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Developing and Implementing Effective (Multi-hazard) Early Warning Systems: The Vital Role of Young Professionals

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Developing and implementing effective (multi-hazard) early warning systems: the vital role of young professionals

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Abstract

Collaboration between policy-makers, practitioners and researchers from multiple disciplines and all geographical regions from local, national, regional and international levels is needed to ensure effective (Multi-Hazard) Early Warning Systems (EWS). This article outlines why young professionals play such a pivotal role in developing and implementing globally, (Multi-Hazard) EWSs the support needed to maintain and improve this role, and actions that young people can take now to realise their important role.

How can we inspire more innovative research and collaboration between disciplines? How can we ensure this skilled capacity at National Hydrological and Meteorological Services (NHMS) and other agencies is sustained?

What is an effective Early Warning System (EWS)?

As defined by UNISDR (2016), an Early Warning System (EWS) is "an integrated system of hazard monitoring, forecasting and prediction, disaster risk assessment, preparedness communication and activities systems and processes that individuals, enables communities, governments, businesses and others to take timely action to reduce disaster risks in advance of hazardous events"1. As shown in Figure 1, an effective "end-to-end" and "people-centred" EWS may include four interrelated key elements: 1) disaster risk knowledge based on the systematic collection of data and disaster risk assessments; 2) detection, monitoring, analysis and forecasting of the hazards and possible consequences; 3) dissemination and communication by an official source, of authoritative, timely,

¹UNISDR. Report of the Open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. (2016)

accurate and actionable warnings and associated information on likelihood and impact; and 4) preparedness at all levels to respond to the warnings received.¹ Warnings are only effective if they are received, understood, and acted upon by those at risk and this comes with its challenges across all four components. Impact-based forecasts and warning services have come forward as a mechanism to help users understand not only what the weather will be, but most importantly, how the weather will impact their daily lives. This paradigm change of translating hazard to relevant sector (user-specific) impacts can provide more meaningful warnings that improve guidance to decision-makers in different sectors and hopefully result in more effective responses². Furthermore, this discourse highlights the importance of partnerships amongst local authorities, non-governmental organisations (NGOs), National Hydrological and Meteorological (NHMS), Civil Protection/ Services **Disaster Management agencies and others** to generate such a warning which spans boundaries of the NHMS the responsibilities. For example the UK Natural Hazards Partnerships³ collaborative environment enables the development of innovative products and services that will provide better coordinated and more coherent assessments, research, and advice.

The importance of EWS is reflected in the global target (g) of the Sendai Framework for Disaster Risk Reduction (DRR) 2015-

2030 "Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030". The 2030 Agenda for Sustainable Development and the Paris Climate Agreement highlight the importance of investing in early warning systems. Collaboration between policy-makers, practitioners and researchers from all geographical regions and from local, national, regional and international levels is needed to reach these targets, along with training and interdisciplinary exchange, particularly for the younger

Why young professionals play a vital role?

generation, as argued here.

Young practitioners, volunteers, scientists and researchers are playing a pivotal role in developing and implementing effective and people-centred (Multi-Hazard) EWS globally. This section outlines the important role young people are taking across EWS development and implementation.

Operational backbone

First and foremost, young hydrologists and meteorologists at NHMS form the operational backbone of EWS; not to forget the young professionals in local or international consultancies, young ICT experts working in disaster management authorities and local volunteers disseminating and responding to the warnings. For example, RIMES (Regional Integrated Multi-Hazard Early Warning System for Africa and Asia) support capacity building in young staff based at national hydro-met agencies through exchanges between regional hydromet

²WMO. Guidelines on Multi-hazard Impact-based Forecast and Warning Services. (2015) Available at:

http://library.wmo.int/pmb_ged/wmo_1150_en.p df

³Natural Hazards Partnership (2017) Available at: <u>http://www.naturalhazardspartnership.org.uk/</u>



Figure 1. Effective Early Warning System (using the four components of people centred EWS, UNISDR 2006¹)

agencies making sure they gain the experience to prepare themselves for future leadership and responsibilities⁴. When given the opportunities, young people play a vital role in new development projects at NHMS and disaster management authorities. consultancies, and NGOs. They are innovating as part of international project teams, making sure to avoid 'business as usual'. Such initiatives have also been recognised bv international organizations, for instance, ICT for Development Mountain Award bv International Center for Integrated Mountain Development (ICIMOD). A youth led project of RIMES was recipient of this award during 2015 for ICT-enabled innovations, good practices, and applications⁵. There is huge potential for voung professionals to contribute to the development of impact-based forecasts and warnings by, for example, identifying and analyzing local vulnerabilities and capacities.

