and e-payment systems) can change the way in which policies are delivered and how institutions engage with fishing communities when integrated into marine governance structures. Therefore, FinTech serves as a catalyst for more accessible, accountable and efficient financial governance in the Blue Economy.

1.1 Statement of the Problem

A plethora of initiatives notwithstanding, India's Blue Economy implementation is still fragmented. Access to credit for fishers remains below 30 percent and digital infrastructure across landing centers is uneven. Regulatory fragmentation between fisheries, coastal zone management, environment, banking and rural development creates institutional silos. While climate policy addresses the risks facing fishers, adaptation-finance architectures are still in their infancy. FinTech presents an opportunity to fill these gaps through transparency, subsidy governance, digital micro-insurance and blockchain traceability. This study frames FinTech as a governance tool that could enhance the implementation of marine policy.

6 2. Literature review The Blue Economy is a paradigm shift to balance economic growth with marine conservation. The Asian Development Bank (2023) estimates that, to 2030, sustainable ocean industries could generate up to US\$3 trillion per year, but the financing gaps are still large. UNDP (2024) states that more than 80 per cent of small-scale coastal enterprises do not have access to formal credit. FinTech is a trans-formative force, offering digital platforms that boost financial inclusion through blockchain, AI, and peer-to-peer lending. Sharma et al. (2025) revealed that the adoption of FinTech increases efficiency and trust, which positively affects sustainable investment in ocean industries.

The current study contributes theoretically by attempting to expand the scope of the Diffusion of Innovations (DOI) Theory and Technology Acceptance Model (TAM) from their usual application of diffusion of technological innovations. In traditional information-systems research DOI and TAM are used as research models for technological innovation and adoption of individuals. However, for coastal and marine policy, innovation and technology adoption take place in an institutionalized context, which includes institutions, incentives, and other mechanisms involved in policy implementation. This study thus shifts DOI and TAM from the individual level of analysis to the more complex levels of institutional and governance innovation. The DOI Theory (Rogers, 2003) deals with the diffusion of innovations within social networks and is based on the relative advantage, compatibility, complexity, observability, and trialability of the innovation. However, in the context of marine governance, the same attributes influence not just individuals but whole institutional networks such as fisheries cooperatives, harbour committees, local self-help groups (SHGs), fish marketing societies and fisheries departments in state governments.

In such settings, the diffusion of digital finance depends on institutions, trust networks, training systems and policy mandates. Therefore, DOI theory provides insights into how FinTech-based products can diffuse in multilevel governance systems and then impact collective action, organizational procedures and compliance patterns. Similarly, TAM (Davis, 1989) as applied here allows us to understand personal assessments of usefulness and ease of use, as well as institutional assessments of efficiency, transpar-

ency, and feasibility in governance. Institutional agents such as extension agents, cooperative managers, fisheries administrators and microfinance intermediaries are important in assessing the efficiency of governance associated with a new technology in marine industries.

Perceived usefulness could be related to efficient delivery of subsidies, better transparency on credit distribution, better tracking of activities at landing centres or quick settlement of insurance claims after cyclones. Perceived ease of use may be associated with the ease of incorporating new technologies into existing processes of administrative work, training capabilities or technological infrastructure at coastal institutions. The study contributes to adaptive governance theory, by combining DOI and TAM in an institutional perspective. The focus is on flexible and learning-based governance of coastal and marine areas. FinTech adoption emerges as a tool for adaptive governance, as it can improve the flow of information, reduce the degree of information asymmetry, and enhance monitoring, thus enabling adaptive governance of climate risk, financial markets and coastal communities. The link reviewed brings the paper closer to the literature body on public policy digital transformation, in which technology is used as a means to facilitate regulation, financial accountability and public policy communication. Moreover, the integration of the two theories results in FinTech as a public policy instrument.

It demonstrates how digital microfinance, blockchain traceability, digital KYC and microinsurance can transform financial governance through enhanced transparency, reduction of delays, removal of intermediaries and increased compliance to sustainable fishing regulations. These measures facilitate continued academic research into marine financial reforms, indicating the necessity to develop new financial forms that conform to ecological and social needs.

