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KEYWORDS	ABSTRACT
sustainable development; coastal areas; Karachi; mangroves; land reclamation; Malir Delta; three pillars of sustainability	Coastal areas give cities great economic, social, and environmental value, yet rapid building on them often damages the very nature that makes them valuable. This paper studies sustainable development along the coast of Karachi, Pakistan, using the case of Defence Housing Authority (DHA) Phase VII-VIII and the neighbouring Malir River Delta. The study follows the three-pillar idea of sustainability environment, society, and economy and asks whether coastal growth in Karachi keeps these three in balance. It uses a mixed approach: a review of recent research, comparison of land-use maps from 1984 and 2017, field visits, and interviews with a marine scientist, estate agents, restaurant visitors, and fishermen from Ibrahim Haidri village. The findings show a clear imbalance. Economic growth from ports, luxury housing, and restaurants is strong, but land reclamation has cleared mangroves and marshlands, reduced fish stocks, cut public access to the shore, and raised the risk from storms and sea-level rise. Weak enforcement of environmental laws makes the problem worse. The paper argues that development cannot and should not be stopped, but it must be made sustainable through balanced planning, mangrove restoration, protection of fishing livelihoods, marine spatial planning, and honest governance. The Hong Kong Chek Lap Kok airport case shows that damaged coastal habitats can be restored when mitigation is taken seriously.
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Introduction

Sustainability can be described as meeting the needs of people today without destroying the ability of future generations to meet their own needs (WCED, 1987). It asks for a balance between three connected goals: a healthy environment, a fair society, and a working economy (Purvis et al., 2019). When any one of these is pushed far ahead of the others, development stops being sustainable and starts to create long-term harm.

Coastal areas are among the most important and most fragile places on Earth. About sixty percent of the world's people live near a coast, which makes these zones centres of trade, housing, fishing, and recreation. The same demand that makes the coast valuable also puts it under heavy pressure. Ports bring trade but also pollution; real estate brings money but also blocks public access; and land reclamation creates new building plots but destroys mangroves, marshlands, and the fish nurseries that depend on them. Because coasts sit where the land meets the sea, mistakes made here are hard and sometimes impossible to reverse.

Karachi is a clear example of this tension. The city grew from a small fishing settlement on the edge of the Indus delta into the largest city and the main economic engine of Pakistan, home to the country's two biggest seaports. This growth has been built heavily on the coast, but almost entirely for economic gain. As the city expanded, mangrove forests shrank, migratory birds declined, and the natural defences of the shoreline weakened (Laghari et al., 2024; Zhou et al., 2024). Karachi also sits near a fault line and in the path of Arabian Sea cyclones, so the loss of natural barriers raises real risk to life and property (Weeks et al., 2023).

This paper looks closely at one part of this coast: DHA Phase VII–VIII and the adjoining Malir River Delta. The aim is to understand how the idea of sustainability works, or fails to work, in the real conditions of Karachi's coastline. The specific objectives are: (1) to explain the three pillars of sustainability and how they appear on the coast; (2) to measure the change in land use and coastal habitat in the study area over time; (3) to record how development has affected the local fishing community and public access to the shore; and (4) to suggest practical steps for more sustainable coastal development.

Literature Review and Conceptual Framework

The Concept of Sustainability

Sustainability is often misunderstood as being only about protecting nature. In fact, the idea is wider and includes social fairness and economic health as well (Purvis et al., 2019). The modern framework was shaped by the Brundtland Report, which defined sustainable development and called for nations to work together across generations (WCED, 1987). Today the most common model describes sustainability as three overlapping pillars environment, society, and economy that must be considered together rather than one at a time (Ranjbari et al., 2021).

These three pillars are not equal in the way they depend on each other. The environment is the base, because it provides the air, water, land, and living systems on which everything else rests. Society sits inside the environment, and the economy sits inside society, because money has no value without people and no resources without nature. On the coast, each pillar takes a specific shape, as summarised in Table 1.

Researchers also separate “weak” from “strong” sustainability. Weak sustainability assumes that money earned from using up nature can simply replace that nature later, so a lost mangrove forest is

treated as an acceptable trade for a new housing scheme. Strong sustainability argues that some natural assets such as a storm-protecting mangrove belt or a fish nursery cannot be rebuilt or bought back once gone, and so must be kept whatever the short-term gain (Purvis et al., 2019). Karachi’s coast, as the findings below show, has been managed as if weak sustainability were enough, when in fact many of its coastal assets are the kind that strong sustainability says must be protected.

