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PEOPLE-CENTRED EARLY WARNING SYSTEM: 'LAST MILE CONNECTIVITY' DURING CYCLONE TITLI IN SRIKAKULAM, ANDHRA PRADESH

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Abstract

The paper examines 'last mile connectivity' from a multi-hazard Early Warning System (EWS) perspective to situate it within a broader societal context, highlighting the role of continual communication with warned vulnerable populations as a critical requirement. Taking the case study of a very severe tropical cyclonic storm Titli that struck the coastal district of Srikakulam in Andhra Pradesh, India, in October 2018, the paper identifies specific gaps within the conception of 'last mile connectivity' and calls for a shifting focus from 'early warning delivery' to greater integration with local needs and capabilities. It shows that the effectiveness of EWS depends on several factors, including uncertainties under which people negotiate to receive the warning, inter-departmental coordination, power and communication facilities, and accountability of local authorities. .

Keywords: Early Warning System, Cyclone Titli, Last Mile Connectivity.

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Introduction

During the 20 years from 1998-2017, tropical cyclones were second only to earthquake-related deaths globally, accounting for fatalities of 233,000 people (CRED, 2017, 11). India's coastline extending to approximately 8000 km, is densely populated and faces the risk of tropical cyclonic storms, tsunamis and other coastal hazards to varying extent. The vulnerability arises due to several factors, including topographical features, poor infrastructure and lack of an integrated early warning system. More than 10,000 people died in Odisha Super Cyclone in 1999, while 10,000 lost their lives during the 2004 Indian Ocean tsunami, with 5000 more missing. Together, the disastrous incidents realised the importance of an effective Early Warning System (Henceforth EWS). Since then, a range of measures has been undertaken, including building multi-purpose public shelters along the coast, roads and bridges to access shelters, strengthening last mile connectivity, creating bio shields, etc. A key objective of the National Cyclone Risk Mitigation Project (NCRMP), for example, is 'Strengthening of Last Mile Connectivity' under its first component, 'Early Warning Dissemination' (NCRMP, 2020). Despite progress, the concept of 'Last Mile Connectivity' in practice remains largely transmission of warnings and advisories instead of being seen as the means for empowering communities or being blended within a broader framework of 'People-centred Early Warning System (UNISDR, 2006; Basher, 2006). International experiences over the last 20 years have shown that the Early Warning System must be located within a developmental process to be effective and sustainable. The Sendai Framework 2015-2030 highlights the need for universal access to early warning by 2030. It appeals to develop, maintain and strengthen people-centred multi-hazard, multi-sectoral forecasting and early warning systems through a participatory process and tailor them to the needs of users (UNISDR, 2015, 20).

This paper seeks to contribute to this goal by examining the role of 'Last Mile Connectivity' within a People-centred EWS framework. Using the case of a 'Very Severe Cyclone Titli', the study has the following objectives:

a) Explore various dimensions of 'Last Mile Connectivity', for example, nature of communication mediums, linkage among multiple components, people's needs at the time of warning

b) Analyse gaps exhibited during warning for cyclone Titli, and

c) Implications of the findings for developing a more effective warning system.

Methodology

The study follows a qualitative approach and uses the case study method (Hamel et al., 1993). Fieldwork was conducted in Srikakulam district, Andhra Pradesh, in two phases; the first immediately after the landfall of Cyclone Titli in November 2018, and the second in May 2019. At the time of the second phase of fieldwork, another extremely severe cyclone, 'Fani,' threatened the district of Srikakulam, providing an appropriate setting to discuss gaps within the early warning system. In total, 12 personal interviews were conducted with key government functionaries at the district and local levels. In addition, nine focused group discussions and five personal interviews were held with local respondents. Six of the government functionaries interviewed were from the Department of Revenue and Disaster Management, including key officials such as the District Magistrate and District Revenue Officer; two were from telecom utility Bharat Sanchar Nigam Ltd. (BSNL), one each from AP Eastern Power Distribution Company Limited (APEPDCL), Fire Services, Agriculture and Police. Group discussions were held in various coastal villages under the following six mandals: Palasa, Mandasa, Srikakulam, Gara, Vajrapukothuru and Santhabommali (Table 1). The mandal as an administrative unit is smaller than erstwhile taluks, and it emerged in the State intending to manage better and modernise revenue administration (Vaddiraju, 2020). Focused group discussions were held in these mandals to gain insights into the community perspective as key stakeholders of

