

## THE MALDIVES AT RISK: ASSESSING THE IMPACT OF RISING SEA LEVELS ON NATIONAL SURVIVAL

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### ABSTRACT

As an island nation in the Indian ocean, the Maldives face an existential threat from rising sea levels caused by climate change. The study examines the environmental, economic and social consequences of the rising sea level in Maldives and reviews present adaptive strategies. A qualitative research design, involving interviews with key stakeholders, analysis of policy documents and historical flooding data is used to generate a comprehensive understanding of the issue. Highlights include that the Maldives suffers heavily with rising coastal flooding, saltwater intrusion and loss of essential infrastructure. These effects are exacerbated by the national dependence on tourism, which is extremely sensitive to environmental decline. Although there is an appeal to adaptive strategies including land reclamation and island raising, these strategies are often costly, environmentally compromising, and limited in their ability for scale. Mangrove restoration and coral reef conservation among others are ecosystem-based approaches that provide sustainable alternatives but need to be invested in, scaled up. Insufficient enforcement, fragmented governance and lack of funding are examples of policy gaps contributing to the ineffectiveness of adaptation action. The study calls for urgent actions to reinforce policy coherence, secure a wide range of funding sources and scale up community-based adaptation projects. The study will continue to support local capacity-building efforts, the scaling up of ecosystem-based solutions and even innovative technologies such as floating infrastructure. But Maldives have a lot to offer for other vulnerable island countries and humanity in general. They tell how integrated, equitable and aspirational climate adaptation the way is forward, published in the journal Nature Sustainability, highlights how adaptation can be consistent with sustainable development goals while emphasizing a need for more international cooperation to face rising sea levels.

**Keywords:** Rising sea levels, climate adaptation, Maldives, ecosystem-based solutions, sustainable development

### INTRODUCTION

One of the most geographically unique nations on Earth is the tropical archipelago located in the Indian ocean, Maldives. Maldives is made up of about 1,190 coral islands in 26 atolls which covers fairly more than 90,000 square kilometers of land area, yet consists only of water. As the lowest-lying country on Earth most of the islands are only around a meter above sea level (Magnan et al. 2022). This

geographical trait only emphasizes, though, the country's natural softness to rising sea levels.

The Maldives' economy depends on tourism, providing approximately 28 per cent of the GDP and more than 60 per cent of foreign exchange earnings. The nation's clear oceans, beautiful beaches and colorful coral reefs draw in millions of tourists each year and supports a large part of the nation's

population (Thy 2021). But this reliance on tourism also makes it susceptible, because ecological damage jeopardize the economy. The socio-economic context of the country also puts the risks associated with climate change under a greater impact, with low natural resources, high dependencies on imports and traditional farming.

The Maldives faces an existential threat from rising sea levels, driven by global climate change (Kumar, Nagar, and Anand 2021). With rising global temperatures, melting polar ice caps and expanding oceans, the Maldives is facing climate change through coastal flooding, erosion and saltwater intrusion. However, some of these phenomena are already eroding the habitability of the islands — imposing freshwater systems, agriculture land and essential infrastructure.

If current trends continue, forecasts suggest that by the mid-21st century at least many islands will be uninhabitable due to flooding driven from land by waves and the potential destruction of infrastructure (drinking water supply) areas. Its flat geography offers no natural protection against the consequences of approaching storm surges and rising tides (A. Gray 2020). Furthermore, local ecosystems and agricultural productivity are impacted by saltwater intrusion into freshwater lenses due to depleting aquifers drink.

Seawalls, land reclamation and mangrove restoration – adaptation efforts that come with their own risks are just some of the measures already happening in response to climate breakdown, although it remains unknown whether they will be effective (Vaughn 2022). While all countries are at risk from the impacts of sea-level rise and global warming, deprived of immediate, universal and sustainable policy response the Maldives could end-up being one of the first imperil led nations to disappear under rising oceans -- which also necessitates urgent local and foreign attention.

This study aims to comprehensively assess the impact of rising sea levels on the Maldives and evaluate the efficacy of existing adaptation strategies. Specifically, the research has the following objectives:

- To assess the environmental, economic, and social impacts of rising sea levels on the Maldives.

