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Governing the blue economy in arid coastal regions: opportunities, constraints, and stakeholder perspectives from the Eastern Province coast of Saudi Arabia

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Introduction: The blue economy has emerged as a strategic framework for aligning marine-based economic development with environmental sustainability and social equity. Empirical evidence from arid and industrialized coastal regions, however, remains limited.

Methods: This study employs a convergent mixed-methods design using a structured questionnaire administered to 404 stakeholders across the Eastern Province coastline of Saudi Arabia, complemented by qualitative open-ended responses. Quantitative analyses included descriptive statistics, exploratory factor analysis, and regression modeling, while qualitative data were thematically analyzed.

Results: Results indicate strong stakeholder support for blue economy development, particularly in fisheries, aquaculture, tourism, and logistics. Two core dimensions, perceived opportunities and perceived constraints, significantly influence stakeholder support. Institutional fragmentation, environmental degradation, and weak regulatory enforcement emerged as key barriers.

Discussion: Findings reveal a dual governance dynamic characterized by high economic optimism alongside institutional and environmental concerns. Strengthening coordination, participation, and regulatory enforcement is essential for sustainable blue economy governance in arid coastal regions.

KEYWORDS

aquaculture, arid coastal regions, blue economy, coastal governance, community participation, institutional capacity, marine spatial planning, marine tourism

1 Introduction

The blue economy has emerged as a prominent global framework for integrating ocean-based economic development with environmental sustainability, social equity, and long-term resilience. Beyond its sectoral scope, the blue economy has evolved into a governance paradigm that determines how institutions, power relations, and knowledge systems influence access to marine resources and balanced distribution of benefits and risks across society (Bennett et al., 2021a; Hoareau, 2025). Recent scholarship highlights that the absence of a robust governance framework, inclusive participation, and environmental safeguards may allow blue economy initiatives to perpetuate extractive development models under a sustainability discourse, a practice widely criticized as “blue washing” (Bennett et al., 2021b; Reis-Filho et al., 2024).

Globally, blue economy strategies are being recognized as key drivers for achieving the United Nations Sustainable Development Goals (SDGs), particularly SDG 14 (Life Below Water), while promoting economic diversification, food security, and climate resilience (Lee et al., 2020; OECD, 2020; European Commission, 2024). However, current data indicate that blue economy outcomes vary significantly by region, dictated by institutional capacity, stakeholder participation, governance coherence, and socio-ecological settings (Kelly, 2023; Karuppiah et al., 2025). This has prompted a transition in the literature from sector-centric approaches toward systems-based and justice-oriented frameworks that emphasize governance, equity, and power dynamics (Nathan et al., 2022; Hoareau, 2025). Despite these advancements in research, there is a significant gap in empirical blue economy research concerning arid, industrialized, and semi-enclosed marine systems, such as those of the Arabian Gulf. These contexts present specific challenges, such as ecological vulnerability, high industrial pressure, fragmented governance, and limited regeneration capacity. This leads to a transferability gap in blue economy models derived from island states, temperate coastlines, or small-scale fisheries systems (Santos et al., 2021; Li et al., 2024). Addressing this gap is essential for advancing both theory and practice.

Within this broader debate, the case study of Saudi Arabia is unique and compelling. Marine and coastal resources are positioned as strategic assets in the Kingdom for achieving Vision 2030 goals related to economic diversification, tourism development, logistics expansion, and environmental conservation (Saudi Vision, 2016; GCC, 2024). Significant attention has focused on the Red Sea coast through flagship mega-projects such as NEOM and Red Sea Global (Robitzch et al., 2023; Red Sea Global, 2023), including large-scale coastal investment initiatives led by the Public Investment Fund, which emphasize sustainable luxury tourism as a pillar of economic transformation and environmental stewardship (Public Investment Fund (PIF), 2020). Despite these national investments, empirical research examining blue economy dynamics along the Eastern Province coastline bordering the Arabian Gulf remains limited (MEWA, 2019; PIF 2022; Alhowsaish, 2025). This region, comprising major ports (Dammam, Jubail), industrial zones, traditional fishing communities, and ecologically sensitive habitats, represents an important testing ground for blue

economy governance due to high economic intensity and environmental stress (Figure 1).

Drawing upon recent calls for stakeholder-centered, governance-focused blue economy research (Bennett et al., 2021a; Gbolahan et al., 2023; Kelly, 2023; Alhowsaish, 2025), this study follows a mixed-methods approach to investigate the perceptions of different stakeholder groups regarding blue economy opportunities, barriers, and governance priorities in the Eastern Province. Rather than considering the region as a purely geographic site, this study positions it as an analytical lens through which broader questions of institutional capacity, sectoral trade-offs, and social equity can be investigated in arid coastal settings.

Specifically, the study aims to: (1) evaluate stakeholder perceptions of sectoral opportunities within the blue economy; (2) identify institutional, environmental, and governance challenges impacting implementation; and (3) obtain policy-related insights for inclusive and sustainable blue economy governance. This study empirically translates governance and equity dimensions in a hyper-arid, industrialized coastal system, advancing blue economy scholarship beyond descriptive regional accounts, offering evidence-based insights essential for policymakers, planners, and researchers navigating comparable coastal contexts globally.

2 Literature review

The blue economy has advanced beyond a sectoral development model into a multidimensional governance framework that incorporates economic diversification, environmental sustainability, and social equity. Early policy discourse highlighted the growth potential of ocean-based industries. However, recent research increasingly underscores that blue economy outcomes are essentially molded by governance quality, institutional capability, and justice imperatives (Bennett et al., 2021a; Kelly, 2023; Hoareau, 2025). This section critically evaluates existing literature to delineate the core dimensions influencing blue economy implementation. These insights inform a literature-based conceptual framework (Figure 2) that establishes the analytical framework of this study.

Early blue economy and blue growth frameworks were primarily focused on the development of marine-based economic sectors, such as fisheries, aquaculture, tourism, shipping, and offshore energy, aiming to discover new sources of growth and diversification (OECD, 2020; World Bank, 2023). While these approaches successfully elevated the maritime growth within development agendas, empirical growth demonstrates that economic expansion is not synonymous with environmental sustainability or social inclusion. Based on recent research, weak governance structures, unequal power relations, and exclusionary decision-making processes may result in ecological degradation and social conflict, disproportionately impacting small-scale fishers and coastal communities (Bennett et al., 2021b; Nathan et al., 2022; Reis-Filho et al., 2024).

To counter these challenges, the concept of blue justice has emerged as a critical extension of the blue economy concept, highlighting fairness, participation, and the equitable distribution

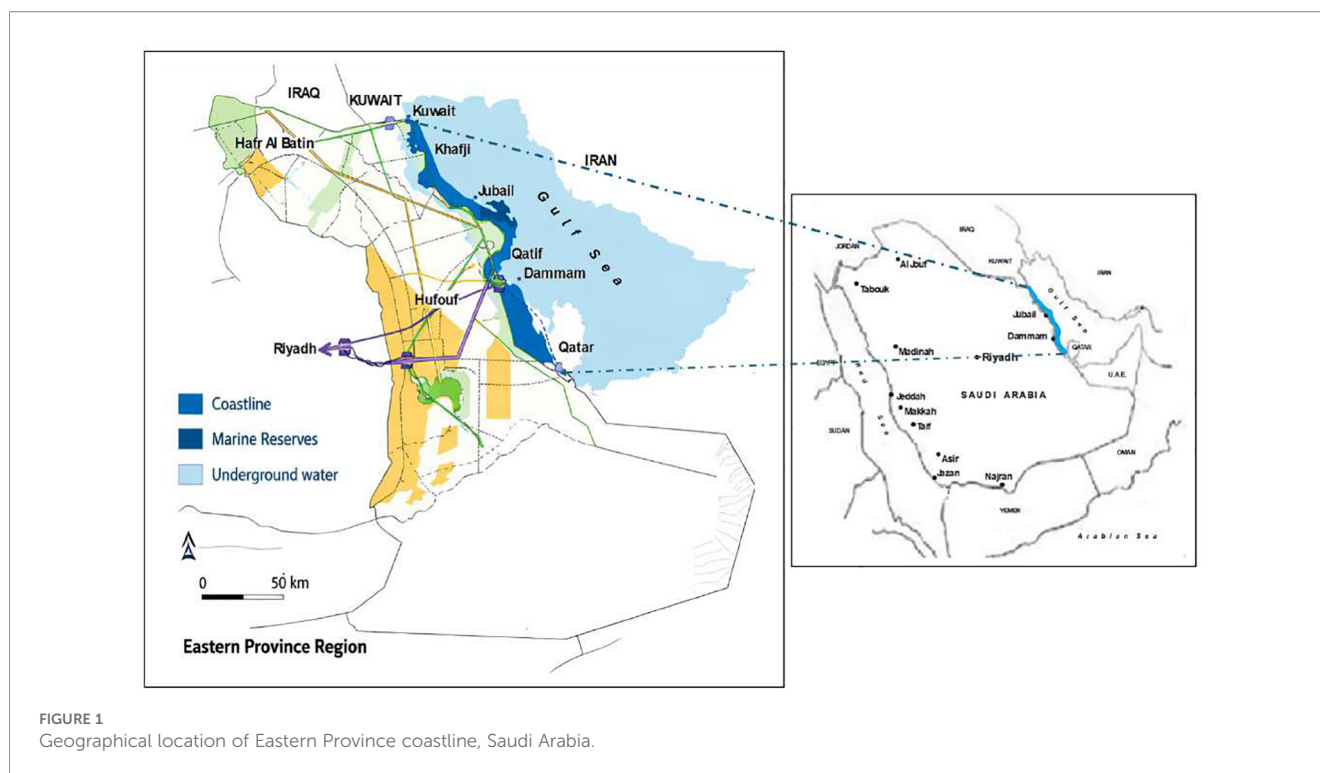


FIGURE 1
Geographical location of Eastern Province coastline, Saudi Arabia.

of benefits and risks inherent to marine development (Bennett et al., 2021a; Hoareau, 2025). Within this evolving discourse, governance integrity, defined in terms of institutional coherence, regulatory enforcement, accountability, and inclusiveness, is now considered a critical factor of blue economy outcomes. As presented in Figure 2, governance and justice are no longer considered as peripheral concerns, but rather as core concerns that influence all other dimensions of blue economy development.

