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Article

Sustainable Livelihood and Effective Disaster Response: A Case Study of Phailin Cyclone of Odisha, India

Damodar Panda [1,*], Rashmi Rani Anand [2] and Maya Devi [3]

[1] Department of Geography, Utkal University, Vani Vihar, Bhubaneswar, Khorda District, Odisha 751004, India

[2] Centre for African Studies, School of International Studies, Jawaharlal Nehru University, Munirka, New Delhi, Delhi 110067, India

[3] Department of Physics, Kalinga Institute of Industrial Technology, Bhubaneswar, Odisha 751024, India

[*] Correspondence: damodar_65@rediffmail.com

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Abstract: The Odisha coast is one of the most cyclone-prone areas of India. In recent years, the state experienced two catastrophic tropical cyclones: the 1999 Super Cyclone and Phailin in 2013. Due to the impact of cyclones, the infrastructure and occupation of the people are severely affected. In coastal Odisha, people primarily rely on agriculture, livestock, pisciculture, and horticulture for their livelihoods. Storm winds, heavy rainfall, and storm surges from sea waves inundate cultivable land, damage horticultural plants, and kill domestic animals and poultry birds. The state government provides financial assistance for the recovery of the loss, which is inadequate. Therefore, people find an alternate source of income to overcome the loss. This research article aims to explore the relationship between disaster management and livelihood security in the context of Very Severe Cyclone Phailin. The study demonstrates that community-level cooperation and government support at the state and national levels in disaster risk reduction have led to the protection of human life and a decrease in people's suffering. To make disaster management effective, the government's initiatives in community involvement in preparedness, response, and recovery can reduce disaster risk and protect the livelihoods of vulnerable people. This article examines various measures implemented by the government and proposes necessary improvements to mitigate disaster risk in livelihood support following tropical cyclones in the state.

Keywords: Sustainable Livelihood; Phailin; Impact; Response; Relief; Compensation

1. Introduction

Odisha, with its 480 km long coastline, is located on India's eastern coast. The coastal zone of Odisha is very vulnerable to frequent cyclonic storms due to its physiography and location (**Figure 1**). Fourteen districts of the state, including six coastal districts, are prone to cyclones [1]. The state generally experiences two cyclone seasons: the pre-monsoon and post-monsoon seasons. The post-monsoon season (October and November) cyclones are very destructive [2]. The coastal settlements are frequently damaged by cyclonic storms, which are accompanied by storm surges, torrential rain, floods, and high wind speeds. The storms turn in a north-northeast direction towards the state. In the world, the east coast of India is the sixth most cyclone-prone. Over the last 130 years, Odisha has experienced 97 cyclones, including 23 severe cyclones. The Impact of climate change has resulted in an increasing frequency, magnitude, and intensity of cyclones. The coastal region of Odisha, located north of Puri, where the

majority of storms and depressions cross the state, is the most vulnerable. The modern forecasting technique faces significant challenges in predicting the evolving nature of cyclones.

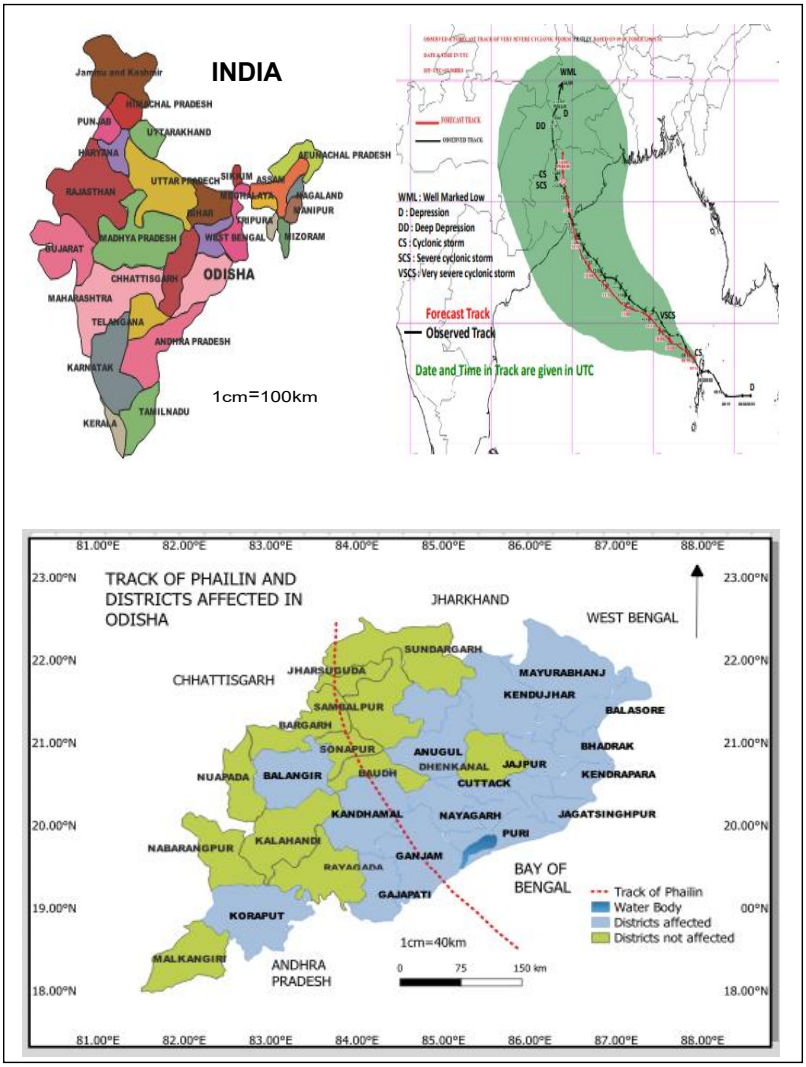

Figure 1. The Study Area and Track of Phailin (IMD).

