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Climate change and SDGs in Odisha: Its challenges and future roadmap

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Abstract
This paper takes a close look at how Odisha is progressing towards the Sustainable Development Goals (SDGs), while paying special attention to the very real ways climate change is affecting that journey. By examining key indicators, we explore how climate change and the SDGs are deeply connected — and how rising environmental pressures are making several important targets much harder to reach. The study highlights the specific disruptions caused by climate change, such as extreme weather events and mounting difficulties of human life in agriculture, and shows how these challenges slow down or even reverse hard-earned development gains. The paper argues strongly for urgent and effective responses: strong climate adaptation and mitigation measures, a major push toward renewable energy, building infrastructure that can withstand climate shocks, and making sure resources reach the people and communities who need them most. Ultimately, the findings make it clear that continued and intensified effort is essential. Only by deliberately weaving climate action into the heart of development planning can Odisha State in India build a genuinely resilient and sustainable future.

Keywords: Climate change, sustainable development goals, climate resilience, govt. initiatives

Introduction
Sustainable development is a model of the Triple Bottom Line(TBL). Triple Bottom Line involves three constituents like people, profit and planet. Sustainable Development Goals (SDGs) covers 17 no. of goals out of which climate change is the 13 no. goal. There is the Nexus of Triple Bottom Line approach in Sustainable Development Goals. Climate Change is one of the biggest global environmental challenge for Sustainable Development. It has become a serious threat, not just to our environment but also to the growth and development of the nation. Climate change creates barrier in Sustainability towards various ways including changing the atmosphere and changing the living pattern that impact agriculture, human health, water resources, elimination of animals and plants. Climate change action revels impact on Stakeholders of society like people, businessman, industry and ecosystem directly or indirectly. Thus the real challenge is to integrate the management of a climate related hindrances into the policies, programs, practices of sustainability of the society. For this purpose the present issue is required to be addressed not only at a global and / or National levels but also at the regional level.

Objectives of the paper
1. Assessing Odisha's Progress towards SDGs.
2. Analysing the impact of Climate Change on SDGs Achievement.
3. Identifying policies and actions implemented by the govt. to adopt and mitigate the vagaries of Climate Change in the state.

Hypothesis
Climate Change creates adverse effects on agriculture, industry, foresting, water resources, human health & wellness of the state.

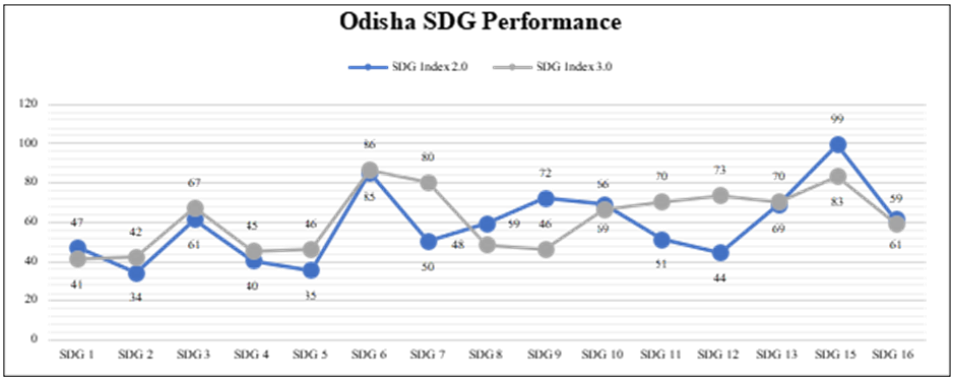
Methodology
The methodology involves a thorough review and analysis of published reports and data from credible sources such as the World Bank, United Nations Development Programme (UNDP), NITI Aayog, and the Ministry of Environment, Forest, and Climate Change (MoEFCC). These reports offer valuable insights into the effects of climate change on specific SDGs—particularly SDGs 7, 13, 2, 11, and 15—and their connections with other goals. The analysis draws upon statistical data, progress indicators, and case studies from both national and international organizations to evaluate India's responses to climate-related challenges. This secondary research is further supported by policy documents and frameworks, including India's Nationally Determined Contributions (NDCs) and the National Action Plan on Climate Change (NAPCC), providing a solid basis for understanding the progress and obstacles in achieving climate-focused SDGs in Odisha.