Alongside this normative shift, research consistently identifies a set of strategic sectoral pathways typically leveraged to pursue blue economy strategies. Aquaculture, marine tourism, maritime logistics, and ecosystem-based services are consistently highlighted as drivers of growth, especially in developing and coastal economies pursuing diversification (Lee et al., 2020; FAO, 2022). Strategic planning tools, including integrated sectoral assessments and hybrid methods such as SWOT-AHP, are increasingly used to assess these opportunities while considering environmental and institutional challenges, especially regarding aquaculture expansion (Abdel-Hady et al., 2024). However, sectoral development is seldom benign. Marine tourism can increase coastal degradation, while port expansion and logistics activities may aggravate pollution, habitat loss, and spatial conflicts, particularly in semi-enclosed and ecologically sensitive seas (Santos et al., 2021; Li et al., 2024). Consequently, the literature cautions against treating sectoral opportunities in isolation. Instead, it emphasizes that sectoral pathways are inherently interdependent and mediated by governance arrangements, an insight explicitly captured in the “Sectoral Pathways” dimension of Figure 2.

A recurring theme in blue economy studies is the critical role of governance capacity, defined as the institutional ability to facilitate cross-sectional coordination, integrate diverse knowledge systems,

and enforce regulatory frameworks effectively. Numerous studies identify fragmented mandates, overlapping institutional jurisdictions, and ineffective inter-agency coordination as persistent barriers to successful blue economy implementation (Karuppiah et al., 2025; Argente-Garcia et al., 2026). These governance deficits often compromise robust strategies and intensify conflicts between economic objectives and environmental limits. Hence, recent research highlights the importance of participatory governance and knowledge integration as drivers for improving legitimacy and adaptive capability. By integrating local, traditional, and scientific knowledge, policymakers can improve policy responsiveness and long-term sustainability (Ogar et al., 2020; IOC-UNESCO, 2020; Gbolahan et al., 2023). Building on this perspective, Kelly (2023) recommends a systems-integration approach to governance, which aligns ecological constraints, economic priorities, and social values through institutional design rather than managing them in isolation. These interconnections are presented in Figure 2 under the “Governance Capacity” dimension, which frames institutional coordination, stakeholder participation, and knowledge integration as mutually reinforcing drivers of blue economy effectiveness.

Beyond governance structures and participation, research also identifies financing and institutional alignment as catalysts for translating blue economy concepts into practice. Empirical evidence from small island and coastal states demonstrates that coordinated financing mechanisms, when integrated with governance reforms and spatial planning, can function as a catalyst in operationalizing blue economy strategies (Benzaken et al., 2024). Similarly, international organizations emphasize the need to integrate investment frameworks that support long-term governance goals to avoid reinforcing sectoral silos and short-term

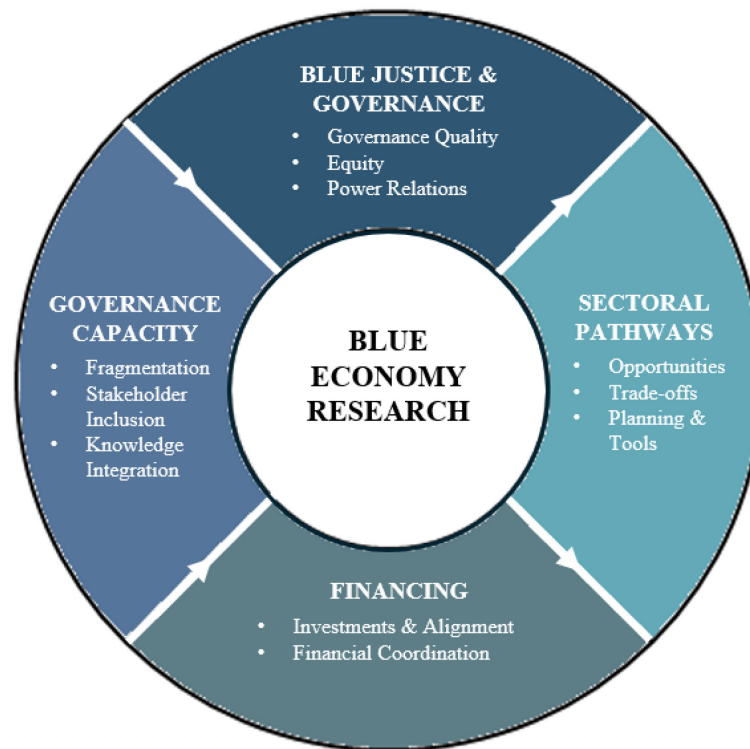


FIGURE 2
Literature-based conceptual framework.

project-based approaches (OECD, 2020; World Bank, 2023). However, many developing economies struggle with fragmented blue economy financing disconnected from broader institutional reform. This limits the policy coherence and sustainability of marine initiatives. Accordingly, Figure 2 positions financing as an essential component, rather than a catalyst that must be integrated with governance capacity and sectoral planning to ensure durable outcomes.

This study utilized insights from existing research to develop a literature-based conceptual framework (Figure 2) designed around four interdependent dimensions: (1) blue justice and governance; (2) sectoral pathways and trade-offs; (3) governance capability and participation; and (4) financing and institutional alignment. The circular design of the framework highlights the systems-focused nature of modern blue economy concepts, emphasizing feedback loops rather than linear connections. Viability of sectoral opportunities depends on governance and justice factors; sectoral transactions reveal governance capability challenges; financing mechanisms either strengthen or weaken institutional coherence; and stakeholder participation determines legitimacy and durable outcomes.

Moving beyond normative models defining how the blue economy should function, this framework serves as an analytical lens based on current literature to investigate the functional interplay between opportunities, challenges, and governance dynamics. In this study setting, Figure 2 presents the theoretical foundation for the empirical analysis of stakeholder perceptions in

Saudi Arabia's Eastern Province. By embedding the conceptual framework within the literature review, the study bridges the gap between theory and empirical inquiry and advances toward more governance-centered, justice-aware, and context-sensitive blue economy research, specifically in arid, industrialized, and semi-enclosed coastal systems.

3 Methodology

This study utilizes a convergent mixed-methods research design to operationalize the governance- and equity-based conceptual framework through empirical analysis, as detailed in Figure 2. The mixed-methods approach is uniquely suited to blue economy research, where economic opportunities, institutional arrangements, environmental constraints, and social equity converge in complex ways. This study integrates quantitative and qualitative data to move beyond sectoral assessment to investigate how governance capability and stakeholder participation support blue economy implementation in an arid, industrialized coastal setting (Tashakkori and Teddlie, 2010; Creswell and Clark, 2018).

As depicted in Figure 3, the research design comprises two parallel strands, quantitative and qualitative, conducted simultaneously and integrated at the interpretation stage. The quantitative strand assesses stakeholder perceptions of blue economy opportunities and challenges, while the qualitative strand uncovers deeper insights into governance challenges,

