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GENDER EQUITY IN DISASTER EARLY WARNING SYSTEMS

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Abstract: Capacities of societies, communities and individuals or a social-ecological system to deal with adverse consequences and the impacts of hazard events define the resilience. New and innovative Emergency Communications, Warning Systems (ECWS) technologies and solutions improve resilience of the nations. Research shows that different types of systems (e.g. decision support, resource management, early warning, communications, and inter-agency) are highly valued in emergency and disaster events reducing live losses. As many individuals have online access today and young women have increased their online communication and young men tend to explore technology resources, the potential of using user friendly third revolution digital technology such as semantic features and devices (e.g. SMART phones) have the potential to improve the access to early warning/risk information supporting community decision making saving lives. These personal and social relations that reflect gender dimensions can certainly be examined improving resilience making communities more prepared for disasters with proactive decision making for early warning. Fostering awareness about gender equity which is the recognition of women and men as active participants in development can tailor made within the context of resilience and more specifically within early warning systems saving lives of the people at immediate risk including the dependence of mother's care (children and older people). In this context, this paper attempts to synthesis literature on the topic of gender equity within disaster early warning systems.

Keywords: *Disaster, Early Warning, Gender Equity*

1. INTRODUCTION

This paper is organized into key sections starting with the abstract, disasters in context, community preparedness for proactive responding, gender dimension, Early Warning Systems (EWS), conceptual framework, methodology and finding in the contexts of need for gender equity within EWS and potentials for gender sensitive early warning with third revolution digital technology and conclusions. As an entry point disasters in context is explained in the following section.

1.1 Disasters in context

Over the last 10 years disasters have continued to impact on well-being and safety of persons, communities and countries claiming over 700 thousand lives, over 1.4 million injured and approximately 23 million homeless affecting more than 1.5 billion people by various ways. As a result, International mechanisms for strategic advice, coordination and partnership development for Disaster Risk Reduction (DRR) had been involved in disaster prevention. Taking example from the recent past Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030 was adopted at the Third United Nations World Conference on Disaster Risk Reduction, held from 14 to 18 March 2015 in Sendai, Japan focusing on four priority areas such as understanding disaster risk, strengthening disaster risk governance to manage disaster risk, investing in disaster risk reduction for resilience, enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction. This highlights that, more dedicated action is anticipated tackling underlying disaster risk drivers and calls for a broader and a more people-centered preventive approach for disaster risk reduction improving resilience (SFDRR, 2015). Resilience or the capacity of a system, community or society potentially exposed to hazards to adopt by resisting or changing reaching and maintaining an acceptable level of functioning and structure within early warning system thus can play a vital role reducing risk drivers such as inefficient communication of risk information specifically early warning to the people at immediate risk resulting live losses (UNISDR, 2004). This capacity can also fill the gaps in preparedness deficiencies advocating proactive responding.

1.2 Community preparedness for proactive responding

Preparedness means the knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to and recover from the impacts of likely, imminent or current hazard events or conditions (UNISDR, 2009). Capacity can be discussed in various contexts but this paper attempts to discuss diverse community capacity in terms of preparedness within early warning systems. As a result, literature synthesis on understanding diverse community capacities in terms of gender based differences and gender relations, the ways in which a culture or society defines rights, responsibilities of men and women in relation to one another for improving preparedness will be discussed in detail (Mbunga, 2003). For example, specific gender factors that derive from the social relations between men and women are reflected in mobility of individuals as women are less able to move away from domestic responsibilities, that makes them more vulnerable for disasters(Centre for Policy Studies, 2001; Enarson and Fordham , 2001; Ariyabandu and Wickramasinghe, 2003; United Nations, 2006). Another example is mothers attend to the safety of children during disasters disregarding their own safety due to social bonding between the mother and the child. This has been proved analyzing the composition of tsunami victims of devastating tsunami 2004 on 26 December that struck eight countries in Asia and five in Africa claimed over 230,000 lives over representing women and children in death toll. The bodies of many women were found tangled with those of children or older people, which suggests that they died trying to save those dependent upon them (Ree et al., 2005). In addition, analyses of mortality rates indicate that due to poorer health, nutrition, living and working conditions of women make them 14 times more likely to die during natural disaster compared to men (AfDB, 2011). This highlights the need for recognizing gender dimensions in decision making during disasters for saving lives.

1.3 Gender dimension

As Moser (1993) highlights triple role of women (productive, reproductive, community managing roles) needs to be recognized to seek meeting strategic gender needs through direct state intervention giving political and eco-

nomic autonomy and reducing inequalities with men. In gaining gender equity as proposed in the Women in Development (WID) approach, during the UN Women's decade 1976-85 recognizes women as active participants in development strengthening decision making systems. This is evident within early warning system that target saving lives of people at immediate risk including the dependents of mother's care such as children and older people.

