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Research Article

Framework For Adaptive Governance In Odisha: A Special Reference To Climate Change And Disaster Management

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ABSTRACT

Odisha is known as a highly disaster-prone state. In the last half-decade, the state has faced more than a dozen disaster occurrences. Due to poor weather conditions, the coastal belts often remained in an alarming situation. Even though the state has witnessed so many small and big floods and bad air streaming over the years that resulted in crop failure, acute poverty, property damages, and human losses. Farmer suicide is also a related problem to it. Disaster has left the state poor, weaker but also helpless, and vulnerable. It badly affected the economic and administrative structure of state machinery. In the same way, the continuous disaster risk in coastal areas of Odisha has highly influenced untold human suffering. Some of the important regions of the coastal belt or the eastern cities of Odisha like Paradeep, Berhampur, Puri, and Balasore; whereas West Bengal and Andhra Pradesh will come under tremendous disaster every year. These regions are even under heavy alert in governmental planning to protect lives from possible disaster risks. Even from an economic point of view, it is not doubtful that Odisha is a poor state. Most people depend on agriculture and crop production as their life support system and their occupations rely on sea areas. And more than 30 percent of people still rely on government schemes under the Below Poverty Line (BPL). Hence any unprecedented disasters make possible countless properties, infrastructure, shelters, and lives and livelihood losses in the states. So, stress is placed on the government and governance process, to tackle disaster damage in Odisha with zero casualties. Institutional capacity building is a significant step with the help of stakeholders and local communities to enhance the maximum possibilities against regular disasters. Thus, the study will focus on the role of adaptive governance structure in countering climate change and disaster risks in Odisha. At the same time, it focuses on the resilience step to be taken in protecting lives, livelihoods, and properties in the hands of effective governance.

Keywords: Disaster-Prone State, Institutional Capacity Building, Live and Livelihood, Disaster Risks, Adaptive Governance, Zero Casualties]

Introductions:

The conceptualization of disaster management and resilience governance has been a top priority today at all government and political institutions worldwide. From developed countries to middle developed and underdeveloped countries in recent times focused their attention on keeping human lives and livelihoods secure and protected. However, the disaster is more alarming in the context of South Asia and the middle or central part of Asia Pacific. Among the suffering regions of the world, the situation is even more depressed and vulnerable in the areas of China, India, Kazakhstan, and the South Asian part of the world. According to the National Disaster Management Authority report, India is one of the vulnerable countries where almost all Indian states are disaster-prone. The vulnerable profile of India not only includes the regular happening of seasonal floods, tsunamis, cyclonic storms, and hurricanes in the coastal belt and hilly areas merely of India but also supposed to have tropical changes or geopolitical conditions (NDMA, 2023:1). India has even become the third natural disaster-facing country after China and the USA (Atlas Magazine, 2023). The World Risk Report 2023 suggests India has become the third highest disaster risk country after the Philippines and

Indonesia (Bündnis Entwicklung Hilft, 2023). Natural disasters not only force human death toll but untold suffering. Homelessness, poverty, drought, displacement, property losses, and disease are common phenomena and consequences of this happening. From the deep analysis of the Asian Development Bank, World Bank, and UN agencies the state of Odisha has lost around 24 thousand crores in damage at the emergence of cyclonic storm Fani in May 2019. This is comparatively four times greater than the severe cyclonic storm of Phailin (2013) as estimated by the World Bank (Mohanty, 2021:4-5). Saudamini Das (2016) also estimates the economic and natural disasters consequence in Odisha. To her, the economy is the bedrock of the societal growth of Odisha that can be measured through GDP, national income, employment, saving, capital investment, human development, and advanced skills. With the occurrence of this natural disaster, Odisha can't move ahead to change its position from a poor state to and capital of natural disasters. Odisha is an agrian-based state, wherein 59 percent of rural and urban people's livelihood is dependent. Most of the rural households are marginal farmers whose livelihood depends upon suitable weather patterns and seasonal rainfall in crop production. Farmers earn very low wages in comparison to other Indian states and the state of Punjab (poverty and Human Development Monitoring Agency, 2022).

The Odisha's Economy Survey (2015-16) reports suggest that Odisha from 1891 to 1970 experienced 952 small and big cyclonic storms and then till 1999 more than 13 major disasters occurrence were held that took a heavy toll of 22,228 human lives and caused 3,421,000 persons homeless. However, 9,658 people were killed, and 49 lakh people were otherwise affected in the 1971 cyclone, (Poverty and Human Development Monitoring Agency, 2020). It can be argued that Odisha is the most vulnerable picture in terms of climate disasters and natural catastrophes among the most affected Indian states. The state has gone through more than 100 tropical cyclones between 1891 to 2021. Among the most dangerous include namely 1999 super cyclonic storm that killed 100000 people and left untold suffering and poverty state into Odisha (Mohanty, 2021:1-4). In the last decade, Odisha has also faced severe cyclonic events known as phailin, hudhud, titli, and amphan that changed the pattern of Odisha government from having a suffered zone to an Odisha disaster model zone in the country OSDMA:2021). Focusing on the coastal belt and sea area level requires a little bit top an action plan to overcome tough situations. Even if unprecedented weather events and disaster occurrences affected those of government machinery in particular and every social group of people in general. During a disaster, it is not an easy rather challenging task for institutional rebuilding to reveal the ground realities and conditions of people in that particular region. For that, social scientists, and policymakers, have developed a new approach and method of doing work which is called adaptive governance.

