Indigenous Knowledge as Early Warning Guide in Disaster Management

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Abstract

The experience and knowledge of older generation on disaster are rich with local warning indicators from birds, animals, and other natural phenomena. Stories about natural disasters in the past are found in oral literatures, songs, poems, and even lullabies. Such past knowledge can not only reduce disaster risk but also prevent human casualties in the face of disasters. However, indigenous knowledge is often discarded as "unscientific." Such local knowledge needs to be integrated with the scientific early warning system and could help in disaster risk reduction and increase the resilience of vulnerable communities.

Keywords

Indigenous Knowledge · Traditional Knowledge · Early Warning Systems · Disaster Risk Reduction

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Introduction

Indigenous or traditional knowledge has increasingly gained attention among policy makers, development practitioners, academic, and other scientific communities in recent decades. Today, as Mistry (2009: 371) pointed out, the "discourses on development and environment extol the benefits of incorporating indigenous knowledge into policy development, as well as on the ground interventions." This development is largely seen as the outcome of the inadequacy, and some even consider as a failure, of the modern technologies, institutions, and western knowledge to solve problems so prevalent in remote areas in Asia and Africa. It has come a long way from being considered as an "obstacle to development" to the phase of romanticization and, in the last decade, as an important component in disaster management (Agrawal, 1995; Trogrlić & van den Homberg, 2018). In the field of disaster research, the potential of indigenous knowledge for effective disaster risk reduction is fully acknowledged now.

However, indigenous knowledge was earlier considered to be unscientific and looked-down for decades by the vast majority of people. They were largely regarded as superstitious belief of socially backward societies. It was seen "as inefficient" and "inferior" (Agrawal, 1995: 413) (For instance, during colonial rule the British considered small settlements of indigenous people with certain agricultural practices such as shifting cultivation as environmentally destructive, and attempts were made to impose a settled agriculture. For more details see Haokip (2020)). Particularly when such traditional or local knowledge help indigenous peoples in maintaining their autonomy from state control, they are decried as unscientific and superstitious and such practices were outrightly rejected. Indigenous knowledge is defined by Mercer and others (2010: 218) as "a body of knowledge existing within or acquired by local people over a period of time through accumulation of experiences, society-nature relationships, community practices and institutions, and by passing it down through generations." Hence, such knowledge are understood and applied easily by the next generation and subsequently passed on to the succeeding generations through folk stories and songs, dances, paintings, and carvings. However, as it is duly stressed in permanent forum on indigenous issues, "global histories of colonialism, exploitation and dispossession continue to undermine and undervalue these aspects" ("Indigenous People's Traditional Knowledge Must Be Preserved, Valued Globally, Speakers Stress as Permanent Forum Opens Annual Session," UN Permanent Forum On Indigenous Issues, 22 APRIL 2019, accessed on 23 February 2022 at: https://www.un.org/press/en/2019/hr5431.doc.htm).

There is a realization that indigenous knowledge can make important contribution "to contemporary natural resource management issues, researchers and development workers have been documenting and recording indigenous knowledge with the aim to produce a bank of knowledge which could be incorporated into development projects" (Mistry, 2009: 373). In recent decades indigenous knowledge on the environment and ecology as a whole are found to be sustainable and thus ignited interest in such knowledge system. The potential for effective disaster risk reduction is now well recognized worldwide. Indigenous knowledge "is increasingly being

seen as one of the critical components in reducing disaster risks at local levels, building resilient communities and sustainable livelihoods" (Trogrlić & van den Homberg, 2018: 13). The indigenous early warning systems are essential for disaster risk reduction in rural areas as there is a growing literature that shows lack of uptake of official warning information about impending disasters. Ever since the emergence of vulnerability perspective in disasters, which "assumes that a real disaster occurs when it strikes an underprivileged population" (Donner & Rodríguez, 2011), the potential of integration between indigenous and scientific knowledge and the participation of stakeholders has increasingly been promoted by academia and international development and donor agencies (Dekens, 2007).

Indigenous Knowledge and International Agencies

Despite the increasing recognition and rapidly growing studies of indigenous knowledge in recent years and the emphasis on early warning systems to reduce disaster risks, there are not only inadequate studies on indigenous early warning systems, but they are also largely not integrated with the scientific knowledge and official early warning systems. The climate change community recognized the importance of indigenous knowledge on early warning system, and efforts are made to not only include but also integrate such knowledge for an effective disaster risk reduction system, particularly in rural areas.