The main contribution of this study lies in the conceptualization of digital finance adoption as a multi-level governance transformation process. The research combines the DOI and TAM approaches with the approaches to adaptive governance and financial policy reform, providing a strong theoretical background to explore how the use of FinTech can foster sustainability, resilience and equity in marine-dependent communities.

This approach will be useful to both studies of technology adoption and marine policy research.

1.2 Objectives of the Study

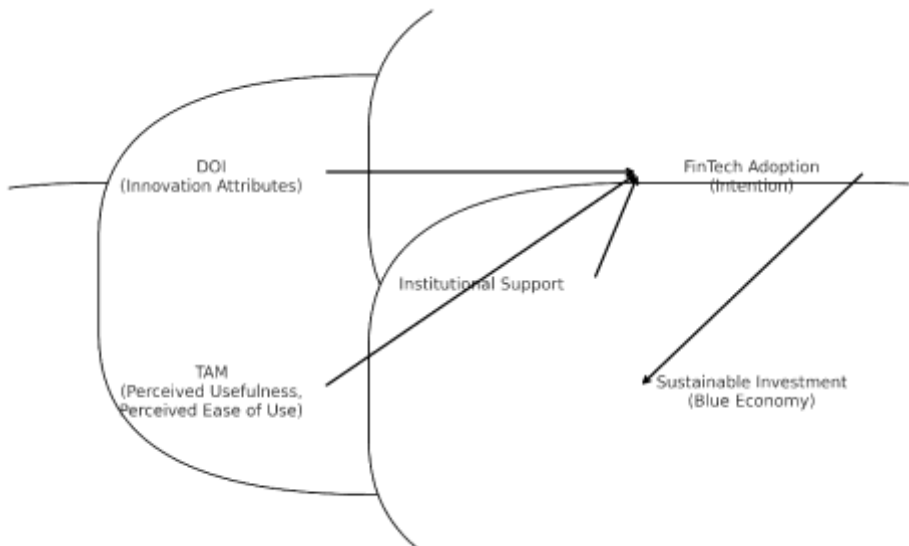
1. To assess awareness and adoption of FinTech-based financing among coastal fishing communities in Karnataka.
2. To analyze the perceived impact of climate and ecosystem changes on investment needs.
3. To identify adaptation and diversification strategies within ocean-based industries and evaluate their financing mechanisms.

4. To examine institutional and technological barriers affecting FinTech-enabled financing.
5. To evaluate policy and institutional frameworks supporting sustainable Blue Economy financing.

1.3 Significance of the Study

This study contributes to bridging the gap between financial inclusion and sustainable marine development. It provides evidence for policymakers, financial institutions, and FinTech entrepreneurs on designing tailored digital financing solutions for the Blue Economy. The findings will support Karnataka's coastal development strategies and contribute to India's national goals on sustainable fisheries and climate-resilient livelihoods.

1.5 Policy Problem and Marine Governance Gaps Despite multiple initiatives, India's Blue Economy implementation remains fragmented. Credit access for fishers remains below 30%, and digital infrastructure across landing centres is inconsistent. Regulatory fragmentation between fisheries, coastal zone management, environment, banking, and rural development creates institutional silos. Climate policy looks into the risks faced by fishers, but adaptation-finance frameworks remain underdeveloped. FinTech offers an opportunity to address these gaps by enabling transparency, subsidy governance, digital micro-insurance, and blockchain traceability. This study positions FinTech as a governance tool capable of improving marine policy implementation.