Here norm-setting can be placed as the most priority area for the management of the coastal ecosystem. This includes the major problems of disaster risk, water management, disaster recovery, supply chain, and integrated structural and institutional preparation for all government institutions during the happening of disasters and climate change. Even to monitor all ground realities and community interests emphasis is made on the top priority areas of governance setting. Apart from non-state actors and voluntary wings, any separate entities hardly will achieve such norms without the proper involvement of associated institutions and state government. Even in social science research, and in academic endeavors, inquiries are undertaken for the role of the state, government, stakeholders, political leaders, and public personnel in challenging times (Hota and Rishi, 2017). Further, it asks for the participatory and effective role of these political institutions to safeguard people's interests. From this essential need adaptive governance is a required agenda for government institutions during all crucial and challenging times, especially to recover disaster resilience, climate change, coastal management, fisheries, and ecosystem management (Varma et al, 2014). Interestingly, studies of governance have different aspects. From participation in the democratic sphere to cooperation in the action sphere. Based on that, it can be also categorized further different ways. Out of various approaches and models of governance, this is given importance to place the ideas of adaptive government in the case of Odisha state and the advocacy of different cells, units, departments, public agencies, and legislation. So, the study examines the capacity-building approach that has been developed by the most vulnerable state of Odisha to able disaster management state in the country and the world.

Theorizing Adaptive Governance

The term adaptive governance was first coined by Deitz (Bedi, 2019). Adaptive governance is also known as polycentric governance or adaptive-co management system as it focuses on the adaptive capacity of governance in the matter of climate change, risk reduction, future uncertainty, and socio-ecological management. As a theoretical approach, adaptive governance was initially derived from the discipline of ecology, then conservation science which later became a part of the organization or governance system. In short, to *Walch,* it was from a socio-ecological system and adaptive management (Walch, 2017; Timothy Karpouzoglou et al 2016; Djalante, 2012). However, Holling proposed the concept of adaptive management in his active scientific hypothesis testing in the ecosystem to know how scientists can learn and adapt to the ecosystem (Dialante et al 2011). Natural Resource Management in ecological systems and socio-ecological changes can be well managed through adaptive governance. It enables and encourages multiple stakeholders and actors including the state, civil society, private bodies, and policymakers to resolve complicated societal issues. Ecological

management is one of the suggested approaches to adaptive governance. The nature of adaptive governance is societal-centric which interacts with diverse societal setups and institutions on a cross-sectional basis. Secondly, it establishes a link or chain of relationships between actors. Thirdly, partnership or network connection with multi-stakeholders or actors is a large basis. In short, adaptive governance is a combination or integration of ecological dynamism plus management structure plus public policy-making. The areas like - water governance, livelihood management, coastal management and climate change, and disaster risk reduction issues can be resolved with the help of adaptive governance. Bakkour (2015) stresses institution capacity-building policies such as public awareness, relief operation, and resource delivery capacity of government. Some of the working features of adaptive governance are namely (1) to build adaptive capacity- which means it focuses on building governance adaptive capacity to change or self-organize; (2) collaboration - open a window of partnership with societal actors to resolve societal problems; (3) knowledge and learning- it promotes indigenous method and scientific knowledge through learning by doing and policy initiatives and lastly (4) scaling- represents polycentric authority, mixed type hierarchy and economic management (Timothy Karpouzoglou et al 2016). Chandini Bedi (2019; Dialante et al 2011) mentioned important characteristics of adaptive governance are (1) dialogue between state, market, and institutions (2) polycentric governance system in environmental issues (3) flexibility approach; (4) collaboration of stakeholder; (5) public participation; (6) changes and innovation through knowledge exchanges.

Adaptive governance is also known for anticipatory, co-management, and management governance. This is also known as risk-reduction governance. It views that institution, policy, and norm-setting units are some major agents of risk management. It calls for the participation of the different ladders at different scales at the working organizational level for a greater benefit to people. Its main aims are the reduction of risk, increase livelihood security and capital management, and enhance the adaptive capacity of institutions. Policy effort, social learning, linking actors to find their place, and strengthening group approaches to meet any emergency need are the major determinants of adaptive governance (Hurlbert, 2018) The following efforts are concentrated under adaptive governance. The working methods of adaptive governance focus on the following ways-

- Doing planning to meet the anticipation of incoming risk, creating a concentrated response from the side of government regulators and private businesses, focusing on the poor and marginalized section is a central issue of analysis; Promoting the agenda of inclusive development; critical importance of institutions including networks, leadership, and structures in responding to a natural resource crisis; Systematic plan for risk mitigation in linking the institutional sphere
- creates a space for equitable distribution of resources through participation and inclusive governance by combining these elements
- Social learning (learning within social groups through interaction) occurs by addressing the complex systemic problems by changing and deepening understanding by improving routines, questioning assumptions, and changing norms, values, and assumptions underpinning strategies and action
- Reduce the extreme risk of disasters through disaster risk reduction and minimize the risk to livelihoods through the livelihoods approach
- Adaptive governance aims to address issues of inequity by addressing its institutional dimension (ibid)