The livelihoods of the rural people are significantly affected by cyclones as most people depend on natural resources sensitive to climate [3]. People living in traditional houses made up of local materials not resistant to cyclones and floods and depending on agriculture are mostly affected as their houses and crops are easily damaged. The situation was further aggravated by further damage to the infrastructure and power supply. The sufferings of the people are aggravated day by day by the increasing intensity of the cyclones. After the 1999 Odisha Super cyclone, which inflicted heavy casualties and loss of property, the government of India and the Odisha government adopted prevention and mitigation measures for disasters. As a result, the loss of life in subsequent cyclones could be minimized; however, the loss of property is still high, affecting the livelihood of the affected people. The government initiated several measures after the disaster to normalize the situation, including the livelihood support. In comparison to the loss, the government's assistance is minimal; thus, the livelihood of the people is unsustainable. This article aims to study the management of cyclone disasters for livelihood security and suggest appropriate measures for sustainable livelihood in the face of disasters in Odisha. It examines Cyclone Phailin and its impact on livelihood assets, the role of the government and community in disaster management, and identifies the drawbacks in the process of protecting livelihoods through improved community resilience and government policy.

2. Materials and Methods

Both qualitative and quantitative methods are employed to analyze community coping strategies and livelihood security on the impact of cyclone Phailin. The required information is collected from the memorandum on Phailin submitted by the SRC, Government of Odisha, to the Government of India as well as interaction with affected people regarding their role, community contributions, and the role of the government and NGOs. The memorandum is an official document available to the public based on facts and figures collected from the affected areas. The primary data collected at the village level are cross-verified for accuracy regarding the distribution of compensation and subsidies. Print and electronic media play a vital role in the dissemination of accurate information on the impact of Phailin, community response, the role of government and NGOs in response, relief, and rescue. The collected data were analyzed to assess the impact of Phailin on the livelihood of the community, as well as the community and government response to it.

The "sustainable livelihood approach (SLA)" framework of UNDP is applied to study the livelihood assets due to the impact of disasters. The 1987 UN Environment summit developed SLA as an innovative tool to consider people's livelihood in the context of vulnerability [4,5]. It has three components: livelihood (natural, social, physical capital and human financial), vulnerability (shock, trend, and seasonality), and structure and processes transformation (institutional management) (**Figure 2**). People can have a wide range of livelihood assets depending on the natural disasters and institutional management. The maximum wind speeds and precipitation are likely to increase in tropical cyclones; therefore, the institutional management system needs to be strengthened to mitigate the impact. It has been applied flexibly in various ways to develop the most effective adaptive strategies in disaster management [6,7]. The livelihood assets were widely impacted by Phailin. The tropical cyclone impacted livestock, crops, land, planted trees, drinking water, irrigation, transportation, industry, and power supply. Income, food prices, and job opportunities were adversely impacted. Social aspects were affected between the community, government and NGOs.

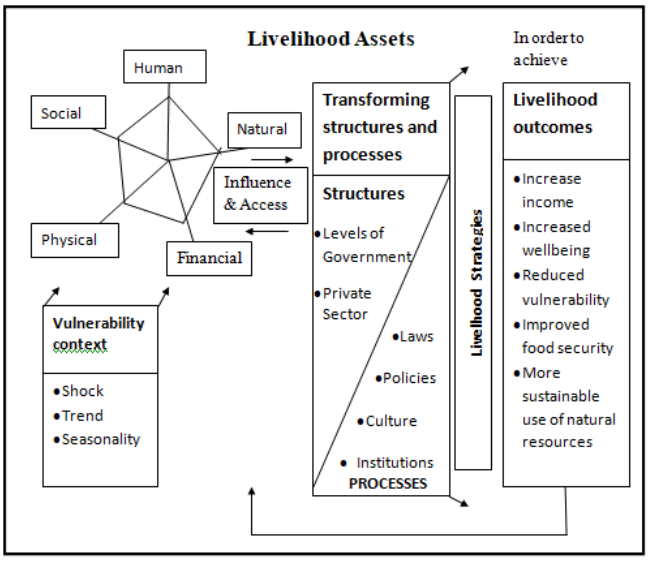

Figure 2. Sustainable Livelihoods Framework (Modified from DFID).