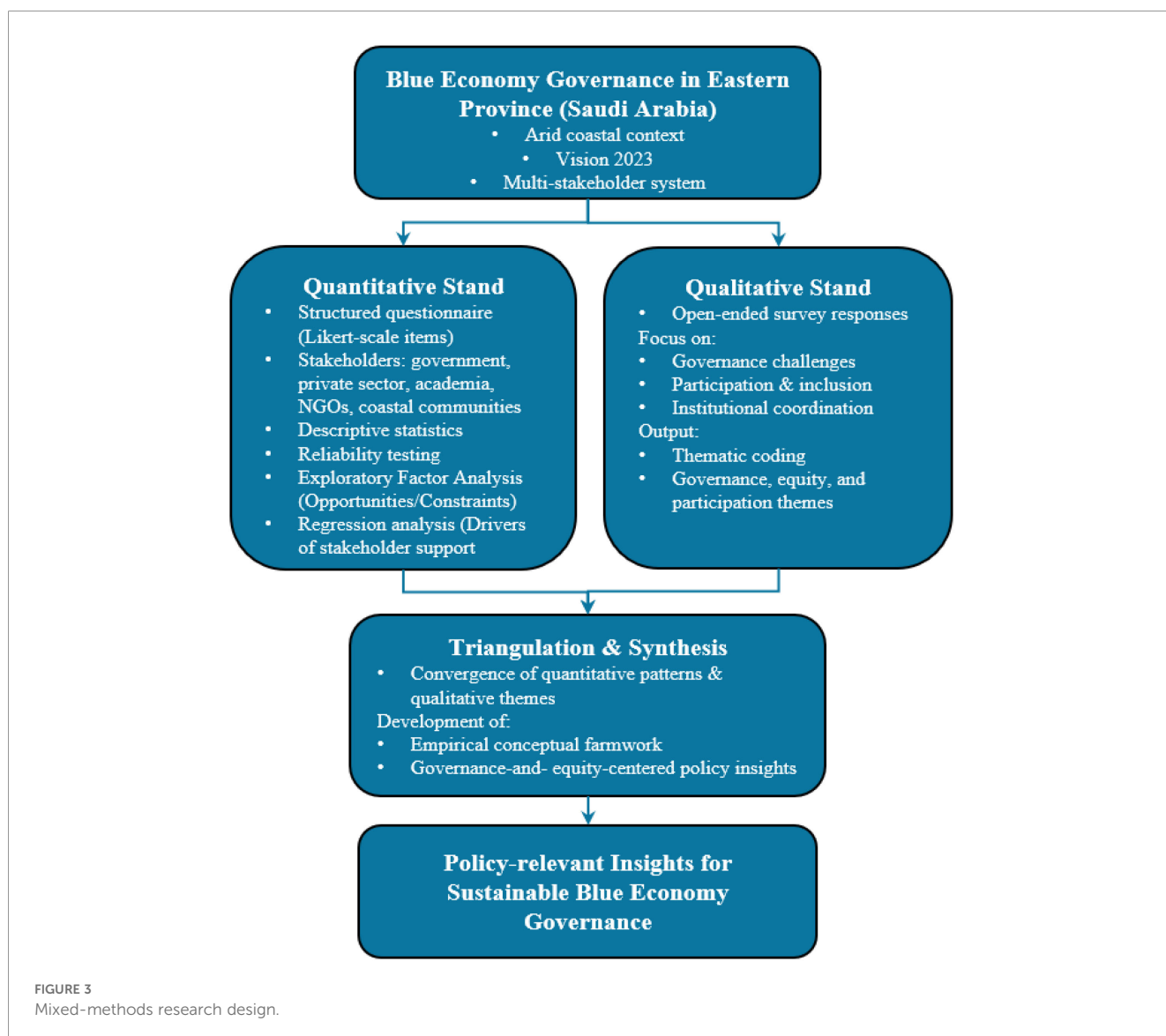
dynamics, and institutional coordination (Palinkas et al., 2015). The convergence of these strands facilitates triangulation, ensuring that the study’s theoretical propositions are thoroughly validated by the empirical insights.

Data were collected utilizing a structured questionnaire directly aligned with the conceptual dimensions derived from the literature review and presented in Figure 2. The survey utilized closed-ended items on five-point Likert scales to assess perceptions of sectoral opportunities (e.g., fisheries, aquaculture, marine tourism, maritime logistics) and institutional and environmental challenges (e.g., fragmented governance, weak regulatory enforcement, environmental degradation). In addition, the survey included open-ended questions to allow respondents to explain governance arrangements, participation mechanisms, and policy priorities. This design ensured that the survey effectively captured both measurable patterns and contextualized stakeholder perspectives.

The target population included a diverse set of stakeholders engaged in or affected by coastal and marine activities, especially representatives from government agencies, the private sector,

academic and research institutions, non-governmental organizations, and coastal communities. Respondents were chosen utilizing purposive sampling, which is well-suited for an exploratory governance study where informed insights and circumstantial knowledge are critical. This approach focuses on depth and relevance rather than statistical representativeness and is commonly used in policy-oriented sustainability studies. Sample size estimation was determined utilizing Cochran’s formula at a 95% confidence level and a 5% margin of error (Etikan et al., 2016). Among the 550 individuals contacted, 404 completed the survey, yielding a response rate of 73.5%, which is deemed robust for governance and policy research in the GCC context (Humood, 2013; Al-Oufi et al., 2000; Elmahdy et al., 2022; Robitzch et al., 2023; Alhowaish and Alkubur, 2025). To ensure broader representation, the study targeted individuals geographically distributed across the Eastern Province coastline, including Dammam, Jubail, Qatif, Khobar, and smaller coastal settlements (Alhowaish, 2015).

Data were collected between September and November 2025 utilizing an online survey distribution as well as in-person outreach,



supported by institutional networks and professional associations. Before full deployment, the questionnaire was pilot tested with 30 participants representing academia, government, and the private sector (Creswell and Clark, 2018). Feedback from the pilot phase guided minor revisions to enhance clarity, relevance, and sequencing of questions, thereby improving content validity and respondent comprehension.

Quantitative data analysis utilized a multi-stage process comparable with the mixed-methods design presented in Figure 3. The study utilized descriptive statistics initially to profile participants and evaluate the overall trends in awareness, perceived opportunities, and perceived challenges concerning the blue economy. Inferential statistical tests, such as Chi-square tests and one-way ANOVA, were utilized to investigate associations between stakeholder attributes and perceptions where group sizes facilitated valid inference. Reliability analysis utilizing Cronbach's alpha validated high internal consistency for the opportunity and constraint scales (Palinkas et al., 2015; Etikan et al., 2016).

To investigate the underlying structure of stakeholder perceptions, exploratory factor analysis (EFA) was conducted utilizing principal component analysis with Varimax rotation (Creswell and Plano Clark, 2018; Hair et al., 2019). Sampling adequacy and factorability were evaluated utilizing the Kaiser–Meyer–Olkin (KMO) measure and Bartlett's test of sphericity, with study findings surpassing accepted thresholds (Tabachnick and Fidell, 2019). The analysis generated a robust two-factor solution aligning with perceived opportunities and challenges, empirically confirming the conceptual distinction derived from the literature-based outline. Factor scores generated from the EFA were subsequently applied to an ordinary least squares (OLS) regression model to evaluate the impact of these dimensions on the overall stakeholder support for blue economy development (Hair et al., 2019). Stakeholder support functioned as the dependent variable, while opportunities and challenges were considered as key predictors along with control variables including gender, age, education level, and stakeholder category. This analytical strategy directly reflects the causal logic recommended in Figure 2 and operationalized by employing the mixed-methods design presented in Figure 3.

Qualitative data from open-ended survey responses were evaluated utilizing thematic analysis. Responses were coded inductively to delineate recurring themes concerning governance reform, institutional coordination, regulatory enforcement, environmental monitoring, community participation, gender inclusion, and skills development (Braun and Clarke, 2006; Bryman, 2016). Subsequently, these qualitative insights were integrated with quantitative findings during the triangulation stage presented in Figure 3. This enabled the study to delineate areas of convergence and divergence between measured perceptions and narrative details. This integration strengthened interpretive validity and augmented the policy relevance of the study results. In addition, ethical considerations were addressed based on established social research standards (Israel and Hay, 2006). Ethical approval was acquired from the Institutional Review Board of the affiliated academic institution. All participants were

informed of the study's purpose, guaranteed confidentiality, and offered informed consent before participation. Study participation was voluntary, and respondents could withdraw at any stage. All data were anonymized and securely stored.

Several methodological limitations of this study should be acknowledged. The use of purposive sampling impacts the generalizability of study findings beyond the study context, and reliance on self-reported perceptions may introduce response bias, especially regarding governance performance. Time and logistical constraints also limited the inclusion of in-depth interviews or participatory workshops. Nevertheless, the mixed-methods design, high response rate, and systematic integration of quantitative and qualitative evidence offer a robust empirical basis for investigating blue economy governance dynamics in the Eastern Province of Saudi Arabia.

4 Results

4.1 Respondent profile

The survey generated 404 valid responses, capturing a broad range of stakeholders engaged in marine and coastal development across Saudi Arabia's Eastern Province (Table 1). Stakeholder distribution was relatively balanced, with government officials comprising 19.6% of respondents, coastal community members 19.3%, academics and researchers 16.6%, NGOs and civil society representatives 16.3%, and private-sector participants 16.1%, while 12.1% identified as "other." This diversity indicates the inherently multi-actor nature of the blue economy, emphasizing the need for coordination among public institutions, market actors, civil society, and local communities to ensure legitimacy and effective governance (OECD, 2020; World Bank, 2023).

Geographically, participants were focused in Dammam (25.7%), followed by Khobar (17.1%), Qatif (16.8%), and Ras Tanurah (13.4%), with the remaining participants drawn from Jubail, Khafji, Safwa, and other regions. This spatial distribution reflects the Eastern Province's dual coastal structure, where industrial and port-centric cities coexist with historically fishing-dependent towns. This geographic variation highlights the significance of region-specific policy approaches that equalize industrial growth and traditional coastal livelihoods (Burt, 2014; Voyer et al., 2018; Saleh and Munir, 2023).