- To examine the effectiveness of current adaptation strategies, such as land reclamation and seawall construction, in addressing these impacts.
- To provide evidence-based recommendations for enhancing resilience to sea-level rise.

This study seeks to address the following research questions:

1. What are the potential impacts of rising sea levels on the Maldives' environment, economy, and population?
2. How effective are current adaptation efforts in addressing these impacts?

The Maldives is a global byword for climate vulnerability. The risky state of the land has opened eyes to international climate change mitigation and adaptation. It would not just lose an entire country, it would also indicate how climate inaction will devastate the world to other at-risk areas. Solving this problem is essential for the existence of the Maldives, but it is also vital to broader global climate governance and sustainable development along with environmental equity. The study must act now, and with the same resolve nationally and internationally to secure the resilience of our economy, our people and most importantly the very environment that sustains all life in these islands for without it, there will be no Maldives.

A lot of research has addressed the Maldives vulnerability to climate change, especially its low elevation to the sea level. Research have identified the material do dangers of seaside flooding, erosion, and salt water intrusion as nicely as the socio financial effects of these processes on coastal populations. In addition, the Maldives has been at the forefront of international climate negotiations and lobbying on adaptation needs to highlight gradual implementation by requesting financial and technical support. Yet, while there is knowledge around the wider impacts of climate change, there remain significant gaps in understanding how specifically sea level rise affects the environment, economy and people of Maldives. In addition, the capacity of existing adaptation measures have not been quantitatively examined. This also includes addressing the gaps in revenue mobilization, such as by enabling domestic resource generation through better inclusion of private sectors while providing

with right policies to stimulate growth towards sustainability: By doing this, this study intends to develop a holistic overview of the challenges and opportunities for Maldives.

## 2. Literature Review

### 2.1 Perceptions of Climate Change Risks

The Maldives is billed as a climate change hotspot by global institutions such as the UNFCCC and other intergovernmental organizations. For international stakeholders, the Maldives is a test-case for holding the world accountable to its biggest failure on climate. Such stakeholders tend to support large-scale investment and technological assistance to enable the Maldives to adapt or mitigate. The divide is even starker in the Maldives, where opinions are split between government, private sector and local communities (Scott et al. 2020). Governments generally think about risks from climate change in a policy frame, the result is that economic stability and support for international cooperation on provision of funds becomes the dominant media framing.

The tourism industry feels risks more severely, simply because the health of the environment impacts their livelihood. At the same time, local communities feel on-the-ground effects of sea-level rise saltwater infiltrating fresh water sources and farmland—compounded by everyday vulnerabilities (Polic 2021). However, there remains a significant divide between the international community and domestic stakeholders. Whereas influential international organizations think in terms of a global solution and long-term roadmaps, local communities are mostly concerned with instant deliverables. This difference in perception makes it more challenging to collaborate and can slow on holistic adaptation efforts.

### 2.2 Adaptation Policy Effectiveness

Several adaptation frameworks have been established in the Maldives, namely the National Adaptation Program of Action (NAPA) and the Strategic Action Plan 2019–2023. Such policies stress an integrated climate adaptation with economic and social development perspective across multiple sectors. However, the consistency of their coherence with these frameworks and its linkage to international climate agreements is not uniform. Duplicated roles and siloed decision-making

invariably cause wastefulness. Financial arrangements for adaptation policies in the Maldives are largely dependent on international financing, such as GCF and other development organization grants (2020 ރުސޯލަތުގެ ސަރުކާރު). These funds are critical lifelines, but often they cannot do the whole job. But they also face disbursement holdups and hard terms on the outlays.

A key issue is also the enforcement of adaptation policies. Adequate technical capacity is needed to see all these plans through, but limited institutional capacity combined with inadequate technical know-how results in piecemeal implementation of strategies (Browne 2024). At the same time, local stakeholders have little capacity/training to guide and implement adaptation measures that increase vulnerability.