3. Overview of the Literature

Asia is the world's most disaster-prone area. In this region, the highest number of people are killed and affected by natural disasters. Due to its impact, a huge economic loss occurred [8]. The most common type of natural disasters experienced are hydro-meteorological disasters, including tropical cyclones [8]. The Fifth Assessment Report of the Intergovernmental Panel on Climate Change of Working Group 1 states that, though the number of cyclones may not increase, their wind speed and rainfall intensity will increase. The impact of cyclones will be greater in the coastal regions. Out of 35 severe tropical cyclones in the world, 26 cyclones developed over the Bay of Bengal [9]. Across the world in recent years, the frequency and magnitude of disasters are increasing, resulting in

increased human suffering [10,11]. These disasters have negatively impacted infrastructure, property, and human lives. In the last decade, 75,000 people were killed annually, and 200 million were affected by natural disasters. This resulted in an economic loss of USD 162.2 billion and is likely to increase in the future [12].

The risks of disaster depend on global climate change, population growth, weak legislative measures, the absence of disaster management (DM) institutions, and inadequate government capacities at both national and local levels [13].

The mitigation of the impact of disasters needs a comprehensive policy that includes a multi-sectoral, multidimensional, and community-based approach to disaster management [6]. A holistic and comprehensive DM policy can be adopted and implemented by the government within the structure of the government DM as a central component [8]; as an effective legal framework at all levels, the responsibilities, duties, and mandates, of all relevant stakeholders must be enacted [14], along with coordination with the local–level government and community through an institutional framework and necessary mechanisms [3,15,16]. Many countries of the world have developed DM systems based on their past experiences, availability of resources, political structures, cultures, legal contexts, and vulnerability to disasters [17].

The Government of India enacted the Disaster Management Act 2005. The implementation of disaster management plans is monitored to ensure their effective execution by various government departments, thereby preventing and mitigating the effects of anticipated disasters.

The government formulated the disaster management plan based on past experiences from natural disasters that took a heavy toll on lives, such as the Odisha super cyclone in 1999, the Gujarat earthquake in 2001, and the Tsunami in 2004. As part of awareness generation, Disaster Management is included in the study and research. Capacity building is one of the major components of Disaster management. Steps are being taken to create skilled and trained professional manpower through Disaster Risk Reduction education.

The factors that contribute to community vulnerability to natural disasters include social, environmental, financial, and community-specific factors. Climate change-induced natural disasters have been a global concern and a challenge for humanity for centuries. The developing countries are more affected by natural hazards, lacking the most basic resources.

An individual, group, or community's livelihood resilience involves anticipating and mitigating livelihood challenges, recovering from past and present vulnerabilities, and adapting to a challenging livelihood environment [18].

Livelihood is a complex concept that people understand through its consequences, and adopt a particular livelihood approach to live [19]. Livelihood refers to how people meet their basic needs by utilizing available resources and sustain themselves in the face of stress and shocks [20]. Livelihood encompasses the local resources that communities use, including traditional local knowledge, social organizations, solidarity networks, skills, and technology [19]. A sustainable livelihood can withstand and recover from stress and shock, enhance or maintain its assets and capabilities, and provide sustainable opportunities for the next generation [20].

Extraordinary measures are taken in rare events of disasters to alleviate people's hardships related to the resources and assets that are part of their everyday life [21]. People access and use resources that are exogenous to them, depending on their capacity to recover from disasters [9]. To overcome the impact of disasters, people depend on receiving sufficient support from the government, Non-Governmental Organizations (NGOs), and the provision of insurance and loans [5]. Communities and individuals' access to livelihood resources, such as social networks, legal rights, employment, healthcare, credit, savings, or external assistance, determines their resilience or vulnerability to disasters [22].

Individuals and social communities during and after disasters are not passive; they demonstrate the ability to adapt to changing environments or overcome disasters. For example, using traditional housing and shelters in the Solomon Islands, the indigenous people of Tikopia survived Cyclone Zoe in 2002 [23]. In 1990, Cyclone Ofa hit Samoa, and the traditional houses commonly built up of local materials were rebuilt within 5 months, but none of the European–style houses were rebuilt during this period. The cooperation of kinship is vital in dealing with disaster management [24]. The needs and perceptions of recovery of the disaster-affected people are different from those of the government and external agencies. To strengthen people's livelihood and recovery, the disaster response mechanism should be built at the local level [24]. In Indonesia, the empowerment of communities of their household, local wisdom, and gender, including traditional values, culture, and religion, helps the communities manage their livelihood resources and effectively reduce disaster risk [25]. In Malaysia, natural assets, physical

assets, and social assets are significantly related to the sustainable livelihoods of the vulnerable community [26]. Over four years of experience on post disaster reconstruction have identified good practices such as reconstruction settlement should be linked to formerly existing livelihoods and promote gender equity through improving their economic situation, sustainable use of natural resources, and community participation in the reconstruction and livelihood interventions process, which are highly relevant for the further post disaster recovery process [27].