Adaptive governance promotes inclusive development. The central concerns are discussed under

- the natural resource base and ecosystem services on which society depends (here in particular the issues of climate variability and change, and water, etc.
- issues of access to resources of marginalized people and the allocation of resources, rights, responsibilities, and risks within society
- Relational approaches to counter the concentration of power and this is addressed here primarily through a participatory process (ibid)

Following are the major areas of demand for adaptive governance

- The social and human dimensions of global climate change; Adaptation for agriculture production and livelihood management
- Strengthening the adaptive capacity of institutions (knowledge, experience, supply chain, technology, ideas, funding, creativity). Community empowerment (participation, inter-relationship, The Earth Systems Governance (ESG) Framework (ibid)

Conceptualizing Climate Change And Disaster Management

According to the United Nations Office for Disaster Risk Reduction (UNODRR,2022:18), disaster refers to a 'serious disruption of societal activity that tends to affect humans, economic, material, and environmental losses that turn into a serious vulnerability condition'. So, any form of vulnerable condition that is hazardous is equal to the idea of disaster. The Disaster Management Act (2005) also states that a 'disaster can be a form of calamity or catastrophe that arises out due to natural or human action resulted in heavy human suffering and property losses or any radical destruction that beyond of human capacity' (National Disaster Management Authority, 2024). Disaster management also implies making a continuous effort through an integrated way of

planning, organizing, and implementing to prevent any form of threat or risk and adapting the resilience method of capacity building (ibid, 2024). To O'Brien et al (2006) disaster management includes the reduction of risk posed by actual and potential hazards. For them, there are three important perspectives or lenses to classify hazards such as (1) natural hazards; (2) technological, and ; (3) emergency hazards. Further according to 'Global Natural Disaster Assessment Report: 2022 'The global pattern of natural disasters can be described in three important ways. Firstly, the spatial pattern of global natural disasters, secondly; the continental pattern of global natural disasters and finally, regional or countrywide global natural disasters (National Climate Centre, 2023: 10-13). Spital natural hazards address metrological or hydrological disasters such as floods and storms. Natura disasters result due to heavy temperatures and heat waves in ocean areas. Regional or countywide disaster reflects the frequency of disasters in a particular region or country(ibid, 2023). As OECD (2018:6) describes climate resilience stands for climate recovery or climate adaptation strategy. It focuses upon integrated planning or policy designing which anticipates, prepares, and is ready to adapt a rapid recovery program against any disruption or hazardous risks.

(A) International Framework On Disaster Management

In the international scenario, On 15 December 1970, the UN General Assembly first passed a resolution on the framework of Natural Disaster and Disaster Risk Reduction (NDDRR). It was perhaps the first international expression under the United Nations to the Secretary General of the General Assembly to prepare pre-disaster planning in national and international spheres for the parties states. Again the UN General Assembly came up with another important resolution in December 1971, namely the establishment of 'The United Nations Disaster Relief Officer (UNDRF). As a result, in January 1972, the UNDRF formally came into being. Faruk N. Berkol, a Turkish diplomat was appointed, as Director of UNDRO in Geneva. Despite that, the threat of natural disasters could not have materialized in any part of the world. During 1980, there were some destructive damages took place in many regions of the globe such as the Ethiopian droughts and famine of 1983–85, the Nevado del Ruiz volcanic eruption in Colombia (1985), and the Mexico City (1985) and Armenia earthquakes of 1988. For this large-scale devastation and dangerous disruption, the UNGA declared the International Decade for Natural Disaster Reduction (IDNDR) by proposing two other resolutions in the years 1987 and 1988 respectively. Therefore, 1979 to 1989 was regarded as a decade for natural disasters. In the same year, the 'Tokyo Declaration' was also announced to enhance the framework of IDNDR. To some extent, the year 1989 was a watershed period in the history of the development of the international disaster framework. The United Nations General Assembly organized another resolution on December 22, 1989, as a decade of the international community for the cooperation of disaster reduction and the second Wednesday of October as International Day for Natural Disaster Reduction (UNODRR, 2022: 6-18)