EWS. Further, a limited number of interviews was held with key informants in the same area to validate findings from the group discussions at an individual level. Each group discussion comprised a minimum of five and a maximum of 30 residents with an average of 15 members. Interview respondents who are government functionaries are coded as RO 1, 2, etc., key informants as R 1, 2, etc., and Group Discussions are coded as GD 1, 2, etc.

Table 1

Type of Responders involved in Primary Data Collection

Types of Responders	Brief Description
Government Agency Representatives (District and Local Levels)	Department of Revenue and Disaster Management, BSNL, Fire Services, APEPDCL, Agriculture, Police
Personal Interviews with Local (Key) Informants	Palasa, Vajrapukothuru, Mandasa Mandal
Group Discussion Participants	Palasa, Mandasa, Srikakulam, Gara, Vajrapukothuru and Santhabommali Mandal

People-centred EWS and Last Mile Connectivity

Evolution of People-centred Early Warning System (EWS): Hazard warning is among the most studied phenomena in disaster studies, and from an early period, it is conceptualised as a system comprising different components (Anderson, 1967; Whitmer et al., 2018). In the 1970s, following a major famine, the Food and Agriculture Organisation (FAO) established a 'Global Information and Early Warning System' in Africa and subsequently established the 'Famine Early Warning System' (Torry, 1988). The 1990s brought out a number of studies and surveys to assess the status of early warning systems for different hazards (O'Neill, 1997). Key findings of the period pointed to the need for greater emphasis on local contexts such as governance and institutional mechanism, connectivity, vulnerable population's ability to act on warnings, etc. (UN IDNDR, 1997; Mileti and Sorensen, 1990; Sorensen, 2000). A series of international conferences were held, for example, at Potsdam, Germany, in 1998 and at Bonn in 2003 and 2006, etc., leading to a reconceptualisation of the early warning system (UN ISDR, 2006). It has since consolidated into a framework that comprises four interrelated components:

- Risk knowledge
- Monitoring and warning service,
- Communication and dissemination, and
- Response capability (Basher, 2006)

This framework, known as the 'People Centred Warning System,' attempts to overcome deficiencies of the still popular 'end-to-end' linear paradigm with little public engagement (Basher, 2006; Collins, 2009). The new paradigm highlights the need to cater to the local population, who should be seen as proactive, resilient and able to protect themselves if provided with a relevant warning (Spahn et al., 2014). This people-centred EWS focuses on seamless integration of all four components and a much greater role of local community members for the overall effectiveness (Thomala et al., 2009).

Last Mile or First Mile? The concept 'last mile' in disaster warning is traced to the post-Cold War period when installed siren networks were not being used often, creating a gap between emergency managers and vulnerable populations during a crisis (Klaft and Ziegler, 2013). The idea, 'last mile connectivity', however, is used in diverse fields, for example, in telecommunication, where it represents challenges involved in delivering telecom services to the end users (Nandi et al., 2016). It is used in other developmental contexts, for example, in bridging the digital divide, providing access to electricity power (Glinski, Kes, & Sultana, 2017), access to public transport (Rajput, 2016), sanitation facilities etc. Last mile connectivity in disaster management is closely linked with the evolution of EWS. Historically, far greater emphasis was given to accurate hazard prediction and forecasting, which focused on strengthening hazard detection and monitoring (Mileti & Sorensen, 1990). Despite having a reasonably accurate detection and monitoring system and availability of precise risk information, considerable losses pointed to gaps in the overall conception and forced a rethink on important dimensions that were overlooked (UN IDNDR, 1997).