4. Results

4.1. Impact of Phailin

The IMD informed the origin of the Phailin over the Bay of Bengal near the Andaman Sea at a distance of 1350 km from the Paradeep coast of Odisha. After its origin, Phailin moved in a northwesterly direction and struck the southern coast of Odisha at Gopalpur on the 12 October 2013 at 9.15 pm with a wind speed of 205–220 kmph. After striking the coast, the cyclone ravaged the coastal districts of Ganjam, Khurda, Puri, Kendrapada, and Jagatsinghpur with wave surges reaching up to 3.0–3.5mtrs height. The adjoining coastal districts affected are Gajapati, Koraput, Nayagarh, Keonjhar, Mayurabhanj, Balasore, Bhadrak, Jajpur, Cuttack, Bolangir, Angul, Kandhamal, and Deogarh (18 districts). Between 10 and 21 October, the state recorded incessant rains and floods with high wind speeds, causing serious damage in the State. It resulted in inundation of the coastal regions, damage to houses, croplands, and infrastructure. Most of the damage was in the Ganjam district, where Phailin made landfall. Due to its impact, 132.35 lakh people in 18 districts, 171 blocks, 18,374 villages and 44ULBs were affected (**Table 1**). In the post-super cyclone 1999, no action was taken on the vulnerability assessment of the community.

Table 1. Impact of Phailin in Odisha.

Items	Number	Items	Number
Number of districts affected	18	Length of road damaged in km.	19,837.65
Number of villages affected	18,374	Number of schools buildings damaged	5,828
Number of people affected	23,235,981	Number of community assets damaged	4,199
Cropped area affected in ha	1,100,501	Length of the river and the canal embankment damaged in km	1,580.28
Houses damaged	541,200	Number of irrigation projects damaged	6,759
Number of humans lives lost	44	Fishing community boats and nets damaged	40,256
Number of persons with grievous injuries	61	Traditional craftsmen affected	15,333
Animals lost including poultry	1,76,525		

Source: SRC, Odisha.

4.2. Natural and Financial Capital

The Phailin affected 18 districts of Odisha with a population of 29,505,988 and a population density of 394/sq.km. Most people live in villages. The major occupations of the people are agriculture (62%), livestock (85%), labourers (60%), and household industry (4.5%). Due to the impact of Phailin, approximately 1,100,501 ha of cropped land were affected, resulting in crop loss of more than 50% in 6,51,590 ha. Total crop loss was $268,934,525.89. Livestock are called the poor man's ATM as they support family income. People in villages keep livestock as an additional source of income and to meet their additional nutritional requirements. Animal waste products are also used as manure for crop growth. Animals usually consume the crop byproducts. Some people exclusively depend on livestock for their livelihood. Drought animals are used for plowing the land and transporting crops from the field. In order to save the livestock from the impact of Phailin, steps were taken to shift them to safe places and provide fodder and drinking water. In spite of some preventive measures taken, a large number of livestock and poultry birds were killed by strong winds and damage to their sheds. About 70.59 lakh livestock were affected, including large—3,250,810; small—1,439,028; and poultry—2,368,865. The total number of animals killed was: large—1,500, small—3,002, and poultry—170,970 (**Table 1**). The loss of animals is much less than the loss in the Super Cyclone of 1999 because of adequate preventive measures taken by the community and the government. Due to flooding of the grazing land, animals suffer from not getting green fodder, thus reducing milk production. Due to the loss of raw materials, 3,455 traditional craftsmen, 767 handloom weavers, and sericulture farmers had their livelihoods affected. To survive, they choose an alternate livelihood.

Due to crop and livestock losses, the livelihood of the rural population was affected, as their source of income was drastically reduced. The prices of essential commodities were exorbitant due to a supply shortage following

the disruption of the communication network. Marginal farmers and agricultural laborers are forced to migrate in search of work outside. The compensation provided to the affected people is based on the Odisha relief code. The input subsidy is provided to the farmers whose crop loss is more than 50% and it varies from rainfed, irrigated, and perennial lands. For livestock replacement, one large animal and four small animals per household. Assistance provided for the repair of damaged houses varies from $14.58 to $817. The assistance provided by the government is much less than the actual loss, which has adversely affected the livelihood of the people. Animal farmers' income was reduced, adversely affecting their livelihood. Due to the death of small animals and poultry birds, farmers incur heavy losses, and cost of meat increased in the market. The compensation given to them is much less than the actual loss.

4.3. Human and Physical Capital

In any natural disaster, precious human lives are lost mostly due to lack of awareness and ignorance. It is a challenging task to save the precious lives from the fury of disasters. As part of the disaster preparedness plan, the state government took several measures to minimize the loss of human life. After getting cyclone warnings, instructions were issued to the district collectors by the SRC to ensure zero casualties in the likely affected districts. As preventive measures, people living in temporary houses and low-lying areas must be shifted to nearby multipurpose cyclone/flood shelters or other buildings identified as temporary shelters before the cyclone makes landfall. It must be ensured that no one is allowed to stay in temporary houses. People were appealed through print, electronic, and announcements by the public address system to move to safer places along with valuables, food, important documents in polythene bags, and domestic animals. 11.55 lakh people were evacuated in a unique case in the world due to a natural disaster. Instructions were issued to take special care while shifting people with physical challenges, children, the infirm, the old, nursing mothers, and pregnant women to safer places and cyclone shelters. Arrangements were made for lighting, drinking water, and temporary toilets at the shelters. People were served adequate dry and cooked food at the shelter. The fishermen were advised to return from the sea. Schools and Anganwadi Centres were closed to avoid loss of life and injury. At strategic and vulnerable places, NDRF, ODRAF, CRPF and OSAP teams were deployed for search and rescue operations. For search, rescue & relief operations, more than 350 teams of volunteers were formed, comprising Home Guards, Fire Service personnel and Civil Defense volunteers. Personnel of Indian Army were deployed in highly vulnerable locations of Cuttack, Puri and Ganjam, districts to cooperate with the administration.