Concerning demographics, the respondents were predominantly male, accounting for 65.1% and the rest were female, accounting for 34.9%. The majority of the participants fell within the 26–45 age group (60.9%). This concentration indicates significant engagement from mid-career professionals, who typically occupy significant institutional and decision-making roles within governance processes. Women's significant representation within non-government organizations (NGOs) and civil society categories highlights their leadership in advocacy and community-based marine initiatives. The respondents were highly educated, with more than three-quarters holding at least a bachelor's degree—

TABLE 1 Respondent profile and inferential statistics (n = 404).

(a) Demographic and stakeholder characteristics				
Variable	Category	Frequency	Percentage (%)	
Stakeholder Category	Government	79	19.6	
	Coastal Community	78	19.3	
	Academia/Research	67	16.6	
	NGO/Civil Society	66	16.3	
	Private Sector	65	16.1	
	Other	49	12.1	
Region	Dammam	104	25.7	
	Khobar	69	17.1	
	Qatif	68	16.8	
	Ras Tanurah	54	13.4	
	Jubail	43	10.6	
	Khafji	32	7.9	
	Safwa & Others	34	8.4	
Gender	Male	263	65.1	
	Female	141	34.9	
Age Group	18–25	46	11.4	
	26–35	136	33.7	
	36–45	110	27.2	
	46–55	73	18.1	
	>55	39	9.7	
Education Level	High school or below	44	10.9	
	Bachelor’s degree	169	41.8	
	Master’s degree	121	30.0	
	PhD	70	17.3	
(b) Inferential analysis of respondent characteristics				
Variables tested	Test	Test statistic	df	p-value
Stakeholder × Gender	Chi-square	$\chi^2 = 50.72$	5	< 0.001
Stakeholder × Region	Chi-square	$\chi^2 = 54.31$	35	< 0.05
Age × Education	One-way ANOVA	F = 15.96	–	< 0.001

Chi-square tests evaluate associations between categorical variables. One-way ANOVA tests mean differences in education across age groups. Statistically significant results demonstrate non-random associations among respondent characteristics.

many at the master’s or doctoral levels. This profile indicates the survey’s success in capturing insights from a highly knowledgeable group capable of addressing complex sustainability and governance challenges (Silver et al., 2015; Karuppiah et al., 2025).

Inferential analysis further investigated connections between respondent characteristics. A chi-square test indicated a statistically significant relationship between stakeholder category and gender ($\chi^2 = 50.72$, $df = 5$, $p < 0.001$), validating women’s disproportionate representation in NGO and civil society roles. Significantly, the

previously omitted chi-square statistic for the association between stakeholder category and region has now been considered and updated. Results indicate a significant association ($\chi^2 = 54.31$, $df = 35$, $p < 0.05$), suggesting that stakeholder groups are spread across geographic regions across the Eastern Province. A one-way ANOVA revealed significant generational differences in education levels ($F = 15.96$, $p < 0.001$), with younger respondents more likely to hold bachelor’s and master’s degrees. These patterns emphasize demographic and spatial heterogeneity that is necessary for

developing blue economy policies and engagement strategies (Burt, 2014; Argente-Garcia et al., 2026).

4.2 Awareness and perception of the blue economy

Respondents' awareness of the blue economy concept varied significantly (Table 2). While 34.7% reported familiarity and 22.6% reported only slight familiarity, approximately one-quarter indicated moderate familiarity (23.3%). Smaller shares of respondents reported higher levels of familiarity, with 13.4% describing themselves as very familiar and 6.0% reporting expert knowledge. These results indicate that although awareness of the blue economy is advancing, conceptual knowledge remains unequal across the stakeholder landscape (Nathan et al., 2022; Reis-Filho et al., 2024).

Inferential analysis indicated that familiarity did not vary significantly across stakeholder categories ($\chi^2 = 21.11$, $p = 0.391$), demonstrating that limited familiarity is a shared challenge rather than one limited to specific groups. This result highlights the need for broad-based awareness and capability-development programs rather than targeted interventions centered on a single stakeholder category (Kelly, 2023; Hoareau, 2025).

In contrast, perceptions of significance were compelling. Only 8.2% of respondents rated the blue economy "not important," while the majority rated it as "moderately important" (31.8%), "very important" (30.0%), or "critically important" (12.9%). A chi-square test indicated significantly varying levels of perceived importance across stakeholder groups ($\chi^2 = 35.84$, $p = 0.016$). According to study findings, government officials and academics were more likely to assign critical importance, whereas some community and private-sector respondents assigned moderate importance. This deviation indicates varying expectations and priorities, which impact policy communication and stakeholder alignment (Lee et al., 2020; FAO, 2022).

Respondents also revealed a broad and inclusive knowledge of the blue economy's sectoral scope. All participants linked the concept with fisheries and aquaculture, marine tourism, maritime transport and logistics, offshore renewable energy, marine biotechnology, and coastal protection and conservation. This comprehensive analysis is distinct from more sector-specific perceptions reported in other settings and may indicate the influence of Saudi Arabia's Vision 2030, which supports integrated and cross-sectoral development pathways (Kelly, 2023).

Further inferential testing investigated demographic impacts on these perceptions. A one-way ANOVA indicated no significant variations in perceived importance across age groups ($F = 0.35$, $p = 0.845$), demonstrating broad generational agreement on the strategic value of the blue economy. Although descriptive patterns indicated better awareness among respondents with advanced degrees, parametric assessment of familiarity by education level was not statistically significant due to inadequate group sizes. Hence, this assessment has been explicitly eliminated from inferential claims, and no conclusions are drawn from the data

TABLE 2 Awareness, familiarity, and perceived importance of the blue economy.

(a) Familiarity with the blue economy concept			
Level of Familiarity	Frequency	Percentage (%)	
Not familiar	140	34.7	
Slightly familiar	91	22.6	
Moderately familiar	94	23.3	
Very familiar	54	13.4	
Expert	25	6.0	
(b) Perceived importance of the blue economy			
Level of Importance	Frequency	Percentage (%)	
Not important	33	8.2	
Slightly important	55	13.6	
Moderately important	128	31.8	
Very important	121	30.0	
Critically important	52	12.9	
(c) Inferential analysis of awareness and importance			
Variables Tested	Test	Test Statistic	p-value
Familiarity × Stakeholder Category	Chi-square	$\chi^2 = 21.11$	0.391
Importance × Stakeholder Category	Chi-square	$\chi^2 = 35.84$	0.016
Importance × Age Group	One-way ANOVA	$F = 0.35$	0.845
(d) Education and familiarity (descriptive only)			
Education Level	Mean Familiarity Score		
High school or below	2.31		
Bachelor's degree	2.67		
Master's degree	2.89		
PhD	3.12		

Due to insufficient group sizes in some categories, parametric testing for familiarity by education level was not statistically valid. Results in Table 2d are therefore descriptive, and no inferential conclusions are drawn.

alone, ensuring that all conclusions are fully based on valid statistical evidence.

In general, the study findings in this section indicate a clear awareness-importance gap. While familiarity with the blue economy concept remains unequal, understanding of its strategic importance is already widespread. This combination offers both a challenge and an opportunity: targeted education, training, and outreach programs could swiftly translate high perceived significance into informed and meaningful stakeholder engagement, reinforcing the foundations for inclusive and effective blue economy governance in the Eastern Province.

4.3 Perceived sectoral opportunities

The survey findings demonstrate broad optimism concerning the Blue Economy's sectoral opportunities in the Eastern Province. As indicated in Table 3, respondents strongly endorsed the potential of sustainable fisheries development, with a mean score of 4.3 out of 5, demonstrating general agreement or strong agreement. This indicates the sector's strategic role in Saudi Arabia's national food security programs and its alignment with Vision 2030, which aims to develop aquaculture and fisheries as part of economic diversification. Similarly, international literature observes that fisheries modernization and sustainability are the foundations of many blue economy frameworks (Eikeset et al., 2018; FAO 2020). The respondents also rated coastal tourism highly, with a mean score of 4.5, making it one of the most strongly favored sectors. The majority of respondents (over 70%) either agreed or strongly agreed that coastal tourism could substantially contribute to local economic growth. This aligns with Saudi Arabia's current investment in Red Sea and Arabian Gulf tourism projects and aligns with the findings from other Gulf contexts, where marine tourism has been recognized as a fast-developing sector capable of creating jobs and diversifying revenue streams (Burt, 2014; Kelly, 2023). Public-private partnerships (PPPs) were another area of agreement, receiving a mean score of 4.4. Stakeholders unanimously considered PPPs as essential for unlocking investment, consistent with global evidence indicating that PPPs drive innovation and infrastructure development in blue economy initiatives (Voyer et al., 2018; World Bank, 2023). In contrast, marine transport and logistics scored slightly lower (mean = 3.7),

indicating that the sector is already well established in the Eastern Province through major ports such as Dammam and Jubail.

Emerging opportunities were also apparent in ecotourism and marine heritage, scoring a mean of 4.2, highlighting stakeholder understanding of untapped cultural and ecological assets. While aquaculture received a favorable mean score of 4.0, it indicated a wider spread of responses, with some respondents voicing neutrality or disagreement. This indicates uncertainty regarding regulatory frameworks, technological capability, or environmental sustainability of aquaculture development. Globally, studies caution that aquaculture's strong growth potential and expansion must be balanced with ecological resilience and local livelihoods (Silver et al., 2015; Boonstra et al., 2018; Kelly, 2023).