Literature survey on climate change and SDGS
The literature from the World Bank, UNDP, NITI Aayog, MoSPI, MoEFCC, IMF, Oxfam, and other global and national institutions, have thoroughly examined the impact of climate change on achieving the Sustainable Development Goals (SDGs). These studies highlight how climate change hinders progress toward various SDG targets, posing a major obstacle to advancing multiple goals. They emphasize the complex interplay between climate change and sustainable development, stressing the urgent need for coordinated international and national efforts to address these challenges and refocus on achieving the SDGs.
The literature analyses the multidimensional effects of climate change on critical SDGs such as poverty eradication, health, food security, clean water, and sustainable cities. Additionally, it captures the proposed mitigation and adaptation strategies globally and within India, emphasizing frameworks developed to combat climate change. The review includes insights into climate finance, key policies, and collaborative approaches that are essential for mobilizing resources to implement effective climate adaptation and mitigation efforts.

SDGs in the context of Odisha

Odisha being a state focused on progressive development through social reform, government action and participation of societal actors, has conceptualized and implemented several initiatives for the realization of SDGs at all levels of governance. Further, the state had also organized a series of consultations with the key stakeholders, focusing on capacity-building, development of monitoring frameworks and sharing of new ideas and best practices related to the SDGs. In line with the national convergence plan, the state has also adopted the Whole-of- Government Approach (WGA) in addressing the 2030 SDG targets.

The SDG Index 3.0, 2020-21 prepared by the NITI Aayog, presents Odisha with a composite score of 61 which is three points higher than its score in the SDG Index 2.0, 2019-20 (58). The SDG Index 3.0 which considered a total of 115 [2] indicators for the comparison of states according to their achievement in terms of SDG, has ranked Odisha at the top for SDG 14 – Life Below Water. The report also shows that the state is a frontrunner in SDGs 3, 6, 7, 10, 11, 12, 13 and 15 and has shown remarkable progress in SDG 12 with a sharp rise in the composite score from 44 in 2019 to 73 in 2020. However, it is to be noted that the state is an aspirant in SDGs 1, 2, 4, 5 8, and 9, and is a performer in SDG 16 as can be seen from the graph. Furthermore, the Multidimensional Poverty Index (MPI) Report 2021 [10], based on NFHS 4 by the NITI Aayog, also shows 29.35% of the people in Odisha are multidimensionally poor with the state having an MPI of 0.136.



Source: SDG India Index and Dashboard 2020-21, NITI Ayog

With the objective of driving SDG-based development activities in the state, the Odisha State Indicator Framework (OSIF) for SDGs has also been developed to identify prospects for further convergence and co-implementation of schemes and programme and clear monitoring of progress. Out of the 367 OSIF Indicators, 269 are consistent with the National Indicator Framework (NIF) for SDGs while 98 are Odisha-specific indicators. The OSIF includes 100 Outcome Indicators, 143 Output Indicators and 124 Process Indicators. The SDG framework in the state thus shifts the focus to larger outcomes which are attainable with adequate policy and budgetary support from the government and other stakeholders.