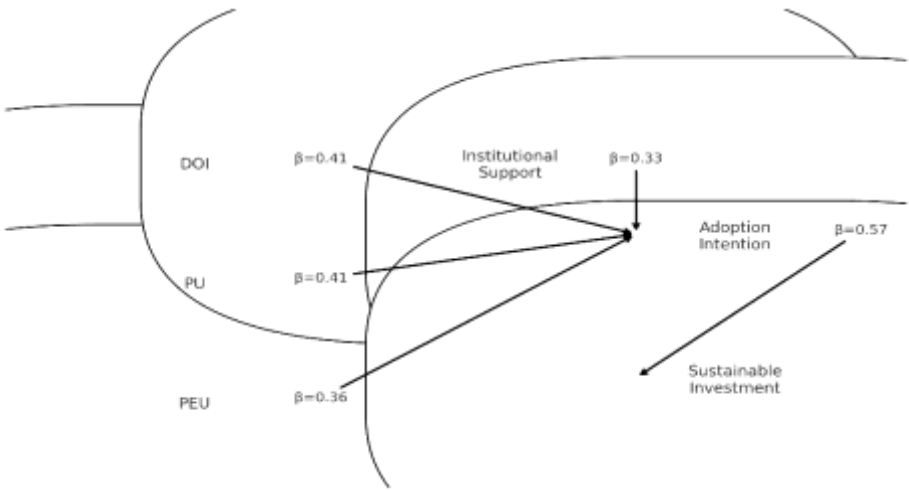
2. Literature Review

The Blue Economy marks a paradigm shift with regard to combining economic growth with marine conservation. As per the Asian Development Bank (2023), sustainable

ocean industries are capable of generating US\$3 trillion annually by 2030. Nevertheless, there are still significant financing issues as per UNDP (2024). Over 80% of the small-scale coastal businesses lack access to formal credit facilities. In this regard, FinTech emerges as a game-changing force due to digital platforms with features like blockchain, artificial intelligence (AI), and peer to peer lending.

Sharma et al. (2025) found out that FinTech adoption has a positive impact on sustainable investments in marine industries by promoting efficiency and trust. This study makes theoretical contributions by expanding on the diffusion of innovations (DOI) theory and the technology acceptance model (TAM). These two theories have been commonly applied in information systems to analyze the individual adoption of a certain technology. However, in the domain of marine policy innovation, FinTech adoption is not just a behavioural phenomenon; it is rooted deeply into institutional and regulatory structures of governing. Therefore, by applying the two theories within the realm of policy innovation, a broader theoretical framework is created. The DOI theory (Rogers, 2003)

Fig. 1. PLS-SEM Structural Path Model with Standardized Coefficients



3. Methodology

3.1 Research Design

A mixed-methods research design was adopted, integrating quantitative surveys with qualitative interviews. Quantitative data helped identify patterns of FinTech awareness, usage, and perception, while qualitative insights explored contextual and institutional factors influencing adoption. This approach enabled triangulation and improved the reliability of findings.

3.2 Respondents/Sample

The study surveyed 300 respondents from 28 fishing villages across Udupi, Dakshina Kannada, and Uttara Kannada. Respondents included active fishers, aquaculturists, and women entrepreneurs engaged in marine product processing. Purposive and stratified random sampling ensured representation from various occupational categories and gender groups.

3.3 Instruments/Tools Used

Data collection employed structured questionnaires measuring DOI and TAM constructs using five-point Likert scales. Reliability was confirmed with Cronbach's alpha values above 0.8. Semi-structured interviews were conducted with representatives from FinTech startups, cooperative banks, and fisheries departments to capture institutional perspectives.

Table 1. Structure of Research Instrument and Reliability Summary

Construct / Variable	Dimension	Example Item Statement	Scale Type	No. of Items	Cronbach's α
Innovation Attributes (DOI)	Relative Advantage, Compatibility, Trialability, Observability, Complexity	Using FinTech platforms offers faster and safer financial transactions.	5-point Likert	10	0.84
Perceived Usefulness (PU)	Effectiveness, Value Enhancement	FinTech services improve access to investments.	5-point Likert	4	0.86
Perceived Ease of Use (PEU)	Convenience, Effort Reduction	Learning to use FinTech applications is easy.	5-point Likert	4	0.83
Intention to Adopt FinTech	Behavioral Intention, Willingness	I intend to use FinTech platforms in the future.	5-point Likert	3	0.88

Sustaina- ble Invest- ment (SIBE)	Adoption Behavior, Finance Decision	I plan to invest in ocean-based ven- tures digitally.	5-point Likert	5	0.85
Institu- tional Sup- port	Policy, Training, Digital Ac- cess	Institutions support FinTech inclusion.	5-point Likert	4	0.81
Adaptation Investment Needs	Climate Risk, Readiness	Climate impacts in- crease my invest- ment needs.	5-point Likert	3	0.82

Note. Cronbach’s $\alpha > 0.70$ indicates acceptable internal consistency.