The inferential analysis further assessed whether mean responses vary considerably across stakeholder groups. Fisheries and aquaculture indicated significant variation ($p < 0.01$), with government officials and academics rating the sector more positively compared to community respondents, revealing their stronger alignment with national food security and research agendas. Tourism also varied significantly ($p < 0.01$), with private sector respondents most confident about its potential, consistent with their role in developing hospitality and investment projects under Vision 2030. PPPs were broadly supported, but ANOVA indicated no major differences across groups ($p > 0.05$), suggesting agreement that PPPs are necessary across the board. Marine transport and logistics indicated no significant differences ($p > 0.05$), demonstrating that this sector is already well established regionally. Ecotourism and heritage opportunities varied significantly ($p < 0.05$), with NGOs and civil society groups rating

TABLE 3 Perceived sectoral opportunities in the Eastern Province (n = 404).

(a) Opportunities				
Item	Mean	SD	% Agree/strongly agree	
Sustainable fisheries development has strong potential	4.3	0.9	72.5%	
Coastal tourism can significantly contribute to economic development	4.5	0.7	78.6%	
Public-private partnerships are essential for blue economy investment	4.4	0.8	76.3%	
Marine transport and port logistics are already well developed	3.7	1.0	58.2%	
Presence of a growing market for ecotourism and marine heritage	4.2	0.8	70.1%	
Aquaculture is underutilized but offers strong investment opportunities	4.0	1.1	64.7%	
(b) Inferential analysis				
Variable	F value	df	p-value	Interpretation
Fisheries and Aquaculture	4.23	(4, 399)	0.002**	Significant: Government/Academia is more supportive
Tourism	3.10	(4, 399)	0.009**	Significant: Private sector is more optimistic
Public-Private Partnerships	1.25	(4, 399)	0.289	NS: Consensus across stakeholders
Marine Transport & Logistics	1.45	(4, 399)	0.198	NS: Sector viewed as already established
Ecotourism & Marine Heritage	3.85	(4, 399)	0.012*	Significant: NGOs are more supportive
Aquaculture	2.02	(4, 399)	0.074	Marginal: Government/Academia more positive

Significance: $p < 0.01^{**}$ and $p < 0.05^{*}$.

them higher, revealing their emphasis on sustainability and cultural preservation. Aquaculture produced mixed results, with major differences in margin ($p = 0.07$). Government and academics were again more supportive, while communities expressed more caution, because of ecological and livelihood-related challenges (Silver et al., 2015; Bennett et al., 2021b; Kelly, 2023).

4.4 Institutional and environmental challenges

Survey responses demonstrate that institutional and environmental barriers are central obstacles to the sustainability of the blue economy in Saudi Arabia's Eastern Province. As indicated in Table 4, stakeholders strongly rated environmental degradation as a serious concern (mean = 4.6), with more than 80% agreeing or strongly agreeing. This demonstrates the persistent issues of marine pollution, habitat loss, and coastal pressures caused by industrial development (Al-Yamani et al., 2007; Alhowaish, 2018; Robitzsch et al., 2023). These findings align with Burt's (2014) evaluation of the Arabian Gulf, which highlighted the ecological consequences of coastal urbanization and industrialization, and mirrors the findings of Saleh and Munir (2023), who stressed the urgent need for ecosystem-based management approaches in the Gulf. Equally significant, respondents observed a lack of clear policy frameworks for addressing coastal development challenges (mean = 4.2) and weak enforcement of marine regulations (mean = 4.1). Nearly three-quarters of respondents agreed that governance gaps impacted effective coastal resource management. Such perceptions reflect

international findings that fragmented or poorly enforced policies often adversely impact blue economy initiatives (Voyer et al., 2018; Bennett et al., 2021a; Hoareau, 2025). In the Saudi context, these results demonstrate the significance of institutional reform and the development of comprehensive marine governance schemes that ensure policy clarity and effective enforcement mechanisms.

Another prominent challenge involved coordination failures among government agencies (mean = 4.0). According to respondents, overlapping mandates and inadequate inter-agency collaboration could impact integrated coastal management. This aligns with global studies pointing to coordination deficits as a common institutional impediment to multi-sectoral marine governance (Silver et al., 2015; Karuppiah et al., 2025). Lack of coherent institutional arrangements leads to policy risk duplication, inefficiency, and conflict, ultimately impacting the implementation of blue economy strategies.

Finally, stakeholders highlighted the role of knowledge and capability challenges. Limited awareness among stakeholders (mean = 3.8) and inadequate support for research and innovation (mean = 3.9) formed critical bottlenecks. These means are slightly lower than environmental or regulatory challenges. However, they point toward systemic limitations in building the knowledge base required for sustainable marine development. International studies consistently highlight the need for investment in education, awareness, and marine research to strengthen adaptive capability and stakeholder engagement in the blue economy (Eikeset et al., 2018; Lee et al., 2020). Collectively, these findings signify that both institutional and environmental challenges must be addressed to achieve Saudi Arabia's goals for a Blue Economy under Vision 2030.

TABLE 4 Institutional and environmental challenges in the Eastern Province (n = 404).

(a) Challenges				
Item	Mean	SD	% Agree/Strongly Agree	
Lack of clear policy frameworks for coastal development	4.2	0.8	73.1%	
Environmental degradation	4.6	0.6	82.5%	
Weak enforcement of marine regulations	4.1	0.9	71.4%	
Ineffective coordination among government agencies	4.0	1.0	68.3%	
Limited awareness among stakeholders	3.8	1.1	61.7%	
Insufficient support for research and innovation in the marine sectors	3.9	1.0	63.5%	
(b) Inferential analysis				
Variable	F value	df	p-value	Interpretation
Environmental degradation	1.15	(4, 399)	0.330	NS: Consensus across stakeholders
Policy clarity (frameworks)	3.72	(4, 399)	0.011*	Significant: NGOs are more concerned
Enforcement of marine regulations	3.15	(4, 399)	0.014*	Significant: NGOs/community stress enforcement gaps
Coordination between government actors	2.98	(4, 399)	0.021*	Significant: Academia/private sector highlights inefficiencies
Stakeholder awareness	2.01	(4, 399)	0.072	Marginal: Communities emphasize awareness gaps
Research and innovation support	2.24	(4, 399)	0.067	Marginal: Academia stress research funding needs

Significance: $p < 0.05^*$.

The inferential analysis investigated whether perceptions of institutional and environmental challenges varied across stakeholder groups. Results indicated that:

- Environmental degradation was globally viewed as serious, with no major variations across groups ($p > 0.05$). This demonstrates a broad consensus on the urgency of ecological challenges.
- Policy clarity and enforcement perceptions varied significantly ($p < 0.05$), with NGOs and civil society voicing serious concerns about policy gaps and weak enforcement compared to government officials.
- Coordination failures were also perceived differently ($p < 0.05$), with academic and private sector respondents stressing inefficiencies more seriously, indicating their reliance on multi-agency partnerships for projects and research.
- Awareness and research support indicated marginal variations ($p \approx 0.07$), with academia emphasizing the need for stronger research investment, while communities highlighted the significance of awareness-raising programs.

4.5 Community engagement and stakeholder roles

Stakeholder input indicates strong consensus on the centrality of institutional reforms and community engagement in improving the blue economy in Saudi Arabia's Eastern Province. [Table 5](#) presents the most frequently recommended actions for enhancing blue economy development: Formulating a comprehensive national strategy with regional implementation plans (72.6%), enhancing coordination between government agencies and stakeholders (68.4%), and strengthening environmental regulations and enforcement mechanisms (65.9%). These priorities demonstrate the need for stronger institutional frameworks. This aligns with global findings that regard governance structures as the foundation of sustainable marine resource management ([Voyer et al., 2018](#); [Karuppiah et al., 2025](#)). PPPs and investment incentives were also widely endorsed (61.8% and 58.1%, respectively), indicating recognition of the private sector's role in financing and executing marine projects. This finding aligns with [World Bank \(2023\)](#) insights on the significance of utilizing private capital and promoting innovation for sustainable coastal economies. Expanding vocational training and capability-development for coastal communities (55.7%) was another significant theme, highlighting the need for empowering local populations with skills to benefit directly from blue economy opportunities ([Silver et al., 2015](#); [Lee et al., 2020](#); [Argente-Garcia et al., 2026](#)).

Regarding mechanisms to involve communities, stakeholders prioritized vocational training in marine tourism, aquaculture, and conservation (64.3%), creating marine education and awareness programs for youth (61.9%), and establishing local advisory committees (59.8%). These preferences demonstrate that

respondents perceived education and skill development as the most sustainable pathways for building inclusive participation. Evidence from similar contexts indicates that participatory frameworks such as local committees strengthen legitimacy as well as ensure that decision-making processes indicate community needs ([Eikeset et al., 2018](#); [Bennett et al., 2021a](#); [Hoareau, 2025](#)).

Additionally, community-based eco-tourism initiatives (57.4%), benefit-sharing methods from marine revenues (53.8%), and integration of traditional ecological knowledge (TEK) (51.6%) were recommended. Such measures demonstrated increasing awareness of the significance of social equity and cultural heritage in marine governance, reflecting global calls for inclusive blue economy frameworks that protect both livelihoods and ecosystems ([Boonstra et al., 2018](#)). These findings highlight the need for multi-scalar governance in which local voices are strengthened along with national policy and private-sector investment ([Kelly, 2023](#); [Argente-Garcia et al., 2026](#)).