The International Decade for Natural Disaster Reduction Framework (IDNDRF) was established on 1 January 1990 following the adaptation of resolution 44/236 of the United Nations (UN). It was an international action framework, that primarily focused on reducing the intensity and degree of disruption in any form and risk possibilities in developing countries. The IDNDR consists of five goals and three programs. It says that the country will develop a sound mechanism for capacity building at the national legislation process to mitigate the effect of natural disasters; strategic building through scientific knowledge and innovative skill; technology building for the prediction, implementation, and assessment of natural disasters to prevents its risk, damages, and human lives. The three programs include namely risk assessment, mitigation plan, and warning system. At the institutional level, IDNDR has constituted the following organs (1) a special level committee; (2) a scientific and technical committee; (3) a secretariat; (4) a board of directors; (5) additional institutional arrangement; (6) the national committee on IDNDR and (7) regional IDNDR initiatives. However, the brainchild and founding father of the international decade for natural disasters was Frank Press, a geophysics and earthquake engineer for his leading role in pioneering the ideas of IDNDR while delivering a keynote lecture at the 8th International Congress of Earthquake Engineering in San Francisco in 1984 (UNDER, 2022: 18-26). Apart from that, the World Conference on Natural Disaster Reduction was held in Yokohama, Japan in 1994 on May 23-27. This was also known as the Yokohama declaration which emphasizes universal order to enact policy commitments at non-states and states action plans of developing countries and minimizing the gap of natural disaster occurrence (IDNDR, 1994:1-5). The Hyogo framework was also introduced in 2005, it included the period from 2005-2015. It was built up to the response to the Yokohama declaration. It was also an action plan that distinctively covered the problem of natural disasters and mechanisms for mitigation. Resilience building at the community level was the central goal of this declaration to tackle natural hazards across the globe and to oversee the progress report of states (ISDR, 2005). The Sendai framework (2015-2030) appeared at the third UN World Conference on Disaster Risk Reduction. It was a robust agenda that examined the major gap between the Hyogo declaration and Yokohama conference targets and failures. It addresses sub-national and national actors to prepare a national strategy roadmap for disaster risk reduction. It covered goals like reduction of disaster mortality by around 1lakh, reduction of national GDP loss, preparing disaster reducing strategy by 2020, and so on. It also includes four priority areas such as (1) understanding disaster risk; (2) strengthening disaster risk reduction governance at all levels; (3) investment for disaster resilience and (4) enhancing the capacity for disaster preparedness (UNDRD, 2015: 1-36)

(B) National Framework On Disaster Management

The first national institutional effort in disaster management in India was made in 2005. For the effective management of disaster risk a parliamentary initiative was made, wherein the presidential assent was made on 23rd December 2005, particularly known as the Disaster Management Act of 2005. This could be possible after a long fifty-six years of independence. The Disaster Management Act not only provides a comprehensive framework for capacity building at the institutional level but also prepares a national plan of resilience governance for risk prevention: Mitigation risk, resource management, and national policy-making. The act also recommended setting up six institutional bases namely (1) the national disaster management authority; (2) the state disaster management authority; (3) the district disaster management authority; (4) the local authority; (5) the national institute for disaster management; and (6) national disaster response force (Ministry of Law and Justice, 2005).With the approval of the union cabinet On 22nd October 2009 national policy on disaster management was laid down.

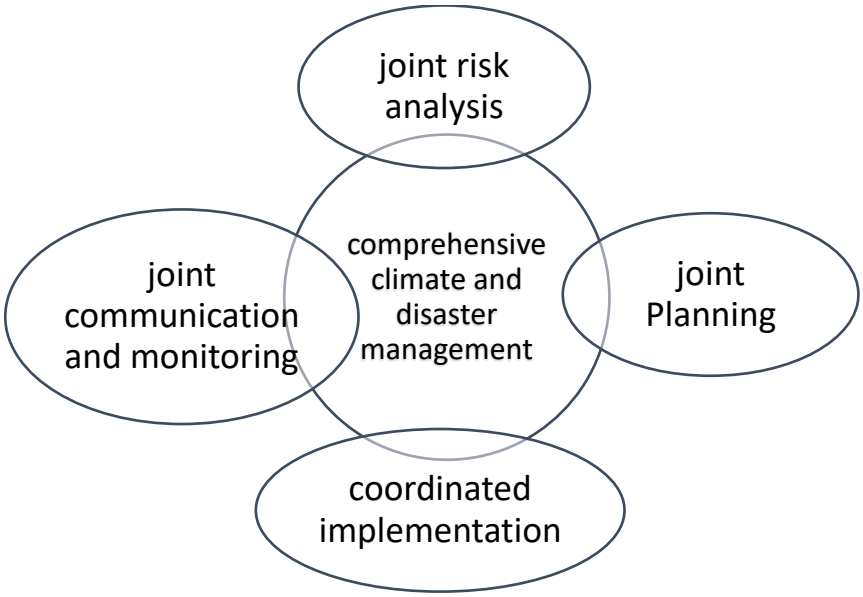

Figure-1. Collaboration for climate change and disaster risk reduction integration model
source: Regional Assessment Report on Disaster Risk Reduction 2023 Europe and Central Asia (2023)