Social studies research had also recognized equity as a central concern answering the intrinsic questions of power and positionality but ignores gender equity in Technology (Crocco et al., 2008). This is a critical omission intentionally or unintentionally which this paper critically examined within disaster early warning systems. Development of EWS can be discussed with reference to revolution of digital technology as explained in section 2.2 of this paper. However, access to and familiarity of digital devices and technology emerge with the internet access needs to be further explored improving networking capacities of the men and women in the communities at risk.

Women's interest in computer with the internet access is linked more to its capacity for delivering new ways to accomplish tasks or connect to others, than to technological features like its power or speed, which hold interest for men (Venkatesh and Morris, 2000, as cited in Brown et al., 2003). Women's interest on connect to others needs to be further examined and strengthened as a measure of building networking capacities of women during early warning saving lives of them and the dependents. There are influential factors in girls' changing interest in computers such as male-dominated computer use, societal gender bias, and gender bias in computer software (AAWU, 2000) as mentioned before become important in this regard. Recent research by Bain and Rice (2007) indicates that girls and boys have relatively equal interest in computers as far as middle school. While conducting a study of project-based learning in which middle-school girls and boys collaborated for ten weeks, researchers found they had to intervene to make a gender equitable learning environment (Ching et al., 2002, p. 178; McGrath, 2004). This suggests women's and men's equal access to technology needs to be facilitated by external decision makers. This is an important consideration in EWS as early warning is generated externally expecting proactive response by the communities internally saving lives.

1.4 Early Warning Systems

A critical consideration in early warning systems is informing diverse community groups ensuring proactive and accurate responding of those who are at immediate risk. Therefore in developing early warning systems, an essential requirement will be to recognize that different community groups have different vulnerabilities according to culture, gender or other characteristics that influence their preparedness capacity and proactive responding to early warning. As a result, influencing the institutionalization of early warning process within communities. In achieving institutionalization of early warning process gender based responsibilities within the community saving lives during a disasters become important. Women and men often play different roles in society and have different access to information in disaster situations. Therefore, information, institutional arrangements and warning communication systems should be tailor made to meet the needs of men and women in the vulnerable community (EWC III, 2006). For example, as Zillman (2003) points out, an increasing number of governments have implemented meteorological and hydrological warning systems for reducing disaster impact through a top bottom approach. Nevertheless, a comprehensive review of issues related to early warning systems undertaken and presented by Mileti and Sorensen (1990) highlights that, a warning system means of getting information about an impending emergency, communicating that information to those who need it, and facilitating good decisions and timely response by people in danger cannot be achieved with top down approach. Therefore, important aspects such as factors affecting how people receive and perceive warning information, how information is presented to individuals to ensure adequate response minimizing the impacts provoked by such events become key considerations. Mileti and Sorensen (1990) further identify four sequential processes which should take place when the warnings issued as below.

1. People receive the warning message
2. The warning message is understood
3. The warning message is believed
4. The warning is then personalized

When the warning message is personalized by those at risk it is expected people to react via execution of specific activities such as evacuation (Mileti and Sorensen, 1990). However, people believe in the warning message will depend on the degree of reliability or trust concerning the imminent event

people assigned to the institutions or source of the information that is provided (Patton, 2008; Haynes et al., 2008). Therefore, credibility of the early warning provider is an essential consideration for people to react. People at risk can disregard warnings because of the credibility issues resulting life losses. Credibility is very much applicable with reference to gender roles such as mother's care giving role for children and elders protecting their lives during a disaster. Highest credibility could be seen with mother's care giving role compared to all other gender roles such as father, grandmother, etc. This is a good opportunity to institutionalization of early warning process within the community for saving lives. In turn both women and men who have the potential to play the mother's care giving role will get the equal recognition that counts for gender equity.

Expected credibility can be gained through accurate forecasts and may be lost due to issuing false alarms. As stated by ISDR-PPEW (2005a; 2005b) and by de Leon et al. (2006), there are four basic elements which must be incorporated into every early warning system to make it effective.

1. Prior knowledge of the risks faced by communities
2. Technical monitoring and warning service for these risks
3. Dissemination of understandable warnings to those at risk
4. Knowledge and preparedness to act

Operational aspects of early warning systems can be illustrated with four sequential phases as follows (de Leon, 2003, 2005; de Leon et al., 2006).

