



CHAPTER - 11

FROM COASTAL MARGINS TO DIGITAL MARGINS: DIGITAL INEQUALITIES AND SOCIAL EXCLUSION AMONG COASTAL FISHER COMMUNITIES IN THE BAY OF BENGAL REGION

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Abstract:

This chapter focuses on the implications of digitalization in ocean governance and the formation of new forms of digital exclusion among marginalized coastal small-scale fisherfolk communities in the Bay of Bengal region. Specifically, it covers the issue of the implications of digitization of fisheries governance, e-licensing, and disaster management for marginalized communities in coastal India and Bangladesh. While the technologies of big data and satellite help enhance efficiency, these communities are faced with many structural challenges due to inadequate infrastructure, poor economic conditions, inability to comprehend text-based software applications, and digital illiteracy among other challenges. These marginalized communities end up being algorithmically invisible while economically advantaged people benefit much from the digitalization process. This chapter explains why digital exclusions constitute an important form of social injustice through social exclusion theories, the capability approach, and human security approaches and suggests effective adaptation strategies and policy interventions for increased

digital inclusion.

Keywords: New Blue Economy, Digital Exclusion, Small-scale fisheries, Bay of Bengal, Social Injustice

1. Introduction

The oceans have emerged as critical assets for human development and security, serving as important geographic areas for economic growth, sustainability, and national prosperity. Oceans cover about 72% of the surface of the Earth and contribute to global trade systems, food security, energy production, maritime transport, and biodiversity conservation. With a wide range of economic activities, including fisheries and marine products, desalination, seabed mining, shipping and ports, offshore wind power, seaside tourism, marine sports and recreation, the ocean economy is valued at \$2.5 trillion annually (The Tokyo Foundation for Policy Research, 2021). The coastal communities, comprising 44 per cent of the world's population, rely on marine ecosystems for daily subsistence.

Recently, the term 'Blue Economy' has become popular in scholarly and policy discussions on development agendas across countries, driven by the growing realization among policymakers, international institutions, and state actors about the significance of the marine economy and the need for sustainable ocean governance. Beyond their ecological importance, the oceans serve as critical supply lines for global oil transit, and ensuring the uninterrupted movement of oil shipments across sea lanes is essential for global economic stability and energy security, as evidenced by the largest fuel crisis caused by the recent US-Iran crisis in 2026. The discussions on the "Blue Growth" and the "Blue Economy" agendas describe the oceans as new economic frontiers which have attracted the interest of governments, business executives, funders, conservationists, and multilateral institutions such as the World Bank and the United Nations. It is a leading agenda item in ocean-based conferences and summits that also explore the possibilities of deeper private-sector engagement in the ocean sector, while minimizing the effects of environmental degradation caused by various economic activities (Bennett, 2018; Hoegh-Guldberg et al., 2015).

A key sector of the blue economy is fisheries and aquaculture, which are integral to ensuring employment generation, food security and coastal area development. Small-scale fisheries are an important economic activity in the Bay of Bengal region, helping in poverty alleviation in coastal areas, and therefore, fisheries management in a sustainable manner remains a central component of blue economy policies. The use of digital technology has brought

about a shift in the current management of the seas. Modern technologies are being used, such as real-time Maritime Domain Awareness (MDA), spatial planning through satellite technology, electronic catch certificates, digital market networks and automatic vessel tracking systems. Yet, such digital transformation has not yet levelled the playing field across communities.

Coastal populations tend to lie on the marginal peripheries of poverty, infrastructure deficit, vulnerability to climate and weak state presence. With the growth of digital governance systems, these communities remain at risk of being excluded from access to welfare services and opportunities. The issue of digital inclusion of the coastal populations engaged in fisheries is essential for their survival, livelihood protection and autonomy. This concept of the ‘digital margin’, which leads to social marginalization of the fishing communities on account of their geographical marginality, arises out of the fact that there exists no link between the communities and the digital technology network.

This chapter argues that the digital divide in the Bay of Bengal Region is a new kind of social exclusion. Peripheral communities with a long history of economic and political underdevelopment are more and more pushed towards what can be called the ‘digital margins’, which further compounds their geographical exclusion and social exclusion and deprives them of economic growth and access to various welfare services. This shift is emblematic of the broader processes by which technological development can mirror and exacerbate existing social inequalities, thereby necessitating an equal availability of digital information for all.