People who were accommodated in relief camps and temporary shelters, whose houses were either severely damaged or washed away by the flood, were provided with polythene. Emergent relief of flattened rice, jaggery, and rice was distributed for sustenance to the severely affected people for 7 to 15 days. Other essential items distributed were kerosene, candles, matchboxes, and other essential materials. Relief materials, including dry food, were airdropped by Indian Air Force helicopters in inaccessible affected areas. For the restoration of the health services in the affected area, medical relief centers with medical staff were deployed. To prevent contamination of the drinking water, ORS, Halogen tablets, and ASVs were supplied. Despite various health measures taken, people suffer from diarrhea when drinking contaminated water. The government's preventive measures to ensure zero casualties, keeping in view of about 10,000 human casualties caused by the 1999 Super cyclone, the previous severe cyclonic storm the state experienced in the last 100 years. The human casualties were reduced to 44, and 81 were injured.

A maximum of 10 people were killed in the Ganjam district. Injured persons were treated, and ex gratia assistance of $1,753.92 was paid as per SDRF norms to the families of the deceased.

Infrastructure, including roads, houses, canals, power, telecommunication, handicrafts, boats, nets, and tools, was severely damaged. The infrastructure of the affected area is not resilient to cyclones and floods. Damage to boats and fishing nets affected the livelihoods of fishing communities. Due to the loss of looms, equipment, accessories, and raw materials, the livelihood of the poor artisans was affected. The poor artisans lost their looms, equipment, accessories and raw materials. The damage to Tasar plants, Mulberry crops, and Eri crops affected the livelihood of the farmers. Extensive damage to the roads severely affected the transport and communication in the cyclone-affected area. Power transmission was disrupted due to damage to the electrical installations. Damage to the river and canal embankments and other irrigation projects severely affected the agriculture. Rural Pipe Water Supply Systems and Tube wells are damaged/submerged in rural areas due to cyclones & floods.

4.4. Social Capital

For effective disaster risk reduction, community response is crucial. In Odisha, floods and cyclones are relatively common natural disasters. People are well-acquainted with it and take appropriate measures without outside assistance, not even government support. People normally keep track of natural disasters through electronic and print media. They also observe the situation based on wind velocity, cloud conditions in the sky, and changes in floodwater levels in nearby rivers. People help each other in accommodating families living in temporary houses and shifting animals to safe places during cyclones. People and domestic animals are also accommodated in nearby schools. People voluntarily shift to higher places, i.e., river embankments with their food and livestock and stay in a temporary structure, i.e., polythene cover. Community members helping each other during a time of crisis is the best community participation in disaster risk reduction. For the reconstruction of damaged houses, people help with labour and materials. The government communicated cyclone warnings to the people and advised them to shift to cyclone shelters from low-lying areas and vulnerable houses with their animals. People extend their cooperation to the administration without taking any risk to their lives from the bitter lesson learnt from the 1999 super cyclone. The NGOs and other national and international agencies extend their helping hand in providing relief to the people. Due to a lack of coordination among the government agencies, the NGOs, and other agencies, the streamlining distribution of relief materials was affected.

5. Post Super Cyclone Government Strategy for Disaster Management

Odisha State Disaster Management Authority (OSDMA) was created by the government of Odisha as an autonomous organization under the Board of Revenue on 28 December 1999, after the 1999 Odisha super cyclone. Its function is to reduce the loss of life and property, and it is the first state of India to develop a state disaster management authority before the establishment of the National Disaster Management Act of 2005. It has given the responsibility of preparedness, mitigation, relief, restoration, reconstruction, and coordination of aid agencies. Odisha Disaster Rapid Action Force (ODRAF) was developed in 2001 as a professionally trained force. With emergency equipment, it will assist the administration in search, rescue, and relief operations effectively in disasters. ODRAF helped the institutional arrangements in reducing casualties, reestablishing communications, and facilitating the quick deployment of equipment and personnel, thereby minimizing time and expenditure. In 16 coastal districts, the Community Based Disaster Preparedness (CBDP) programme was implemented from 2002 to 2009 to reduce the vulnerabilities in communities, with the support of the Government of India (Ministry of Home Affairs) and the United Nations Development Programme (UNDP) with a goal of "Sustainable Disaster Risk Reduction of communities in the most hazard-prone districts". In the coastal villages of Odisha inadequate permanent/RCC roofed houses were available either in public or private sector with disaster resistant capability of Super Cyclone magnitude. Due to a lack of safe shelters, precious human lives were lost during the Super Cyclone of 1999. In Ersama block of Jagatsinghpur district the vulnerable people did not find safe shelters to save their lives from maximum storm surge. The Indian Red Cross Society (Odisha State Branch) constructed 23 cyclone shelters that could save 42,000 lives. After the Super Cyclone, 168 multipurpose cyclone shelters were constructed with the financial support of Red Cross, World Bank, Chief Minister Relief Fund and Prime Minister Relief Fund by 2008. The extremely severe cyclonic storm Fani, with a wind speed of 170–180 kmph, crossed over Odisha in 2019, affecting 14 coastal and adjoining districts, impacting 1.32 crore people, killing 64, and causing a total loss of $1,084.69 million. The damages were much higher than those caused by Cyclone Phailin.