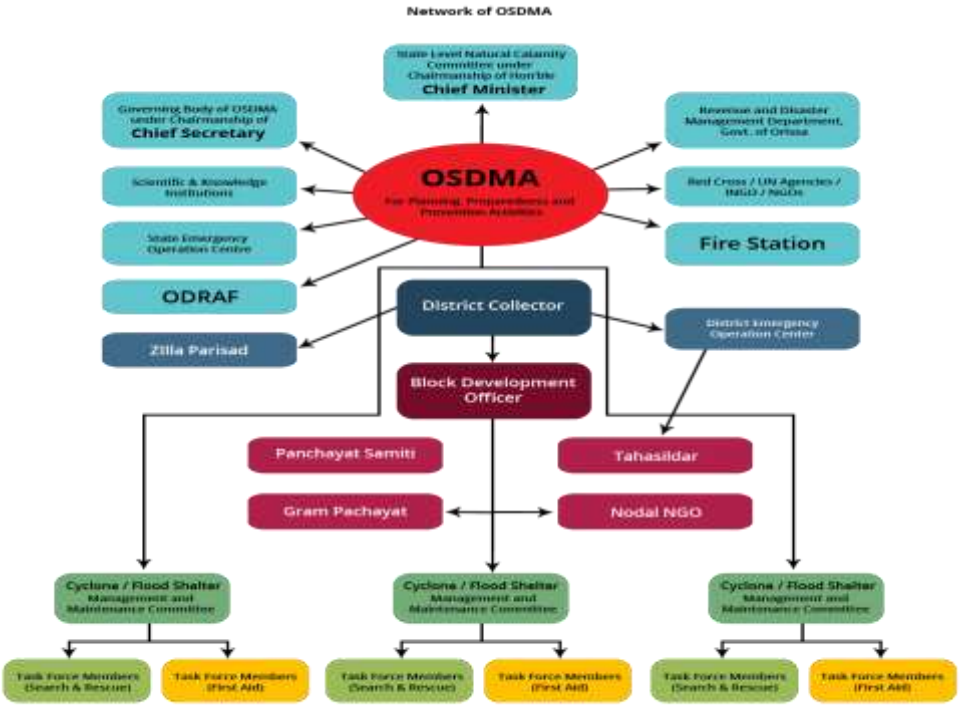

Figure -2
Source: Architecture of Odisha State Disaster Management Authority(OSDMA),

Approaches To Study Adaptive Environmental Governance In Odisha

Colin Walch (2019) rightly pointed out that Odisha set an example in using adaptive governance in 2013 for the first time. The government constituted a flexible and efficient governance approach to reducing possible disaster risk and tropical changes in Odisha after the severe Super Cyclone of 1999. The state of Odisha invites inter-governmental and interdepartmental cooperation, which is a more flexible working approach, based on learning by doing, and a reduction of ecological and economic damage which are some important features of the adaptive environmental governance as led by the Indian state of Odisha. Reducing possible disaster risk, predicting uncertainty, assuring to get out of traumatic conditions, and collaborating with the stakeholders and non-governmental institutions are important needs of adaptive governance, on the other hand, to bring behavioral changes. Adaptive governance is a significant tool of coastal management (Sahoo and Satpathy,185:2020) for fixing possible disaster risks. Odisha is a poor, vulnerable, and highly disaster-prone region that requires adaptive governance to adjust economic, political, and social risks at all levels and to overcome sudden disaster consequences.

Four cases have forced the Odisha government to use adaptive governance in the present decade such as Super Cyclone 1999, Phailin (2013), Hudhud (2014), and Titili (2018). The eastern Odisha of the Bay of Bengal is a most suffered climate zone and station of disaster happening every single year. Mishra and Satpathy (2020) noted that floods, cyclones irregular rainfall, drought, and poverty are the associated consequences of climate change in Odisha states. Flood problems in many parts of Odisha state combined with a regular problem during monsoon and non-monsoon time. If the flood problem is not controlled there is a severe threat to the livelihood, livestock, community, and poor people—the suggested criteria of the method that based on certain variables in decision-making levels at the flood situation. Adaptive governance shares and enables the key process of a multi-cellular decision-making (MCDM)center by using a collaborative approach. It is based on the expert views of experienced people who served this critical service in adverse situations and as a need during a difficult period of flood in the rural and urban districts of Odisha. In the words of Pal et al (2017), another name for adaptive governance is risk-reduction governance. This is also known as risk management or risk alternative governance. Developing administrative preparedness at the institutional level during the cyclone of Phailin (2013) on the eastern coast of Odisha state can be argued as the adaptation of adaptive governance. A holistic governance system is a real-time picture to control this disaster. Federal unit shares help to strengthen cooperative federalism in Odisha states. There is another possibility that shares adaptive governance pre-prepared, risk-reduction, and advanced resilient methods. The disaster risk is starched up to west Bengal, Andhra Pradesh, from the Bay of Bengal. Coastal cities like Ganjam, Puri, Pradeep, Jajapur, and Jagatsinghpur remained hotbeds of climate and disaster risk every year. Loses of livestock, property, physical infrastructure, and quick evacuation from dangerous situations are some of the strong features of adaptive governance adopted by the Odisha state.

In a negative sense, adaptive governance means adopting the best governance plan to manage uncertainties, possible risks, and calamities that result from maximum suffering. This process can fix flood management, coastal management, ecosystem management, and climate risk management. Adaptive governance is also known as disaster management governance. A trusted plan for future courses of action in controlling, managing, and reducing the risk of severe hurricanes, natural hazards, and critical weather conditions. Positively, offering the right direction at the administrative scale like ensuring development policy, Strengthening the capability of the institution, Efficiency rebuilding, appointing trained officials to mitigate disaster risk, Public-Private Partnership (PPP), community governance, trust-building, and client satisfaction. The Socio-Economic scale is managing socio-ecological costs, Resource scarcity, Poverty and health risks, Farmer death, Livelihood, managing Food shortage); and the Political scale is strong willpower, Policy advocacy, Preparedness, Dynamic of people's demands and needs, and economic funding). However General principles are - creating awareness, disaster alerts, news broadcasting, publishing official risk index, evacuation-resettlement, and relief assurance to migrated inhabitants. Coastal governance is also meant to be coastal management, recovery of damages, deforestation, electrification, infrastructure reconstruction, and building evacuated places to get zero casualties.