The United Nations Office for Disaster Risk Reduction defines an early warning system as "An integrated system of hazard monitoring, forecasting and prediction, disaster risk assessment, communication and preparedness activities systems and processes that enables individuals, communities, governments, businesses and others to take timely action to reduce disaster risks in advance of hazardous events" and recommended "people-centered" early warning systems ("Early warning system," accessed on 11 March 2022 at: https://www.undrr.org/terminology/early-warning-system). The Paris Agreement on climate change not only recognized the importance of early warning systems, but it urged upon parties to the United Nations Framework Convention on Climate Change to "strengthen their cooperation on enhancing action on adaptation, taking into account the Cancun Adaptation Framework." The Agreement recommended that "adaptation action should follow a country-driven" approach "taking into consideration vulnerable groups, communities and ecosystems, and should be based on and guided by the best available science and, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems, with a view to integrating adaptation into relevant socio-economic and environmental policies and actions, where appropriate" (UNFCCC 2015).

The Sendai Framework for disaster risk reduction of 2015 emphasizes, among others in priorities for action, the understanding of disaster risk reduction and the role of indigenous or traditional knowledge and highlighted the importance of involving indigenous people (UNISDR, 2015). The Framework recognizes the role "indigenous peoples" can play, "through their experience and traditional knowledge," and "provide an important contribution to the development and implementation of plans and

mechanisms, including for early warning." It recommended "a broader and a more people-centred preventive approach to disaster risk," in which "governments should engage with relevant stakeholders," including indigenous peoples "in the design and implementation of policies, plans and standards." It recognizes the complementary role traditional or indigenous knowledge can play in the approach and decision in disaster risk reduction and observes that "Indigenous peoples, through their experience and traditional knowledge, provide an important contribution to the development and implementation of plans and mechanisms, including for early warning." The Sendai Framework recommended thus: "To ensure the use of traditional, indigenous and local knowledge and practices, as appropriate, to complement scientific knowledge in disaster risk assessment and the development and implementation of policies, strategies, plans and programmes of specific sectors, with a cross-sectoral approach, which should be tailored to localities and to the context."

Indigenous Knowledge on Early Warnings

There is no dearth of indigenous knowledge in different spheres of human life among indigenous and other communities. Their knowledge on early warnings is learned through "phenomenological experience." There are various stories emerging in different parts of the world where indigenous communities utilize their local knowledge on early warning signs and escape major disasters. Here four cases or incidents of disasters are examined to explain how indigenous knowledge on early warning systems is in fact saving the community from disaster.

1970 Bhola Cyclone

The 1970 cyclone in the then East Pakistan, and now Bangladesh since 1971, is so far the deadliest tropical cyclone on record with 300,000 deaths and some estimated to as many as 500,000 lives lost. Since then huge resources were geared toward the establishment of national warning systems and to build cyclone shelters. For instance, the Red Crescent Cyclone Preparedness Programme played an important role in the installation of radio networks and trained volunteers. However, a study shows that "household preparedness and survival potential appear to be very much dictated by economic and social circumstance. Cyclone shelters and other protective/enabling infrastructure are still scarce on the chars and in the most rural costal districts... which are extremely vulnerable to cyclones and tidal surges," despite huge investment for building cyclone shelters and setting up of national warning systems (Howell, 2003: 4).

In her study of the "indigenous early warning indicators of cyclones" in Bangladesh during the 1970 cyclone, which were mostly derived from animal behaviors and weather patterns, Philippa Howell (2003: 2) observed that in such areas the "poor people are more likely to live in marginal, low-lying areas most prone to flooding" and "the poorest are least likely to hear radio warnings or understand the meaning of different warning signals." Howell reported that the uneducated people are most likely

to feel alienated from a scientific system, and more so are the women "due to the purdah system." In such condition indigenous early warnings are essential for early action. Muhammad Nurul Islam narrated: "I know there are Disaster Signals ranging from Signal No. 1 to 10, but I have no idea what they mean. I can predict any disaster coming when the sky turns gloomy, bees move around in clusters, the cattle become restless and the wind blows from the south" (Howell, 2003: 4).