The government of India, after the Odisha super cyclone 1999 and the Bhuj earthquake 2001 adopted an effective disaster management plan for the whole nation. Disaster Management Act, 2005 (DM Act 2005) coordinates disaster management (DM) at the national, state, district, and local levels. Disaster management is a paradigm shift from the disaster response, warning, evacuation, relief, and reconstruction approach of the past to an integrated, proactive, and holistic approach for Disaster Risk Reduction (DRR) by strengthening pre-disaster measures, preparedness, mitigation, and emergency response. The State Disaster Management Plan (SDMP) is prepared under the National Disaster Management Act, 2005. "The aim of the act is to significantly reduce loss of life and number of people affected, reduce economic loss, and damage to infrastructure through prevention, preparedness and mitigation and capacity building at all levels to effectively respond to disasters for a safer and disaster resilient state".

International Strategy for Disaster Reduction of the United Nations defines early warning as 'timely and ef-

fective information to the individuals exposed to hazards through identified institutions that allows individuals exposed to a hazard to take actions to avoid or reduce their risk and prepare for effective response' [28]. The dissemination of early warning about the impending cyclone and facilitating a timely response by people in danger [6]. People's awareness and reaction to a natural hazard can improve through the timely dissemination and communication of early warning messages to the community in a disaster area [29].

The first cyclone warning was issued by the IMD to the government three days before the 1999 Super Cyclone, against a four-day forecast that Phailin that strikes the coast of Odisha. The state government disseminated the warning to the district collectors and the general public through electronic and print media. District collectors were asked to activate the disaster management machinery, such as conducting mockdrills, setting up cyclone shelters, and preparing for evacuation. Updates on the cyclone warnings were disseminated, and appropriate measures were taken to mitigate the impact of Phailin. In the case of Super Cyclone, people neither took the warning seriously nor took adequate preventive measures. Total evacuation in Super Cyclone was 1.5 lakh, and in Phailin was 11.55 lakh. The government did not want to take a risk. Therefore, most people were evacuated. The community's response to evacuation was positive, as people, having learned from their bitter experience in Super Cyclone, voluntarily shifted to cyclone shelters (**Table 2**).

Table 2. Response of the Government for the Restoration of Normal Livelihood.

Items	Cost in $	Items	Cost in $
For the loss of life Ex-gratia	77,172.48	Cattle health care	789,849.01
Clothing and utensils	6,606,329.86	Assistance to Fishermen	1,166,287.19
Gratuitous relief for dire need of sustenance	32,897,111.87	Input subsidy-Fish seed farm	710,466.55
Search and rescue measure	148,498.63	Assistance for Artisan and handloom weavers	255,686.58
Evacuation	134,467.26	House Building assistance	32,141,474.84
Temporary accommodation	4,614,893.08	Repair of Roads & Bridges	111,749,311.19
Temporary shelter	9,492,219.48	Repair of rural/urban water supply system	4,306,015.93
Emergency supply of drinking water	143,049.78	Repair of irrigation works	50,380,077.68
Clearance of debris	1,169,280.55	Repair of community assets owned by Panchayats	28,767,809.31
Disposal of the dead bodies/carcasses	23,385.61	Repair of PHS/CHC	1,736,580.39
Agricultural input Subsidy.	45,066,831.80	Repair of primary school buildings	27,897,408.56
Input subsidy for sericulture farmers	23,348.19	Repair of community assets (college/University buildings)	5,603,192.38
Replacement of milch /drought animals	255,148.71	Restoration of power supply	122,556,971.29
Provision of fodder for the animals	1,314,271.34	Repair of other govt. buildings	6,029,956.40
		Total	496,057,095.97

Source: SRC Odisha.

6. Community Initiatives for Disaster Management

Despite warnings issued by government agencies about the Super Cyclone, the local people did not pay attention, believing that cyclones are a regular phenomenon and that people are well-acquainted with tiding over the crisis. Heavy loss of life and property in the super cyclone was due to people being unaware of the severity of the cyclone and ignoring the warnings. People's perception completely changed after Super Cyclone, which was observed in Phailin after a gap of 14 years. People voluntarily shifted to shelters with their valuables and livestock, and cooperated with the government agencies in the evacuation process. As part of the disaster response mock drills are conducted at the cyclone shelters.