Table 1. The three pillars of sustainability and their form on the coast.

Pillar	Core meaning	How it appears on the coast
Environment	Keeping natural systems and life-cycles in balance so they can renew themselves	Oceans, mangroves, estuaries, marshlands, and fish nurseries that shelter marine life and protect land from storms
Society	Fairness, equality, culture, and access to shared spaces	Beaches and seafronts as free public space for recreation, and the culture of fishing communities
Economy	Financial activity that supports livelihoods now and in the future	Ports and trade, commercial fishing, and high-value real estate along the water edge

Environmental Sustainability and Coastal Life-Cycles

Environmental sustainability means keeping natural life-cycles working at a rate that lets them recover. On the coast, the key assets are the ocean, the adjoining land, and marine life. The ocean helps control the global climate by absorbing heat and carbon dioxide. The coastal edge holds special habitats such as mangrove forests, marshlands, and fish nurseries. Mangroves act like sponges that soak up extra water during storms, and their dense roots hold the land together and break the force of waves. They also shelter young fish, which supports both biodiversity and local fishing.

When these habitats are removed, a chain of damage follows. A United Nations blueprint for ocean and coastal sustainability named four linked causes of coastal decline: unsustainable fishing, climate change and ocean acidification from industrial dumping, loss of habitats and species, and unsustainable land reclamation (summarised in Table 2). Removing marshlands exposes the land to storms, destroys marine habitats, lowers fish numbers, and pushes people toward harmful fishing. Dumped waste also lowers the pH of seawater, which harms marine chemistry and adds to global warming. Recent studies of the Indus delta confirm that reclamation is the main driver of wetland and mangrove loss in the region (Laghari et al., 2024; Zhou et al., 2024).

Table 2. Four connected drivers of coastal environmental degradation.

No.	Driver of degradation	Main effect on the coast
1	Unsustainable fishing practices	Fish stocks fall faster than they can recover, hurting long-term food supply

2	Climate change and ocean acidification from industrial dumping	Seawater chemistry changes, harming marine life and speeding up warming
3	Loss of habitats and biodiversity	Fewer species and weaker ecosystems as nurseries and shelters disappear
4	Unsustainable land reclamation	Mangroves and marshlands are cleared, removing natural storm barriers

Economic Sustainability and Coastal Life-Cycles

Economic sustainability means producing wealth in a way that meets today’s needs without removing the chance for future income. Seas and oceans carry a large share of world trade, and ports are the main economic life-cycle on the coast. Ports create formal jobs in logistics, management, and services, and they allow large-scale commercial fishing that earns high returns. However, this same activity often pushes out small-scale local fishermen, who cannot compete with large vessels and must travel far into deep water to survive. Evidence from comparable reclamation projects shows that small-scale fishers lose both income and access when the coast is rebuilt for larger economic uses (Bamasood et al., 2025).

There is also a hidden feedback loop between the environment and the economy on the coast. Mangroves act as a barrier that saves land from erosion; their unique roots absorb extra water and provide a breeding ground for young marine life; the grown fish then support commercial fishing; and that fishing gives fishermen a steady source of income and a prosperous livelihood. Each link depends on the one before it. When the mangroves are removed, the whole chain breaks: the land erodes, the nurseries disappear, the fish decline, and the fishermen lose their income. This shows that an economy built on the coast is not separate from nature but grows directly out of it.

Real estate is the second major economic life-cycle. Land with a sea view earns a premium, which creates strong demand and limited supply. Only a small, wealthy group can afford these plots, which widens the social gap in the area. In short, coastal development can be very profitable, yet when it serves money alone it damages the environmental and social pillars and becomes unsustainable over time.

Social Sustainability and Coastal Life-Cycles

Social sustainability is about wellbeing, fairness, and access. Beaches and seafronts are natural public spaces where people from all backgrounds gather for rest and recreation, and they help shape the identity of a community or city. When the land near the sea is bought up privately, public access shrinks and only a few people can enjoy the shore. This is a form of social injustice, and it is closely tied to the economy: when the coast is developed only for profit, social sustainability falls.

Lessons from Chek Lap Kok, Hong Kong

The Hong Kong International Airport, built by reclaiming land around Chek Lap Kok island, shows that coastal damage can be partly repaired. Construction destroyed much of the island’s coastal habitat and mangrove cover. In response, a mangrove mitigation and restoration programme replanted forests at Tai O, which grew into a healthy habitat and nursery for young fish and supported the local fishing economy. The case proves that even large projects can protect the three pillars if mitigation is planned early and taken seriously. This lesson matters for Karachi, where mitigation has largely been ignored.