This chapter seeks to look at the phenomenon of digital inequalities and how they contribute to social exclusion amongst coastal fishing communities in the Bay of Bengal region. With the help of theoretical perspectives like Digital Divide Theory, Social Exclusion Theory, Capability Approach and Human Security Approaches, this chapter seeks to explore the intersections between digital transformations and maritime livelihoods. The study uses analysis of cases from India and Bangladesh to explore the impact of digital access on welfare services, livelihoods, disaster preparedness and social inclusion.

2. From Blue Economy to “New Blue Economy”

Digital technologies are changing the way fisheries are managed and operated today. The blue economy is increasingly embracing digital tools to manage fisheries, ensure welfare, access markets, promote financial inclusion, reduce disaster risks and integrating it in the governance systems of maritime and coastal areas (Aderinto et al., 2026). Information availability and public service delivery are increasingly dependent upon technological connectivity.

While the former idea was primarily linked to the sustainable use of marine resources, it has now shifted to an increasing use of digital technologies in ocean governance, management, and development of the marine sector, such as in fisheries monitoring, electronic licensing, satellite weather forecasting, mobile banking, and electronic commerce in fish marketing.

The term “Blue Economy” has become popular in global discussions following the Earth Summit held in 2012 in Rio de Janeiro and has been considered an extension of the concept of “green economy” in the ocean context (United Nations Environment Programme, 2012). The new concept of the blue economy is based on sustainability, digitalization, adaptation to climate change, inclusivity, and good governance. The traditional Blue Economy was mainly centred around economic activities and sustainable use of resources, but in the “New Blue Economy” concept, the oceans are viewed both as economic resources and socio-ecological systems. The framework of the “Blue Economy” includes digital inclusion, community involvement, social justice, and human security. In this digital age, technology plays a critical role in digital fisheries management, satellite ocean surveillance, artificial intelligence, big data, digital markets, mobile money, blockchain-based seafood traceability, and e-governance. On the one hand, it helps in improving the efficacy of maritime operations, whereas on the other hand, it gives an opportunity to coastal communities to access services. However, what should not be forgotten is that technologies create unequal access, leading to discrimination and inequalities. Even though digitalization can offer several benefits, there are still inequalities that exist among coastal fishing communities. They often lack access to smartphones, internet connectivity, affordable technology, and digital skills. Women working in the fisheries also face additional barriers to accessing and using technology (Hilbert, 2011).

Therefore, the new concept of blue economy can be defined as socially inclusive, technology-based, and sustainable management of the ocean that integrates economics, sustainability, digital technology, and the utilization of marine resources into a single system to improve ecological well-being and the quality of human life.

2.1 Bay of Bengal Region and Coastal Fisheries

The aquaculture sector is the most rapidly expanding sector of the world's food industry, and the extent of its growth makes it perfectly suited for the concept of the Blue Economy. However, the threat of environmental damage caused by aquaculture to small-scale fisheries' fishing grounds is clearly visible. (European Commission, 2012). The fishing operations will be able to provide economic and food resources in such environments that lack infrastructure or

have food distribution disrupted by episodes of violence. (Gillett, 2016). The rural and coastal population highly engage in small-scale fisheries, and it provides a foundation for local economies, offers income support for both men and women and contributes to community development (Bavinck, 2014). Additionally, SSF also has wider non-financial values and is crucial to preserving coastal communities' identities, cultures, and overall well-being (Jentoft and Eide, 2011; Weeratunge et al., 2014).

The Bay of Bengal Region is one of the most densely populated regions, with a significant population living in coastal areas, whose lives are connected to the marine environment. This region consists of the coastal regions of Bangladesh, India, Myanmar, Sri Lanka, and Thailand, contributing to maritime trade, fishing, tourism and other economic activities. But the region faces different challenges such as climate change, cyclones, coastal erosion, rising sea levels, resource depletion and environmental degradation, which necessitate effective maritime governance. The small-scale fishing communities in these coastal regions contribute to the economy, provide food security, create employment and support coastal livelihoods. The fishing communities in Sundarbans (India and Bangladesh), Khulna, Satkhira, Cox's Bazar (Bangladesh), Orissa, Andhra Pradesh and Tamil Nadu (India) depend greatly on the marine environment. Yet these groups have always been vulnerable due to poverty, geographic isolation, lack of proper infrastructure, environmental uncertainties, and their exclusion from the process of service delivery. However, with the advent of the digitalization of the governance process, welfare delivery, and the economy, the dynamics of inequality have gained another facet. This is because

Within this emerging digital maritime landscape, digital access is as important as physical access to marine resources. Digital devices will provide vital information to the fishing communities along the coasts in matters of weather predictions, cyclone alerts, market information, mobile money, enrolment in welfare programs, and government programs. Cell phones and internet devices offer ways to live better, to receive timely warnings and aid during disasters and to enjoy social security benefits. Yet, inequalities in terms of access to the internet, usage of smartphones, digital literacy, cost, and infrastructure in coastal regions continue to exist, which prevents all stakeholders from enjoying the benefits of digital transformation. The small-scale fishers, women in fisheries value chains, senior citizens, and internally displaced groups have faced challenges that prevent them from using the digital platforms. With increasing digitalization in terms of welfare, management, and economics of the fisheries, there is a pressing concern about the deprivation of some of the most basic rights and necessities of these people due to their

inability to connect to the digital world.