The multipurpose cyclone/flood shelters constructed by the government in vulnerable areas, along with the maintenance of these shelters, were assigned to the Community-Based Cyclone/Flood Shelter Management and Maintenance Committee (CSMMCs/FSMMCs) at each MCS/MFS in the village. The committee consists of 20–25 members from both male and female representatives from the government, PWD, PRI, NGO, SC, ST, School/College, etc., and have received marginal training. Fifty task force volunteers are identified at each shelter village between the age groups of 18–35 years, both male and female. Out of 50 task force volunteers, 25 are for the search and rescue operation and 25 for First Aid assistance. They take care of the management and maintenance of the shelter buildings and are involved in the disaster preparedness activities on a regular basis. The shelters are properly maintained by community ownership and involvement in the asset management. The shelters were provided with a number of pieces of equipment to be used during a disaster. The equipment provided to the shelters to be used during disasters includes generator sets, telescopic tower lights for nighttime and inflatable tower lights, power saws, search and rescue equipment, a First-Aid kit, free kitchen utensils, and about 50 items.

7. Coping Strategies for Enhancing Community Resilience to Tropical Cyclones

This article analyzed the livelihood security of the community in disaster management due to the impacts of Cyclone Phailin. The Vulnerability of the community depends on the people's capacity to adapt, extent, frequency of exposure, and sensitivity of the hazards [7]. The coping strategies and the impact of Phailin are summarized in **Figure 3**. Developing institutional mechanisms for disaster management at national, state, district, block, and village levels and efforts of the stakeholders helped to minimize loss of human lives. The minimization of the loss of life became possible by the strong commitment of the government in shifting its policy from a reactive approach of relief, restoration, and rehabilitation to a proactive approach of planning, preparedness and prevention measures. The cooperation between the community-based organization and government agencies helped evacuate 11.55 lakh people from vulnerable coastal areas to safer places through the transformation of disaster management structures and processes. Following the super cyclone, the community became proactive in preparedness, response to early warnings, evacuation, and recovery from Phailin. The focus was on preventing human casualties to zero and evacuating livestock to protect the livelihoods of rural families.

Figure 3. Multipurpose Shelters, Road Clearance, and Houses Damaged by Phailin.

The loss of human life was minimized to 44, but the loss of livestock was 1.7 lakh. The loss of livestock had a significant adverse impact on the livelihoods of rural agricultural and livestock farmers. It had a long-term effect on the livelihoods of the livestock-dependent population in rural areas, as many families relied on their livestock as a primary source of income. In contrast, others used it as an additional source of income. In order to reduce the impact of disasters on the livelihood of the community, community resilience to disasters requires more strategic disaster risk reduction planning and actions that promote livelihood. Based on this, the resilience program applied an integrated approach to mitigate disaster risk, enhance livelihoods, and promote ecosystem restoration. Local farmers were encouraged to adopt climate–resilient agriculture, such as saline-tolerant and first-growing rice varieties [30].

Involvement of the local community is crucial in reducing the vulnerability of people and minimizing losses resulting from natural or man-made disasters. Because people are not only the first to suffer from the adverse impact of disasters but also the first to respond and deal with them, the role of public awareness and recognizing their contributions is an integral part of DRR.A well-prepared community gets maximum benefits in the aftermath of a disaster. To get the benefits of the role of local communities in disaster management is to recognize their role officially and provide them with funds, qualified personnel, and a legal and institutional framework. The Community-Based Disaster Risk Management (CBDRM) involved local communities in DRR to reduce vulnerabilities, minimize human suffering, and accelerate recovery using their capacities and coping mechanisms, such as social organizations, local knowledge, resources, and connections.

The Capacity building for DM is one of the key approaches to the sustainable development of the International Framework for DRR. The government is continuing capacity building at all levels, from the local to the national level,

considering its importance in DM. In Japan, awareness generation and enhancing the capacity of the stakeholders became useful for DRR. To strengthen DM capacities, steps are taken for community drills, DM plans, and DM related laws and regulations are reviewed and revised. Improved training is also implemented, recognizing the role of volunteers, public-private partnerships, and the utilization of information and communication technology in DM, and DM research.

To overcome the impact of disasters, the community's resilience plays a crucial role. For a sustainable livelihood, search, rescue, and first-aid, the community-level volunteers can respond effectively and efficiently in any disaster if trained on different techniques. OSDMA, sponsored by NIDM, has implemented Apada Mitra-Training of Community-level volunteers in disaster response. Apada Mitra volunteer service can be used in disasters and other community-level day-to-day incidents.

Construction of around 30,000 disaster-resilient houses has been taken up under the Odisha Disaster Recovery Project (ODRP) for disaster recovery and future risk. These houses are constructed within 5 km of the High Tide Line (HTL) in Ganjam, Khurda, and Puri districts. The construction of houses, as per policy guidelines and terms of reference (ToR), has been adopted for Owner-Driven Construction of Houses (ODCH) at $3,507.84 per house with 300 sq.ft.area. Livestock are the lifeline of the poor villagers. Loss of livestock adversely affected their livelihood; hence, adequate measures need to be taken to shift livestock to safe places with fodder and drinking water. After a cyclone, animals face the problem of fodder till the situation becomes normal. People should be encouraged to store sufficient fodder for the animals (**Figure 4**).