Suggested Academic Work On Adaptive Environmental Governance In Odisha Disaster Management

Author	Name of Disaster	Notable Study Areas	Key Focused Areas
Yamini Meduri (2016)	"Hudhud Cyclonic storm"	prepared and coordinated relief operation Mechanism	Reduction of vulnerability, relief recovery operation, and disaster management.
Das and Dsouza (2020)	Hudhud and Phailin cyclonic storm	Resilence of community-affected areas based on socio-economic variable	Focuses on the resilience-building approach
Biswanath Das (2016)	Hudhud and Phailin cynonic storm	People evacuated to a safe place	Scrutiny and planning for a more successful governance process

Mohanty et al. (2020)	Super cyclone, Phailin, Hudhud, titli, Fani, and Bulbul	Management of the power sector	Strengthening of funding mechanism for building resilience in governance
Mohanty et al. (2020); Potel (2018); Yadav and Brave (2014)	Super cyclone to present (2020); Phailin (2018;2014)	Risk management in Odisha (2020); Flood management in coastal areas (2018); Capacity building in disaster preparedness (2014)	Institutional policy engagement at the national and international level (2020); engagement of stakeholders; with the local community for management, and evacuation of people (2018;2014)
Panda et al. (2020)	Fani (2020)	Resilence of Disaster Risk in Coastal Areas of Odisha (2020)	A Semi-structural preparation for shelter arrangement
O.P.Mishra (2023)	Early phase 1999 to 2004 disaster in Odisha	Advocacy of Odisha Disaster Model	Robust infrastructure response mechanism
Acharya and Panda (2019)	Super cyclone to titli	Livelihood issue of coastal areas people	Socio-economic mechanism to strengthen supplies chain towards people

Research Design
Methods and Materials:

It is based on the doctrinal method of social science research. Government annual reports and primary publications have been followed extensively. The collected data are largely from government official sources that have been shared by the government of Odisha. Legal, administrative, and institutional frameworks have been extensively used to give a plausible outcome at the end of the research. Odisha State Disaster Management Authority (OSDMA) is a major part of the analysis, apart from that a detailed and extensive literature work has been followed. Newspaper input, articles, books, and journals played a major role in the analysis of this discussion.

Objectives of the Study:

The following are the major key objectives of the research work -
A. To understand the concept of climate change and disaster management.
B. To know the key importance of adaptive environmental governance in the context of Odisha.
C. To elucidate the theoretical perspective of adaptive environmental governance.
D. To delineate the socio-economic issues and disaster profile of Odisha.
E. To examine the status of the Odisha Disaster Model.

Working Hypothesis:

- Adaptive governance will reduce the possible property loss, lives, and livelihood losses in the coastal areas of Odisha
- Adaptive governance is based on community-driven and risk-reduction governance
- Stakeholder and government partnership is the best method of fixing disaster risk in Odisha.

Studying The Socio-Economic Profile Of Odisha

Odisha is the 'hotbed' of climate change and disaster risk. In the east, the sacred ocean of the great Bay of Bengal is situated. The coastal areas of Odisha stretch 488 km which covers around 4.87 percent of the total area of the country. Odisha has Chhattisgarh in the west; and Andhra Pradesh in the Southwest part whereas West Bengal, Bihar, and Jharkhand states are called the North-East states. The state is full of richness and cultural diversity. More than 37 percent of the land is acquired under forest cover. The state has the mineral potential of ore, bauxite, coal, and iron resources. The male literacy ratio is 81.59 percent and the female 64 percent as per the 2011 census report. The state has 3.9 percent of households in India. In terms of the labor force, 39 percent are marginal workers and 61 percent are main workers from the state of Odisha. Odisha is an Agro-economy-based state—particularly an industrial-based economy. Odisha has a rural background. Around 83 percent are from rural areas. Crop production and agriculture are the lifeline and backbone of the state. This is an important medium of people's livelihood in the state. The state is often recognized as backward and poor in India (Odisha State Disaster Management Authority, 2023). It is odd to know how well a state will stand after a 100-time cyclone and natural calamities from 8191 to 2014. The Odisha people have seen the terrible destruction of 1971, 1999, and 2013 severe cyclones and natural disasters which were highly destructive and damaged lives and livelihoods in the state (Odisha State Disaster Management Authority, 2014)