The traditional fishing communities were marginal communities by virtue of their geographical location and economic frailties. However, in the contemporary world where everything revolves around digitalization, these very communities find themselves marginalized by the technological structures that facilitate the provision of welfare services, livelihood, information and government services. Therefore, digital marginality is much beyond being an issue of connectivity, but rather a process of production of inequality within the developing systems of governance and development.

2.2 Theories of Digital and Social Exclusion in the New Blue Economy

In the 'New Blue Economy', digital connectivity has become a prerequisite for participation in the maritime economy and coastal governance (Organisation for Economic Co-operation and Development, 2016; World Bank, 2017), which has also resulted in new forms of exclusion for coastal communities with limited access to digital infrastructure, skills, and institutional support, as discussed before. It is important to examine these challenges through four complementary theoretical perspectives.

Digital Divide Theory suggests that disparities in digital access, literacy and outcomes reinforce existing social and economic inequalities (Van Dijk, 2020; International Telecommunication Union [ITU], 2023). Small-scale fishing communities in the Bay of Bengal face challenges due to poor internet connectivity, low ownership of smartphones and low levels of digital literacy, which restrict their access to digital fisheries governance, welfare schemes and market information.

Silver (1994) elaborates on the concept of exclusion in the context of the Social Exclusion Theory as a consequence of institutional processes that restrict the capacity to engage in economic and social life. Expanding on this, Burchardt et al. (2002) emphasize that social exclusion is a multi-dimensional process that isolates individuals from mainstream economic, social, and political frameworks. Fisheries registration, as well as delivery of subsidies and disaster assistance, is increasingly digitalized, risking the exclusion of fishers without access to digital technologies from public services. It also creates algorithmic invisibility, where marginalized populations are underrepresented in digital databases and policy planning (Eubanks, 2018).

The Capability Approach (Sen, 1999; Nussbaum, 2011) defines development as the expansion of human freedoms rather than the ownership of resources. Digital technologies can only benefit coastal fishers when

supported by enabling factors such as affordability, education, connectivity and institutional support (Robeyns, 2005).

Finally, the Human Security Framework highlights the importance of digital connectivity for livelihood security. Improved access to weather forecasts, cyclone warnings, digital financial services and government welfare programmes aid in building resilience in climate-vulnerable fishing communities. (FAO, 2022; United Nations Development Programme [UNDP], 1994).

These approaches show that digital inequality in the New Blue Economy is a structural form of social exclusion rather than a simplified form of technological divide. Coastal fishing villages in the Bay of Bengal region can thereby shift from coastal to digital edges in the absence of inclusive digital policies, which would restrict their access to sustainable Blue Economy initiatives.

3. The Digital Imperative in Modern Small-Scale Fisheries

The transition to the New Blue Economy integrates digital technologies into different aspects of fisheries management, market systems, welfare delivery, and disaster preparedness. The internet connection has become an entirely indispensable channel with direct impact on the survival and sustainability of the coastal community and to ensure their involvement in the modern maritime economy. There has been an enormous increase in the application of digital devices by the governments in the Bay of Bengal region for processes of registration, subsidies, payments, and forecasting.

3.1 Climate Resilience, Early Warning, and Sea Safety

Involvement of traditional fishing boats in the hazardous region of the Bay of Bengal increases the vulnerability of small-scale fishermen to disasters such as cyclones and storm surges. Forecasting using satellite communication technology, mobile phones, and early warning systems helps in reducing the disaster risk by providing current weather information.

3.2 Livelihood Security and Value-Chain Integration

Earlier, the fishermen depended on the broker owing to the information asymmetry issue, but today the fishermen have alternatives such as mobile phones and online markets, aside from mobile money, which will allow them to deal with the market directly. This is what allows them to sell their produce at the market price.

3.3 Digital Governance and Fisheries Management

The use of e-licensing, digital documentation, geospatial mapping, and monitoring of vessels will increase the efficiency of fisheries management as well as facilitate the detection of any IUU fishing activities. However, while these technologies facilitate ease of access to subsidies, welfare programs, and disaster compensation, the efficiency of these technologies depends entirely on digital equality. In its absence, the concept of digital governance will worsen the current disparity.