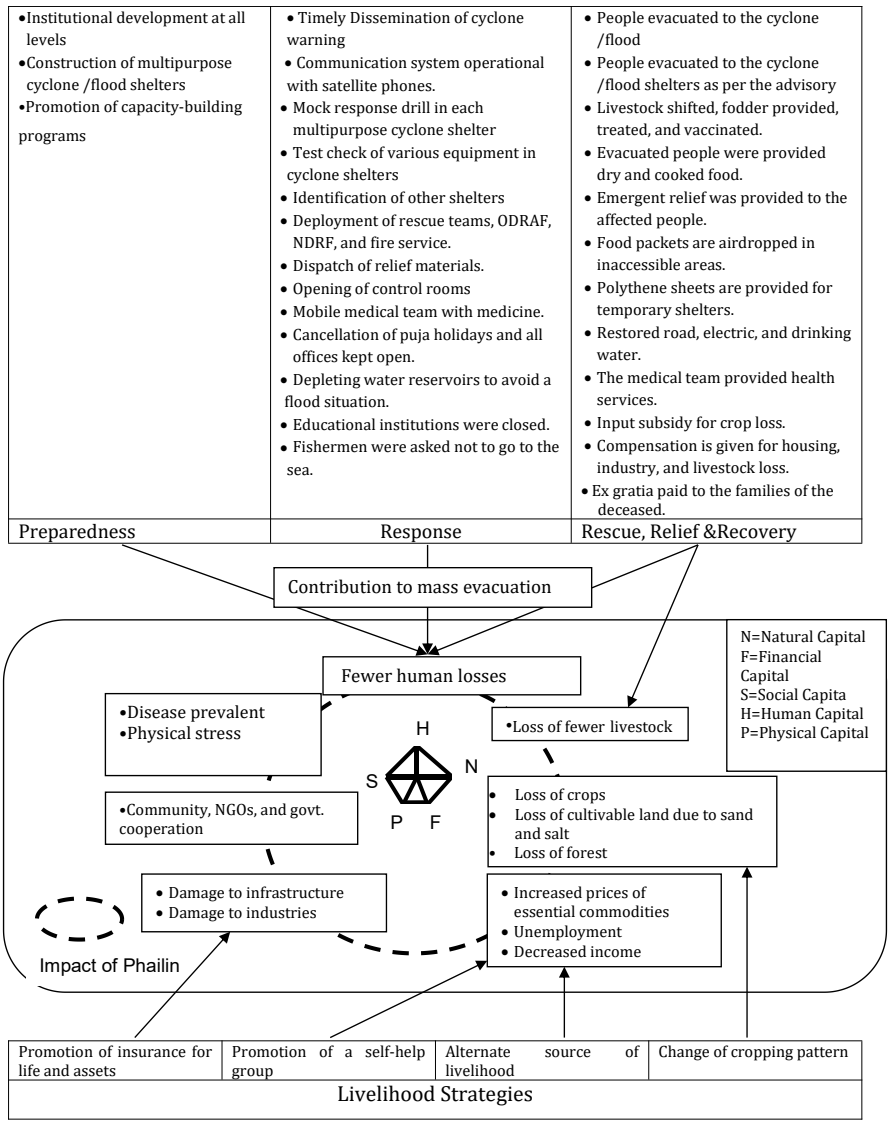

Figure 4. Impact of Phailin and Coping Strategies.

8. Conclusions

Although Odisha is highly vulnerable to cyclonic disasters, various steps are being taken by the government for the livelihood security of the vulnerable community. People living in vulnerable areas with traditional houses and poor economic conditions are mostly affected by the cyclones. The capacity of disaster management depends on community involvement. The Phailin highlights one of the largest evacuations executed in the world to save precious lives. It is possible due to strategic planning and community involvement. Hence, disaster management should be linked to livelihood security on development planning. Improvement of the warning dissemination to the community and community response could help to minimize the loss of life, livestock, and property. After the bitter experience of the 1999 Super Cyclone, the community became proactive in saving their lives. The construction of a large number of multipurpose cyclone/flood shelters by the government accommodates vulnerable people. For sustainable livelihood, it is believed that the need for disaster-resilient livelihoods enhances the capacity of vulnerable communities. Diversification of agriculture, resilience to cyclones, assistance to self-help groups, and promoting a disaster insurance scheme with government subsidy can sustain livelihoods. Under the Prime Minister's permanent/RCC housing scheme for the poor, a large number of houses are constructed. Cyclone and flood-resilient infrastructure needs to be constructed to prevent economic loss. To protect the standing crops, particularly paddy, advisories are being issued to harvest the mature crops and keep them in safe places. To normalize the post-Phailin situation, the government provided compensation and input subsidies to the affected people to revive their livelihood. The present case study highlights that, in the face of the disaster, the local community is not passive, but rather active, in tiding them over the impact of the disaster. During and after the disaster, the local people utilize their traditional knowledge in conjunction with government assistance to mitigate the disaster's impact. The government and other agencies should assist the local community in developing disaster-resilient housing and alternative livelihoods. While providing humanitarian aid, every care must be taken to benefit those in need.

Author Contributions

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Conflicts of Interest

The authors declare no conflict of interest.

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