'Last Mile Connectivity' here refers to reaching out to the last segment of the vulnerable population so as to enable them to take necessary and appropriate action for safety. This last segment can be remotely located, often in difficult terrain, inaccessible for various reasons so as not being able to be communicated. There can be many reasons for this last mile inaccessibility, for example, the timing of warning, which can be at odd hours of the night to a breakdown of power system or simply incompetence of emergency manager in delaying warning notification. The experience of the 2011 Japan earthquake and resulting tsunami showed that during the crucial warning period, there was large-scale power failure disabling the telecommunication network and constraining warning transmission. Besides, it was found that 65 per cent of those deceased were elderly or those aged above 60, who were unaccustomed primarily to social media networks and did not access warnings using these platforms (Appleby, 2013). In South Asia, the significance of Last Mile Connectivity was reinforced during the 2004 Indian Ocean tsunami, in which 230,000 people died (Elliott, 2006). The absence of effective EWS was held to be primarily responsible for this catastrophe, but it was also found that thousands of lives could have been saved if only there were means to distribute alerts locally even after the initial tsunami strike. In Sri Lanka, for example, tsunami waves started hitting its 'Ampara' district on the Southeast coast and over the next four hours, these waves engulfed nearly two-thirds of the country's coastline. In such a situation, an effective local alert system would have minimised the death toll considerably (Anderson, 2007).

Within the 'People Centred EWS framework', last mile connectivity is not to be limited to communication and dissemination but integrated within the broad framework. However, in practice, 'last mile connectivity' is often interpreted in a particular way that highlights its connectivity aspects. As a result, the emphasis shifts to leveraging Information and Communication Technology (ICT) to ensure connectivity to all who need warning information. In this perspective, 'last mile connectivity' becomes overcoming rural infrastructural challenges or those which inhibit the local population's access to media and other conventional channels (Stanciugelu et al., 2017). In recent times, this conception has been increasingly under scrutiny. Huggel et al. (2012), for example, point to the process aspect, such as the scope for negotiation between warning agencies, scientists, emergency managers and locals, providing a vision for the kind of connectivity and adaptation required for the last mile (Huggel et al., 2012). It is recognised that connectivity should be linked to the community's ability to take actions instead of being limited to transmitting information (Bedi, 2006; UNISDR, 2006). Marchezini et al. (2017) call for a re-conception of the 'last mile' to become the 'first-mile' approach; so that people and their needs remain at the centre of EWS design and execution. A notion of 'first mile' is to ensure that social aspects such as culture, livelihoods, gender, etc., are incorporated within EWS for early action and sustainability is aimed through stakeholder's participation from the design stage itself (UN ESCAP, 2019). It views communities and their vulnerabilities as the starting point for developing a local system with strong linkages to national EWS (UNISDR, 2010; Stal, 2013).

Warning medium choices: Redundancy is a necessary feature in 'last mile connectivity' as even the most reliable system can fail during a disaster. Hence, multiple layers of redundancy are usually considered to avoid the system's complete failure. In addition, the American Meteorological Society identifies geo-location, identification of source, date and time and consistency in warning content across mediums as features of best practice for a warning system (AMS, 2018). The importance of 'geo-location' draws from the experience that a general warning to a large population will include many for whom such a warning is neither required nor relevant. Similarly, adding and deleting words in the warning content without careful consideration can change its meaning and should be avoided.

There are broadly two types of warning notification mechanisms - Mass notification method and Addressable notification method. Technological innovations have resulted in the combination of these two types into various other types, for example, addressable methods getting integrated into performing the role of a mass notification system (Table No. 2).

Table 2

Last mile Notification Method (adapted from Fakhruddin, 2007)

Mass notification	Addressable Notification	Integrated Method
• Radio • Television/Weather Channel/Cable television • Sirens/ Loudspeakers • Electronic Signs • Social Media/ Newspaper	• Telephone/Cellular/ Satellite Phone • VHF/HF Radio • Fax/Telegram/ Email • HAM Radio • Door-to-door/ Residential	• VHF/HF or other radio-based Siren and Loud Speaker System • Internet-based system • Temple/Mosque Address • Short Messaging Services/ VOIP