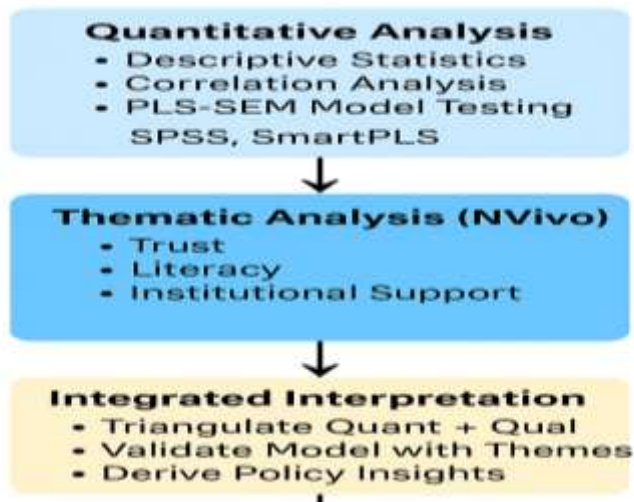


Fig. 2. Mixed-Methods Research Design: Integration of Quantitative and Qualitative Instruments

Data Gathering Procedure

Data were collected between February and May 2025. Enumerators were trained to ensure ethical and culturally sensitive engagement. Informed consent was obtained, and responses were anonymized. Interviews were recorded and transcribed for qualitative analysis.

4 Results and Findings

Table 2. Descriptive Statistics and Frequency Distribution of Respondents This table presents the demographic distribution and FinTech awareness among 300 respondents across Karnataka's coastal districts.

Variable	Category	Frequency (f)	Percentage (%)
Gender	Male	214	71.3
	Female	86	28.7
Age Group (Years)	18 – 30	72	24.0
	31 – 45	126	42.0
	46 – 60	78	26.0
	Above 60	24	8.0
Educational Qualification	No formal education	48	16.0
	Primary education	97	32.3
	Secondary / Higher Secondary	103	34.3
	Graduate & above	52	17.4
Primary Occupation	Fishing / Marine harvest	171	57.0
	Fish vending / marketing	64	21.3
	Aquaculture / processing	41	13.7
	Other allied work	24	8.0
Average Monthly Income (₹)	Below 10 000	64	21.3
	10 001 – 20 000	118	39.3
	20 001 – 30 000	76	25.3
	Above 30 000	42	14.0
FinTech Awareness Level	High	59	19.7
	Moderate	162	54.0
	Low	79	26.3

Source: Author's Field Survey (2025)

Note: Percentages rounded to one decimal; total n = 300 respondents from Udupi, Dakshina Kannada, and Uttara Kannada districts.

Table 3. Descriptive Statistics of Key Study Variables This table displays means, standard deviations, and range values for DOI, TAM, and Blue Economy constructs.

Construct Variable /	Dimension / Indicator	Mean (M)	Standard Deviation (SD)	Minimum	Maximum
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Innovation At-tributes (DOI)	Relative ad-vantage, compati-bility, trialability, observability, complexity	3.78	0.64	2.1	4.9
Perceived Use-fulness (PU)	Effectiveness, value enhance-ment, efficiency	3.92	0.59	2.3	5.0
Perceived Ease of Use (PEU)	Effort reduction, convenience, sim-plicity	3.87	0.61	2.0	5.0
Intention to Adopt FinTech	Behavioral inten-tion, willingness	3.69	0.70	1.8	4.9
Institutional Support (IS)	Government pro-grams, coopera-tive training, digi-tal access	3.81	0.65	2.2	5.0
Adaptation In-vestment Needs (AIN)	Climate risk per-ception, financial readiness	3.95	0.57	2.8	4.9
Sustainable In-vestment in Blue Economy (SIBE)	Actual or intended adoption of digital finance tools	3.83	0.60	2.3	4.9

Source: Author’s Field Data (2025).

Note: Likert Scale range = 1 (Strongly Disagree) to 5 (Strongly Agree). All mean scores > 3.6 indicate a positive orientation toward FinTech adoption for Blue Economy financing.