Odisha has been a frontrunner among many major Indian states in introducing far-reaching reforms in governance and budgeting. The SDG Budget being one of the most significant government fiscal policy documents provides an extensive roadmap for the integration of the 2030 Agenda and the goals, targets and the associated indicators to the state's financial planning regime. It is also a vital means of highlighting accountability and transparency of the state towards its commitment to inclusive development. In this endeavour, the SDG Budget also complements the state's citizen-centric approach through the 5T Framework of Teamwork, Transparency, Technology, Transformation through Time. Odisha is also greatly prioritizing the localization of SDGs in order to promote the last-mile reach of development initiatives. In light of the ongoing pandemic, that state has also placed more focus on ensuring that SDGs are at the core of the initiatives rendered for a response as well as recovery from severe aftershocks. Source- SDG India Index and Dashboard 2020-21, NITI Ayog, Government of India

Impact of climate change in Odisha and its impact on SDGs:

Climate change is hitting Odisha hard, slowing down its economic growth and turning daily life into a struggle for many. Farmers face shrinking harvests from unpredictable rains—sometimes floods wash away crops, other times droughts parch the fields. Summers have grown scorching, with rising temperatures making them nearly unbearable, while health issues like vector-borne diseases spread more easily. Biodiversity suffers too: forests thin out, vegetation shifts, and coastal ecosystems struggle as sea levels creep higher.

The state's 480-km coastline, once a source of pride, now feels like a curse. Frequent cyclones, heatwaves, lightning storms, and back-to-back disasters have battered communities, especially since 1998. Coastal Odisha has been crushed by floods and droughts, but it's the encroaching Bay of Bengal that's stealing homes and farmland. In Kendrapara district, the Satabhaya cluster of seven villages tells a heartbreaking story. Land records from 1930 showed 320 sq km; by 2000, it dwindled to 155 sq km. Villages like Govindpur, Mahnipur, Kuanriora, Kharikula, and Sarpada vanished into the sea between the 1980s and 1990s. Now, Satabhaya and Kanhapur teeter on the edge—Kanhapur, rich with maritime folklore about the legendary Tapoi trader, has relocated three times, its current spot just 50 meters from the waves. Around 20 other villages have lost 60% of their land, and in Puri's Astaranga block, tidal surges threaten Udaykani, Chhenu, Tandahar, Kalamakani, Katakana, and Kaanarapur, forcing families to flee.People are desperate. Youth migrate to distant cities or states as laborers, abandoning farming—their traditional lifeline. Villagers yearn to relocate but cling to ancestral lands. As Mishra and Jena (2015) note, these disasters shatter local

economies.Economists like Smith *et al*. (2001) warn that climate change widens income gaps, hitting developing regions like Odisha hardest with negative market losses—agriculture fails, fisheries dwindle, forests recede, water sources dry up—while health costs soar. Non-market tolls, from disease to displacement, compound the pain across sectors: farming, food security, animal husbandry, industry, mining. For Odisha's coastal families, it's not just data—it's homes swallowed, livelihoods lost and futures washed away.

Climate change and agriculture

Climate change hits Odisha's farmers hard. With 80-85% of rural people relying on rain-fed farming (60% of land) for rice—their main crop—this monsoon gamble is riskier than ever. Cyclones devastate: 1999's Super Cyclone destroyed 2 million tons of rice across 18.43 lakh hectares; Phailin (2013) ruined 12.9 lakh hectares; Fani flattened 60% of paddy and 80% vegetables, plus 3,290 irrigation projects.Food production dropped 40% in 50 years. Coastal fields suffer erosion and salinization. Farmers try adapting—changing seeds, planting dates, or migrating—but poverty, no irrigation, and poor support block them. Crop insurance offers hope.