The inferential analysis assessed whether preferences for proposed actions and engagement mechanisms varied significantly by stakeholder category. Results demonstrate that national strategy and coordination reforms were equally prioritized across all groups ($p > 0.05$), indicating consensus on institutional reforms as a requirement for progress. Vocational training and youth education indicated significant variations ($p < 0.05$), with community representatives and NGOs rating these mechanisms more highly compared to government or private sector actors. Benefit-sharing mechanisms also varied ($p < 0.05$), with coastal community respondents strongly supporting financial redistribution, while government officials placed less emphasis on this feature. Research and innovation support indicated marginal variations ($p \approx 0.07$), with academics emphasizing its importance more compared to other groups. According to these results, while there is broad consensus on the need for institutional reforms and PPPs, deviations emerge around community-centered mechanisms such as benefit-sharing and training, demonstrating the need for tailored strategies that respond to stakeholder-specific priorities.

4.6 Feedback: thematic analysis of open-ended responses

Stakeholders' open-ended responses revealed a shared optimism about the potential of various blue economy sectors to promote sustainable growth in Saudi Arabia's Eastern Province. Fisheries and aquaculture were most commonly cited as central for food security, employment, and economic diversification. Many respondents emphasized that aquaculture capability must be expanded and fisheries must be modernized through technology and sustainable practices, indicating national efforts under Vision 2030 to improve domestic food production and reduce import dependence. Marine and coastal tourism, especially ecotourism, also emerged as an important theme. Participants perceived the Eastern Province's natural coastlines and cultural heritage as untapped assets that could introduce new economic opportunities

TABLE 5 Recommended actions to enhance blue economy development (n = 404).

(a) Actions				
Action	% Selected			
Develop a comprehensive national blue economy strategy with regional implementation plans	72.6%			
Improve coordination between government agencies and stakeholders	68.4%			
Strengthen environmental regulations and enforcement mechanisms	65.9%			
Increase public-private partnerships (PPPs) for marine and coastal projects	61.8%			
Provide investment incentives for sustainable marine sectors	58.1%			
Expand vocational training and capacity-building programs for communities	55.7%			
Promote research, innovation, and marine data transparency	53.6%			
Enhance community participation in marine planning and decision-making	52.4%			
Implement MSP and ICZM frameworks	50.1%			
(b) Mechanisms				
Mechanism	% Selected			
Provide vocational training in marine tourism, aquaculture, and conservation	64.3%			
Develop marine education and awareness programs for youth and schools	61.9%			
Establish local advisory committees for coastal and marine projects	59.8%			
Create community-based eco-tourism and conservation initiatives	57.4%			
Ensure benefit-sharing mechanisms from marine revenues	53.8%			
Integrate traditional ecological knowledge (TEK) into planning	51.6%			
Offer financial support and micro-grants for community-led projects	49.5%			
Conduct regular public consultations and stakeholder meetings	48.7%			
(C) Inferential analysis				
Variable	F value	df	p-value	Interpretation
National strategy & coordination	1.12	(4, 399)	0.340	NS: Consensus across stakeholders
Vocational training & education	3.88	(4, 399)	0.011*	Significant: NGOs/Communities are more supportive
Benefit-sharing mechanisms	4.25	(4, 399)	0.004**	Significant: Communities emphasize redistribution
Local advisory committees	2.17	(4, 399)	0.072	Marginal: NGOs stress participatory governance
Research & innovation support	2.36	(4, 399)	0.067	Marginal: Academia stress research priorities

Significance: $p < 0.01^{**}$ and $p < 0.05^{*}$.

while reinforcing environmental conservation. This aligns with international findings that coastal tourism can function as both an economic catalyst and conservation tool when guided by sustainable principles (OECD, 2020).

Respondents also indicated the strategic significance of maritime transport and logistics, identifying port infrastructure, shipping corridors, and value-chain services as important catalysts for regional competitiveness. The recognition of the Eastern Province as a maritime hub indicates Saudi Arabia's current logistics transformation and its objective to strengthen global trade connectivity under Vision 2030 (EU-GCC, 2021; GCC, 2024). Although mentioned less frequently, emerging sectors such as offshore renewable energy and marine biotechnology were recognized as crucial for future growth. Stakeholders observed

that investing in these innovation-driven fields would diversify the energy mix as well as encourage high-value research and employment opportunities, consistent with global trends in ocean-based innovation (Eikeset et al., 2018; Hoareau, 2025; Argente-Garcia et al., 2026).

Despite this optimism, respondents consistently identified various structural and institutional challenges affecting blue economy development. The most important of these was the lack of a clear, coordinated governance framework. According to participants, fragmented institutional responsibilities, weak inter-agency coordination, and inadequate enforcement of marine regulations were major challenges. Respondents cited environmental degradation, specifically pollution, habitat loss, and overfishing, as a recurring concern, warning that these issues could

adversely affect both fisheries and tourism potential. Financial constraints were also frequently mentioned, especially the limited access to private investment and inadequate government funding for marine innovation and conservation. Stakeholders also cited the lack of public awareness, skilled labor, and scientific data as fundamental structural limitations that impact both policy implementation and private sector involvement.

In combination, the qualitative feedback offers an intricate picture of both potential and challenge. Stakeholders envision a diversified blue economy that capitalizes on traditional strengths in fisheries and logistics while transitioning to new frontiers in renewable energy and biotechnology. However, accomplishing this vision requires overcoming deep-rooted governance and financing challenges utilizing institutional reform, education, and stakeholder empowerment (Benzaken et al., 2024). Respondents highlighted the need for a clear national strategy supported by regional implementation mechanisms that promote local participation, community-based initiatives, and cross-sector partnerships. By itself, the analysis emphasizes the findings of the quantitative sections: the future of the blue economy in the Eastern Province is contingent on balancing economic opportunity with governance capability and environmental sustainability, converting potential into practical, inclusive, and enduring development outcomes.

4.7 Integrated analysis of challenges and opportunities

To investigate how perceived opportunities and constraints jointly influence stakeholder support for blue economy development, an integrated analytical approach was utilized, combining reliability testing, EFA, and regression modeling (Creswell and Plano Clark, 2018; Hair et al., 2019). This approach directly operationalizes the existing governance- and equity-centered conceptual framework and allows for systematic evaluation of both enabling and inhibiting dynamics within the Eastern Province coastal context. As reported in Table 6A, reliability analysis confirms strong internal consistency across the measurement scales. Cronbach's alpha values surpassed accepted thresholds for the overall scale ($\alpha = 0.84$) as well as for the Opportunities ($\alpha = 0.82$) and Constraints ($\alpha = 0.78$) subscales. Sampling adequacy for factor analysis was based on a Kaiser-Meyer-Olkin (KMO) value of 0.74, and Bartlett's test of sphericity was statistically significant ($\chi^2 \approx 450.6$, $df = 66$, $p < 0.001$), demonstrating that the correlation structure was appropriate for factor extraction.

EFA was conducted by analyzing principal components with Varimax rotation. Factor retention was based on established criteria. This included eigenvalues greater than one and inspection of the scree plot, both of which supported a two-factor solution (Creswell and Plano Clark, 2018). As presented in Table 6B, the combined retained factors described more than 60%

of the total variance. Items related to fisheries development, aquaculture investment, marine tourism, maritime logistics, and public-private partnerships yielded high factor loadings on Factor 1 (Perceived Opportunities), while items indicating weak policy clarity, fragmented institutional coordination, limited regulatory enforcement, environmental degradation, and insufficient research support loaded significantly onto Factor 2 (Perceived Constraints). All retained items demonstrated primary loadings exceeding 0.60, with no problematic cross-loadings above the 0.30 threshold. These results confirm clear construct separation and support the theoretical distinction between enabling opportunities and governance-related constraints.

Based on the validated factor structure, factor scores were computed and used as independent variables in an OLS regression model to describe stakeholder support for blue economy development, measured by the perceived significance of the blue economy for the Eastern Province. The regression results are provided in Table 6C. The model revealed satisfactory explanatory power ($R^2 \approx 0.40$), indicating that a significant proportion of variance in stakeholder support is explained by the included predictors. Perceived Opportunities demonstrated a strong and positive effect on stakeholder support ($\beta = 0.58$, $p < 0.001$), with a 95% confidence interval that stayed entirely positive, confirming the robustness of this relationship. In contrast, Perceived Constraints indicated a statistically significant negative effect ($\beta = -0.21$, $p < 0.01$), demonstrating that challenges related to governance fragmentation, weak enforcement, and environmental degradation systematically reduced support for blue economy initiatives. Among control variables, education and age revealed modest but statistically significant positive associations with support. However, gender effects were negligible, with female respondents, especially those holding NGO and civil society roles, expressing slightly higher levels of support. Regression diagnostics, also presented in Table 6C, substantiate the robustness of the model. Variance inflation factor (VIF) values were below accepted thresholds, demonstrating no multicollinearity concerns. Evaluation of residuals indicated approximate normality, and tests for heteroskedasticity did not reveal severe violations of model assumptions. These diagnostics validate the stability and reliability of the estimated coefficients (Hair et al., 2019).