### 2.3 Structural Adaptation Strategies

Dredging Land reclamation, on the other hand, uses sand over layers of materials to create new land. For instance, the study see huge land reclamation interventions in the Maldives, where an artificial island called Hulhumalé was built example as a home and business opportunities for those Maldivians displaced by climate change. Although these projects can be seen as somewhat innovative, they are also criticized for their environmental effects like destroying coral reefs and entire marine ecosystems (Yadav 2022). Another approach is to elevate current islands above sea-level. This method means raising potential flood zones, like residential areas and infrastructure hubs. While technically it is feasible to raise islands, such an expensive and intricate operation could also risk ecological devastation and social displacement. Although they hold great potential, structural strategies come with their own issues. Land reclamation and island raise are both resource, capital and technology intensive processes.

### 2.4 Historical Coastal Flooding Events

The 2004 Indian ocean tsunami was a devastating event that showcased the vulnerability of our nation to extreme coastal activities. Additionally, localized flooding has become more common as sea levels rise and storms surge higher. Lessons learned from previous flooding events highlight the need for proactive planning and resilient infrastructure. The building of seawalls at places like Malé — the capital

— over recent years has lessened the impact of storm surges. Yet, they are still not far-reaching enough to prevent future dangers from the rising seas (S. Gray 2023). The rising number and intensity of the floods along its coasts indicate that the Maldives needs more holistic measures with a long-term vision. Looking at previous data can build predictive models making governmental organizations to focus more on high risk areas and manage resources better.

## 2.5 Theoretical Frameworks

The study adopts three theoretical frameworks to analyze the impacts of rising sea levels and the effectiveness of adaptation strategies in the Maldives.

### **Social Amplification of Risk Framework (SARF)**

The Shared Assessment of Risk Framework (SARF) enables us to understand perceptions/cues around climate change risks among humans at different levels (Simpson et al. 2021). This framework highlights cultural, institutional, and social factors that influence perceptions about risk. This is SARF especially in the Maldives offers some insight into why international and local stakeholders often divergent views on climate risk. Some players, such as international agencies, exaggerate risks to capture global attention and funding, whereas others — for example -local communities downplay risk to secure livelihoods.

### **Analytical Framework for Policy Effectiveness:**

This framework takes advantage of the procedural coherence of adaptation policies. Through analysis of those factors, the gap in current policies is revealed and recommendations for improvement are made (Skivington et al. 2021). For example, checking for coherence means looking at whether national policies are aligned with international climate agreements and integration is the extent to which climate adaptation is included in more general development strategies.

### **Adaptation Pathway Approach:**

The adaptation pathway approach investigates for example structural solutions including land reclamation and island raising as sustainable responses to sea level rise (Nazarnia et al. 2020). It allows for a degree of adaptability where strategy can

shift as new information emerges and circumstances dictate. In the Maldives, this methodology offers a practical framework for delivering short-term gains while ensuring sustainable long-term development.

## 3. Methodology

The purpose of this study is to provide a qualitative research design for sea level rise impacts and existing adaptation strategies in the Maldives. This research lends itself to a qualitative approach, facilitating an in-depth exploration of stakeholder's experiences, perceptions and reaction(s) to climate change. The current study aims to fill this gap by shedding light on how contextual and subjective aspects that contribute to climate vulnerability and adaptation approaches in Singapore differ, as such insights are often untouched by quantitative studies. This research highlights the need to understand how environmental, economic, and social systems in the Maldives are responding to rising sea levels before potential structural and policy-based adaptations can be assessed as being pragmatically viable. By utilizing qualitative methods, the study enables a rich integration of perspectives providing complexity to our comprehension of resilience challenges and opportunities for adaptation to an existential threat from climate change.

In-depth interviews are held with relevant stakeholders, including government officials, NGOs, and representatives of local communities. Due to the flexibility they provide participants with in expressing their own perspectives, as well as granting the researcher additional probing ability on particular themes semi-structured interviews are selected. Individual interviews (n = 10) with national and sub-national government officials—particularly from the Ministry of Environment, Climate Change and Technology — there are valuable insights on the development and implementation of climate adaptation policies. When local community members share personal experiences of how their livelihoods and environments are impacted from rising sea-levels, along with NGO initiatives and advocacy on adaptation projects done at the national level, it has a much larger impact. This triangulated approach officials said will represent a wide range of voices and viewpoints.