Many new initiatives have evolved worldwide, such as one in the Caribbean, where different organisations have come together under the Community Alert Project (CAP) to notify the vulnerable population. It combines different mediums such as mass emails, smartphone apps, devices that interrupt radio and television programmes, sirens, etc. (UNDP, 2015). Similarly, an initiative in Mongolia seeks to use Voice over Wireless Fidelity to reach people in an environment where telecommunication infrastructure is scarce (ESCAP, 2008). The experiment in Sri Lanka after the 2004 tsunami comprises a 'hazard information hub' which is linked to local communities through multiple means such as mobile phones, CDMA Fixed wireless handsets, Satellite Radios and GSM -based remote alarm devices, etc. This project showed that for a communication medium to be effective, ease of operation and maintenance are key features that further shape its regular usefulness. Mobile phones, for example, were far more successful on these counts than other specialised technologies. Internet of Things (IoT) is one of the new communication paradigms that envision integration across different networks, including satellite, cellular and social media (Kamruzzaman et al., 2017). However, as Sutton, Hansard & Hewett (2010) aptly summarise, the overall challenge remains the same, how to get the right information to the right people at the right time so that they make the right decision.

In the last decade or so, there have been several initiatives in India towards EWS that involve local communities; for example, Flood EWS established in Surat City, Gujarat (Rajasekhar et al., 2016). Similarly, a landslide EWS that affects communities in all stages is being implemented in the hilly region of Darjeeling (The Hindustan Times, 2018). The number of users in India accessing social media networking sites such as WhatsApp, Facebook, Twitter, etc., has increased significantly in recent times even though social media have both advantages and disadvantages (Brynielsson et al., 2018). For example, there are questions over distortion and filtration of original warning, interpretation in diverse ways and rumours, which can be counterproductive. Despite the various advances and penetration of mobile and internet-based media, last mile connectivity cannot do away with low-end technology or word of mouth means to prevent a complete failure. For example, in many areas, announcements through loudspeaker mounted on a vehicle remain practical, keeping in view poor road and general accessibility in adverse weather conditions. Similarly, word of mouth as a means of communication carries its relevance on account of the personalisation of danger.

Linkage to Evacuation: Public response, particularly during a cyclone or tsunami, involves uncertainties arising from forecast accuracy, past experiences, difficulties faced during evacuation to nearby safe shelters, etc. (Aguirre, 1991). In the case of cyclones, the coastal population generally have a sense of familiarity due to the recurring nature of the phenomena, and thus is aware of its destructive potential. However, due to such keen observation, they recognise that every cyclone carries destructive potential, although each need not necessarily severely impact its own settlement. This leads to a situation where people delay their action until the danger has breached a threshold (Dash, 2015). Consequently, the warning does not lead to a necessary response; instead, such warning is often repeated several times over multiple channels in an attempt to make people consider it more seriously. Furthermore, various facilitation measures such as transport services are arranged for evacuees, and if need be, coercive measures like forced evacuation policy are employed to ensure that people are safe when the cyclone strikes (Dash, 2016).