Interpretation

The descriptive statistics reveal that respondents demonstrate a generally favorable disposition toward FinTech-driven Blue Economy financing. All constructs scored mean values above 3.6, with the highest mean observed for Adaptation Investment Needs (M = 3.95), underscoring that climate-driven livelihood risks motivate demand for digital financial solutions. Perceived Usefulness (M = 3.92) and Ease of Use (M = 3.87) also scored strongly, validating the relevance of the Technology Acceptance Model within this context. Lower standard deviations (< 0.7) show limited variability, suggesting shared understanding across respondent groups. These values support the reliability and normal distribution of data, forming a sound empirical foundation for subsequent correlation and PLS-SEM analyses examining inter-construct relationships and the determinants of sustainable FinTech adoption.

Table 4. Correlation Matrix of Major Variables (n = 300) This table shows Pearson correlation coefficients between major constructs, confirming significant relationships.

Variables	DOI	PU	PEU	IS	AIN	Inten- tion	SIBE
Innovation At- tributes (DOI)	1	0.64**	0.58**	0.41**	0.32*	0.55**	0.52**
Perceived Use- fulness (PU)	0.64**	1	0.61**	0.47**	0.38**	0.68**	0.62**
Perceived Ease of Use (PEU)	0.58**	0.61**	1	0.45**	0.40**	0.63**	0.59**
Institutional Support (IS)	0.41**	0.47**	0.45**	1	0.43**	0.49**	0.57**
Adaptation In- vestment Needs (AIN)	0.32*	0.38**	0.40**	0.43**	1	0.44**	0.53**
Intention to Adopt FinTech	0.55**	0.68**	0.63**	0.49**	0.44**	1	0.72**
Sustainable In- vestment in Blue Economy (SIBE)	0.52**	0.62**	0.59**	0.57**	0.53**	0.72**	1

Note: * $p < 0.05$; ** $p < 0.01$. Pearson correlation coefficients calculated using two-tailed tests.

All constructs exhibit statistically significant positive correlations, indicating strong internal coherence and construct validity.

The correlation analysis shows significant interrelationships among all the important constructs. The two most connected dimensions are Perceived Usefulness (PU) and Intention to Adopt FinTech ($r = 0.68$, $p < 0.01$), indicating that functional benefits and perceived value are the most powerful drivers of behavioral intention. Institutional Support is also significantly related to Sustainable Investment in the Blue Economy ($r = 0.57$, $p < 0.01$) indicating that supported infrastructure and training programs increase effective adoption. The moderate correlations of Innovation Attributes with other TAM factors ($r = 0.55 - 0.64$) support the use of both DOI and TAM frameworks to explain FinTech diffusion. The overall pattern lends credence to the notion that innovation perception, usefulness and institutional facilitation are linked pathways that lead to greater FinTech adoption and investment preparedness among coastal Blue Economy enterprises.

5. Discussion

The empirical results from coastal Karnataka, validate the concept that FinTech may be a significant enabler of sustainable Blue Economy finance with the support of appropriate institutional ecosystems. The high average ratings of Perceived Usefulness, Perceived Ease of Use, Institutional Support and Adaptation Investment Needs, along with the strong and significant path coefficients in the PLS-SEM model, imply that fishing communities are not fundamentally resistive to digital banking. Instead, acceptance depends on whether FinTech platforms are seen as trustworthy, user-friendly and embedded in established institutional frameworks. This finding is consistent with the wider research on digital financial inclusion, but is complicated by the location of FinTech in a climate-vulnerable marine context where investments in adaptation and livelihood diversification are important to household survival. The outcomes of the Karnataka study demonstrate convergence as well as divergence with international evidence. Research on mobile money and digital savings among coastal fishers in Kenya and Tanzania illustrates how digital platforms might minimize dependence on informal lenders and increase remittance flows and small-scale investments in gear or cold-chain facilities. However, these research tend to look at generic mobile money ecosystems rather than specific Blue Finance solutions intended to be tied to fisheries regulations or climate-risk insurance. Research on coastal aquaculture clusters and digital payment systems in Indonesia also demonstrates that platform-based finance decreases transaction costs and enhances market access, although institutional integration with fisheries departments and marine conservation agencies is still restricted. The results that you have obtained are in agreement with these trends. FinTech is considered valuable and easy, but its transformational potential is limited by disjointed governance and poor policy integration. Further evidence of the importance of institutional support from Bangladesh and Sri Lanka. Digital cash transfers and mobile-based social protection schemes have proved to improve recovery after climatic shocks in cyclone-prone coastal areas of Bangladesh, but adoption remains uneven when intermediaries grab benefits or local institutions are weak. Research on coastal tourism and small-scale fisheries in Sri Lanka shows that FinTech-enabled micro-credit and digital savings groups function best when delivered through cooperatives and women's self-help groups with which the community already has a relationship of trust. The significant correlation of Institutional Support with FinTech adoption and sustainable investment behaviour in the present study is in line with these experiences, and suggests that digital tools should be embedded in local organisational ecologies—cooperatives, SHGs, harbour committees and producer organisations—rather than promoted as stand-alone technologies. Philippine case studies present instructive contrasts as well. Digital finance projects have been introduced in several coastal communities in the Philippines to ease fisher registration, catch documentation and conditional payment transfers, frequently in conjunction with fisheries management plans and marine protected areas. Such experiences