In the case of the 1970 cyclone, the natural disaster occurred at the middle of the night, and some local indicators such as weather and sea or river patterns would not be visible few hours beforehand. However, other indicators particularly from the behaviors of animals occurred about a week before the disaster struck. For instance, a septuagenarian Muhammad Abdul Ali Majhi said: "We take notice of continuous crying of the dogs, increase of flies and mosquitoes, movement of ants, crying of kurpals, hot and humid weather and so on. These signs occur about 5-7 days earlier." An octogenarian Bibi Sahera Khatun also confirmed this when she said: "The dogs had been howling for four days before the flood hit in 1970." Despite the deadliest tropical cyclone on record with 300,000 deaths, those giving the information of the local indicators survived despite their marginality and vulnerability. Howell's study found out that older people have "knowledge of local warning indicators based on animal behaviour or natural phenomena" and largely not transmitted to younger generations and regarded as unscientific.

Floods and Draughts in Malawi

Malawi, in the Sub-Saharan Africa, is one of the least-developed countries in the world with an economy heavily dependent on agriculture. With a largely rural and rapidly growing population, the landlocked nation is highly prone to natural disasters. In recent decades there is an increase in frequency, intensity, and magnitude of these calamities, especially floods and droughts, "and have adversely impacted on food and water security, water quality, energy and sustainable livelihoods of most rural communities" (DoDMA, 2015: viii). Malawi is also frequented with heat waves, strong winds, dry and cold spells, hailstorms, thunderstorms, landslides, mudslides, earthquakes, pest infestations, disease outbreaks, and fires.

Earlier Malawi had relied totally on indigenous early warning systems in preventing disasters or reducing disaster risks. These systems were developed by communities predicting upcoming disasters through various signs and indicators locally observed. In recent decades there are scientific early warning systems at the national level, as well as a number of community-based early warning systems which are implemented across the country by nongovernmental organizations, often in cooperation with local governments. However, the early warning systems operating in Malawi are inadequate. Despite recent efforts by different stakeholders in improving the existing early warning systems in Malawi, there are still a number of gaps. Studies indicated that "the existing early warning systems for floods, dry-spells and droughts are not providing an accurate warning information in a timely manner. In addition, the existing EWS in the country does not take into account the rich indigenous knowledge held by community members" (Trogrlić &

van den Homberg, 2018: 7). The National Disaster Risk Management Policy of Malawi in 2015 included the "development and strengthening of people-centred early warning system" in its policy priority areas (Government of Malawi, 2015: 5).

There are two main categories of ecological indicators which could be used as early warning signs: the changes in the behavior of animals and plants. In Malawi the most common early warning sign of heavy rain, which eventually leads to flood, is the behavior of ants. Before heavy rain the ants become very active and move around in large numbers in farms and even disturbing villagers in their homes. The same behavior is also observed among insects such as spiders and mosquitoes. Likewise various birds are also "found in increased numbers of producing a specific, loud sound are seen as indicators of heavy rainfall." Heavy rainfall is also indicated by movements of pythons, grasshoppers, rats, cats, and other animals. The behavior of hippopotamus is an interesting indicator of not only heavy rains but also the extent of the upcoming floods. In their study Trogrlić and van den Homberg (2018: 34) indicated: "The hippo will move away from the water and walk for more than a kilometer on dry lands. These animals also give us an understanding on how the floods will behave. Every place where the hippo passes through, it is exactly the place where the floods will reach. Where the hippo did not go, the floods will not reach those lands." Trees were also seen as an important indicator of heavy rainfall among various communities in Malawi. The bountiful flowering and bumper fruits borne by trees are the two ecological indicators.

There are also various early warning signs that communities draw from meteorology, particularly on forecasting floods, by sensing the temperatures, the pattern of wind blow, and intensity of rainfall. Very hot temperatures are indicative of higher amount of rainfall, while the wind direction is also believed to be indicator of heavy rain and flood. Local communities were aware of the impending flood by monitoring and reading the intensity of rain. For instance, a person from Khungubwe said: "For floods we do not focus on the cloud or wind but on the intensity of the rain" (Trogrlić & van den Homberg, 2018: 35). The communities are aware that flood will occur after several days of rain and monitoring the intensity of rain can predict upcoming flood and prepare in advance to minimize the impacts.

In the case of draught and dry spell too, there are several ecological indicators embedded in the local knowledge of communities. The indicators are broadly the changes in plant behaviors, such as cassava giving lower yield than normal, certain trees shed all their leaves, and bush grass dries. Several studies identify the gaps in the early warning systems and suggested integration of indigenous knowledge with scientific knowledge (Chiotha et al., 2017; Trogrlić & van den Homberg, 2018). People-centered early warning systems are crucial for disaster risk reduction in countries such as Malawi.