Cyclone Titli, Srikakulam, Andhra Pradesh

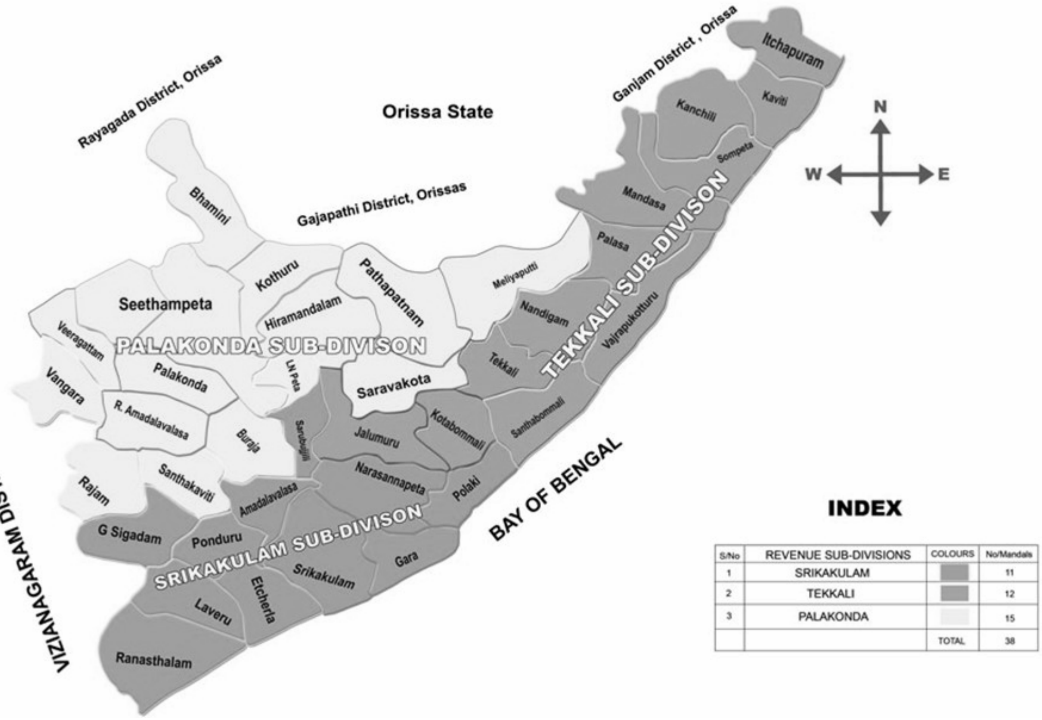
Srikakulam District, formerly known as 'Chicacole', has a coastline of over 193 km on the east, the Eastern Ghats on the west, Vizianagaram on the south-west side and shares its border with the State of Odisha on the north. The district was carved out of Visakhapatnam in 1950 and bifurcated in 1979 to form Vizianagaram as a separate district. Generally considered amongst the most under-developed regions of Andhra Pradesh, Srikakulam has a population of 2.7 million and is administratively divided into three revenue divisions and 38 mandals comprising 1868 revenue villages. The district is vulnerable to various hazards, including tropical cyclones, tsunami, inland flooding, fire, epidemics, industrial accidents, etc.

Tropical cyclone Titli categorised as a 'Very severe Cyclonic Storm' by India Meteorological Department (henceforth, IMD), was detected as a low-pressure system over the North Indian Ocean on the morning of 7th October 2018. It developed further to become a 'cyclonic storm' by noon of 9th October and into a 'very severe cyclonic storm' by the noon of 10th October. The storm was characterised by rapid intensification on 10th October, and at its peak, it packed a wind speed of over 150 km per hour. Contrary to the initial expectation that it would hit south Odisha, the cyclone made landfall during the intervening night of 10th and 11th October 2018 near 'Palasa' in Srikakulam (IMD, 2018). Nine people died under its impact, and more than 12 lakh people in 872 villages were affected. Thirty thousand houses and public infrastructure such as roads, transport, electricity, irrigation, etc., suffered severe damage (AP SDMA, 2018). The first IMD bulletin for Titli was issued on 8th October, and it continued periodically until the cyclone weakened post-landfall.

Warning during Cyclone Titli: The IMD has been regularly updating Srikakulam district authorities were by IMD on the status of the cyclonic storm Titli since the beginning. The confusion over possible landfall over the neighbouring Odisha coast, together with the cyclone's rapid intensification on 10th October, led to a delay in action. Emergency Operation Centre (EOC) was activated on 10th October in the district headquarters of Srikakulam. It was found that most mandals and villages of the district could be reached through multiple forms of communication, including television, mobile phone and social media such as WhatsApp. A set of villages identified as the most remote and

Figure 1

Map of Srikakulam District Showing Mandals



S/No	REVENUE SUB-DIVISIONS	COLOURS	No/Mandals
1	SRIKAKULAM		11
2	TEKKALI		12
3	PALAKONDA		15
		TOTAL	38

Source: Srikakulam District Administration

vulnerable were reached through cellular communication by the evening of 10th October. For the district authorities, in addition to regular IMD issued bulletins, Real Time Governance Society (RTGS), an internet-based platform operated by the State Government, was a very popular warning information source. RTGS provided information, including projected damage scale due to cyclonic impact and immediate access to various State government advisories for undertaking specific measures.