Taken together, the literature points to four planning rules: protect the ecology of sensitive areas; base land use on social and environmental value, not only money; make development benefit the majority rather than a few; and safeguard cultural assets. Modern tools such as integrated coastal zone management and marine spatial planning turn these rules into practice by coordinating all users of the coast (Jiang et al., 2023; Jattak et al., 2023). The rest of this paper tests whether these rules are followed in Karachi.

Research Methodology

The study uses a mixed-methods design that combines qualitative and quantitative evidence. The aim was to understand sustainability in coastal development within the local context of Karachi, rather than only through foreign theory. The research began with observations during visits to coastal areas and was then expanded through secondary research and primary fieldwork.

Because few local texts were available, the review drew mainly on international literature and on recent peer-reviewed studies of the Indus delta and the Pakistani coast. To connect theory with local reality, the study then focused on a single site chosen with clear criteria: the area had to contain a natural environment, show rapid change in land use, host economic, social, and recreational activity, and face a threat of losing its ecological character. DHA Phase VII–VIII and the adjoining Malir Delta met all four conditions, with roughly thirty percent of the Phase–VIII extension built on reclaimed land. Table 3 summarises the data sources.

Table 3. Summary of data sources and methods.

No.	Method	Source / participants	Purpose
1	Literature review	International and recent peer-reviewed studies	Build the three-pillar framework and compare with local conditions
2	Map comparison	Malir Delta satellite maps, 1984 and 2017	Measure change in land use and habitat over time
3	Site analysis	DHA Phase VII–VIII, Malir Delta, Ibrahim Haidri, Do Darya	Observe current activities and physical change
4	Expert interview	Dr. Muhammad Shoaib Kiani, Institute of Marine Science,	Understand ecology, history, and governance

5	Informal discussions	University of Karachi	Capture community and user perspectives
		Fishermen (Abdul Hakim, Baber), estate agents, restaurant visitors	

Limitations

The study faced several limits. The site lies on the outskirts of the city, which reduced the number of visits and the accuracy of demographic data. Many residents of Ibrahim Haidri were reluctant to speak, fearing that researchers might take away their remaining resources, and restaurant managers were also guarded. Fieldwork during Ramzan limited access to restaurant menus, and the informal nature of the discussions meant conversations could not be recorded, only noted. These limits mean the findings should be read as a detailed local picture rather than a full statistical survey.

Findings, Discussion, and Analysis

Karachi: A General Overview

Karachi began as a fishing village on the eastern edge of the Indus river delta and grew into the commercial and industrial heart of Pakistan, with an estimated population of around eighteen million at the time of the fieldwork. It hosts a naval facility, shipyards, power plants, and the country's two largest seaports. This growth has been impressive, but it has come at a cost. Among the three pillars of sustainability, only the economic pillar carries real weight in the city. Revenue from ports and trade has not been turned into social or environmental improvement, while the natural environment has shrunk. Heat waves have become common in a city once known for cool sea breezes, and migratory birds that wintered on its shores have declined as mangroves and marshlands were cleared.

Rapid urban growth is confirmed by remote-sensing studies that track how built-up land in and around the city has expanded while natural cover has fallen (Wahla et al., 2023). With roughly twenty-six kilometres of coastline inside its limits, Karachi needed a focused study area, which is why the Malir Delta and DHA Phase VII–VIII were chosen for close analysis.

Change in Land Use: Malir Delta, 1984–2017

A comparison of maps from 1984 and 2017 shows a dramatic change. In 1984 the delta was covered with patches of foliage and a large number of estuaries that sustained the ecosystem and absorbed extra water during tides and floods. There was little building near the land edges. By 2017, much of the land that once held forest had been reclaimed for residential, recreational, and mixed uses. The Malir River, one of only two river systems that bring fresh water to the sea in Karachi, now also works as a city drain, yet it still feeds the marshlands that support the remaining mangroves. Table 4 sets out the main changes.

Table 4. Change in land use and habitat in the Malir Delta, 1984 to 2017.