Meaningful insights are derived from qualitative analysis of data collected through interviews,

document review, and historical methods. Stakeholder interviews are subjected to thematic analysis to identify patterns and themes. Such as diversity in risk perception, political obstacles in policy implementation and socio-economic consequences. Thematic coding allows the various stakeholders perspectives to be based categories and abstract interpretation. The study compares different adaptation strategies including land reclamation, island raising and nature-based responses with predicted pathways of sea-level rise to assess the efficacy of each strategy. Parameters for this assessment are practicality, cost, environmental sustainability and social equity.

A major element of the research which is always really important and should relate to ethical considerations on such a study are also presented, following them up with how this maintain the integrity of the research whilst providing benefits for its participants. The answers for stakeholder interviews will all be in an anonymized form to protect the identity of the participant, so anonymity and confidentiality are always prioritized. Access to sensitive information is limited exclusively to the research team, and data is held in secure storage. All participants provide informed consent before any interview. Participants are given information that fully explains the purpose, methods and possible consequences of the study, and they must be assured they can withdraw from the study without penalty at any time.

## 4. Findings

### 4.1 Stakeholder Perceptions

Ethics addresses high-level concepts of right and wrong, providing consideration in research that is fundamental to the integrity of the study, the researchers and protects the dignity of research participants. Stakeholder interviews are conducted under a medium of anonymity and confidentiality where all responses will remain anonymous in order to protect participants identity. Sensitive information is stored securely with access by the research team only.

All participants provide informed consent prior to any interview. Researchers will give participants thorough details of the goals, plan, and potential ramifications of a study while also telling them that they can withdraw from the study at any time without

consequence. In this process, participants are given every opportunity to know that they are consenting freely and completely.

The Maldives stands as one of the most visible symbols the study have for the existential threat from rising sea levels, something that international agencies, like the United Nations and other global climate efforts view as a critical battleground in the fight against climate change. With the Maldives, for these agencies a "climate ground zero," not to act could mean allowing a nation submerged for the first time in armed history. As such, global actors often exaggerate sea level rise risks to mobilize international support and raise the necessary funds for mitigation and adaptation solutions. They have long-term sustainability and the consequences for humanity if the Maldives descends into peril, and impact for other nations at risk.

### 4.2 Policy Gaps

A major gap is the low enforcement of adaptation policies. Though the National Adaptation Programme of Action (NAPA) and the Strategic Action Plan (SAP) 2019–2023 highlight elaborate pathways to mitigate the challenges posed by climate, implementing these are often haphazard. Poor institutional capacity and fragmented governance structures hinder the translation of policy objectives into operational measures. For instance, zoning rules are in place to prevent building on floodplains but often these regulations are unenforced or ignored, increasing exposure.

Poor funding adds to the limitations of adaptation policies. The Maldives is extremely reliant on international financial assistance such as grants from the Green Climate Fund, and bilateral agreements. But these funds often fall short of the hundreds to billions needed for extensive adaptation works, including land reclamation and seawalls. In addition, funds are often subject to delay in disbursement and high levels of bureaucracy which compound the financial difficulties of Maldives. The absence of a stable and predictable funding mechanism means that many adaptation initiatives remain nascent or frozen.

### 4.3 Adaptation Strategies

Adaptation efforts in the Maldives have revolved around land reclamation and raising islands. Land

reclamation has the potential to be a long-term solution, as seen in projects like Hulhumalé, an artificial island built to accommodate population overflow and create new opportunities for economic development. In the same context, island-raising schemes hope to raise already-existing islands above anticipated sea levels to save important roads and homes.

Even if these strategies promise real gains, they are limited in their potential benefit by economic and ecological constraints. Such land reclamation projects are not just money-intensive ventures, but require constant upkeep. In addition, they may cause negative environmental ramifications such as coral reef and marine habitat destruction. Scale and social equity — Island raising can never overcome the scale issue, where climate measures in a few larger islands that serve as urban centers for many smaller more vulnerable inner islands are weighted more than they should be.