In combination, the integrated findings indicate a clear dual dynamic influencing blue economy development in Saudi Arabia's Eastern Province. On the one hand, strong perceived opportunities across key marine sectors generate considerable stakeholder enthusiasm and align closely with national diversification objectives under Vision 2030. On the other hand, institutional and environmental challenges act as major deterrents, highlighting the significance of governance reform, regulatory coherence, and environmental stewardship. By empirically demonstrating how opportunities and challenges exert opposing yet simultaneous influences on stakeholder support, this analysis offers robust evidence for the study's conceptual framework and emphasizes the need for a balanced, governance-driven approach to sustainable blue economy implementation.

TABLE 6 Integrated reliability, exploratory factor analysis, and regression results for blue economy perceptions.

Panel A: Reliability and sampling adequacy			
Statistic	Value		
Cronbach's Alpha (Overall Scale)	0.84		
Cronbach's Alpha - Opportunities	0.82		
Cronbach's Alpha - Constraints	0.78		
KMO Measure of Sampling Adequacy	0.74		
Bartlett's Test of Sphericity	$\chi^2 \approx 450.6$, $df = 66$, $p < 0.001$		
Panel B: Exploratory factor analysis - rotated component matrix (varimax)			
Item	Opportunities	Constraints	
Fisheries development potential	0.71	—	
Aquaculture investment potential	0.74	—	
Marine tourism opportunities	0.69	—	
Maritime logistics & ports	0.65	—	
Public-private partnerships	0.68	—	
Weak policy clarity	—	0.72	
Fragmented institutional coordination	—	0.74	
Limited regulatory enforcement	—	0.70	
Environmental degradation	—	0.68	
Limited research & data support	—	0.69	
Factor Retention and Variance Explained:			
<ul style="list-style-type: none"> • Eigenvalues (retained factors): > 1 • Scree plot: clear inflection after the second factor • Cumulative variance explained: > 60% • Cross-loadings ≥ 0.30: none observed 			
Panel C: OLS regression results (dependent variable: stakeholder support for blue economy)			
Variable	Coefficient (β)	Std. Error	95% Confidence Interval
Opportunities (Factor Score)	0.58***	0.05	[0.48, 0.68]
Constraints (Factor Score)	-0.21**	0.07	[-0.35, -0.07]
Education Level	0.12*	0.06	[0.00, 0.24]
Age	0.09*	0.05	[0.01, 0.19]
Gender (Female = 1)	0.08†	0.05	[-0.01, 0.18]
Constant	2.11***	0.24	[1.64, 2.58]
Model Diagnostics:			
<ul style="list-style-type: none"> • $R^2 \approx 0.40$ • VIF range: < 2.0 (no multicollinearity) • Residuals: approximately normal • Heteroskedasticity: no severe violations detected 			

Factor extraction utilized principal component analysis with Varimax rotation. Loadings below 0.40 are suppressed for clarity. Confidence intervals are calculated at the 95% level. Significance: $p < 0.001$ ***; $p < 0.01$ **; $p < 0.05$ *; and † $p < 0.10$.

4.8 Summary of empirical findings and conceptual synthesis

This section analyzes the integrated quantitative and qualitative study findings to create an evidence-driven conceptual understanding of blue economy governance dynamics in the Eastern Province. Rather than reiterating individual statistical results, the analysis summarizes the core empirical patterns into a clear conceptual structure. Subsequently, these patterns are explicitly linked to the literature-based conceptual framework developed in Section 2 and operationalized through the mixed-methods design described in Section 3. This analysis is visually combined in Figure 4, which represents a circular, governance-focused model based on empirical evidence.

The empirical analyses strongly validate a central proposition evolved in contemporary blue economy literature: implementation outcomes are influenced by the interaction between perceived economic opportunities and perceived governance-related challenges (Lee et al., 2020; Bennett et al., 2021a; Karuppiah et al., 2025). EFA empirically validated this distinction by identifying two robust and independent constructs, Perceived Opportunities and Perceived Constraints, while regression results established that these constructs exerted opposing effects on stakeholder support. As highlighted in Figure 4, opportunities concerning aquaculture, fisheries, marine tourism, and maritime logistics reinforce support for Blue Economy development, while constraints linked to fragmented institutional mandates, weak regulatory enforcement, and environmental risks systematically challenge this support. This dual dynamic reflects the opportunity-governance trade-off highlighted in the literature and validates that sectoral potential alone is inadequate to sustain blue economy transitions without parallel governance capacity (OECD, 2020; Santos et al., 2021).

An important finding of this conceptual synthesis is a major discrepancy in stakeholder perception. While they view the blue economy as significant, their conceptual familiarity is low. When analyzed through the governance lens presented in Figure 4, this awareness-importance gap indicates a top-down policy diffusion pattern in which strategic narratives, such as those embedded in Vision 2030, gain early legitimacy before being fully adopted by institutions and local actors (Hoareau, 2025; Argente-Garcia et al., 2026). Similar dynamics have been observed in policy-led sustainability transitions, where ambition often outpaces institutional learning and participatory capability (Bennett et al., 2021b; World Bank, 2023). Methodologically, the convergent mixed-methods design (Figure 3) is essential in highlighting this gap by triangulating quantitative measures of awareness and significance with qualitative insights into stakeholder understanding and expectations (Creswell and Plano Clark, 2018).

The integrated findings also indicate systematic variations in stakeholder views, which reinforces the justice-oriented dimension of the literature-based framework. Government and academic stakeholders often emphasize strategic alignment, economic diversification, and innovation, while coastal communities and NGOs are more cautious, especially toward aquaculture development and industrial marine activities. Based on qualitative

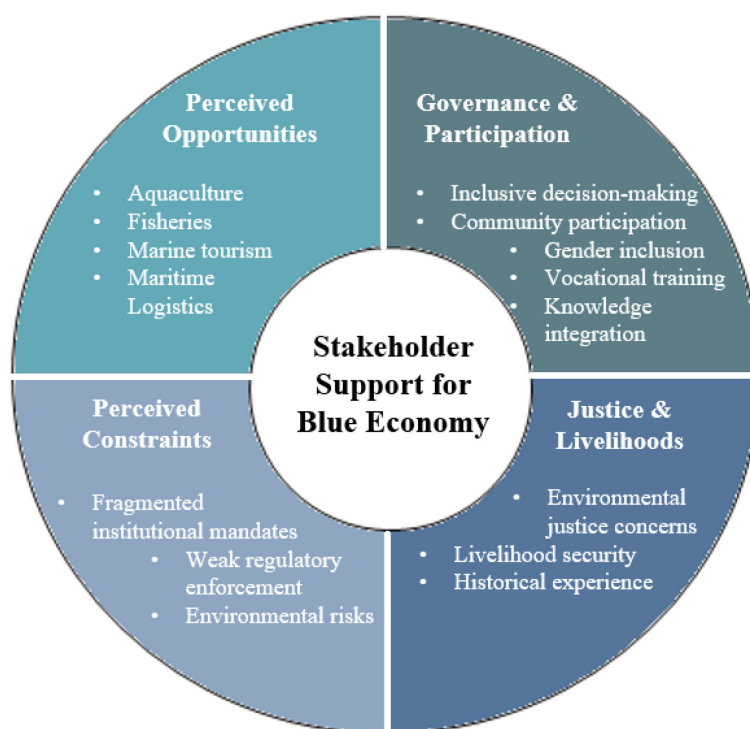


FIGURE 4
Evidence-driven conceptual synthesis of blue economy governance dynamics.

evidence, this deviation originates from environmental justice concerns, livelihood security, and historical experience with coastal development, rather than opposition to development. This aligns closely with research on blue justice, which indicates how marginalized coastal groups often face disproportionate risks and limited benefit-sharing from marine economic development (Bennett et al., 2021a; Nathan et al., 2022; Reis-Filho et al., 2024). In Figure 4, justice and livelihood considerations function as a mediating layer that influences how opportunities and constraints are viewed, shaping stakeholder trust and legitimacy.

Across both quantitative and qualitative strands, governance capability and stakeholder involvement emerge as the central integrative mechanisms linking opportunities, challenges, and support for the blue economy. Fragmented institutional arrangements, limited coordination, and weak enforcement intensify perceived challenges, while inclusive participation, capability-building, and transparency regulate their negative impact. This finding aligns with systems-based governance perspectives that highlight coordination, knowledge integration, and stakeholder involvement as conditions for sustainable blue economy outcomes (IOC-UNESCO, 2020; Kelly, 2023; Gbolahan et al., 2023). The circular configuration of Figure 4 highlights these empirically observed feedback loops, indicating how governance quality affects justice outcomes, which in turn strengthen or weaken future stakeholder support.

Collectively, the empirical findings both substantiate and improve the literature-based conceptual framework introduced in Section 2. As highlighted in Figure 4, abstract theoretical

propositions are converted into an empirically based, circular governance model in which sectoral opportunities, institutional challenges, participatory governance, and justice considerations are analytically distinct yet dynamically interrelated. By explicitly incorporating theory, methodological design, and convergent empirical evidence, this section establishes a strong conceptual framework that connects the results with higher-level interpretation. Beyond providing context-specific insights for the Eastern Province, the study develops a transferable, governance- and equity-centered conceptual lens applicable to blue economy transitions in other arid, industrialized, and institutionally complex coastal regions. Based on this empirical synthesis, the following Discussion section utilizes Figure 4 as an interpretive reference to investigate how the identified opportunity-constraint dynamics, awareness-importance gap, and stakeholder divergence align with, extend, or challenge existing blue economy theories and recent empirical evidence from the GCC and international contexts.