http://www.rimes.int/em/tag/capacity-building/ ⁵ ICIMOD (2017) Available at:

Innovative research and development

Young scientists and researchers are paving the way on innovative topics such as impact-based forecasting and warning (e.g. Sai (2017)⁶), warning dissemination through mobile applications (e.g. Nespeca (2017)⁷) and evaluating the effectiveness of warning response (e.g. Cumiskey et al. $(2015)^8$ at the community level. Furthermore, young researchers conducting their postgraduate research can take different approaches to tackling such EWS challenges by combining both the technical and social aspects and taking a multidisciplinary approach. A recent workshop brought together young scientist to identify the research gaps and the pivotal role for them to address these

⁴ RIMES (2017) Available at:

http://www.icimod.org/?q=20601

⁶Sai., Fabio. (2016) Mainstreaming impact based forecasting and warning in Bangladesh. MSc. Thesis. IHE Delft Institute for Water Education

⁷Nespeca V., Alfonso L. 2017. E-Aid: Smartphone and Web Applications for Community-Based Disaster Management in Accra. MSc Thesis Report. IHE Delft Institute for Water Education.

⁸Cumiskey, L., M. Werner, K. Meijer, S.H.M. Fakhruddin, and A.Hassan. 2015. "Improving the social performance of flash flood early warnings using mobile services." *International Journal of Disaster Resilience in the Built Environment* 6(1): 57–72.

gaps was clearly recognised, see Deltares (2016)⁹. Although innovative research can be driven by academia, it is also being done as part of development projects, where young people work closely with NHMS are encouraged to tackle the challenges from all sides. Figure 2 presents a project conducted by RIMES on 'Mobile Services for Flood Early Warning' and 'ICT Enabled Risk Information Gateway Development' led by a young practitioner from RIMES who is driven to "connect the unconnected, learning from lessons learned and make use of ICT for the vulnerable, hard-to-reach benefit of communities at risk"

Bridging the communication and technology gap

Young people are seen as a powerful driving force in modern technology and especially communication technology such as mobile applications and social media. Their skills can be capitalized to enhance communication and response to early warnings by creating the links between local people and modern technology.

Young people are creating and contributing to developing open source data and tools, such as Open Street Map initiatives collecting exposure data, for example Fernandez and Shaw (2016)¹⁰





Figure 2. Community meeting (top) and flood level gauge to validate flood warnings (bottom). Pictures nicely highlight the curiosity and interest of the younger generation in the community. (Source: RIMES Bangladesh)

and Ramina Huria (2017)¹¹, providing crucial information to deliver impact based warnings. Youth are also leading the way developing ICT tools and mobile applications, for example the Messiah application¹², which sends emergency alerts to pre-identified group developed within the Code for Resilience Programme (GFDRR, 2015)¹³, a disaster mapping service in Indonesia, Peta

 ¹¹Ramanihuria. Community-based mapping project (2017) Available at: http://ramanihuria.org/
¹²Messiah. n.d. Messiah App. http://www.messiahapp.com/.
¹³World Bank and GFDRR. Code for Resilience: bridging Communities for Disaster Basecone

⁹Deltares and UNESCO-IHE. Young Scientists Event on Disaster Risk Reduction. (2016) Available at: https:// www.deltares.nl/app/uploads/2016/03/Outcom edocument_YoungScientistsEventonDRR_final.pdf

¹⁰Fernandez, G., and R. Shaw. "Participation of Youth Councils in local-level HFA implementation in Infanta and Makati, Philippines and its policy implications." *Risk, Hazards & Crisis in Public Policy* 5(3). (2014): 259–278

bridging Communities for Disaster Response (Global Facility for Disaster Reduction and Recovery). (2015) Available at: http://codeforresilience.org/apps/.