#### 4.4 Flood Risk Assessment

The Maldives has a record of increased coastal flooding with higher frequency and intensities over time. The devastating Indian Ocean tsunami that struck the region in 2004 revealed the threat posed by these extreme events to the nation, whilst elements of chronic inundation such as more recent floods caused by storm surge and high tide highlight a growing associated risk. The escalating impacts on islands previously exempt from flood disruptions underscores the criticality of inclusive flood management approaches. Floods in the Maldives can be very damaging to infrastructure, especially in areas of great population density such as Malé. Floodwaters cause extensive destruction of roads, buildings and other public utilities, resulting in high repair costs and significant interruptions to daily life. This exacerbates the social and economic costs of the flood response, when critical infrastructure like hospitals and schools are also threatened.

Flooding especially threatens the tourism industry, which makes up a large part of the Maldives' GDP. Coastal erosion and inundation endanger beaches, resorts and coral reefs, all of which compromise the nation's international tourist attractiveness. Both tourism infrastructure damages not only incur revenue losses in the short term, it also threaten the long-term viability of this sector. Flooding also has

another major effect — saltwater intrusion into freshwater lenses. Shallow aquifers in the Maldives supply drinking water and agriculture on many islands but are increasingly polluted with salinity. This has made communities turn to costly, energy-intensive desalination processes, further straining local and national budgets.

## 5. Discussion

### 5.1 Implications for Policy and Practice

The research highlights the vital need for the improvement of policy coherence in climate adaptation efforts in the Maldives (ESCAP 2023). Most of the current frameworks, despite intention to support businesses and help define a meaningful impact) fall prey to fragmentation and overlap, which dilutes their effectiveness. To that end, the Maldives needs one body capable of finding room in ministry budgets and its national development plans for matching climate adaptation policies across sectors and levels of government. The body must be to align the national policies such as the National Adaptation Programme of Action (NAPA) in addition with global commitments under pacts like the Paris Accord. The study needs a single unified approach so that study do not duplicate efforts, to make sure implementation is easier and effective and also the capacity of the country to address climate risks is increased.

Negotiations for adaptation strategies can only win traction when funding is readily accessible and certain. The Maldives needs to reform its system of financing through the mixing of external resource mobilization and domestic revenue collection and private sector investment (Shareef 2023). To lure international funds, the Maldives may be able to present itself as an icon of global climate change, calling on such support via means like the Green Climate Fund (GCF). At home, there is potential to find new financing – such as climate bonds or tourism levies – which would raise resources that are dedicated to adaptation. Moreover, establishment of a climate adaptation fund with transparency-based governance would restore trust and facilitate optimal allocation of resources.

Successful adaptation requires much local community and private sector participation. The Government must begin to implement a bottom-up approach for stakeholders by making decisions with

diverse participation at the centre. Community-based adaptation interventions, in which locals are involved in planning and implementation, guarantee culturally-sensitive strategies that consider specific local needs (Castro, Berkel, and Epstein 2023). Likewise, the tourism private sector should be incentivized to sustainably invest in nature — funding mangrove restoration or coral reef conservation for example, which are crucial to safeguarding the natural assets these businesses rely on (Fuldauer et al. 2022).

## 5.2 Challenges and Opportunities

The results highlight the urgent requirement for better policy coherence in climate adaptation efforts in the Maldives. Existing frameworks in different sectors are well-meaning yet need a unifying effort because they tend to be fragmented, often competing or overlapping efforts that just dilutes their effectiveness (Siebert 2023). It should bring coherence of national policies especially NAPA with international obligations derived from agreements like the Paris Accord. Such an integrated approach will minimize duplication, simplify execution and across the country help plug the climate risks (Melina and Santoro 2021).

National and local communities, as well as the private sector, need to be part of adaptation efforts. The government should take a bottom-up approach in improving stakeholder engagement based on inclusive decision-making processes (Sanga, Gonzalez Benson, and Josyula 2022). For example, those community-based adaptation initiatives and strategies that empower local community members to be involved in design/implementation processes will lead to culturally appropriate strategy as well as well-targeted local solutions. Likewise, the private sector — especially tourism — should be incentivized to invest in sustainability (for example, financing the restoration of mangroves or conserving coral reefs) that will help protect their underlying assets.