In similar developing areas like Majuli river island in the Indian state of Assam, residents "are living in consonance with nature" and not only have several traditional adaptation practices to cope with frequent floods and riverbanks erosions of the Brahmaputra river, but "their traditional wisdom helps them to detect and identify the possible hazards or disasters." They have the indigenous knowledge of early warning system predicting heavy rain and flood "which they observed through some signals from nature before any major event is about to happen which assists them to

prepare from disaster and reduce its impacts and the communities have mastered these over the years." They also have the "coping mechanism developed by communities" such as storage of food grains and housing structure which "were based on their folklore or stories which are passed from one generation to another that were useful in understanding nature and the causes of disasters." A village leader from Jengrai Gaon responded to Chetry (2020: 21):

> We have our own flood predictions techniques and we observe sets of early warning sign which help us to predict the intensity of flood. Like the soil sediments coming downstream from which we get an idea of how heavy the rains would be. If soil sediments are flowing in the river before the onset of monsoon, it signals that flood will come and the rain would be heavy leading to floods.

Smong in Simeulue Island, Aceh, Indonesia

The Indian Ocean earthquake and tsunami on 26 December 2004 killed more than 200,000 people. The intensity of earthquake was the third-largest ever recorded magnitude with its epicenter between Simeulue and mainland Sumatra, about 40 km from the northernmost tip of the Simeulue island. The earthquake created a series of massive tsunami waves surging vertically up to 30 m (100 feet) high and caused huge damages to life and property in the surrounding coasts of the Indian Ocean affecting about a dozen countries. However, in Simeulue island in Aceh, there were only 7 deaths from a population of 78,128 people (The population figure is as per the official recorded in 2000 census). Studies show that people escape such a massive tsunami through the local knowledge of early warning system called *smong*. The term is derived from "Devayan language word of 'Kemong' or 'Seumongan' which means 'splash of water' or 'tidal wave or tsunami'," and it "is used for tsunami warning when big earthquakes occur in Simeulue Island" (Syafwina, 2014: 573). In simple words it refers to "the ocean coming onto the land" (McAdoo et al., 2006: S665) and warns everyone of the incoming high tidal waves or tsunami and instructs them to run for higher grounds.

The story of *smong* went back to more than a hundred years ago when a 7.8 magnitude earthquake hit the Indian Ocean on 4 January 1907 causing a tsunami that wreaked havoc killing about 70% of the total population in the island. Survivors of this tragic disaster passed on their experiences orally "to the next generation through buai-buai (lullaby) in family daily lives, nafi-nafi (advices) from old generation to the youth and through traditional poems and songs called Nandong that are performed in communal events in Simeulue." One of the popular Simeuluean songs on smong is reproduced below (Syafwina, 2014: 576):

Enggelmonsaocurito
Inangmasosemonan
Manoknopsaofano
Uwilah da sesewan
Unen ne aleklinon
Fesangbakat ne mali

Manoknopsaohampong
Tibo-tibomawi
Angalinon ne mali
Uweksuruiksahuli
Maheyamihawali
Fano me singatenggi

Please listen to this story
One day in the past
A village was sinking
That what have been told
Starting with earthquakes
Following by giant wave
Whole the country was sinking
Immediately
If the strong earthquake
Followed by the lowering of sea water
Please find in hurry
A higher place

Smong has become a "part of the Simeulue indigenous culture, transmitted through songs, short poems, lullabies, and stories" and is "a key word understood by the entire population of Simeulue that describe the occurrence of giant waves after a major earthquake." During the 26 December 2004 tsunami, the indigenous knowledge of *smong* was to a great extent successful in giving early warning leading to "a massive evacuation of the entire Simeulue beach area within a few minutes after the earthquake" (Suciani et al., 2018: 1).