Bencana¹⁴ and the E-Aid app for disaster management in Ghana under development by Nespeca (2017). When working together young practitioners from different disciplines such as ICT, hvdrology. media. community volunteering can co-develop socially relevant solutions alongside the users. Risk communication has been highlighted as an area where the potential influence of young people as 'communication agents' (resources and receivers) has been underestimated, particularly for early warning information (Mitchell et al. 2008¹⁵). The power of young people's social networks should be capitalized on not only to disseminate warnings through schools, households, and communities, but also to build awareness before disasters on how to respond to warnings. Further research on the influence of youth at the local level receiving and transmitting warnings using social media is needed to fully understand the social dynamics and performance of this medium of warning communication. people Young can work towards developing complementary tools and approaches that embrace the heterogeneous nature of communities.

How can young people be supported?

The global, national and local community engaged in (Multi-Hazard) EWS developments need to take joint-action to support our young practitioners, scientists and researchers today and in the future. This includes bilateral and multilateral donors, local and regional NHMS, the World Meteorological Organisation, Regional forecasting centres e.g. RIMES, NGOs, universities (local and international), engineering consultancies, national governments and others. Here we outline possible ways to do this.

Challenging roles in international projects and initiatives

To prepare for the (Multi-Hazard) EWSS now and in the future young people need to part of the conversation at global, national and local levels to develop (Multi-Hazard) EWS of the future. For instance, global initiatives, like the Climate Risk and Early Warning Systems (CREWS)¹⁶ should recognise the value of involving young professionals within development projects. Other ways could include involving vouth in national activities such WMO workshops on EWS development¹⁷. Young practitioners and scientists, if formally involved, can offer new insights from a holistic and fresh perspective. It is important to include young professionals and researchers so that they can get access to invaluable knowledge and experience from these initiatives. This can then be further built upon to help the global and/or local development of EWS and of course to help other young researchers interested in these developments.

¹⁴Petabencana. (2017) Available at: https://petabencana.id/map/jakarta

¹⁵ Mitchell, Tom, Katharine Haynes, Nick Hall, Wei Choong, and Katie Oven. "The roles of children and youth in communicating disaster risk." *Children Youth and Environments* 18, no. 1 (2008): 254-279.

¹⁶CREWS. (2017) Available at:

https://www.gfdrr.org/crews-climate-risk-earlywarning-systems

¹⁷WMO (2016) Available at:

http://www.wmo.int/pages/prog/amp/pwsp/events workshops en.htm

Networking and communities of practice

The current development of (Multi-Hazard) EWSs demands а multidisciplinary approach. In order to achieve a "people centred" svstem. networks between young people involved across different sectors (e.g. hydro-met, disaster management, voluntary, media) should be established. By investing resources (e.g. time and financing) to develop these networks young people working or researching on all the different components of an EWS including data collection. forecasting and emergency response, can support each other to understand the current situation from all points of view and plan new developments.

UNISDR and WMO, along with other and national agencies, international announced the establishment of an international network for multi-hazard early warning systems (IN-MHEWS)¹⁸ to share expertise and good practice. It is critical that young people play an active and dynamic role in this network to ensure national and local activities amongst youth can occur. Furthermore, national and regional (hvdromet) agencies should ensure meaningful participation by young practitioners and researchers at their interdisciplinary regional and global networking and knowledge sharing events. For example the Expert Forum on DRR in a Changing Climate¹⁹ and the Regional Flood Early Warning System Workshop²⁰.

Furthermore, some communities focus on specific components of EWS e.g. HEPEX on hydrology²¹, Delft-FEWS on flood forecasting²² or youth engagement e.g. Water Youth Network²³ and Young Hydrological Society²⁴. However, none of these communities incorporate all the end-to-end processes involved with early warning nor do they focus on the interdisciplinary nature. Hence, the networking and communities of practice amongst EWS professionals must strongly involve youth.

Support innovative research at postgraduate level

Encouraging innovative research within and across disciplines to click together the pieces of the MH-EWS puzzle is critical to ensure the next generation of EWS experts. The complexities of delivering "people-centred" EWS requires much more interdisciplinary research than currently available (see Figure 3), especially if the effectiveness of current EWS is to be evaluated and monitored as part of the Sendai Framework monitoring of Target g. Clearly the current evolution of EWS demands that a multidisciplinary

https://hepex.irstea.fr/

¹⁸WMO. A Multi-Stakeholder Partnership for Promoting and Sharing Best Practice in Multi-Hazard Early Warning Systems and Services for Disaster Risk Reduction and Resilience. (2015) Available at:

https://www.wmo.int/pages/prog/drr/document s/IN-MHEWSConceptPaper16415.pdf

¹⁹El Nino Ready Nations. (2015) Available at: http://elninoreadynations.com/lessons-learned-

disaster-risk-reduction-in-a-changing-climate/ ²⁰ RIMES and SAWI. Proceedings of the