4. Analytical Dimensions of the Digital Exclusion on the Coast

The benefits of digital transformation remain unevenly distributed, mirroring underlying socio-economic inequalities across geography, income, education, and gender.

4.1 Geographic and Infrastructural Exclusion

Bangladesh, the Sundarbans, and Orissa fishing communities face the problem of poor connectivity and electricity supply. However, the situation becomes much more complicated in the case of extreme weather conditions because the people who are the most exposed to the consequences of climate change are cut off from the rest of the world at such times.

4.2 Economic Constraints

The cost associated with having and maintaining the phones as well as accessing mobile Internet is one of the biggest expenses in regions where income is very seasonal and depends on fishery production.

4.3 Digital Literacy and Inclusive Design

Online communication faces an obstacle in the form of the text-based user interface that is not easy for uneducated people to use since it is based on a certain language. Older people, women, and uneducated people cannot access such services since they are based on certain languages.

5. Digital Exclusion among Coastal Fishing Communities in India: Evidence from the Sundarbans and Kendrapara-Bhitarkanika Coast

There is a huge push for digitizing the Indian fisheries sector through various programs, including Pradhan Mantri Matsya Sampada Yojana (PMMSY), National Fisheries Digital Platform (NFDP), digitization of vessel registration, mobile advisories and benefit transfer. As per the Department of Fisheries Annual Report (2024-25), all these programs would be instrumental

in digitalizing fisheries management systems, improving market linkages and generating income opportunities for fishing community members (Department of Fisheries, 2025). But these programs have not been equally helpful for all communities of fishers, particularly small-sized and geographically placed communities that face difficulties in accessing such facilities. With respect to this, the Sundarbans of West Bengal and the Kendrapara-Bhitarkanika on the coast of Orissa can be considered as examples.

5.1 Indian Sundarbans

The Sundarbans of India is home to thousands of families who depend on fisheries in estuaries, crab harvesting, and small-scale marine fisheries. People living in Gosaba, Basanti, Patharpratima, Kultali, and Sagar Islands are suffering from poor connectivity of transport infrastructure, inadequacy of electricity, and mobile phone connectivity issues that make them unable to access online services (BOBP-IGO, 2023). Since the processes of fisheries registration, applying for subsidy claims, insurance claims, and participation in programs such as PMMSY have been digitized, fishermen are having challenges accessing the digital facilities due to illiteracy, lack of smartphones, and dependence on Common Service Centres (Department of Fisheries, 2025).

Climate change resilience is also another challenge that is being experienced by the fishermen due to poor connectivity of the internet. The occurrence of cyclone storms such as Amphan (2020), Yaas (2021), and Remal (2024) has made it necessary to have access to weather forecasting and early warning using the internet. Poor connectivity hinders their access to Potential Fishing Zone (PFZ) advisories and emergency communications (FAO, 2024).

5.2 Kendrapara–Bhitarkanika Coast, Orissa

Apart from the Orissa coastline, the Kendrapara-Bhitarkanika coastline is another vulnerable area concerning the climatic situation and impact on the fisheries industry. The villagers of Jamboo, Kharinasi, Talachua, and Batighar depend significantly on fishing. Despite the impressive progress made in digital governance in the areas of fisheries registration, weather forecasting, and welfare assistance, many households in this community still suffer from issues related to connectivity, digital literacy, and affordability (Department of Fisheries, 2025). Moreover, the women who are involved in fish processing and selling face even more challenges in accessing digital services and finance.

The fishing people residing in the vicinity of the Bhitarkanika National Park and Gahirmatha Marine Sanctuary experience increasing challenges due to the conservation policies that are strongly dependent on digital tools. Consequently, the fishermen are unable to utilize the benefits of digital governance in the form

of compensation schemes and interactions with the authorities.

In summary, the two cases show that digital exclusion cannot be solely based on technology but on geography, climate, and even governance as well. Investments in digital infrastructure and local digital literacy, along with governance for small-scale fishing communities, are essential to integrate them into the digital fishery management framework.

6. Digital Exclusion among Coastal Fishing Communities in Bangladesh: Evidence from the Khulna–Satkhira Sundarbans and Cox's Bazar–Teknaf Coast

It is through the vision of “Smart Bangladesh by 2041” that Bangladesh has succeeded in using digital technologies in the management of its fisheries sector. Examples include a digital fisheries database system, digital extension services, and a digital licensing system, as well as welfare services. Nonetheless, despite all the above-mentioned strategies being implemented in the effort to improve governance in fisheries and the growth of the blue economy in Bangladesh, the lack of digital connectivity remains a challenge to small-scale fishermen.