***Dissemination and Communication**:* From the district level, cyclone advisories and warnings were communicated or disseminated mainly through two approaches:

a) Public broadcasts such as television/cable TV, radio, websites, newspaper, etc.

b) Personalised communication using multiple means such as Very High Frequency (VHF)/ High Frequency (HF) Radio, emergency meetings with village members, announcements through loudspeaker mounted on the vehicles, tom-tom notification, and WhatsApp.

The first category generally suffers from their inability to notify at odd hours, apart from their limited relevance at the local level. Among the options from the second category, HF/VHF Radio communication was cited by most district-level functionaries as more reliable because of its ease of use on account of its regular operation, requiring relatively less power. However, the official interviewed also pointed to various limitations of communication medium belonging to the second category. For example, HF/VHF Radio communication requires further action to ensure that the received warning is distributed as per requirement at the local level. Similarly, loudspeaker announcement or personal meeting by local level functionaries involves travel across vulnerable areas under adverse weather conditions and is also time-consuming and may not be feasible.

Power Outage and Connectivity: In addition to the aforementioned limitation of warning means, a key challenge was found to be disruption in power supply caused either by the hazard condition or due to a precautionary measure to suspend electricity supply in anticipation of adverse weather. Respondent RO 6 from the State Power Distribution agency summarises this dimension from his experience during Cyclone Titli as follows.

"There are 32 sub-divisions under Srikakulam division and a control room at the division level to monitor the situation. On the night of 10th October, a decision was taken to suspend the power supply in Srikakulam division due to the prevailing weather conditions. It was taken at the level of Divisional Engineer in coordination with other agencies; in this case, it was done through a WhatsApp group comprising senior functionaries of electricity department, district EOC and district magistrate."

Electricity power in fieldwork sites was reported to be lost between 8-11 PM of 10th October or a few hours before cyclone Titli's landfall. Loss of power had significant implications as it disrupted access to warning means such as television, mobile recharge, etc. Several local residents, for example, R1, R2 and R5, as well as various participants during each group discussion, pointed out that the power outage became a constraint in receiving further updates, and also led to disruption in telecom services. Respondent RO 4 from Bharat Sanchar Nigam Limited (BSNL), a government-owned telephone operator, narrated this particular challenge in the following way:

"On the evening of 10th October, around 8 PM, electricity supply was cut off. It severely impacted the communication network. BSNL Base Tower Station (BTS), some of which are remotely located, neither have DG (Diesel Generator) sets for longer backups nor are they manned through the night. In this scenario, wind force, rain and consequent water seepage damaged 156 out of the total 230 BTS in the district. It led to severe communication breakdown for several days until repair works were carried out on site."

***Accountability at the Local Level for Warning Distribution*: A difficulty identified by district level officials (RO 2, 3 and 12) was ensuring the local level functionaries perform their duties and responsibilities as per the expectation. From this perspective, the local functionaries are a vital intermediary in warning transmission and their role in how such warning recommendation is seen and evaluated by vulnerable people. For instance, their role in overseeing that warning reach each household in various habitats/villages under their jurisdiction, arranging transport, facilitating safe shelters, etc. Local level functionaries, on their part, are caught between their assessment of an impending cyclonic threat, expectation from local residents in terms of the nature of action required and that of the district level authorities.

Linking Connectivity with the Response: Coordination Challenges: Transmission of early warning to every village/individual is a prerequisite for any precautionary action but in itself does not guarantee appropriate action. During the second phase of fieldwork, Srikakulam district was put on high alert for another extremely severe cyclone, 'Fani', which eventually made landfall on the Odisha coast. Early warning for 'Fani' was communicated to vulnerable coastal communities, yet it was overlooked beyond watching for further updates and monitoring the weather. In a group discussion (GD 8) held in front of a multi-purpose cyclone shelter at Kollipada village under Santhabommali Mandal, local residents explained their lack of action as follows:

"We have heard about cyclone 'Fani' on television news, but as you can see, the weather is so hot, and hence no one has come to the shelter yet. We will remain in our house but will be watchful. MRO (Mandal Revenue Officer) had come during cyclone Titli, but he has not come here."