Climate change hits Odisha industries

Odisha's economic boom since 2005 rides on industry—mines, steel plants, and power stations fueled by rich minerals. Twelve industrial hubs like Angul-Talcher, Jharsuguda, and Paradip churn out growth but spew pollution. About 65% of factories fall in the "red" polluting category, with Odisha ranking 9th in CO2 emissions (8,539 kilotons annually, growing 6.74%). Angul's coal mines, NALCO aluminum plant, and thermal stations dump toxic waste—fluoride, heavy metals, ash—poisoning groundwater and rivers. Fly ash ponds contaminate water, harming health and fish. Heatwaves from these hotspots make life unbearable. Jharsuguda's sponge iron units blanket air with dust; poor waste disposal ruins land, water, and lungs. Industry guzzles power from rain-fed hydropower, but droughts slash output. Agro-processing thirsts for scarcer water. Cyclones disrupt ports, stalling exports. Floods and storms threaten factories' long supply chains. Forests blanket 37% of Odisha—teak, sal, bamboo inland; mangroves along coasts. They sustain 40% of people, especially tribes, providing 25-52% of household income and 7% of GSDP. Forests curb erosion, tame floods, and shield against cyclones. Yet 50% are degraded. Mining, cities, roads, and firewood demands drive deforestation, spewing 20% of state CO2. Tribes lose wild foods and medicines; desertification starves communities. Elephants raid villages as habitats vanish, sparking deadly human-wildlife clashes. Industry pollutes and heats up the climate, while forests that could absorb carbon dwindle. Factories suffer from the very droughts and storms they help intensify. Odisha needs urgent adaptation—cleaner tech, water management, reforestation—to save both its industrial engine and forest lifeline from climate chaos.

Climate change and water resources

Odisha's water woes have exploded with booming population, sprawling farms, and factories sucking rivers dry. Climate change pours fuel on the fire—erratic rains, hotter air, and rising seas turn abundance into crisis. Rainfall days dropped from 120 to just 90, totals shrinking from 1502 mm (1961-2000) to 1482 mm post-2000. Mahanadi River swings wildly—September floods rage, April turns bone-dry. Sediments and factory waste clog rivers; low flows can't flush pollutants, spiking salinity. Fish struggle in warm, oxygen-poor waters, slashing fisheries' GSDP share from 1.55% (2000-01) to 1.11% (2009-10). Sea levels swallow beaches, flood estuaries, and saltify freshwater aquifers. Coastal wetlands expand, eroding farmland. Net sown area shrinks, irrigation intensity falls to 30.9%, yields crash. Odisha bears 54.7 lakh hectares of degraded land (5.18% of India's total)—29 lakh hectares (45% of cultivable land) suffer severe erosion. Water erosion scars 32 lakh hectares. Urban slums drown in waterlogging—worse than any Indian state—breeding waterborne diseases, polluting groundwater, and fouling drinking supplies. Families boil suspect water, kids fall sick, farmers watch crops wither. From drinking taps to fish markets to paddy fields, climate change strangles Odisha's water lifeline, hitting the poorest hardest. state towards its commitment to inclusive development. In this endeavour, the SDG Budget also complements the state's citizen-centric approach through the 5T Framework of Teamwork, Transparency, Technology, Transformation through Time. Odisha is also greatly prioritizing the localization of SDGs in order to promote the last-mile reach of development initiatives. In light of the ongoing pandemic, that state has also placed more focus on ensuring that SDGs are at the core of the initiatives rendered for a response as well as recovery from severe aftershocks.

Climate change and human health

Climate change brings deadly health crises to Odisha's poor. Hot, humid floods breed malaria (36% of India's cases), dengue, chikungunya. Droughts wreck water systems, spiking diarrhea. Coastal salinity raises blood pressure. Heatwaves kill—2,000 in 1998 alone. Cyclones like Fani (41 deaths, 15M affected) shatter homes, injure thousands. Malnutrition grows as crops fail; pollution fuels asthma, heart attacks. Fisheries crash from warm waters. Odisha's weak health infrastructure buckles under vector, water-borne diseases. Odisha's 2010-15 Climate Plan targets 11 sectors with ₹17,000 crore. Focus: resilient crops, shelters, solar boats, plantations. Budget rose to 4% by 2015. Still, heatwaves, cyclones persist. Poverty blocks adaptation—need pucca homes, clean water, sanitation to shield vulnerable from climate's health toll.