6.1 Khulna–Satkhira Sundarbans

The number of families residing in estuarine settlements in Khulna and Satkhira areas near Bangladesh Sundarbans and relying on estuarine fishing, crab collecting, and shrimp farming is huge. The development of digital technology is high, but the number of services for internet connectivity, electricity provision, and digital skills for registration and other programs is low (Ministry of Fisheries and Livestock, 2024).

Climate vulnerabilities and associated issues cause a bigger problem of digital alienation. After the emergence of tropical storms such as Sidr, Aila, Amphan, and Remal, it is necessary to receive notifications through the digital alerting system. However, fishermen without internet and smartphone connections have to contact the authorities informally, and consequently, it takes more time for evacuation and recovery.

6.2 Cox's Bazar–Teknaf Coast

The Cox's Bazar–Teknaf coastal zone is the largest fishing ground in Bangladesh and is an important hub for artisanal fisheries. The digital fisheries information system, digital database, and digital market advisory services for the market are being provided by the government to increase the efficiency of the market and fisheries management (Department of Fisheries, 2024). However, due to the unavailability of digital technology, the artisans are not able to

participate in the market.

Fisheries communities are dependent on traditional intermediaries because of limited access to smartphones, digital finance, and market information. Older fishers and even seasonal migrants usually lack digital knowledge and thus are unable to benefit from digital technology, such as weather forecast services, digital payment services, and digital fisheries services. Therefore, the artisans have not been able to benefit much from the New Blue Economy while better-off fishers and traders have benefited a lot.

The two cases clearly show that digital exclusion in Bangladesh is not limited to infrastructure, but also covers issues of affordability, digital literacy, institutional accessibility, and gender discrimination. Closing such gaps will require tailored digital literacy programs, robust coastal communication infrastructure, multi-language digital interfaces, and fisheries governance that is gender-inclusive.

7. Policy Responses and Adaptation Strategies

For dealing with digital exclusion in the Bay of Bengal, the policy solutions should not be limited to the top-down approach of imposing technology. They must be people-oriented and intersectional in nature. This is because digital exclusion itself is a systemic problem and helps in reproducing the existing inequalities.

7.1 Framework for Policy Interventions

Governments need a multi-layered strategy across infrastructure, economic considerations, and institutions.

Infrastructural Investment: It is essential to make telecommunications an essential utility service. The government should create a reliable telecom infrastructure to ensure connectivity during emergencies.

Fiscal Support: In dealing with the challenge of economic considerations, the government should provide subsidies for purchasing rugged mobile phones to fishermen and free data regarding vital information like weather forecasts and welfare programs, etc.

Inclusive Design: Application developers should not design applications based on universal interfaces. Instead, they need to use a participatory interface design of applications that involve icons and voice guidance.

7.2 Small-Scale Fisheries Adaptation

The small-scale fisheries need to adapt through collective action.

Digital Co-operatives: The community must tap into its informal governance structure to provide digital kiosks in the areas where fishing occurs. Controlled by the youth, these centres would enable the older illiterate fishermen to get the advantage of having updated information about market prices and to complete their licensing procedures without exploitation by middlemen.

Intersectional Empowerment: Adaptation measures should aim to empower women and youth. Women's self-help groups will get micro-credits and e-commerce training so that they have an economic cushion when fishing is banned.

Territorial Defense: In line with the FAO guidelines, mapping tools need to be used to digitize the traditional fishing grounds so that industrial aquaculture is prevented from encroaching into these areas using technological means of human security.

8. Conclusion: Recasting the Digital Future of the Bay of Bengal

The emergence of a new paradigm, "New Blue Economy," based on big data, has resulted in structural shifts in terms of governance of the ocean through digital licensing, registry, and satellite surveillance. However, the case of India and Bangladesh proves that these structural shifts could not facilitate the flattening of the playing field. On the contrary, due to a lack of any government interventions, these vulnerabilities have been accentuated, and the marginalized community of small-scale fisherfolk has been pushed into digital margins, defined through processes of dispossession and disappearance through administration and algorithms.

To survive in this new world, policies related to the maritime sector need to adopt co-designing approaches, which should include climate-resilient networking, icons-based as well as localized interfaces. At the same time, the small-scale fisheries sector should change its approach through the formation of digital cooperatives with youth, microfinancing of post-harvest activities for women and custom-based zone mapping. In short, it is important to cross this digital margin.

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