1. Monitoring of precursors
2. Forecasting events
3. Warning: declaration and dissemination
4. Anticipated response

There are two important aspects to be considered here and the first one to be in a case of earthquakes and avalanches system do not really monitor precursors but rather all potential events and issue a warning as quickly as possible in case the events trigger a disaster. Second factor is that the early warning

systems also encompass cross-cutting aspects such as governance issues ensuring vertical and horizontal cooperation, legal mandates delegating responsibilities to agencies to carry out monitoring, forecasting and emission of warnings, perceptions and expectations on the type and degree of response expected from institutions and people at risk according to different level of alerts/warnings. Operational aspects related to these systems such as communication systems and formats to exchange information among the different agencies and dissemination schemes and specific systems which originate from the type of hazards or events being targeted for early warning become important. Therefore it is understood that what information related to risk needs to be carefully select and present in an understandable manner to the target group is essential to improve the effectiveness of EWS. For example hazards maps can only represent the current state of knowledge in terms of probabilities of occurrence of events associated with particular period of return, in particular geographical area in the world. EW frameworks developed focusing above four sequential phases (monitoring, forecasting, warning dissemination and anticipated response) are formalized through Standard Operating Procedures (SOPs) institutionalizing of early warning process among the relevant agencies. However, SOPs are yet to be developed for working men, women as well as men and women in the domestic sphere providing mother's care giving role for children and older people.

Given the explained background the research gap, associated research aim, objectives and methodology of this study can be elaborated as follows.

1.5 Research gap, associated research aim, objectives and methodology

Even if the literature related to gender and disaster management intensely recognise the need of gender sensitivity improving disaster resilience, it barely identifies ways of achieving gender equity specially in pre disaster phase during early warning and responding to early warning using third revolution digital technology. Therefore, the overall research aims to critically examine the effect of third revolution digital technology on gender equity within disaster early warning systems. However, objectives of this paper within the overall research context can be elaborated as follows.

- Carry out a detailed literature synthesis on identifying the need of gender equity within early warning systems
- Examining potentials for gender sensitive early warning with the third revolution digital technology.

In view of synthesizing literature on gender equity in early warning systems extensive literature review was done referring journals paper, reports, case reports, assessments and related literature reviews. In addition, two discussions were conducted with the EW focal points of Disaster Management Centre and Department of Meteorology Sri Lanka to clarify case reports. Analysis of community decision making toward institutionalization of early warning process in the community with the use of third revolution digital technology was carried out. Third revolution digital technology in early warning for improving community capacities achieving gender equity, strategies for gaining risk knowledge and communicating risk with the use to social support digital networks improving community preparedness were other areas focused synthesizing this detailed literature review. Detailed literature synthesis on the topic of gender equity in disaster early warning thus helps justifying the need to have gender equity within early warning systems and potential for gender sensitive warning with third revolution digital technology.

2.0 LITERATURE REVIEW

2.1 Need of gender equity within early warning systems

According to Castells and Cardoso (2005), networking societies with electronic based technologies can change social morphology, where key social structures and activities are organized around electronically processed information networks. As a result, operation and outcomes in processes of production, experience, power and culture can be modified. In this regard semantic features and SMART phone emerge as a result of third revolution digital technology can play a vital role. However, critical knowledge and evidence of disaster managing agencies become important to engage with community networks and support people playing a vital catalytic role bridging or linking emergent roles and strengthening disaster preparedness for early warning. Therefore reliable links between providers and users of warn-

ings, capacity of communities and authorities to respond appropriately need to be considered. A failure in any of these elements can mean the failure of the whole warning system resulting life losses (Tsunami Early Warning Service Guidebook for InaTEWS, 2012). Factors such as people's knowledge on hazards that lead them for self-early warning and react appropriately, access to risk knowledge, ability to understand risk, need to react/ response to avoid risk, acting accordingly become importance saving lives due to disasters. This is an important social factor to be considered as children and women over represent in disaster death tolls. Therefore, political and governance environment should be sensitive enough identifying such social factors and promote access to risk information via familiar devices such as computers and mobiles phones.