Halo in Kuki Indigenous Knowledge

The Kukis are indigenous transborder community settling in the Indo-Myanmar and Indo-Bangladesh borderlands. They are endowed with rich cultural heritage including traditional knowledge on environment and ecology, meteorology, forestry, traditional agriculture practices, medicinal plants and herbs, and distinct social values and a "democratic check and balances" system in their traditional governance (Kukis are indigenous people settling in the Indo-Myanmar borderlands. To know more about them, read Haokip (ed.). The Kukis of Northeast India (2013); and a further reading on their chieftainship form of governance and its democratic elements can be found in Haokip (2022: 10–11)). They have indigenous knowledge of early warning systems and make predictions, and such indigenous knowledge were handled down from generation to generation. The traditional meteorological knowledge has been useful for predicting weather and climate, and, like other indigenous communities around the world, such forecasting is used "as a guide in making important decisions that enable them cope and adapt to climate change-induced extreme weather variation" (Balehegn et al., 2019). Combined with such knowledge is the utilization of societal values in community-based resilience building. In this process people of the same community are brought together, and they collectively

manage a disaster by discovering "their culturally resilient values, stories, memories and connections in their life for the purpose of understanding their identity and becoming resilient. The activities also promote self-discovery and reflection, understand their own identity, manage change and transition, and build the skills necessary to become resilient." The Kukis have the cultural value systems called *Khankho* and *Tomngaina*, which "instruct the youth and their social institutions to act in times of disaster, conflict, war and other calamities" (Haokip, 2018: 282–283). These social values help them to not only cope with disaster but also build a strong indigenous post-disaster recovery system.

On 20 June 2020, a halo was observed in the Indian state of Manipur. Social media were flooded with the picture of the 22° halo which has a colored ring. According to the Kuki traditional knowledge, it is a sign that there will be heavy rains and floods in the near future. In some other societies, there is a saying that "ring around the moon means rain soon." Halo is an atmospheric optical phenomenon which is the result of either the sun or moon shining through thin clouds which contain millions of tiny ice crystals. The phenomenon is "due to the refraction of light that passes through the crystals, or the reflection of light from crystal faces, or a combination of both effects. Refraction effects give rise to colour separation because of the slightly different bending of the different colours composing the incident light as it passes through the crystals" (Fig. 1) (Britannica, "Halo," accessed on 29 March 2022: https://www.britannica.com/science/halo-atmospheric-phenomenon).

Fig. 1 A picture of halo on 20 June 2020 in Manipur, India

Fig. 2 A picture of flood in Jildung or the Iril river in Saikul subdivision in Manipur

Halo basically occurs due to high moisture content in the atmosphere. There is truth in such prediction by indigenous peoples "because high cirrus clouds often come before a storm" (What causes halos? EarthSky, Accessed on 31 March 2022 at: https://earthsky.org/space/what-makes-a-halo-around-the-moon/). Storm is normally followed by heavy rain, and incessant rain leads to flood. Within a month since the occurrence of halo in the state of Manipur, there was incessant rain in some parts of the state, and on 14 July 2020, the river Jildung, or the Iril river, overflowed the banks, and several acres of paddy fields were flooded and destroyed. These two incidents, of a halo and flood, not only prove that indigenous knowledge on early warning systems are reliable today, but they are best suited to rural masses who fail to read and understand modern systems or a far-flung area where modern communication systems could not reach them easily. A news report on 16 Jul 2020 also informed about mudslide at Moulding village, near Leimakhong bazaar under Kangpokpi district in Manipur due to incessant rain (Fig. 2) (Imphal Free Press, "Villagers living under fear of landslide in Manipur," 16 Jul 2020, accessed on 23 February 2022 at: https://www.ifp.co.in/1279/villagers-living-under-fear-of-landslide-in-manipur).

Conclusion

Early warning systems are important component for disaster risk reduction. In recent years the importance of indigenous early warning systems is increasingly recognized, and integration of such knowledge with the scientific early warning systems is emphasized. Studies in recent decades have shown the existence of a largely ignored but huge body of indigenous knowledge on early warning systems which were preserved for generations. Such local knowledge came to light only after their successful utilization in saving lives in major disasters around the world. Today international agencies recognize the indigenous early warning systems and encourage the integration of the indigenous early warning systems with the scientific systems for a more effective early detection of disasters and thereby to reduce the impacts of disasters. Earlier I argued that "Such integration would help the indigenous communities in understanding scientific knowledge better and develop an integrated approach to community based disaster risk reduction and resilience building" (Haokip, 2018: 296). Despite such recognition, efforts by climate change community to integrate the traditional knowledge and scientific knowledge on early warning systems for an effective disaster risk reduction system are slow and tardy. For an affective early warning system, the focus should go beyond a mere integration of indigenous and scientific early warning systems; it should be people-centered, which is crucial for reducing disaster risk.

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