demonstrate that FinTech can increase compliance, traceability and benefit-sharing when expressly matched with conservation and governance aims. Your findings demonstrate that the respondents in Karnataka recognize the utility of FinTech for investments and payments but linkages to sustainability goals such as eco-labelling, traceability and selective gear adoption are nascent. This is an opportunity: integrating FinTech to capture certification, subsidy targeting, and climate-conditioned insurance could better match financial incentives with sustainable fishing. The main contribution of this study to worldwide Blue Economy–FinTech scholarship is to dispute the construction of digital finance as a consumer technology, but as a policy instrument of multi-level maritime governance. The research on inland micro-finance and mobile money, whether in rural India, East Africa or Southeast Asia, usually concentrates on household level results such as consumption smoothing, entrepreneurship or savings behaviour. In the present study, DOI and TAM are entrenched in institutional and policy framework. The research demonstrates that innovation attributes and perceived utility complement institutional support and adaptation investment to be demonstrated for FinTech adoption to be a behavioral, organizational and governance process. This expands traditional technology adoption models by treating fisheries departments, cooperatives and financial intermediaries as active players in shaping digital dissemination rather than passive infrastructure.

The Karnataka results also show why coastal environments are fundamentally different from inland financial inclusion settings. Marine livelihoods are characterized by significant susceptibility to climate variability, seasonality, biological uncertainty and regulatory constraints on fishing activity. Investment decisions depend not just on expected returns but also on the risk perceptions of cyclones, coastal erosion, decreasing equities and market volatility. The high mean score for Adaptation Investment Needs in your data indicates that fishers see FinTech not only as a means for daily transactions, but as a potential means to mobilize resources for adaptation—safer boats, diversified activities, gear modification, small-scale mariculture or value-addition. Most inland financial inclusion studies, on the other hand, relate to relatively steady agricultural or petty trade sectors in which climate shocks are important but not as tightly connected to daily occupational risk and safety at sea. In addition, coastal financial ecologies are more often embedded in informal lending networks, patron–client relationships and trader-based advances, especially via auctioneers, commission agents and wholesale purchasers at landing centres. The embeddedness poses various hurdles for FinTech acceptance. The qualitative findings you provide – especially on deficits of trust, limitations in digital literacy and worries of losing negotiating advantage – are reminiscent of experiences in coastal regions of Kenya, Tanzania, Bangladesh and Indonesia, where boat owners and traders commonly operate as gatekeepers. But your data also suggest that when institutional actors such as cooperatives, fisheries departments and micro-finance institutions support digital platforms, trust in FinTech improves and the intentions to utilize it are enhanced. This