Locating The Case Of Hudhud 2014: A Brief Study Of Odisha's Disaster Profile

In 2014, the government of Odisha declared "Hudhud" a very severe cyclonic storm in the state. With just a passing one-year gap of the terrible severe cyclonic storm of Phailin in 2013, the state again came under a heavy alert to face the Hudhud cyclonic storm. Yet the state is ably managing it. Firstly, the government of Odisha

with the help of the Revenue and Disaster Management Department (RDMD) and Special Relief Commission (SRC) started a pre-preparedness assessment unit to tackle disaster risks (Odisha State Disaster Management Authority, 2014). 15 districts of Odisha were pointed out as affected zones special for cyclonic storms. Except for the coastal areas of Odisha, Kalahandi, Malkangiri, Mayurbhanj, Koraput, and Koenjhar were focused by the district administration. India's metrological department is a special agency that informed about the progress of cyclonic storms from the Andaman Sea (ibid: p1). 33 lakh people of Odisha were affected by the cyclone of Hudhud. From 15 districts 37 local urban bodies and 9657 villages under 1276 GPs of 99 Blocks and 508 wards, people were affected. The physical property of kuchha and pukka houses was also damaged. Under severe damage 2799 kuchha houses were listed. 343 pucca houses & 40,244 kutcha houses have been partially 21 damaged (ibid: p20)

Table No.1. A Profile of the Hudhud Disaster Damage in Odisha

Sl.No	Type of Damage	Total Number
No.1	**House Damages**	
	House damage	2799
	Full Pukka House damange	343
	Partial Kuchha House damage	21
	Full Kuchha House Damage	40244
No.2	**Crop Damage**	
	The hectare of agricultural area	2,47,557
	hectare have sustained crop loss of more than 50%	40,484.50 hectare
No.3	**Livestock Affected**	
	Large size animal	198
	Small size animal	472
	Livestock Poultry	39350
No.4	**Losses of Livelihood**	
	Standing mulberry crop	210.8
	Eri crop in hectare of land	40.6
	747 sericulture farmers	747
	Loss of Equipment and Materials of Traditional Artisans	718
No.5	**Damage to Nets and Boats of Fishermen**	
	Boats	30
	fishing nets	171
	fish ponds	141
	Fish farm in Hector	53.15

Sources: Based on Government of Odisha, Memorandum on the severe cyclonic storm Hudhud, 2014, Odisha State Disaster Management Authority https://www.osdma.org/publication/hudhud/#gsc.tab=0

Major Working Agencies Of Odisha's Adaptive Environmental Governance During The Operation Of 'Hudhud' Cyclonic Storm

- District Emergency Operation Centre
- Chief secretary of Odisha government at the departmental level
- Chief secretary of Odisha government at departmental levels
- Revenue and Divisional Commission of Odisha
- Collector and Managing Director of the Odisha government
- The Odisha Disaster Rapid Action Force (ODRAF),
- Fire Service Units and the National Disaster Response Force (NDRF)
- The Departments of Works, Rural Development, Panchayati Raj, and Housing & Urban Development
- DISCOMs and District Administration, power supply agency

Sources: Based on the Government of Odisha, Memorandum on the severe cyclonic storm Hudhud, 2014, https://www.osdma.org/publication/hudhud/#gsc.tab=0

Institutional Efforts For Budgetary Allocation
Table-2

Sl.No.	Categories	Numbers	Assistance of Cost
Lost Families' member	SDRF Norms	3	4.5 lakh
Clothing and utensils for families	SDRF Norms	3640	92.82 Lakhs

Gratuitous Relief for families	SDRF Norm	_____	249.31 lakh.
Cost of Search and Rescue measures:	SDRF Norm	2,55,043 evacuated	.126.00 lakh
Provision for temporary accommodation, food, clothing, and medical care	SDRF Norms	2.55 lakh people	Rs.539.13 lakh
An emergency supply of Drinking in rural areas and urban areas	Rural Area	_____	94.12 Lakh
	Urban Area	_____	22.00 laks
Clearance of Debris in public areas	SDRF norms	_____	7.92 lakh
Disposal of Carcasses:	SDRF Norms		5.35 lakh
De-silting of Fish Farms	SDRF Norms		4.31 lakh
Agriculture input subsidy to SMF farmers where crop loss is 50% and above	SDRF Norms	2,47,557 hectares of affected arable land	2377.89 lakh
Input subsidy to farmers other than small & marginal farmers:	Irrigated land	502 hectors	71.97 lakh
	Non-irrigated land	1072 hector	
	Perennial corps	20 hectors	
Assistance to Small and marginal Sericulture farmers	SDRF norms	747 no sericulture	Rs.8.05 lakh
		40 heaters of Eri	
		210.8 hectares of Mulberry crops	
Replacement of milch/ draught animals	SDRF Norms	--------	41.78 lakh.
Provisions of fodder/feed concentrate in the cattle camps:	RDRF Norms	----------	30.69 lakh
Assistance to fishermen:	SDRF Norms		Rs.4.91
Repair/restoration of the immediate nature of the damaged infrastructure in eligible sectors	Road and Bridge	37431.18 lakh	Rs.72758.215 lakh
	Rural-Urban Water Supply	8565.24 lakh.	
	Irrigation	8010.435 lakh	
	Community Assets owned by Panchayat	Rs.4460.15 lakh	
	Primary Health Centres	60.80 lakh	
	Primary School Buildings	3795.41 lakh	
	Repair and restoration of the power supply	10435.00 lakh	

Sources: Collected from Government of Odisha, Memorandum on the severe cyclonic storm Hudhud, 2014, https://www.osdma.org/publication/hudhud/#gsc.tab=0