Regional Flood Early Warning System Workshop (2015). Available at:

http://documents.worldbank.org/curated/en/43 1281468000591916/pdf/103879-WP-PUBLIC-Rimes-Workshop-Proceedings-13Jan2016.pdf

²¹HEPEX. (2017) Available at:

²²Deltares. (2017) Available at:

https://oss.deltares.nl/web/delft-fews/

²³Water Youth Network (2017) Available at:

http://www.wateryouthnetwork.org/

²⁴ Young Hydrological Society (2017) Available at: https://younghs.com/

approach should be taken on future Collaboration research. between universities and consultancv organisations from all relevant sectors, can provide young researchers with new insights into practical challenges and fuel innovative solutions, especially if local fieldwork arrangements can be made possible to collect data from affected communities. This last aspect is essential if the work of young researchers aspires to evolve towards a more "people centred" perspective.



Figure 3. Breakout session identifying Early Warning System gaps on each component ¹⁰

Education and capacity building

Educational events in local universities and colleges to encourage new programmes, motivate interest and raise awareness are needed. Furthermore, opportunities for further education once working in a NHMS should be accessible and incentives provided to ensure their return to these agencies. National governments need to encourage higher educated hydromet professionals to return to service the NHMS after obtaining postgraduate degrees abroad. Interdisciplinary training and (peer-topeer) capacity building programmes are needed to share and generate knowledge across generations. Although often specific sector capacity building programmes, e.g. disaster response, can lack connection to other related topics such as long term risk management and hydro-met components, so it is important that both specialised and cross cutting training is provided.

Regional organizations like RIMES' Asia-Pacific Economic Cooperation Climate Center (APCC) arrange on site and off-site training programs²⁵ for the professionals of NHMS of their member countries. RIMES arranges secondment training programs for NHMS's professionals where they get opportunity to learn and gain experience from on-the-job training over a span of 3-6 months. There should be explicit opportunities for young scientists to ioin such initiatives. Moreover, there are exclusive programs for young scientists such as that arranged by APCC²⁶ which select scientists from developing countries and invites them to APCC to support their research while from APCC's benefiting data and expertise. There are also examples of joint programs for young scientists arranged by RIMES, APCC and other research organizations²⁷ which can be further promoted and replicated, see Figure 4.

²⁵ RIMES (2017) Available at:

http://www.rimes.int/training.php

²⁶ APCC. n.d.. Available at:

http://www.apcc21.org/ic/yssplist.do?lang=en&b bsId=BBSMSTR_00000000021

²⁷ WCRP. CORDEX Science and Training Workshop in East Asia. (2015) Available at: http://english.iap.cas.cn/news/201512/t201512 14_157356.html



Figure 4. Young Scientists from the 4th WCRP CORDEX Science and Training Workshop in East Asia (Source: Institute of Atmospheric Physics, Chinese Academy of Sciences)

What can young professionals do themselves?

This section aims to provide some general advice targeted at young EWS professionals on their journey towards more effective (Multi-Hazard) EWS:

- Engage in the IN-MHEWS and other WMO related activities.
- Advocate at global, national and local levels to create and enhance your voice as young professionals on EWS developments.
- Join and utilise existing networks (personal and organisational) to meet others 'in the same boat' and share your knowledge on EWS developments e.g. write a blog post.
- Build partnerships and relationships outside your organization's boundaries both horizontally (across sectors) and vertically (across levels).
- Step outside your specialised comfort zone and jointly innovate with other young and not-so-young EWS experts across sectors.
- Contribute to building the evidence base of EWS effectiveness globally evidence-base by conducting and publishing applied research.

Conclusion

By supporting young professionals on the above identified areas, a bigger space opens for them to contribute innovative ideas towards implementing more "people-centred" and effective (Multi-Hazard) EWS globally. The authors hope that by 2030 young professionals on EWS developments continuously are connected, working closely together implementing projects and have a strong and sustained voice at all levels including within the IN-MHEWS.

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