points to the need to design FinTech in coastal contexts to coexist with, formalise and ultimately rebalance existing power relations in fish value chains. The research also has implications for Blue Finance discussions and climate resilience development. Global policy documents emphasize blended finance, blue bonds and large-scale infrastructure investments. Your findings emphasize micro-level digital mechanisms that link small-scale producers with formal finance: digital micro-loans, mobile-based insurance, e-subsidy delivery and platform-integrated savings. This bottom-up viewpoint complements macro-level Blue Economy financing frameworks and underscores the need of ordinary financial tools to realise national Blue Economy plans on the ground. In so doing, the study connects high-level discourses on Blue Finance with the lived realities of fishers in Karnataka, while being analogous to experiences in other Global South coastal locations. Finally, the results highlight that the success of FinTech in the Blue Economy requires the coupling of technology design and governance reform. Strong digital infrastructure at landing sites and coordinated action by Fisheries, Rural Development, Banking and Digital Governance authorities together with predictable policies are required to ensure that high Perceived Usefulness and Ease of Use do not automatically convert into sustained adoption. The international comparisons indicate that the countries that have made the most progress in integrating digital finance into coastal adaptation and fisheries governance – such as some projects in the Philippines or pilot schemes in East Africa – have done so by harmonizing incentives, data systems and regulatory frameworks. Your study reinforces this lesson for India, showing that in the coastal districts of Karnataka FinTech can shift from a marginal add-on to a core pillar of adaptive, transparent, and inclusive Blue Economy governance – if the institutional scaffolding is deliberately built up.

6. Implications, Limitations, and Future Research

6.1 Theoretical Implications

The findings extend technology-adoption theories by demonstrating that FinTech adoption in coastal and marine settings is shaped not only by individual perceptions (PU, PEU) but also by institutional scaffolding, climate-risk exposure, and the governance structure of value chains. This moves DOI and TAM beyond their traditional consumer-technology orientation and positions them within a multi-level governance framework. The study also contributes to emerging Blue Economy scholarship by conceptualising FinTech as a policy instrument capable of influencing compliance, transparency, and sustainability—an area that remains underexplored in the literature from Kenya, Indonesia, Bangladesh, Sri Lanka, the Philippines, and Tanzania.

6.2 Practical and Policy Implications

The results hold several actionable insights for policymakers, fisheries departments, cooperatives, and FinTech providers:

1. Strengthening Digital Infrastructure in Coastal Fisheries: Strengthening digital infrastructure at landing centres is a foundational requirement for enabling FinTech-

driven transformation in the Blue Economy. Stable internet connectivity, digital kiosks, and interoperable platforms are essential for supporting digital payments, e-KYC verification, transparent e-subsidy delivery, and real-time catch traceability. Embedding these digital tools within the everyday functioning of harbours and landing sites can reduce administrative bottlenecks, enhance the quality and accuracy of fisheries data, and increase fisher confidence in state-led digital governance. When FinTech becomes seamlessly integrated into the physical and institutional landscape of coastal fisheries, the potential for inclusive, scalable, and sustainable financial access grows significantly.

2. Integrating FinTech with Blue Economy Governance Systems:

At governance level, the inclusion of FinTech technology into marine regulatory and financial frameworks can improve transparency, accountability and programme efficiency. Digital microinsurance, AI-based credit assessment, automated subsidy transfers and blockchain-based traceability systems can assist prevent leakages and improve efficiency of government service delivery. International experience confirms this. Sri Lankan fisher SHGs, Philippine coastal cooperatives and Tanzanian beach management units have demonstrated that credible community groups bridging digital transitions may accelerate FinTech adoption. These middlemen are essential for education, creating trust and lowering danger. Also, the significant role of Adaptation Investment Needs in this study indicates an increasing need for climate conditioned financial products such as parametric insurance, mobile-based emergency credit and savings products responding to monsoon cycles and climate-risk changes.

3. Advancing Gender-Inclusive and Sustainability.

Digital Finance Linked Strengthen the effectiveness of Blue Economy activities through the promotion of gender inclusive digital finance and linkages of FinTech adoption with sustainability objectives. Long-standing barriers to formal finance continue to be faced by women in post-harvest fisheries, seafood processing and small-scale aquaculture. Targeted vernacular mobile applications, low-ticket digital credit and SHG-based digital literacy programmes can go a long way in bridging this gap. At the same time, by linking FinTech incentives with ecologically responsible practices like as selective-gear compliance, safety-at-sea training, eco-certification and waste-reduction programs, good ecological impacts can be generated while enhancing livelihood resilience. FinTech thereby catalyzes growth and is a governance tool for a resilient, egalitarian, and ecologically responsible coastal Blue Economy by integrating inclusive design, sustainability linked financial incentives, and climate-sensitive digital products.