There is considerable socio-economic hardship within the Maldives that would need to be addressed in order to make implementation of climate adaptation feasible. Large-scale efforts such as land reclamation (expanding the coast by filling in existing seas) or seawall construction are expensive and, when budgets are tight, can be beyond the

capacity of a developing nation such as Cambodia (Jouffray et al. 2023). Secondly, relying heavily on tourism makes the economy susceptible; any impact on arrivals due to environmental deterioration or global economic recessions will inhibit the country from financing adaptation. As much of the international funding goes to urban centres like Malé, social inequalities make the implementation of adaptation measures even more complex on smaller and less economically relevant islands. Such inequity threatens to deepen systemic vulnerabilities among already disadvantaged populations.

Another challenge is that the technical know-how needed to develop and execute effective permutational strategies does not always exist. Say, land reclamation and island-raising projects require high-level engineering skillsets and environmental analyses to mitigate ecological harm. Likewise, ecosystem-based methods like mangrove restoration or coral conservation are better suited to those experienced in marine biology and habitat restoration (Sunkur et al. 2023). Though international partnerships can be a useful resource for technical support when needed, the Maldives should focus on capacity-building initiatives that will cultivate local expertise and lessen dependence on foreign assistance.

We cannot separate all these from adaptation. Rapid leadership changes and changing political priorities repeatedly derail long-term planning and implementation. Additionally, the lack of enforcement and application of some regulations weakens adaptation effectiveness. Robust governance frameworks and policies that can transcend political leaderships are important to maintain progress on climate projects (Akpuokwe et al. 2024). Nevertheless, it also presents the Maldives with enormous potential to benefit from international cooperation and financing. The Maldives, one of the most affected country by climate change, can become a strong voice to call for more action and assistance from around the world. If Maldives actively engages in international climate forums like the UNFCCC, it can bolster its influence as a global climate governance actor (Andrachuk et al. 2022).

## 5.3 Broader Implications

The experience of the Maldives offers important lessons not just for other low-lying, climate change-

vulnerable countries. The specific geographic and socio-economic context of Arctic areas, where the immediate adaptation pressures are balanced with limited recovery time, is underlined (Heggelund 2023). Maldives is an example, where the reliance on land reclamation builds on a positive note of a structural solution but driven by environmental compromises and heavy resource demands. The shift towards ecosystem based approaches and findings from activities focused on mangrove restoration and coral reef conservation delivery of low-willingness-to-pay alternatives which can be leveraged in other small island developing states (SIDS). This approach not only improves climate adaptability but also promotes biodiversity and local livelihoods providing co-benefits that are in line with the global sustainable development goals.

The difficulty of accessing resources and expertise highlights the ongoing problem faced by many SIDS in seeking international climate finance. Maldives also has the opportunity to influence international policymaking by pushing for simplified funding processes and capacity-building initiatives that could better serve the needs of vulnerable island states (Garrett 2023). The Maldives is both a victim of climate inaction — and a terrifying glimpse of the fate that awaits us all. Moreover, its residents would become among the first modern cases of climate refugees if the Maldives becomes uninhabitable through rising sea levels — a precedent leading to future displacement crises. Nations disappearing would create such repercussions on the international level that current norms wouldn't even apply when it comes to victims of lands lost to submergence.

Losing the Maldives would mean global failure when it comes to climate change measures and further erode confidence in institutions and accord aimed at tackling this existential challenge. And it highlights the growing imperative for joint, fair, and effective climate efforts to avert a repeat fate elsewhere in the world at risk. The Maldives are finding ways to stay afloat in rising seas through innovative adaptation strategies, from floating islands to transitions towards renewable energy (Hafiz, Singh, and Mohamed 2024). And these efforts in their infancy underscore the need to invest in R&D that can spot technologies with scale and sustainability characteristics. With its challenges and lessons learned, the Maldives can also serve as a source of

inspiration for other countries by proving that resilience is possible with innovations.

## 6. Conclusion

The Maldives is in existentially dire straits, with rising sea levels meaning far-reaching consequences for its environment, economy and people. Coastal flooding, erosion and saltwater intrusion are becoming more prevalent and severe, damaging freshwater resources, infrastructure and agricultural land. This is exacerbated by both the geographical vulnerability of the country and tourism, which relies on a stable environment.