Feature	Malir Delta in 1984	Malir Delta in 2017
Vegetation and foliage	Wide patches of mangroves and marsh foliage	Greatly reduced; cleared for building plots
Estuaries and wetlands	Many estuaries absorbing tidal and flood water	Shrunk by reclamation, lowering flood protection
Built development	Very little near the land edges	Extensive residential, recreational, and mixed use
Fish nurseries	Healthy nurseries in mangrove roots	Damaged, cutting commercial fish supply
Public / community access	Open land used by nearby villages	Increasingly privatised and restricted

This pattern matches the warning in the UN blueprint that unsustainable land reclamation is a major cause of coastal decline, and it agrees with delta-wide research showing that reclamation has driven the loss of coastal wetlands across the Indus system over the last fifty years (Laghari et al., 2024). Machine-learning studies of mangrove cover in the same delta report the same downward trend (Zhou et al., 2024). The highest level of change occurred in high-income residential zones near the water, where demand for a sea view is strongest and where the environmental cost of building is rarely considered.

Impact on the Fishing Community

Across the creek from DHA lies Ibrahim Haidri, a village whose people have fished for generations. A former fisherman, Abdul Hakim, explained that the creek was once full of crabs, shrimp, and many kinds of fish often more than the village could sell. Now, he said, the catch is close to nothing, and boats must travel far and stay out for days to earn a little. He blamed two causes: land reclamation, which destroyed the places where fish lived and bred, and the port, whose large-scale fishing takes the catch that local boats once depended on. In his words, the land “has been taken away from us without consideration of the people of the village.”

The human cost is clear. Abdul Hakim’s son, Baber, has left fishing for another profession because there is no longer a living in it. For the family, fishing was not only income but also culture and a bond with nature, and that bond is being lost. This local story matches wider evidence that small-scale fishers suffer most when the coast is reclaimed for larger economic uses, losing both livelihood and identity (Bamasood et al., 2025). It also confirms the warning in the literature that large-scale port fishing can push aside local fishermen.

Real Estate, Restaurants, and Social Exclusion

Estate agents confirmed that plots in DHA Phase VII cost more than in most other parts of Karachi. They explained that the scheme was placed on the coast for its sea views, amenities, and recreation,

even though inland options existed. Projects such as Creek Vista, Creek Marina, and Crescent Bay market an “ultra-class” life on the shores of the Arabian Sea, which supports the theory that land near the coast carries a premium. Restaurants along the DHA coast serve a similar, narrow audience. Office workers with higher incomes visit often, while students from other parts of the city can rarely afford to come. Strikingly, most visitors thought the development was good and were unaware of its environmental consequences. This shows how economic activity on the coast can quietly exclude the majority while feeling normal to those who benefit from it.

The Expert View: Ecology and Governance

Dr. Muhammad Shoaib Kiani of the Institute of Marine Science at the University of Karachi gave a detailed picture of the damage. He explained that constant land reclamation has altered the environment by covering nutrient-rich marshes with foreign soil through dumping. This has removed mangrove forests on the north-eastern side of the delta that once anchored the land and buffered it against tides. It has also destroyed the juvenile fish nurseries in mangrove roots, causing a shortage of commercial fish and hurting villages such as Ibrahim Haidri the most.

On the law, Dr. Kiani was blunt. Marshlands are protected areas under the Ramsar Convention and under local environmental protection law, yet weak enforcement, corruption, and mismanagement let developers exploit the situation. Even after the Sindh government outlawed reclamation around DHA, he said, it continued because enforcement was weak. He also warned that there is not a single research facility physically present on the coast to measure the effects of this rapid change. His account shows that the problem is not a lack of rules but a lack of honest, capable governance the “good governance” that the literature treats as essential to sustainable development.

Climate Risk and the Loss of Natural Defences

The loss of mangroves is not only an ecological or economic problem; it is a safety problem. Karachi lies near a fault line and in the path of Arabian Sea cyclones, and parts of the city sit at or below sea level. Mangroves form a physical barrier that absorbs wind and breaks the force of waves. With these barriers removed, the city has little natural protection in a storm or a surge. The last major cyclone to flood much of Karachi struck in 1905, and the long quiet since then has created a false sense of safety. Recent national assessments warn that sea-level rise and coastal hazards require urgent, evidence-based decision-making, exactly the kind of planning that is missing here (Weeks et al., 2023).

Table 5 brings the findings together, scoring each pillar at the study site. The pattern is the reverse of the ideal: the economy is strong, while society and the environment are weak.

Table 5. Sustainability status by pillar at DHA Phase VII–VIII and the Malir Delta.