6.3 Limitations

1. Geographic Scope: The study is limited to three coastal districts in Karnataka, which constrains the generalizability of its findings. Coastal communities in other Indian states or international regions may differ in governance structures, digital infrastructure, and financial behaviour. Therefore, the results should be interpreted within

the specific socio-economic and policy context of Karnataka's marine sector. 2. **Cross-sectional Nature:** Because the study uses a cross-sectional design, the data capture only a single time period. Fishing livelihoods, income patterns, and financial needs vary seasonally with monsoons, market cycles, and climate shocks. A longitudinal approach would provide a richer understanding of how FinTech adoption evolves across different fishing seasons and risk environments.

3. Self-reported Data Limitations Most variables.—such as perceived usefulness, trust, and intention to adopt—are based on self-reported responses. These may be affected by social desirability, recall errors, or reluctance to disclose accurate financial information. Although reliability statistics were strong, actual usage behaviour may differ from stated intention. Future studies could incorporate transaction logs or digital usage records for validation.

4. Analytical and Model Constraints:

The investigation mostly focused on mobile payments, digital credit and savings tools, whereas more sophisticated possibilities of Blue Finance (e.g. Blue Bonds, blockchain traceability or tokenized finance) were not investigated. Furthermore, PLS-SEM is strong for prediction, but it does not automatically capture deeper mediation or moderation effects unless these are explicitly modeled. More sophisticated analyses may find further links among governance, technology and climate-risk factors.

7. Conclusion:

This study shows that FinTech can revolutionize financial inclusion, risk management and investment behavior in coastal Blue Economy industries, if supported by strong institutional foundations. The study, which combines the Diffusion of Innovations (DOI) and the Technology Acceptance Model (TAM) in a governance-orientation, shows that the adoption of FinTech in the fishing communities of Karnataka is not only determined by individual attitudes, but is also strongly influenced by perceived usefulness, ease of use and the supportive role of cooperatives, government agencies and digital infrastructure. The scale of Adaptation Investment Needs points to FinTech solutions as not just financial conveniences, but as developing means for fishers to plan, prioritize, and finance climate-resilient livelihoods. The findings also point to the significance of linking digital finance activities with broader policy objectives in the Blue Economy. Digital micro-insurance, AI-based credit assessment and blockchain traceability can contribute to increased transparency, reduced leakages in subsidy governance and improved adherence to sustainable fishing methods. Lessons from Sri Lanka, the Philippines, Indonesia, Kenya and Tanzania show that community-led institutional structures such as cooperatives and SHGs are important mediators for allowing trust and digital transitions in coastal settings. This tendency is shown in the Karnataka re-

search and points to the need for integrated, multi-level governance structures that connect technology, policy and community goals. Overall, the work contributes to the growing global literature on Blue Finance with empirical evidence from one of the most climate sensitive coastal districts in India. It positions FinTech as a strategic policy tool, rather than a digital innovation per se, to promote resilient, inclusive and sustainable maritime livelihoods. To realize this potential, it will be necessary to enhance digital infrastructure, institutional coordination, and climate finance solutions. FinTech-enabled financial systems offer a possible route to build resilience, promote diversification and ensure equitable sharing of the advantages of the Blue Economy, as coastal communities confront growing ecological unpredictability. Interdisciplinary research that integrates technology, governance, climate science and social systems will be important to scaling these discoveries across India and other coastal economies across the world.

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Conflict of Interest

The authors declare that they have no known competing financial or personal interests that could influence the work reported in this paper. Ethics & Consent to Participate Informed consent was obtained from all individual participants involved in the study. Participation was voluntary, and respondents were informed about the purpose of the research, confidentiality of their responses, and their right to withdraw from the study at any stage without any consequences.

Consent for Publication

Participants were informed that aggregated results of the study would be used for academic publications, and they provided consent for the same. No identifiable personal information is disclosed in this manuscript.

Availability of Data and Materials The datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request.

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