A key finding in this regard is that considerable coordination is required during the warning period among agencies depending on the nature of preventive measures. Though coordination challenges are widely recognised within the emergency response, this particular aspect is less explored and needs further emphasis. Hazards such as cyclones, tsunamis, floods, etc., potentially involve large-scale public evacuation and require transport facilities for the evacuee, availability of safe shelter with required accommodation capacities, process of evaluating structural safety to be designated as a shelter, provisions such as food and drinking water, quality and quantity of food, lighting and security at evacuation shelters, sanitation facilities, evacuee privacy, etc. Each of these facilities and services requires the participation of a number of government and non-government agencies. For example, for an evacuation to a cyclone shelter, government agencies such as Revenue, School and Education, Police, Transport, Panchayat Raj, Health, Civil Supplies, Non-Government Organisations and Civil Society Groups, etc., are expected to take part, which highlights the scale of coordination requirement. District authorities operating under adverse weather conditions and limited communication facilities face significant challenges in ensuring effective coordination.

Discussion and Conclusion

This study, based on an analysis of early warning during Cyclone Titli, raises a fundamental question. To what extent are different elements of ‘People-centred EWS’ distinct from each other? While an ‘end-to-end’ linear paradigm in EWS is being rejected (Basher, 2006), the overall EWS conception continues to be temporal in nature, in which last mile connectivity focuses on warning delivery independent of overall EWS goals. To put it in perspective, the design of an effective EWS is not necessarily the unavailability of a communication medium but rather a limited understanding of how such delivery is integrated with the public’s willingness to take the recommended action. Availability of warning is an essential first step in achieving response capability, but the continuity of warning service for further updates is as important as well (Kyne et al., 2019). The fieldwork clearly showed that community respondents had access to Titli warning but expected continuity in this service until the threat persisted. Warning thus has to be contextualised within a given social setting, which involves differential nature of the risk posed, trust and credibility of agencies which issue warning, the feasibility of proposed precautionary action from a social perspective, etc. This relationship among different elements of EWS has to be reconceptualised to focus more on the outcome and develop a more appropriate EWS framework.

A key deficiency found within existing EWS in Srikakulam is the lack of engagement with local communities on warning services. Historically, cyclone warning has operated from a top-down perspective, but experiences across social contexts point to the importance of a bottom-up approach or the need for involving members of the local communities who are its key stakeholders. Further, attention is due from policymakers and authorities to bring this change. Moreover, there is merit in exploring a multi-hazard EWS framework, but it should address important distinctions between hazards. For example, a warning system encompassing tsunami has to address a worst-case scenario, such as last mile connectivity and evacuation during a late night and under severe adverse weather conditions. In such a context, the demand for an immediate notification requires a reconceptualisation of last-mile connectivity and ways and means through which the public can respond. In contrast, hazards with a longer lead time; for example, the heat wave, may appear less challenging from a connectivity point of view, but they can be equally challenging when considered from the nature of response anticipated (Whitmore et al., 2018). Connectivity from this perspective has to be seen together with the overall EWS goals and not independently.

Recommendations

India faces unique challenges because of its densely populated coastal areas and increased hazard risk due to climatic change. In this situation, the last mile can be quite large in terms of the number of people at risk. To meet such a challenge, ways need to be developed, including ingenious ones at the planning stage itself, making use of the state-of-the-art technologies in conjunction with local systems and practices. Secondly, the effectiveness of EWS requires re-conception of its design, situating people at the centre and continuity of communication as a prerequisite for the desired precautionary response. Thirdly, the sustainability of multi-hazard EWS initiative is a key challenge that requires much more effort and encouragement from the government. In pursuit of such goals, necessary policies and legislation have to be formulated to transform the conception of disaster warning services from being the State's responsibility to people's initiative.

Author's Contribution:

Biswanath Dash: Conception, Data Collection, Analysis, Manuscript writing

Meena Jagirdhar: Conception and Manuscript Writing

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