The Odisha Disaster Model: Based On Zero Casualties

In 2021, the hon' C.M. Odisha Sri Naveen Patnaik was felicitated with a prestigious award by the UN chief Secretary for implementing an effective disaster management governance against phailin cyclonic storm. This gives a realistic example of Odisha's disaster model based on the zero casualties approach. The government of Odisha successfully evacuated more than 6 million people to the nearest evacuation center. Again in 2013, the government set an early example of disaster management for its successful action and road mark to overcome severe cyclonic storms in the coastal belt of Odisha (Thakur, 2021). The post-disaster response system of Odisha was studied by Prof. Santosh Kumar, the head of the National Institute of Disaster Management (NIDM) comparatively from 1999 to 2019. According to his observation, the state of Odisha developed a new capacity-building approach to face disaster management action plan which is known as the Odisha disaster model. Through this model, the state of Odisha has placed an innovative approach for institutional capacity building, risk management, casualties, evacuation, property losses, poverty reduction, and other related problems against severe cyclonic storms. With the coordination of the India Metrological Department (IMD) and India Disaster Management Authority (IDMA), Odisha became the first state to develop an early warning system in 2018 for the management of natural disasters or any cyclonic storm from sea level to 480 km (Mohanty, 2021: 2-9)

The following are major action plans laid down by the state of Odisha for the disaster management governance model.

- In 2018, Odisha established an early warning system for natural disasters known as the Early Warning Dissemination system to trace the possibilities of cyclonic storms before the 480 km range of the starting point.
- In 1999, Odisha had only 23 cyclone shelters which expanded to 870 cyclone and flood shelter
- Odisha has also established 16 district-level disaster management planning committees which include 155 block-level disaster management planning committees and 22000 village-level disaster management committees.
- Odisha has 20 units of ODRAP or Odisha Disaster Rapid Action Force with all urgent skill and trained capacity staff.
- Now the state of Odisha has launched a few schemes to tackle disaster effects including Biju Pucca Ghar Yojana (BPGY), Mo Kudia, or Pradhan Mantri Grameen Awas Yojana(PMGAY) (Ibid, 2021)

Table No-3. A Comparative Analysis Of Cyclonic Storms From 1999 To 2021 And The Result Of The Odisha Disaster Model

No.	Year	Name of the storm	Affected people	Death toll	Damage worth
1.	1999	Super cyclone		10,000	
2.	2013	Phailin	1.1 million	59	4, 240 crores
3.	2014	Hudhud		Nil	
4.	2018	Titili		77	
5.	2019	Fani		89	
6.	2020	Amphan		N/A	
7.	2021	Yaas		NIL	
8.	2021	Gulab	1.35 million	NIL	
9.	2021	Jawad		NIL	

Sources: From the analysis of Hindustan Time (2021, May 26). 'How the Odisha Model of disaster preparedness came into being'. https://www.hindustantimes.com/cities/cyclone-yaas-how-odisha-s-model-of-disaster-preparedness-came-into-being-101621969683964.html and Government of Odisha Special relief commissioner revenue and disaster management authority (2022). Annual Report on Natural Calamities 2021-22.https://srcodisha.nic.in/annualReport/4vP2yUSqANNUAL%20REPORT%20ON%20NATURAL%20CALAMITIES,2021-22.pdf

Discussion

The present study discusses a systematic overview of the significant role of the adaptive governance system in Odisha. In this respect, the study made a theoretical attempt to find out the needful role of adaptive governance to mitigate future uncertainties and disaster risks with the help of multilevel stakeholders. Here, the Odisha State Disaster Management Authority (OSDMA) played a central role in strengthening adaptive techniques and tools to meet the immediate consequences of disaster. Providing an institutional support system and resilience-building approach is the major objective of adaptive governance. Along with this, sharing power, autonomy, institutional flexibility, and resource allocation at different segments of the management system can be possible. It mainly represents the odisha disaster model system that is a by-product after so many adverse and devastative cyclonic storms like the super cyclonic storm of 1999, titli, Hud Hud, Phailin, and so on.

Conclusion

From the above discussion, it can be assumed that the strategy of adaptive governance has been used as an important source of management tools against climate change and disaster occurrence in the state of Odisha. The state of odisha could easily overcome any breakthrough disaster happening in recent cases by adopting adaptive governance methods. No doubt, odisha is an agricultural-based state. Most of the populations and livelihoods depend upon the best pattern of weather system.

However, due to constant catastrophes at the bank of the Bay of Bengal, the state was recently forced to adopt more resilience techniques to fight against natural calamities. Adaptive governance thus ensures a robust agenda which increases the rate of collaboration among the stakeholders and community engagement by applying this method.

It is also noted that adaptive methods an anticipatory and risk-reduction methods. It alerts both institutional and government agencies to remain prepared to counter climate adversities that regularly happening in the state of Odisha. After the 1999 super cyclone odisha modernized its perspective and marked itself as one of the successful states to adopt adaptive governance to face off climate hurdles and was awarded internationally under the leadership of Naveen Pattanaik.

Limitation of the Study

The study is adopted in the context of climate change and disaster management in the state of odisha. Here adaptive governance is used to resolve immediate socio-economic problems by calling the diverse sets of stakeholders to minimize a wide range of risks and future uncertainties in the present time. The Case of 'Hud Hud' as a cyclonic storm has only been focused on.

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