Pillar	Status at study site	Main evidence
Economic	Strong but narrow	Ports, luxury housing (Creek Vista, Crescent Bay), and

Social	Weak	upscale restaurants generate high value for a few Shrinking public access to the shore; decline of the fishing community and its culture
Environmental	Very weak	Mangrove and marshland loss, damaged nurseries, pollution, and reduced storm protection

The Three Circles: Theory versus Reality

A simple way to picture the problem is to draw the three pillars as overlapping circles. In theory, the circles for environment, society, and economy should overlap evenly, sharing a large common space where development is balanced. The reality on Karachi's coast looks very different: the economic circle has grown large while the environmental and social circles have shrunk, so the shared space in the middle is small. The change needed is therefore clear the environmental circle, in particular, must be expanded before any real balance can return. In practice this means that even a small, honest investment in the environment can create a ripple effect, because a restored mangrove belt brings back fish, which supports fishing families, which in turn strengthens the local society and economy. The Chek Lap Kok case is proof that this ripple is real: one serious act of mitigation restored a whole cycle. Karachi's task is to shift from a model that feeds only the economic circle to one that grows all three together.

Recommendations for Sustainable Coastal Development

The evidence shows that development in Karachi's coastal areas is driven almost entirely by the economic pillar. To move toward balance, the other two pillars must be strengthened. Drawing on the literature, the Chek Lap Kok case, and the expert interview, the following steps are proposed. They follow global sustainable-development guidance that asks planners to weigh environmental responsibility, economic capacity, and social solidarity together, and to educate the public under a "polluter pays" principle.

Table 6. Recommendations mapped to the pillars of sustainability.

No.	Recommendation	Pillar(s) strengthened
1	Carry out an environmental impact assessment before any reclamation, and plan mangrove mitigation early, as at Chek Lap Kok	Environment
2	Replant and protect mangroves and marshlands to restore nurseries and storm barriers	Environment, Economy
3	Keep seafronts and beaches as free public space, limiting private enclosure of the shore	Society
4	Protect small-scale fishing rights and offer fair alternatives to affected families	Society, Economy
5	Develop selected wetlands into an eco-friendly nature reserve with light tourism	Environment, Economy, Society

6	Apply marine spatial planning and integrated coastal zone management to coordinate all coastal users	All three
7	Strengthen enforcement of existing laws (Ramsar, environmental protection) and set up a coastal research facility	All three (governance)

A further step that runs through all of these is public education. The field visits found that most visitors to the coast believed the new development was simply good and had no idea of its environmental cost. If residents, students, and developers understood what is lost when a mangrove belt is cleared, public pressure could become a force for better planning rather than a silent approval of it. Awareness programmes, clear signage at coastal sites, and school engagement would help build the social support that sustainable governance needs. Education also supports the “polluter pays” idea, because people who understand the damage are more willing to accept rules that make polluters carry its cost.

Several of these steps reinforce one another. Dr. Kiani suggested turning intact wetlands into a nature reserve with minimal, eco-friendly tourism, noting that even Dubai which had no natural mangroves has created artificial deltas and mangrove forests for sustainable tourism. Karachi is fortunate still to hold large parcels of intact forest, so careful planning could turn them into both a protected habitat and a source of income. Marine spatial planning offers a practical way to decide, openly and in advance, which parts of the coast are for conservation, which for fishing, and which for building (Jattak et al., 2023). Integrated coastal zone management brings government, private developers, civil society, and communities to the same table so that decisions reflect social and environmental costs, not only profit (Jiang et al., 2023). None of this works, however, without honest enforcement and reliable local data the governance gap the expert identified as the real barrier.

Conclusion

Development along Karachi’s coast is inevitable and cannot be stopped, but it can be guided. This study of DHA Phase VII–VIII and the Malir Delta shows a coastline where the economic pillar of sustainability has grown strong while the social and environmental pillars have been allowed to weaken. Land reclamation has cleared mangroves and marshlands, damaged fish nurseries, reduced public access to the shore, hurt the livelihood and culture of fishing communities, and stripped away the natural barriers that protect the city from storms and sea-level rise. Strong environmental laws exist on paper, but weak enforcement and poor governance have let short-term profit override long-term safety.

The lesson is not that growth is wrong, but that growth without balance is dangerous. The Chek Lap Kok case and the expert interview both show that damaged coasts can recover when mitigation, planning, and honest governance are taken seriously. By restoring mangroves, protecting public space and fishing rights, applying marine spatial planning, and enforcing existing laws, Karachi can still move its coastline toward balance. As the marine scientist in this study put it, the real question

is not whether development should happen, but whether it will be sustainable. Acting now, before the damage becomes permanent, is the only responsible answer.

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