With reference to Sri Lanka, social factors such as political environment and governance had influenced computer literacy in areas prevailed internal conflicts (Eastern and Northern Provinces) resulting low computer literacy. However, Jaffna belongs to Northern province had high computer literacy due to improved access to internet with the establishment of various institutions, communication centers, educational centres with internet access (Department of Census and Statistics, 2012) facilitated by the governance mechanisms after ending the internal conflict in 2009. This highlights, the importance of political and governance environment for improving computer literacy. Similarly computer literacy as well as familiarity with digital technology for improving risk knowledge is influenced by gender biased societal norms and digital technology usage norms and power structures within the communities. As highlighted before, there are three influential factors in girls' changing interest in computers such as male-dominated computer use, societal gender bias, and gender bias in computer software (AAUW, 2000). This can be further elaborated taking another example of woman with a high computer literacy getting more accepted by the traditional decision making hierarchies disregarding societal gender bias such as subornation of women. This motivates more women acquiring computer literacy and knowledge on technology usage. Therefore, access to internet is a better approach overcoming societal gender bias ensuring equity in accessing early warning information /knowledge for both men and women. This is a critical consideration in EW as highlighted before for saving lives of the people at risk specially the dependents of mother's care.

With reference to EW system in Sri Lanka it is evident that the features such as mobile applications have been developed called Disaster Early Warning

Network II (DEWN II) for ensuring equal access to both men and women while ensuring last mile EW. Further, strategies at national level such as, use of female voice to send EW alters (recorded) through 77 number of EW towers along the coastal belt of Sri Lanka can be highlighted recognizing women as active participants due to community credibility on women compared to men. People at risk in the coastal belt believe in female voiced recorded alerts as males send false alerts climbing the early warning towers. In addition, high frequency of female voice compared males can reach long distance supporting last mile early warning. However, this high credibility on women compared to men within early warning system is yet to be adequately recognized institutionalizing early warning process within the communities at risk. This aspect can be further elaborated taking evolution of tsunami warning systems that reflects revolution of digital technology in to consideration.

2.2 Potentials for gender sensitive early warning with third revolution digital technology

The evolution of Tsunami Warning Systems (TWS) reflects the development of Information Communication Technology (ICT). For example, computer systems in Phase 1 (Mainframe Era) were used for very dedicated Tsunami Warning System (TWS) functions in early times before year 1980. A strong influence of digital technology on TWS architecture became visible in Phase II (Microcomputer Era) with the digitalization of sensor data and the availability of microcomputer systems during the period of year 1980 -1990. Phase III (Internet Era) created the concepts and foundation for the architecture of modern TWS and their basic components which include decision support components, sensor systems and warning components during the period from year 1990 – 2000. The development of ocean-wide warning infrastructures happened in Phase IV (Ubiquitous Computing Era) since year 2000 up to date. This paper identifies Phase III (Internet Era) and transition from Phase III to Phase IV (Ubiquitous Era) as critical phases that improved access to warning information by both men and women at immediate risk. The standardization processes of component interfaces and the encoding of data were fostered by the development and success of the Internet promoted by the work of standardization organizations such as World Wide Web Consortium (W3C), Organization for the Advancement of Structured Information Standards (OASIS), Open Geospatial Consortium (OGC) and International Organization for Standardization (ISO) promoting data sharing and shared

understanding. Nevertheless, unless access to right information on right time is ensured benefits of the technological advancement will not be able to trickle down to the communities. Prominent research shows that different types of systems (e.g. decision support, resource management, early warning, communications, and inter-agency) are highly valued in managing disasters (Zschau and Ku¨ppers, 2003; Glantz, 2003; Basher, 2006; Kapucu, 2006; Kurita et al., 2006; Thompson et al., 2006; Troy et al., 2008). For instance, some decision support systems research argues that shared understanding promotes sound communication and coordination across emergencies and disasters (Smith and Dowell, 2000; Thompson et al., 2006; French and Turoff, 2007; D'Antonio et al., 2009). The ongoing development of satellite, wireless, mobile, radio and internet based ICT should allow early warning capacity to expand and grow, subject to any supporting infrastructure limitations. In looking forward with optimism, it is anticipated that future research might examine the use of promising new digital technologies for communication as part of the Emergency Communication and Warning Systems (ECWS) capacity improving equal access to risk information by both men and women (Martin and Rice, 2012). It is equally important to understand that, how familiar men and women using electronic devices/equipment for accessing information. For example in Sri Lanka from total housing units, 78.8 % use TV, 68.9 % use radio, 78.9 % use mobiles, 42.4 % use fixed telephone connections, 15.0 % use desktop and 5.6 % use laptops (Department of Census and Statistics, 2012). This highlights in Sri Lanka many use communication electronic equipment and mobile had become popular compared to land phones, desktop and laptops due to intersecting benefits of easy accessibility in terms of low cost, no documentation requirements and equal access by any individual. Considering the electronic equipment usage highest percentage was recorded in urban sector (85.1%) compared to rural and state sector. In addition, from the total housing units 10.9 % had the access to internet from home comprised with 23.4 % urban, 8.6% rural and 4.1% state sector housing units (Department of Census and Statistics, 2012). On the other hand the capability of third revolution digital technology sending the same alert to mobiles and all media stations simultaneously contributes strengthening more capable, relevant and responsive interactions that support institutionalization of early warning process within the communities. This can be further facilitated with the improved access to SMART phones with internet. As Sri Lanka's total internet connections grew 68.4 % during 2014 largely supported by growth in mobile internet due to people's familiarity with SMART phones accessing internet based information. As a result Sri Lanka's mobile phone sales reached one million uni-