The results expose wide gaps in the capacity of the Maldives to adapt. Although policies like the National Adaptation Programme of Action (NAPA) and Strategic Action Plan (SAP) 2019–2023 lay the groundwork, they suffer due to lack of enforcement, low financing and stakeholder participation. Although structural adaptation approaches such as land reclamation and island raising may serve as potential solutions, they are often limited by their high construction costs, concern over the environmental impacts of settling structures within aquatic systems, and wider issues of social equity. Mangrove restoration, coral reef conservation, and other ecosystem-based strategies complement the approaches above and have longer-proven potential but demand sharp increases in investments to scale them up.

## 7. Recommendations

One of the short-term solutions that Maldives can adopt is to reinforce the policy enforcements and harmonization by having a centralized body to formulate strategies on climate change adaptation effectively. That would resolve fragmentation and align global and national frameworks. They also need to raise further money. The Maldives must diversify its sources of financing by setting up new mechanisms (e.g., climate bonds, eco-tourism fees, private sector partnerships), while cutting down on red tape for global funding (e.g., Green Climate Fund). Moreover, scaling-up community-based adaptation activities can lead to enhanced engagement by a wide set of actors and more locally relevant and widely accepted adaptation actions.

In the long term, Maldives have to learn how do climate adaptation locally. Build more capacity to



reduce reliance on Green/Blue/Mongolian Cathedrals NGOs: If you make an ecosystem better, try and build new skills in the region (engineering, marine biology & etc.) instead of doing it all yourself. The study must also work to scale up ecosystem-based approaches — like restoring mangroves or protecting coral reefs, which can buffer communities from storms while building biodiversity. Investing in technologies, like floating infrastructure and renewable energy options that will make the country more flexible in response to sea-level rise can also help provide greater long-term resilience.

## 8. Future Research Directions

The next generation will want to further investigate new forms of adaptation, like floating cities and algae-based desalination plants that transform the immediate environment into a solution to sea level rise. Research on displacement socio-economics and climate migration is also critical for addressing the human dimensions of climate change. Research should invest in how adaptation strategies can be integrated with sustainable development goals to ensure that the efforts are responding to global challenges in a coherent manner. Filling these gaps could increase the design and implementation of more effective and equitable adaptation policies within Maldives but also for other vulnerable nations.

## REFERENCE

- Akpuokwe, Chidiogo Uzoamaka, Adekunle Oyeyemi Adeniyi, Seun Solomon Bakare, and Nkechi Emmanuella Eneh. 2024. "Legislative responses to climate change: a global review of policies and their effectiveness." *International Journal of Applied Research in Social Sciences* 6 (3): 225-239.
- Andrachuk, Mark, Erica Cunningham Cheok, Emily Darling, Georgina Grace Gurney, Emilie Litsinger<sup>10</sup>, Emma McIntosh<sup>11</sup>, Morena Mills<sup>12</sup>, Tiffany Morrison, Sangeeta Mangubhai<sup>13</sup>, and Jenny Oates. 2022. "CORAL REEF GOVERNANCE: STRENGTHENING COMMUNITY AND COLLABORATIVE APPROACHES."
- Browne, Stephen. 2024. *Developing capacity through technical cooperation: country experiences*. Routledge.
- Castro, Felipe González, Cady Berkel, and Dana R Epstein. 2023. "Cultural adaptations and cultural factors in EBI implementation with Latinx communities." *Frontiers in Public Health* 11: 1007328.
- ESCAP, UN. 2023. "The role of social protection to address climate change in the Maldives."
- Fuldauer, Lena I, Daniel Adshead, Scott Thacker, Sarah Gall, and Jim W Hall. 2022. "Evaluating the benefits of national adaptation to reduce climate risks and contribute to the Sustainable Development Goals." *Global Environmental Change* 76: 102575.
- Garrett, Kelsey. 2023. "The Adaptive Capacity to implement Climate Migration Policy in response to Sea-Level Rise in the Maldives."
- Gray, Allyssa. 2020. "Design in the face of uncertainty: prevention, preservation, and mitigation of coastal damage from storm surge and flooding."