Shortcomings and gaps

- **Limited Integration across Sectors:** Despite the existence of national and state action plans, there is a lack of integration between climate action and sectoral policies. For instance, industrial policies often do not align with climate resilience goals, leading to conflicting outcomes. Challenges of Climate Change and SDG Goals in India 187

- **Vulnerability of Marginalized Communities:** Climate impacts disproportionately affect vulnerable and marginalized communities. The lack of targeted adaptation measures for these groups remains a significant gap in achieving climate justice. The Index's narrow focus on aggregate scores and rankings obscures the experiences of marginalized communities.

NITI Aayog's top-down approach to promoting the SDGs neglects the need for community-led initiatives and participatory governance.

- **Inadequate Climate Financing:** Although efforts like NAFCC and ISA are commendable, there is still a shortfall in climate financing, particularly for adaptation projects at the local level. Many states and local governments struggle to mobilize resources for comprehensive climate action

Measures taken to address climate-related SDGs in Odisha

Odisha tackles climate challenges through practical, multi-faceted actions tied to SDGs

1. **Renewable Energy:** Odisha leads globally in clean energy, targeting 500 GW by 2030 with massive solar, wind, and hydropower investments via National Solar and Wind Missions.

2. **Climate-Resilient Agriculture:** Through NMSA, farmers get drought-tough crops, better irrigation, and research support. PMFBY insurance protects against climate disasters.

3. **Disaster Risk Reduction:** The National Disaster Management Plan builds cyclone shelters and early warnings, safeguarding coastal and flood-prone communities.

4. **Urban Sustainability:** Smart Cities Mission and AMRUT create green infrastructure—water recycling, waste systems, renewables, eco-buildings, and clean transit.

5. **Forest and Biodiversity Conservation:** Odisha commits to restoring 26 million hectares by 2030. Green India Mission and CAMPA drive tree planting and wildlife protection.

6. **International Commitments:** Odisha supports Paris Agreement and Solar Alliance goals—45% GDP emission cuts, 50% non-fossil energy by 2030.

Future strategies and roadmap

Looking ahead, Odisha's practical plans tackle climate change while hitting SDG targets:

1. **Achieving Net-Zero Emissions by 2070:** Odisha aims for net-zero by 2070 through clean energy growth, efficiency upgrades, and carbon capture tech.

2. **Enhancing Climate Resilience:** Coastal shelters, tough crops, and climate-smart urban/rural planning protect vulnerable communities from cyclones and floods.

3. **Expanding Green Finance:** Green bonds, public-private deals, and climate funds fuel Odisha's solar farms, resilient farms, and disaster prep.

4. **Enhanced Policy Coherence and Integration:** Odisha aligns industry, agriculture, and cities with SDGs for unified green growth.

5. **Strengthening Monitoring and Accountability Mechanisms:** District-level SDG tracking sharpens focus on Odisha's climate hotspots.

6. **Targeted Adaptation Strategies:** Women fishers, tribal farmers get custom plans—early warnings, salt-tolerant rice, cyclone shelters.

7. **Mobilizing Climate Finance:** PPPs and bonds channel funds to panchayats and villages for real on-ground action.

8. **Building Institutional Capacities:** Training block officers, farmers, and urban planners to lead Odisha's climate fight.

9. **Leveraging Technology and Innovation:** Solar irrigation pumps, AI weather alerts, and smart cities make Odisha climate-ready.

Conclusion

Weaving climate change into Odisha's SDG framework is crucial for sustainable growth in this disaster-prone coastal state. Climate impacts ripple across agriculture, water, health, and forests—demanding holistic strategies that blend mitigation and adaptation. Odisha's Climate Action Plan, resilient crops, cyclone shelters, and solar push show real commitment to SDGs. Yet challenges persist: erratic monsoons, coastal erosion, heatwaves, and malaria surges test progress. Stronger block-level monitoring, more climate funds for panchayats, and tribal-focused adaptation are vital to hit 2030 targets.

MoEFCC, state agencies, and districts must collaborate. Integrating climate across sectors, sharpening data tracking, and mobilizing green finance will help Odisha build resilience—safeguarding fishers, farmers, and forests while securing sustainable prosperity for future generations.

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