ties in the third quarter of 2014. (The Official Government News Portal of Sri Lanka, 2015). Usage of SMART phone is positively influenced on expanding insular bonding networks enabling horizontal information and knowledge flow (Akama, 2014). Therefore, this horizontal information and knowledge flow can be better utilized strengthening mother's care giving role as a measure of saving lives. This also helps better institutionalization of early warning process within vulnerable communities with improved access to information without barriers of mobility or subordination as interpreted in figure 02.
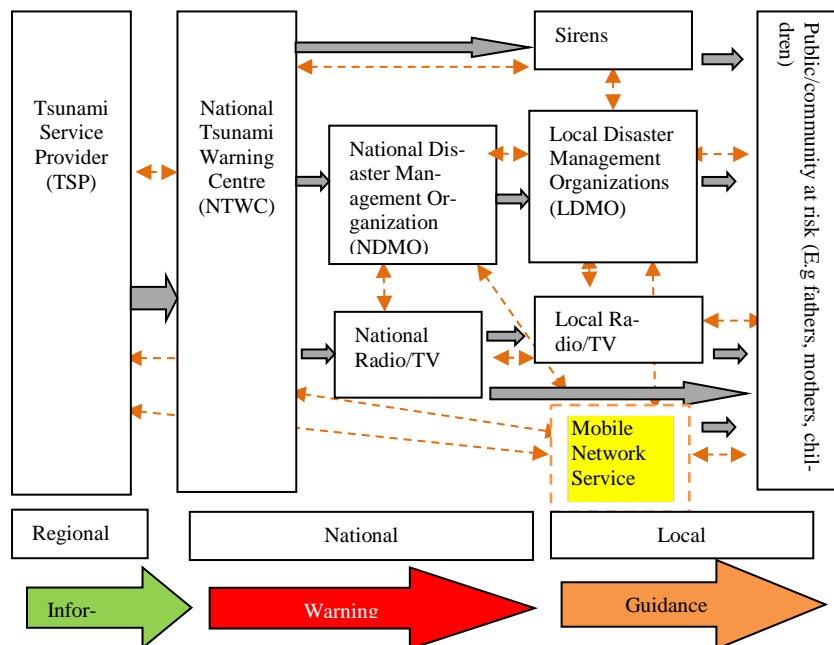

Figure 02: Tsunami Warning Chain with decision making for guidance at local level adapted from IOC/UNESCO (2015)

3.0 FINDINGS

Networking societies with electronic based technologies can change social morphology, where key social structures and activities are organized around electronically processed information networks modifying operation and outcomes in processes of production, experience, power and culture. This is a good entry point devising community capacities with digital technology im-

proving community networking capacities proactively responding to early warning saving lives. As the evolution of Tsunami Warning Systems (TWS) reflects the development of Information Communication Technology (ICT) for networking and the Internet Era that is the third phase of development that created the concepts and foundation for the architecture of modern TWS and their basic components including decision support components, can be better utilized strengthening mother's care giving role as a measure of saving lives. This also helps better institutionalization of early warning process within vulnerable communities with improved access to information without barriers of mobility or subordination as explained in section 2.1. In this regard semantic features and SMART phone emerge as a result of third revolution digital technology can play a vital role. Usage of SMART phone is positively influenced on expanding insular bonding networks enabling horizontal information and knowledge flow. However, critical knowledge and evidence of disaster managing agencies become important to engage with community networks and support people playing a vital catalytic role bridging or linking emergent roles and strengthening disaster preparedness for early warning saving lives.

4.0 CONCLUSIONS

Use of third revolution digital technology and familiar devices such as SMART phones can improve equal access to early warning for both men and women at risk, filling knowledge gaps within the communities for better institutionalization of the early warning process and ultimately achieving gender equity overcoming gender biasness for saving lives. These literature findings confirm the need of gender equity within early warning systems and potentials for gender sensitive early warning with the use of third revolution digital technology achieving two key objectives within the overall research aim of critically examining the effect of third revolution digital technology on gender equity within disaster early warning systems highlighted in the methodology.

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