- Gray, Summer. 2023. *In the Shadow of the Seawall: Coastal Injustice and the Dilemma of Placekeeping*. Univ of California Press.
- Hafiz, Mashrur, Simron J Singh, and Shazla Mohamed. 2024. "Islands at the Brink-Country Brief Maldives."
- Heggelund, Ragna Mathisen. 2023. "Thawing Arctic Realities: Analyzing Arctic Security through the Lens of Arctic Exceptionalism and Great Power Politics."
- Jouffray, Jean-Baptiste, Felix P Barbour, Robert Blasiak, Julia Feine, Louise Gallagher, Daniel Johansson, Jan J Kuiper, Kiran Pereira, Akshat Rawat, and Rafael JP Schmitt. 2023. "Ocean sand: Putting sand on the ocean sustainability agenda." *Retrieved from*.
- Kumar, Abhishek, Shilpi Nagar, and Shalini Anand. 2021. "Climate change and existential threats." In *Global climate change*, 1-31. Elsevier.
- Magnan, Alexandre K, Michael Oppenheimer, Matthias Garschagen, Maya K Buchanan, Virginie KE Duvat, Donald L Forbes, James D Ford, Erwin Lambert, Jan Petzold, and Fabrice G Renaud. 2022. "Sea level rise risks and societal adaptation benefits in low-lying coastal areas." *Scientific reports* 12 (1): 10677.
- Melina, Mr Giovanni, and Marika Santoro. 2021. *Enhancing Resilience to Climate Change in the Maldives*. International Monetary Fund.
- Nazarnia, Hadi, Mohammad Nazarnia, Hadi Sarmasti, and W Olivia Wills. 2020. "A systematic review of civil and environmental infrastructures for coastal adaptation to sea level rise." *Civil engineering journal* 6 (7): 1375-1399.
- Polic, Deanna. 2021. "Ebbs and flows: more-than-human encounters with the Cape Flats Aquifer in a context of climate change."
- Sanga, Naganika, Odessa Gonzalez Benson, and Lakshmi Josyula. 2022. "Top-down processes derail bottom-up objectives: a study in community engagement and 'Slum-Free City Planning'." *Community Development Journal* 57 (4): 615-634.
- Scott, Mark, Mick Lennon, Fiadh Tubridy, Patrick Marchman, AR Siders, Kelly Leilani Main, Victoria Herrmann, Debra Butler, Kathryn Frank, and Karyn Bosomworth. 2020. "Climate disruption and planning: resistance or retreat?" *Planning Theory & Practice* 21 (1): 125-154.
- Shareef, Mohamed Mahid. 2023. "Factors Influencing Value Added Public Services in Maldives." University of Wales Trinity Saint David.
- Siebert, Michael. 2023. *Applying a Systems Thinking Approach to the Construction Industry*. Taylor & Francis.
- Simpson, Nicholas P, Katharine J Mach, Andrew Constable, Jeremy Hess, Ryan Hogarth, Mark Howden, Judy Lawrence, Robert J Lempert, Veruska Muccione, and Brendan Mackey. 2021. "A framework for complex climate change risk assessment." *One Earth* 4 (4): 489-501.
- Skivington, Kathryn, Lynsay Matthews, Sharon Anne Simpson, Peter Craig, Janis Baird, Jane M Blazeby, Kathleen Anne Boyd, Neil Craig, David P French, and Emma McIntosh. 2021. "Framework for the development and evaluation of complex interventions: gap analysis, workshop and consultation-informed update." *Health technology assessment (Winchester, England)* 25 (57): 1.

Sunkur, Reshma, Komali Kantamaneni, Chandradeo Bokhoree, and Shirish Ravan. 2023. "Mangroves' role in supporting ecosystem-based techniques to reduce disaster risk and adapt to climate change: A review." *Journal of Sea Research*: 102449.

Thy, Huynh Thy. 2021. "Design research for coral ecosystem protection."  
서울대학교 대학원.

Vaughn, Sarah E. 2022. "Erosion by design: Rethinking innovation, sea defense, and credibility in Guyana." *Comparative Studies in Society and History* 64 (4): 849-877.

Yadav, Shreya. 2022. "Investigating Historical, Social, and Ecological Dimensions of Coral Reef Resilience." University of Hawai'i at Manoa.

2020 ދިވެހިސަރުކާރުގެ ގެޒެޓް. National strategic framework to mobilize International climate finance to address climate change in the Maldives 2020-2024. Ministry of Environment, Republic of Maldives.