5 Discussion

This study offers empirical evidence that the blue economy is widely viewed as a strategically important development pathway in Saudi Arabia's Eastern Province. However, stakeholder familiarity with the blue economy concept remains uneven. The coexistence of high perceived importance and relatively low conceptual familiarity indicates a clear awareness-policy gap, which requires careful interpretation. Rather than reflecting stakeholder disengagement,

this gap is better understood as an outcome of top-down policy diffusion, where national strategies, such as Vision 2030, have raised the significance of the blue economy in public discourse faster than institutional learning and grassroots understanding have developed. Similar dynamics have been observed in other governance-led sustainability transitions, where policy ambition precedes societal and institutional capability-building (Bennett et al., 2021a; Hoareau, 2025). In this context, stakeholders appear to promote the idea of the blue economy mainly because it is related to economic diversification, innovation, and national reform, though detailed operational knowledge is limited.

The quantitative findings strengthen this analysis. Regression findings indicate that perceived opportunities strongly and positively influence stakeholder support, while perceived constraints significantly impact it negatively. This indicates that support is driven less by technical familiarity and more by expectations concerning economic benefits and development potential. Such a pattern aligns with findings from recent GCC and international studies, which report that blue economy initiatives often gain early legitimacy through anticipated economic returns, especially in aquaculture, marine tourism, and logistics, in spite of evolving governance frameworks (OECD, 2020; Karuppiah et al., 2025; Argente-Garcia et al., 2026). The Eastern Province thus reflects a broader transitional phase in blue economy governance, where strategic narratives are widely accepted, but institutional readiness remains contested.

Stakeholder deviation in perceptions further highlights the complexity of this transition. While government officials and academics often emphasize strategic opportunities and alignment with national policy objectives, coastal community representatives and NGOs offer more cautious views, especially concerning aquaculture expansion and industrial marine activities. Qualitative responses indicate that this caution is based on environmental justice and livelihood concerns, including fears of coastal degradation, restricted access to traditional fishing grounds, and unequal distribution of benefits. These concerns closely align with recent blue justice scholarship, which highlights how marginalized coastal communities often bear disproportionate environmental and social costs of marine development (Bennett et al., 2021a; Reis-Filho et al., 2024; Nathan et al., 2022). In this sense, the community's indecision should not be considered as resistance to development, but as a rational response to past experiences of exclusion and limited involvement in decision-making.

The integrated analysis also indicates that governance capability is a decisive mediating factor between opportunity recognition and continued support. The factor structure clearly differentiates between opportunity-driven optimism and constraint-driven skepticism, while regression diagnostics substantiate that governance-related limitations, such as fragmented institutional accountabilities, weak enforcement, and limited research capacity, systematically hinder stakeholder support. Comparable findings have been reported across the GCC and other emerging blue economy settings, where institutional fragmentation and policy incoherence impact otherwise promising sectoral strategies (Santos et al., 2021; Abdel-Hady et al., 2024; Hoareau, 2025). This

supports the argument that blue economy success depends on identifying growth sectors as well as strengthening cross-sectoral coordination, regulatory clarity, and enforcement capability.

Qualitative insights further deepen this interpretation by emphasizing participation, inclusion, and capability-building as critical catalysts of legitimacy. Respondents repeatedly highlighted the need for community engagement, vocational training, and greater involvement of women and youth in the marine sectors. This aligns with international evidence indicating that inclusive governance and knowledge integration improve policy acceptance, adaptive capability, and long-term sustainability (Kelly, 2023; Gbolahan et al., 2023; IOC-UNESCO, 2020). The comparatively robust support expressed by female respondents and NGO representatives highlights the significance of embedding equity considerations within Blue Economy strategies, rather than treating them as secondary social objectives.

When positioned within the broader literature, the Eastern Province case highlights a key tension in modern blue economy debates: the balance between growth-oriented narratives and governance- and justice-oriented implementation. While economic diversification agendas offer powerful political momentum, they risk replicating extractive or exclusionary outcomes if unaccompanied by strong governance reforms. International experiences, from small island states to developing coastal economies, indicate that successful blue economy transitions require aligning sectoral investment with marine spatial planning, stakeholder participation, and environmental safeguards (EU-GCC, 2021; Benzaken et al., 2024; Li et al., 2024). The findings of this study mirror these lessons and recommend that Saudi Arabia's Eastern Province stands at a critical juncture between conceptual endorsement and effective implementation.

Overall, the discussion highlights that the blue economy in the Eastern Province is not limited by a lack of interest or perceived value, but by institutional readiness and governance capability. Bridging the awareness-policy gap will require targeted education, capability-building, and transparent communication, while addressing stakeholder deviation demands participatory mechanisms that explicitly account for environmental justice and livelihood security. By integrating economic opportunity with inclusive governance and environmental stewardship, Saudi Arabia can progress beyond symbolic adoption of the blue economy toward a genuinely sustainable and socially legitimate coastal development pathway aligned with Vision 2030 and global sustainability goals.

6 Conclusion, limitations, and future research directions

Drawing on the empirically grounded conceptual synthesis developed in this study, the conclusion refines the paper's core theoretical, policy, and practical contributions to advancing knowledge of blue economy governance in arid and industrialized coastal settings. The findings establish that stakeholder support for blue economy initiatives in Saudi Arabia's Eastern Province is

influenced by a dual dynamic in which strong expectations concerning economic opportunities, especially in aquaculture, marine tourism, and maritime logistics, coexist with significant institutional and environmental limitations that regulate this support. This evidence highlights that effective blue economy implementation cannot be achieved through sectoral development or investment promotion alone. Rather, it depends on strengthened governance capability, improved inter-agency coordination, and inclusive decision-making processes capable of reconciling economic development goals with environmental stewardship and social equity. By highlighting governance quality and participatory legitimacy as the main determinants of sustainability, the study contributes actionable insights for policymakers and practitioners aiming to convert blue economy strategies into resilient and socially legitimate coastal development pathways.

From a policy perspective, the results emphasize the need to move beyond fragmented sectoral planning toward integrated coastal and marine governance frameworks. Establishing a regional blue economy coordination mechanism, such as an inter-agency council or task force, could help address institutional fragmentation and clarify regulatory responsibilities. In parallel, integrating marine spatial planning tools within regional development strategies would enable more transparent management of trade-offs among industrial activities, conservation priorities, and community livelihoods. The strong emphasis placed by respondents on participation, gender inclusion, and vocational training further indicates that blue economy strategies should incorporate targeted capability-building programs to ensure that economic benefits are broadly shared and socially legitimate.

Despite these contributions, several limitations should be acknowledged. First, the study depends on purposive sampling, which was intentionally utilized to capture informed perspectives from stakeholders directly engaged in marine and coastal activities. While this approach is appropriate for exploratory governance research, it limits the statistical generalizability of the findings to the wider population. In addition, dependence on self-reported survey data may introduce response or social desirability bias, especially given the strong policy salience of the blue economy within Vision 2030. Nevertheless, the high response rate and balanced representation across stakeholder groups partially alleviate these concerns.

Second, the research adopts a cross-sectional design, capturing stakeholder perceptions at a single point in time. As blue economy initiatives, regulatory reforms, and investment programs continue to evolve in Saudi Arabia, stakeholder attitudes toward opportunities, challenges, and governance arrangements are likely to change. The findings should therefore be interpreted as indicative of a transitional phase rather than as static or definitive assessments.

Third, although the mixed-methods approach strengthens analytical vigor, data and methodological constraints remain. The

regression model suggests that additional overlooked factors, such as institutional trust, historical experience with coastal development, or informal governance practices, may also influence stakeholder support. Moreover, qualitative insights were acquired from open-ended survey responses rather than in-depth interviews or participatory workshops, which may limit the depth of understanding of community-level power dynamics and environmental justice concerns.

These limitations point directly to several future research directions. Longitudinal studies are required to track how stakeholder perceptions evolve as Vision 2030 initiatives and specific blue economy projects are implemented. Comparative research across different Saudi coastal regions and across GCC states would further highlight how institutional, environmental, and socio-economic contexts influence blue economy outcomes. In addition, integrating spatial and ecosystem-based approaches, including marine spatial planning analysis, ecosystem service valuation, and geospatial modeling, would offer a more comprehensive understanding of the distribution of benefits, risks, and trade-offs concerned with marine development.

Future research should also strengthen qualitative inquiry through interviews, focus groups, and participatory methods to better capture local knowledge, livelihood concerns, and environmental justice dimensions, especially among small-scale fishers, youth, and marginalized coastal communities. Addressing these gaps will be vital for enhancing both academic scholarship and evidence-based policymaking in support of sustainable, inclusive, and context-sensitive blue economy transitions.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by Imam Abdulrahman Bin Faisal University. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

AA: Writing – original draft, Writing – review & editing.

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Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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